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Lalo dialects across time and space

Subgrouping, dialectometry, and intelligibility

Cathryn Yang

A-PL 22

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Published by Asia-Pacific Linguistics
College of Asia and the Pacific
The Australian National University
Canberra ACT 2600
Australia

First published: 2015

URL: http://hdl.handle.net/1885/95391

National Library of Australia Cataloguing-in-Publication entry:

Creator:	Yang, Cathryn, author.
Title:	Lalo dialects across time and space: subgrouping, dialectometry, and intelligibility / Cathryn Yang.
ISBN:	9781922185242 (ebook)
Series:	Asia-Pacific Linguistics; A-PL 22.
Subjects:	Loloish languages – China – Yunnan Sheng. Historical linguistics – China – Yunnan Sheng. Sociolinguistics – China – Yunnan Sheng. Yunnan Sheng (China) – Languages.
Dewey Number:	495.4

Cover photo: Sample of traditional Lalo embroidery on a linen shoe. Taken by Cathryn Yang.

For Shizhou, my true-hearted comrade

Acknowledgments

This research would not have been possible without the support and guidance of many people, including academic supervisors, colleagues, speakers, friends and family members. Their contributions have improved this work beyond what I could have accomplished on my own; remaining weaknesses are my responsibility alone. I would first like to thank my principal supervisor, Dr David Bradley, not only for his useful suggestions and constructive criticism of earlier drafts of this work, but also for the time he generously gave in guiding me through the research process. Thanks also go to my co-supervisor Dr Randy LaPolla for his advice and encouragement.

I would also like to acknowledge the Lalo language consultants, too numerous to list exhaustively here, who patiently taught me about their language during my fieldwork in 2008. In particular, Cha Shufang, a Central Lalo (West Mountain) speaker and Cha Jishun, a Central Lalo (East Mountain) speaker, assisted my research and generously hosted me in their home villages.

My fieldwork, which involved traveling to nineteen counties and five prefectures in Yunnan, China, was made possible through the partnership of Bai Bibo and Xu Xianming of Yuxi Teachers' College. Dr Liu Jinrong, head of the Ethnic Language and Literature College of Yunnan Nationalities University, was instrumental in helping me get permission to do research in Pu'er Prefecture. Duan Ling, venerable scholar of Bai and Lisu languages, was a tireless advocate for me in Dali Prefecture. Zhou Yanglei, head of the Ethnic Art Institute of the Lincang Prefecture Culture Bureau, opened the door for me to do research in Lincang. My fieldwork was made possible through the financial support of a La Trobe University Faculty of Humanities and Social Sciences 2007 fieldwork grant and an SIL International project funding grant.

To thank all my other friends who have helped me through the past three and a half years would be another dissertation. Ching Yee Castro was my fun-loving, hardworking helper during the many road trips. Pete and Laura Blackburn and Edwin and Angel Lam generously shared the language data they had already collected, along with their understanding of Lalo language and culture. My father-in-law Yang Qihua, sister-in-law Yang Shicai, and brothers-in-law Yang Shikuan and Yang Shihai have immeasurably enriched my life. My parents Jerry and Julie Fine and my sisters Sarah and Robin and their families have given me tremendous encouragement and strength each step of the way. My husband Yang Shizhou, to whom this book is dedicated, is my hero, and my children Micah, Finn and Pearl bring me new joy every day. Finally, my deep love and gratitude to the Trinity of Father, Son, and Holy Spirit; I could not have done this without you.

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List of abbreviations

1, 2, 3	first, second, third person
C	Central Lalo or Consonant
CE	Central Lalo- East Mountain
CW	Central Lalo- West Mountain
CLF	classifier
CT	cricothyroid muscle
E	Eastern Lalo
EXCL	exclusive
INCL	inclusive
H	Proto Ngwi High-stopped tone
L	Proto Ngwi Low-stopped tone
N	Nasal
NEG	negation, negative
P	Phonation
PB	Proto Burmic
PCLa	Proto Central Lalo
PCWLa	Proto Central-Western Lalo
PL	plural
PLa	Proto Lalo
PN	Proto Ngwi
PTB	Proto Tibeto-Burman
SE	Southeastern Lalo
SG	singular
T	Tone
V	Vowel
VOT	voice onset timing
W	Western Lalo
WB	Written Burmese

List of data source abbreviations

CE-YA	Dali Prefecture, Weishan County, Yongjian, Yong'an
CW-QY	Dali Prefecture, Weishan County, Ma'anshan, Qingyun
C-LJ	Dali Prefecture, Weishan County, Wuyin, Longjie
C-WC	Dali Prefecture, Yangbi County, Wachang
C-LB	Dali Prefecture, Yongping County, Shuixie, Leba
C-CJ	Dali Prefecture, Nanjian County, Xiaowandong, Chajiang
C-QS	Pu'er Prefecture, Jingdong County, Anding, Qingsheng
E-DC	Dali Prefecture, Dali Municipality, Shijiao qu Diaocao
E-HS	Dali Prefecture, Dali Municipality, Fengyi Houshan
E-TS	Dali Prefecture, Dali Municipality, Taiyi Taoshu
Eka	Lincang Prefecture,Shuangjiang County, Heliu, Yijiacun
MD	Lincang Prefecture, Gengma County, Hepai, Mangdi
SE-GP	Dali Prefecture, Midu County, Micheng, Gaoping
W-DT	Dali Prefecture,Yangbi County, Taiping, Dutian
W-SZP	Dali Prefecture, Yangbi County, Longtan, Shuizhuping
W-YL	Dali Prefecture, Yongping County, Changjie, Yilu
W-SLZ	Baoshan Prefecture, Longyang Area, Wama, Shanglizhuo
XZ	Baoshan Prefecture, Longyang Area, Wafang, Xuzhang
YL	Baoshan Prefecture, Longyang Area, Yangliu

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1 *Introduction*

1.1 Purpose

The purpose of this work is to elucidate the diachronic and synchronic relationships between regional varieties of Lalo, a Ngwi (Loloish) language cluster spoken in western Yunnan, China. This book presents the phylogenetic subgrouping of Lalo varieties based on shared innovations after the Proto Lalo phase. As a complement to the subgrouping, a synchronic classification of Lalo varieties according to phonetic distance, intelligibility, and speaker perceptions is also given. Data, collected from nineteen Lalo villages during 2008, includes 1,000 item lexicons, intelligibility tests, and sociolinguistic interviews on contact, dialect perceptions, and ethnolinguistic vitality. The comparative method is applied to the lexical data to first reconstruct Proto Lalo and then to subgroup the daughter varieties. Phonetic distance between varieties is quantified by the Levenshtein edit distance algorithm and analysed with NeighborNet network analysis and multi-dimensional scaling. These methodologies, along with intelligibility test results and sociolinguistic data, enable an integrated synchronic and diachronic depiction of Lalo dialect diversity.

This work is the first to systematically investigate Lalo dialectology. Chen et al.'s (1985) reference to two dialects, East Mountain and West Mountain, is shown to be only the tip of the iceberg of Lalo variation. This work finds that Lalo has four major dialect clusters, Eastern (E), Southeastern (SE) Western (W), and Central (C), and four peripheral varieties, Mangdi (MD), Eka, Yangliu (YL) and Xuzhang (XZ). E, SE, W, and C varieties are located in and around the traditional Lalo homeland of southern Dali Prefecture and phylogenetically comprise the Core Lalo group. C varieties are the most conservative diachronically and are spoken by the majority of Lalo speakers (over 70%); they are also historically associated with Weishan County, the heart of the Lalo homeland. East Mountain and West Mountain Lalo both belong to the C cluster, though certain East Mountain varieties show influence from E varieties. Further back in time than Core Lalo is the Greater Lalo group, which encompasses Core Lalo plus XZ. Ancestors of Eka, the most divergent variety, emigrated out of the Lalo homeland area approximately 300 years ago. MD ancestors emigrated from Dali approximately 200 years ago. It is unclear whether YL of Baoshan Prefecture represents an early settlement or later emigration. Dialectometric analysis also uncovers the four dialect clusters and four peripheral varieties, but not upper-level groupings such as Core Lalo. Intelligibility test results show that cross-cluster comprehension is low, but that most C speakers understand the C varieties in western Weishan County.

Ngwi language studies, including foundational works such as Matisoff's (1973) *Grammar of Lahu* and Bradley's (1979b) *Proto-Loloish,* have much to contribute to the field of linguistics as awhole, especially with regards to Tibeto-Burman language history, tone change, indigenous language dialectology, and endangered language documentation. The reconstruction of Proto Lalo here not only enables a systematic account for the development of modern Lalo varieties, but also helps clarify some issues in the reconstruction of Proto Ngwi rhymes (see Chapter 4.3). The analysis of Lalo tone change in Chapter 5 adds to the understanding of how laryngeal features condition secondary tone change. The examined tone changes show interactions between prevocalic consonants' laryngeal features and pitch contour, and between phonation types and pitch height.

Dialectology studies of Ngwi languages have now begun to reveal the full extent of linguistic diversity in the region (e.g., Pelkey 2011, Wang 2003). This research comes at a critical time for Lalo dialectology and for minority language documentation in southwestern China, where a large number of Ngwi languages are disappearing before linguists are even aware of them (Bradley 2007). Several previously undocumented varieties, some of which are definitively endangered, are presented here. The classification of Lalo varieties is critical knowledge for language planning and maintenance efforts, which is an urgent need for the Lalo language as a whole. This book is one of the first to apply the Levenshtein distance algorithm as a measure of phonetic distance to a Tibeto-Burman language. By proving a strong correlation between phonetic distance and comprehension test results, this book offers further validation of the use of Levenshtein distance as a dialectometric tool, one that may be successfully applied to yet other under-researched languages.

The remainder of this chapter covers essential background to the study: the historical and social context of Lalo, previous research on Lalo, and the theoretical framework used in this book. An outline of the book is also given.

1.2 Historical and social context of Lalo varieties

1.2.1 Phylogeny

Lalo varieties are classified in descending order as Tibeto-Burman, Burmic (Lolo-Burmese), Ngwi (Loloish), Central Ngwi (Bradley 2002b). Burmic, one of the more well-defined subgroups within Tibeto-Burman, includes two branches, Burmish, including Burmese, and Ngwi (Loloish) (Bradley 2002b). Matisoff's (1969, 1972, 2003) reconstruction of Proto Burmic and Proto Ngwi and Bradley's (1979) reconstruction of Proto Ngwi are based on hundreds of cognate sets from over a dozen languages. Both Matisoff's and Bradley's reconstructions are generally acknowledged as reliable, thirty and forty years after their respective publications.

Bradley (1979, 2002b) subgroups Ngwi languages into four branches: Northern, including Nosu and Nasu; Southern, including Hani and Akha; Southeastern, including Phula; and Central, including Lisu, Lahu, Lolo, and Lalo. Criteria for subgrouping include phonological innovations in initials, rhymes, and especially tones. Central Ngwi languages also have lexical innovations for 'dog' and 'fire' (Bradley 2004). Figure 1-1 below illustrates Lalo's family tree. Central Ngwi languages also include Jinuo, Kucong, and possibly Sani, though Pelkey (2008) argues for Sani and Nisu (classified as Northern Ngwi) to be placed in the Southeastern Ngwi branch along with Phula.

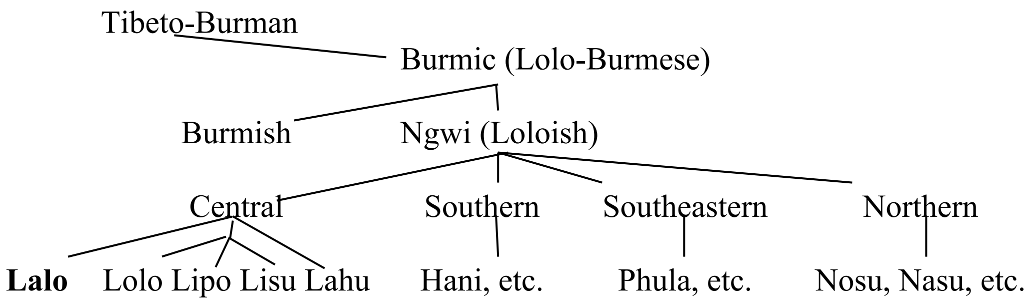


Figure 1-1: Phylogeny of Lalo, based on Bradley (2002b)

Ngwi languages are firmly within the Chinese cultural sphere of influence (a.k.a. the Sinosphere), and as such share certain areal features with Chinese languages, being tonal, monosyllabic, analytic type languages (Matisoff 2003). Ngwi languages such as Lahu and Lalo are characterised by Matisoff (1989) as 'omnisyllabic' languages, in which almost every syllable is assigned a lexical tone, and tonal systems encompass a range of features including pitch height and contour, phonation, duration and intensity.

1.2.2 Population

Lalo ethnic population is estimated around 500,000 (Chen Shilin et al. 1985, Björverud 1998); however, the number of Lalo speakers is far fewer, as many Lalo in Lincang Prefecture and elsewhere have shifted to Chinese. As census data is based on ethnicity rather than language, a population estimate for Lalo (part of the Yi ethnic group) is difficult. An estimate of the number of Lalo speakers, as opposed to Lalo who have shifted to Chinese, is even more complicated. However, based on the Chinese demographic sources listed in Appendix A, as well as interviews with government workers in the Ethnic Minorities and Religious Affairs Bureau at each county visited, a rough estimate of Lalo speakers is given in Table 1-1. Numbers of ethnic Lalo are given in the second column, and Lalo speakers are grouped by dialect cluster. The total number of Lalo speakers of all varieties is probably less than 300,000, about 60% of the number of ethnic Lalo. The *Gazetteer of Nanjian County* (NJXZ 1993) reports that only half the number of ethnic Lalo still speak the language. The overwhelming majority of Lalo speakers belong to the Central Lalo subgroup, with W and E groups trailing behind, and peripheral groups with only a few thousand each. Eka in Shuangjiang County, not included below, has a population of approximately 3,000 speakers.

Table 1-1: Estimated number of Lalo speakers

County	Ethnic Lalo	C	E	W	SE	XZ	YL	MD
Weishan	90,000	80,000			6000			
Nanjian	84,000	42,000						
Jingdong	75,000	50,000						
Yongping	35,000	12,000		20,000				
Yangbi	32,000	10,000		17,000				
Changning	14,000	10,000						
Midu	9000	9000			6000			
Dali	15,000		15,000					
Longyang	16,000			7000		2000	7000	
Gengma	1000							1000
Cangyuan	2000							2000
Yun	150,000	~0						
Fengqing	114,000	~0						
Jinggu	58,000	~0						
Total: ~500,000		213,000	15,000	44,000	12,000	2000	7000	3000

1.2.3 Geography

Ethnic Lalo are found mainly in southern Dali, northern Baoshan, northern Pu'er, and northern Lincang prefectures in Yunnan Province in southwestern China (Chen Shilin et al. 1985). There is also one Lalo village in Nujiang Prefecture (Bradley, personal communication, February 19, 2010). The Chinese government has classified Lalo as belonging to the Yi nationality, a classification shared by many diverse groups such as Lolo, Sani, Phula, Nisu, Nasu, and Nosu. Lalo's geographic distribution in western Yunnan has led Chinese linguists to classify it as "Western Yi" (Zhu 2005). Figure 1-2 shows the location of Yunnan province and the prefectures in western Yunnan where most Lalo live. Weishan County in Dali Prefecture is considered by many as the traditional homeland of the Lalo.

Figure 1-2: Map of Yunnan, China

As Lalo officially belongs to the Yi nationality, county gazetteers and censuses do not reliably distinguish it from other Ngwi languages in the Yi nationality (e.g., Lolo and Nisu), making population estimates and distribution maps difficult. The vast majority of Lalo are found in Dali Bai Autonomous Prefecture. However, not all Yi in Dali are Lalo. Eastern Dali, particularly the area bordering Chuxiong Yi Autonomous Prefecture, is home to various regional varieties of Lolo, Lipo and Lisu. Bradley (2004) also documents a very small number of Lamu speakers in Binchuan County. Fieldwork conducted in Xiangyun and Binchuan confirmed that most Yi in these counties are Lolo or Lipo-speaking; if there are Lalo there, they are very few in number. A divergent dialect of Nisu is found in Yunlong, Yangbi, and Yongping counties; the relevant county gazetteers identify this group as descending from a group of soldiers sent to the area during the first year of the Ming dynasty, 1368 A.D. (YPXZ 1994, YBXZ 2000). Eryuan County in northern Dali is home to the undocumented Ngwi language 'Gomotage' [ɣɔ^{21}mɔ^{33}ta^{55}ɣə^{21}], literally 'people of the mountain,' which is possibly related to languages such as Kua-nsi [kʰua^{33}n̩^{21}sɿ^{55}] in neighboring Heqing County, reported in Castro et al. (2010). There are also some Nosu in Yunlong and Yangbi counties (YLXZ 1992, YBXZ 2000), as well as further north in Dali Prefecture and on up into southern Sichuan Province.

Lincang Prefecture, as late as the early 20th century, was home to many Lalo speakers, as documented by the traveler H.R. Davies (1909). Lolo speakers were probably also present, having migrated out of their traditional homeland in Chuxiong Yi Autonomous Prefecture. However, during fieldwork in Lincang, I found that of the approximately 260,000 Yi living there, only a handful of elderly people still speak their heritage language. In far northern Fengqing County, on the border with Nanjian County of Dali, I found a few elderly Lalo speakers. Government officials in the Minorities and Religious Affairs Bureau at the county and township level were explicit about the dearth of speakers of Yi languages in northern Lincang, whether Lalo or Lolo. In general, Minorities and Religious Affairs Bureau officials are fairly accurate at identifying which areas still have speakers, even for small numbers.

There are however, a few areas in central and southern Lincang where Ngwi languages are being maintained. In central Lincang, there is an under-documented Ngwi language, Limi, reported in Li and Shi (2004). In southern Lincang, there are two Lalo-related groups that still maintain their language, the Eka and the Mangdi (MD) Lalo. Both groups claim Weishan County (referred to as Menghua, an older name for Weishan) as their ancestral homeland, though each group migrated out of Weishan during a different time period.

When speaking Chinese, the ethnic category is always referred to as 'Yi,' never 'Lalo' and certainly not 'Lolo,' a term which has been used by Chinese speakers as a pejorative reference to members of the Yi nationality. Therefore, after the shift to Chinese, assimilated Yi are not able to identify whether they are descendants of Lalo or Lolo. Probably most assimilated Yi in Fengqing and Yun counties are descendants of Lalo, given their proximity to Nanjian County, with some descendants of Lolo scattered throughout eastern Yun County and Lincang County.

Jingdong County in Pu'er Prefecture lies at the crossroads of Chuxiong and Dali, and therefore also at the intersection of outward migrations of Lalo and Lolo. Both Lalo and Lolo groups are found in Jingdong, but ethnolinguistic vitality is waning, with children failing to learn their heritage language. Based on the declining vitality in Jingdong, which is closest to vital areas of Lalo and Lolo, I assume that Lalo/Lolo groups further south in Jinggu County are probably even less vital and possibly already moribund.

Key counties for Lalo in Dali Prefecture are Weishan, Nanjian, Yangbi, Yongping, and the surrounds of Xiaguan (the capital of Dali Prefecture). Weishan, Nanjian, and Yangbi counties in Dali Prefecture and Jingdong in Pu'er Prefecture have been designated as Yi autonomous counties due to the large numbers of Yi living there, most of whom are Lalo. Weishan and Nanjian counties, formerly one administrative unit known as Menghua, are considered the traditional homeland of the Lalo. In Baoshan Prefecture, Lalo speakers are also found in the surrounds of Longyang (the administrative name for the capital of Baoshan.

The topography of the Lalo area is marked by mountain ranges and deep river gorges that are typical of western Yunnan. Lalo tend live at higher altitudes than their Bai or Han neighbors, especially along the Ailao and Wuliang mountain ranges, both of which start in the Weishan/Nanjian area and extend to the southeast. Living at higher altitudes mean less fertile soil and less access to water than in the valleys, with resultant economic disadvantages.

1.2.4 History

As early as the Eastern Han dynasty (25-220 A.D.), loosely connected tribal clusters such as the Kunming and the Sui began the transition from a nomadic, pastoral lifestyle to an agricultural one in western Yunnan (You 1994). In 76 A.D., the Kunming people of Weishan County aided the Han dynasty in their defense of Dali's Yunlong and Yongping counties against the Ailao, a tribe from the Baoshan region (YNYZDC 1986). Though the Kunming people have not been definitively linked with any modern day ethnic group, there is a strong possibility that they were Burmic or Ngwi-speaking peoples, given their cultural characteristics and geographic distribution. There is therefore reason to believe that ancestors of the Lalo (and speakers of other Ngwi languages) have been in the Weishan area for over two thousand years.

Weishan and Nanjian counties in Dali Prefecture are widely considered to be the traditional homeland of the Lalo. Central Lalo speakers who have migrated out of Weishan to Nanjian and Jingdong counties even have a regional autonym linking them to the area. This group call themselves 'Misha-pa,' referring to the ancient administrative region known as Mengshe or later Menghua, which originally encompassed southern Weishan and northern Nanjian (Bai 2002). The last syllable -pa in 'Misha-pa' is Lalo for 'person,' so 'Misha-pa' means 'person from Misha' (pronounced Mengshe in Chinese) (Bai 2002). Mengshe is an historically important region that gave rise to the Nanzhao kingdom, a semi-independent state that challenged imperial China's hold over Yunnan during the Tang dynasty (618.907 A.D.) (Backus 1981, You 1994).

During the Tang dynasty, the Ngwi peoples surrounding Er Hai Lake and Baoshan were known as the Wu Man (literally 'black barbarians') (Backus 1981). The Wu Man of this area were already distinct from the Bai Man (literally 'white barbarians'), a group associated with the Bai. Around the middle of the seventh century, the Meng clan, part of the Wu Man tribal network, together with other chieftains around Er Hai Lake, loosely formed 'The Six Kingdoms', of which the Meng controlled the southernmost region known as Mengshe (Backus 1981). The population of most of the Six Kingdoms were Bai Man, with some Wu Man mixed in; however, the leading Meng tribe were definitely Wu Man (You 1994). Because of Mengshe's southern location in relation to the other chieftaincies, it was referred to as the Nanzhao (南诏), literally 'Southern Kingdom,' which became the standard way of referring to the entire kingdom under the leadership of the Meng clan.

Around 730 A.D., the Tang dynasty used the Mengshe Wu Man, headed by Piluoge, to fight off the Tubo (Tibetan) invasion of the Six Kingdom area and bring the rest of the Six Kingdoms under Tang dominance (Backus 1981, You 1994). The Mengshe were successful in beating back the Tubo, uniting the Six Kingdoms under their leadership, and thus founding the Nanzhao kingdom. The Tang made Piluoge 'King of Yunnan' as a reward for his service. In 742.747 A.D. the Tang used the Mengshe to put down a rebellion of the Eastern Cuan around Lake Dian, thereby increasing Nanzhao's area of influence. The Nanzhao rebelled against the Tang in 750 A.D., provoking the Tang into attacking Nanzhao three times. Each time, the Tang army was defeated at great cost. The Nanzhao continued to expand their influence to the north and south, until a succession of weak, pleasure-seeking kings weakened the Meng family power, and corruption and oppression taxed Nanzhao agricultural production to its limits. In 902 A.D. the Bai Man nobility staged a coup, killing the Nanzhao king and over 600 members of the Meng tribe. The Bai Man then established the Dali Kingdom, which was dominated by pre-Bai peoples.

From comments in *The Book of Southern Barbarians* (Fan Chuo 1961: 79), two aspects of the sociolinguistic context of Tang-era Dali are probable: 1) the Bai Man's speech variety was perceived as most similar to Chinese, and therefore 'more correct' than the Wu Man's, and 2) The Bai Man and the Wu Man did not speak mutually intelligible varieties, since they had to employ intermediaries to communicate their meaning. These aspects fit with the interpretation that the Bai Man were probably ancestors of the Bai people, and that the Wu Man were a distinct linguistic group. The Bai language has long been characterised by influence from Chinese, with large amounts of its lexicon borrowed from Chinese, to the extent that its status as a Sinitic or Tibeto-Burman language is controversial (Wang 2005). Therefore, from the perspective of Chinese historians during the Tang dynasty, the Bai Man's pronunciation would be deemed as 'more correct' than the Wu Man; this fits with the Bai sociolinguistic context. Backus (1981: 50) also links the Bai Man with proto-Bai.

Backus (1981: 50) further links the Wu Man of the Dali region with ancestors of the Yi. But 'Yi' is a contemporary ethno-political category that includes most Ngwi languages, even as it excludes certain Central Ngwi languages such as Lisu and Lahu. All branches of Ngwi were probably already separate by the time of the Tang dynasty; even Central Ngwi had probably already diversified by that time. Speakers of proto-Lisu, one of the Central Ngwi languages genetically closest to Lalo, were already distinct from the Wu Man of the Dali area, as evidenced by their distinct exonym 'Shi Man' or 'Shun Man' (You 1994). The Central Ngwi speakers who have traditionally occupied the Mengshe region are Lalo, and their regional autonym 'Misha-pa' specifically links them to the Mengshe region and the Meng clan. Also, many Lalo themselves claim to have used the surname 'Meng' (蒙) in the past and thus claim descent from the Mengshe tribe, the leaders of the Nanzhao. The current geographic distribution of the Lalo and the dialect diversity found in southern Dali both point to a Lalo point of origin in the very same locale from which the Meng tribe first came to power. The Nanzhao population most likely consisted of both proto-Bai and proto-Lalo speakers. The Meng clan, leader of the Nanzhao kingdom, is more likely to be ancestor to the Lalo than to any other language group.

After the destruction of the Nanzhao kingdom, many Mengshe escaped persecution by fleeing to other areas such as Yangbi and Fengqing (WSDC 1986). Some Meng changed their last name to

‘Cha’, ‘Zi’ and ‘Zuo’, surnames commonly found among the Lalo today (WSDC 1986). Others remained in the Weishan/Nanjian region, which in the Yuan dynasty (1271.1368) became known as Menghua. Menghua is now often used as an exonym to refer to Lalo groups who have migrated out of the Weishan/Nanjian area.

The Mongols invaded and destroyed the Dali kingdom in 1253 A.D., fully incorporating Yunnan as a political entity within China. Increased Han immigration to the Dali area placed increasing pressure on the Lalo people. During the Qing dynasty (1644.1912 A.D.), unsurpassed numbers of Han Chinese migrants poured into Yunnan, settling there and becoming a dominant influence in the area (Giersch 2006). Chinese-speaking Muslims, known as Hui, also became a major ethnic group, especially in the northern section of Weishan’s central valley (Atwill 2005).

These population dynamics served to push the Lalo out of Weishan’s central valley and into the mountains on either side, or out of the Weishan area altogether. Eka speakers report their migration from Weishan to have occurred 300-400 years ago, around the beginning of the Qing dynasty, a date which is also reported in the *Gazetteer of Shuangjiang County* (Zhao 1995). MD speakers claim to have left some 400-500 years ago, but the *Gazetteer of Gengma County* (GMXZ 1995) reports the migration to have occurred more recently, around 200 years ago. Yangliu and Xuzhang Lalo probably also migrated out of the Weishan area, though specific dates of migration are not available (BSDQZ 1998).

1.2.5 Linguistic ecology

Like all minority language communities in China, Lalo speakers are under considerable pressure to assimilate to Chinese. Lalo bilingualism in Chinese is widespread in urban areas, and language maintenance efforts are hindered by the lack of a standardised orthography. In Chinese language policy, one minority group theoretically speaks one language and should therefore use a single writing system. Lalo has been designated as belonging to the western dialect of Yi, so the government permits them to use ‘Standard Yi,’ an ideographic script that has been promoted for all Yunnan Yi (Bradley 2001). However, this script is based on traditional scripts belonging to other Yi groups, not Lalo. Lalo never shared in this tradition, and no Lalo are likely to be motivated to learn this complex ideographic script. Only a few materials have been published in Standard Yi, further decreasing the likelihood of its use by the Lalo. Sadly, it is unlikely that current language policy would permit the Lalo to develop an official orthography based on a Lalo variety. Language policy aside, being a member of a minority group brings certain benefits, such as additional points given on school entrance exams. Also, in counties and townships where Lalo are a significant proportion of the population, Lalo are often selected as local political officials.

Standard Mandarin is the language of education, though teachers in rural areas often speak Southwestern Mandarin, the local dialect of Mandarin spoken in Yunnan. The focus of education is the mastery of Chinese and its writing system. Due to the complications related to the Standard Yi script, no bilingual education materials have been used in Lalo schools. Bilingual education is not currently implemented for Lalo speakers on a county or prefectural level. However, in some primary schools in rural areas with a high concentration of Lalo speakers, Lalo teachers may informally explain the meaning of Chinese words in Lalo (P.L. Blackburn, personal communication, August 6, 2006). Lalo has felt the influence of the Chinese language for a long time, and there are many loanwords from Chinese into Lalo. Vocabulary related to modernisms such as ‘tractor,’ ‘school,’ etc., are all likely to be Chinese loans. However, even with these loans, the great distance between Mandarin and Lalo erects a substantial barrier to Lalo children in learning Mandarin; it is a totally alien tongue they are being required to master.

Lalo, Southwestern Mandarin and Standard Mandarin exist in a triglossic balance. Lalo is used in the home and as a means of intra-group communication. Southwestern Mandarin is the language used to address non-Lalos in the township marketplace or in public domains in rural areas. Standard Mandarin may be used in public domains and secondary schools in towns, but its use is often determined by the speaker’s confidence in his or her correct pronunciation.

Bilingualism in Lalo and Southwestern Mandarin is an attribute of many Lalos, and was already noted by British explorer H.R. Davies (1909) during his trek through Weishan in the early 1900’s.

Certain sections of the population, however, such as older women who have less access to education and less contact with non-Lalos, are considerably less proficient in Mandarin (P.L. Blackburn, personal communication, August 6, 2006). Men and younger people, especially those living closer to towns, are much more likely to be fluent Mandarin speakers. A growing proportion of Lalo parents living in towns, or in villages with a mix of Han and Lalo, may choose to only speak Mandarin to their children. On the other hand, in rural areas with a large concentration of Lalo, inter-generational transmission of Lalo still continues (see Chapter 8.2).

During the Qing dynasty, many Lalo reacted to the influx of Han and Hui migrants by moving (or being pushed) into mountainous regions that were further from Han domination, but also poorer in natural resources such as water and arable soil. Those Lalo groups who were able to establish a local society where the majority of social ties were with other Lalo have been able to maintain their language, as in the case of East Mountain Lalo.

An important aspect in the maintenance of these dense networks is marriage practices. Cha Shufang, a native speaker from western Weishan, reports that West Mountain Lalo tend to marry other Lalo, and that Lalo parents hope that their children marry other Lalo. Bride exchange is a practice in which brides marry into other Lalo villages and their home village receive brides from these other villages. This practice serves to create and strengthen networks between Lalo villages. As in the case of East Mountain Lalo and rural West Mountain Lalo in Weishan, this maintenance of Lalo-centered social networks has led to the strong ethnolinguistic vitality that is observed there today.

In contrast, the low level of vitality of Lalo in Nanjian County is a result of assimilation under the growing Han influence; it is reported that only half the ethnic population in Nanjian can speak Lalo (NJXZ 1993). Likewise, those Lalo who moved out of the Weishan region altogether, migrating south where they came into contact with Chinese and other minority groups, also tend to show much lower ethnolinguistic vitality (GMXZ 1995). The resulting diffuseness of the 'Lalo-ness' of their social networks is a contributing factor to their eventual assimilation to Chinese culture.

However, the vitality shown by rural Lalo also correlates to factors such as living in poorer, more mountainous regions, which make economic success much more challenging. The majority of rural Lalo are poor farmers, producing rice, potatoes and corn. Given the difficulty of making a living in such an environment, it is not surprising that young Lalo are drawn to the more lucrative jobs found in towns. Cha Shufang reports that most young people would gladly move to urban areas, and that it is only lack of opportunity that holds them back. Furthermore, she predicts that if a young Lalo does migrate, they would teach Chinese to their child and not Lalo. This choice is probably influenced by increased contact with Han Chinese and desire to integrate into Han Chinese-dominated society.

In urban settings, young Lalos' eagerness to assimilate and lack of interest in passing Lalo on to their children is also linked to an attitude that devalues Lalo identity. Many Han Chinese have a negative attitude toward Lalo as an identity and as a language. This attitude is usually expressed as a feeling that Lalo are 'backward,' as in less advanced than Han culture. Lalo themselves can sometimes internalise these negative attitudes, especially in urban settings where they are in close contact with Han society. This is a contributing factor to language shift among urban Lalo. On the other hand, many Lalo in western Weishan view the Lalo language as an integral part of identity (see Chapter 8.2). For those who value their identity as Lalo, this link with the language provides further motivation to pass it on to their children. Language as a core value linked with identity is an important factor in language maintenance (Bradley & Bradley 2002).

As of yet, there are no available printed materials for language maintenance work. The lack of any workable orthography for Lalo, caused by current language policy for the Yi, is a major barrier. However, non-print media such as VCDs (similar to DVDs but with less storage capacity) containing footage of Lalo songs, dances and festivals, are becoming more popular in Weishan. These could become an important tool in status planning for Lalo. Using modern media to promote Lalo culture and language could do much to combat negative attitudes towards Lalo as a backward language. In terms of corpus planning, though, Lalo is stymied at the pre-codification stage, and this is a major hindrance to any future maintenance work.

1.3 Previous research on Lalo

Although Lisu and Lahu, Lalo's sister languages, have been the subject of extensive research (Matisoff 1970, 1973 [1982], Bradley 1979a, 1994, 1997, 2006), there are large gaps in the research on Lalo. Until now, no documentation or comparative work on Lalo dialects, and therefore no reconstruction of Proto Lalo, has been accomplished or even attempted. The current consensus that Lalo has two dialects, East Mountain and West Mountain, is shown to be woefully inadequate. Central Lalo is the only Lalo dialect cluster to have been linguistically documented to any degree, being the subject of one reference grammar (Björverud 1998) and a handful of published and unpublished phonological sketches and wordlists. Locations of the data collection sites of these descriptions are presented in Table 1-2. Whether the source consists of a phonological sketch, wordlist, or both is specified in the column labeled 'Type'. As place names have changed several times in the intervening years since data collection, identifying the present day locations of the varieties described is difficult but possible through reference to geographic place name gazetteers from the 1980's.

Table 1-2: Previous research on Lalo

Source	Type	County	Township	Village cluster
Davies, H.R. (1909)	wordlist	Weishan	Dacang	Dianzhong
Björverud (1998)	both, and grammar	Weishan	Wuyin	Longjie
Huang and Dai (1992)	both	Weishan	Wuyin	
YNYF (1984)	wordlist	Weishan	Wuyin	
Hu and Duan (2000)	both	Weishan	Ma'anshan	Bijia
Blackburn, Blackburn & Cha (2007a)	wordlist	Weishan	Ma'anshan	Qingyun
Wang (2003: 60-64)	sketch	Weishan	Qinghua	Yangjiang
Wang (2003: 65.68)	sketch	Weishan	Miaojie	Gucheng
Chen, Bian, and Li (1985)	sketch	Weishan	Niujie	Aiguo
Chen, Bian, and Li (1985)	wordlist	Nanjian	Bixi	Zhonghua
Sun (1991)	both	Nanjian	Bixi	Zhonghua
Wang (2003: 69-73)	sketch	Nanjian	Bixi	Zhonghua
YNYF (1984): W Lalo	wordlist	Yangbi		
Lam and Lam (2008): E Lalo	both	Dali municip.	Xiaguan	Diaocao

Davies (1909) is the first modern record of Lalo, with a short wordlist from Dacang Township in Weishan County. Although Davies was only an amateur linguist, his transcription is still recognisably Central Lalo, probably East Mountain. Chen, Bian, and Li (1985), a sweeping survey of many Ngwi languages, is one of the first to mention a distinction between East Mountain and West Mountain dialects, but does not provide any evidence to substantiate the dichotomy. Other early work on Lalo are the wordlists in YNYF (1984) from Weishan and Yangbi counties. The wordlist from Yangbi is the only previous documentation of a W Lalo variety; unfortunately, the transcription is inconsistent and poor quality.

Björverud (1998) presents the most complete description of a Central Lalo variety, including phonology, morphology and syntax, based on her research in Longjie Village, Wuyin Township, Weishan. Björverud also provides a comparative wordlist in an appendix. While no other source comes close to Björverud's breadth and depth of information and analysis on the Lalo language, Björverud herself acknowledges that historical reconstruction and dialect comparison are outside the scope of her thesis. She therefore limits her description to the variety found in Longjie Village, with only occasional reference to varieties from surrounding villages.

Documentation of non-Central varieties is almost non-existent. YNYF (1984) is the only previous record of a W Lalo variety, and an unpublished 400-item wordlist (Lam et al. 2007) and unpublished phonological sketch (Lam & Lam 2008) are the only sources available on any E Lalo variety. This lack is probably due to the perception of Weishan and Nanjian counties as the traditional homeland of the Lalo, thereby attracting researchers' attention to the exclusion of other varieties.

The East Mountain and West Mountain labels are based on the groups' geographic distribution within Weishan: West Mountain speakers are located in the mountains to the west of Weishan County's main valley, and East Mountain speakers to the east. East Mountain Lalo (less than 10,000 speakers) has a much smaller population and more limited geographic spread than West Mountain, being mainly located in the northeast corner of Weishan County. Given 'East Mountain' and 'West Mountain's' geographic link to the topography of Weishan County, it is not surprising that these labels are only applicable to Lalo varieties within Weishan County. Eastern Lalo speakers in Dali municipality, just north of the East Mountain area, reject the label 'East Mountain,' and instead use a loconym linking them to Dali, not Weishan. The term *loconym,* coined by Matisoff, refers to a place name that has been extended to serve as the name of a group. Likewise, Central Lalo speakers living outside of Weishan also do not use the West Mountain loconym.

Chen et al. (1985) incorrectly affix the East Mountain label to other Lalo dialect groups besides those found in the northeast corner of Weishan. Wang (2003) and Zhu (2005) follow in this error. These sources are wide-sweeping surveys of Yi languages as a whole, and for lack of adequate information have failed to distinguish differences among Lalo subgroups. The result of this false dichotomy is a confusing demographic distribution: East Mountain varieties are claimed to range from Midu in the east all the way west to Baoshan Prefecture, located to the far west of the West Mountain area (Zhu 2005). The East Mountain label thus conflated the Central Lalo in northeast Weishan (the true East Mountain) and the Eastern Lalo spoken in Dali Municipality. Since villages in this area are geographically close to each other, wear a similar ethnic costume, and are located to the east of the West Mountain variety, the label 'East Mountain' may have seemed a good fit, but it does not correspond to linguistic reality.

1.4 Theoretical framework

In order to classify Lalo varieties, I use an integrated theory of dialectology that takes both synchronic and diachronic dialectal relationships into account. Phylogenetic relationships are investigated using theories and methods from historical linguistics. The approach to language change is based on a phonetically based theory of sound change associated with the work of Ohala (1993a, 1993b, 2003), and Labov's (2001, 2007, 2010) theory of sound change that integrates the tree and wave models. These ideas inform an implementation of the comparative method that does not discount the role of contact. Both linguistic and sociolinguistic criteria are incorporated for subgrouping, following Toulmin (2006, 2009). Synchronic relationships between Lalo varieties are explored using ideas from the field of dialectometry, which uses aggregation to quantify dialectal differences, and cross-dialectal intelligibility, that is, the levels of comprehension listeners show when listening to a related language variety.

1.4.1 Sound change

Ohala's phonetically based theory of diachronic sound change is limited to pure sound change, excluding psychological and social factors such as leveling of morphological paradigms and borrowing, and thus focuses on changes that occur as a result of physiological factors in the production and perception of speech. He also constrains his claims to 'mini' sound changes, that is, the variation in pronunciation that is the initial stage of sound change, rather than the 'macro' sound changes that have spread through the speech community.

The basic framework focuses on the central role of the listener's misperception of the acoustic auditory signal. Ohala (2003) notes that speech production and perception show synchronic variation that resembles diachronic change. For example, a close front vowel following a velar stop often conditions palatalisation of the stop, a phenomenon that sets the stage for the diachronic change [ki] > [tʃi]. The seeds of diachronic change are precisely this synchronic, subphonemic variation. The listener, who has extensive experience with variation, is often able to factor out the noise of variation to correctly interpret the acoustic signal. However, variation in speech can sometimes create enough ambiguity that the listener fails to normalise the speech signal, and a novel pronunciation norm develops— a mini sound change.

There are two main types of listener error, and both have relevance to sound change. Firstly, perceptual hypocorrection leads to assimilation: the listener fails to correct and takes the signal at face value. An example of this is the misinterpretation of 'in-perfect' as 'imperfect'. Secondly, perceptual hypercorrection leads to dissimilation: the listener inappropriately applies corrective strategies. For example, Matisoff's (1970) case of glottal dissimilation in Lahu: when the glottal prefix occurred on words in *Low-stopped tonal category that ended in a glottal stop, the final glottal dropped off and left the newly-contrastive high-rising tone in its wake. According to Ohala, dissimilation at a distance is likely to occur with features that tend to spread, such as glottalisation or labialisation. The presence of two glottal stops on the same syllable created maximal ambiguity, leading the listener to undo their effect by interpreting the glottalisation as only occurring on the initial and therefore leading to the loss of the syllable-final glottal stop. One key contribution of Ohala's model is the role given to experimental phonetics in explaining sound change. In keeping with this tradition, I use acoustic analysis of the tonal systems of Lalo varieties to look for the phonetic motivations of the tonal changes, discussed in Chapter 5.

In order to explain how a mini sound change spreads through a speech community to become a macro sound change, I follow Labov's (2001, 2007, 2010) synthesised model of sound change. Labov (2007) presents a reconciliation of the tree and wave models of language change. While he maintains the tree model as the primary output of the comparative method, he recognises diffusion as an important, albeit secondary, process. Each model is best suited for explaining phenomena associated with different mechanisms of language change, that is, change from below (language internal change), and change from above (contact-induced change). According to Labov, languages change mainly through two distinct pathways: incrementation, which happens during the transmission of language by adults to children, and diffusion, which happens through contact and is mostly conducted by adults. The two processes are different because of the different language learning abilities shown by children versus adults.

The tree model best fits the process of transmission, wherein children receive the entire language system as first language learners, including all of the system's complexity and inherent variation. As children faithfully replicate the system, they also relate the variants heard in the community with age, understanding that younger speakers have a distinctive linguistic identity through their differential use of the variable elements. Through generational differences in the use of variants, e.g., an increase in frequency of a variable, each generation of native speakers advance the incrementation of change beyond that of their caretakers. The family tree model is generated by this language internal change, which serves to increase the distance between sister languages.

In contrast, the wave model is useful when dealing with diffusion, which mainly occurs when adults come in contact with each other. As adult learners are limited in their capacity to grasp the complexities of the whole system, diffusion changes are usually at a less abstract level, such as borrowing lexical items or phonetically conditioned alternation, but not lexical or morphologically conditioned alternation. The effect of the transfer of features from one community to another is to diminish distances between languages.

Different social contexts favor either transmission or diffusion. Incrementation requires the unbroken sequence of parent-child transmission, and communities that show this type of change are usually characterised by geographic uniformity and stability through time. Diffusion, on the other hand, is associated with the movement of adults across speech communities for commercial or social reasons, such as that seen along trade routes.

Shared features may be a result of either shared innovation or diffusion, so distinguishing shared innovation, which is the result of shared incrementation of change, from diffusion is crucial for subgrouping Lalo varieties. Labov (2007) provides a general principle for teasing apart transmission versus diffusion type changes, based on the different language learning shown by adults and children. Incrementation often involves a greater degree of structural complexity than diffusion, while diffusion often shows less regularity and is less governed by structural constraints than incrementation. For example, Labov associates splits with transmission rather than diffusion, since adults rarely add new contrasts to their already formed phonological system. Conversely, chain shifts, in which whole subsystems interrelate and evolve together, are more closely associated with transmission than diffusion. Both splits and chain shifts are called on as important subgrouping criteria for Lalo dialect groups, as discussed in Chapter 6.

1.4.2 Reconstruction and subgrouping

In order to subgroup Lalo varieties, I first reconstruct Proto Lalo using the comparative method. Since subgrouping is based on shared innovations, a clear picture of the ancestor language is vital to the process of deciding which shared features are the result of shared innovations or retentions. The comparative method remains the most effective method for establishing linguistic phylogeny (Campbell & Poser 2008, Joseph 2008). Challenges to its efficacy, notably in Durie and Ross (1996) and Aikhenvald and Dixon (2001), serve to further refine awareness of the complexities of real-life linguistic ecology, such as contact-induced change, areal diffusion, dialect chains, and so on. Looking at the full sociolinguistic picture strengthens the comparative method as a diagnostic tool by providing a lens of interpretation that is grounded in social and historical interaction.

The comparative method is by nature a cyclical process built on educated guesses. As summarised in Ross and Durie (1996) and Campbell (2004), the process begins with a hypothesis that the languages in question are genetically related. My hypothesis is that all varieties that share the autonym of *Lalo* and/or affiliate under the exonym *Menghua* are related. To test this hypothesis, I compare the lexicons of these varieties, look for systematic correspondences, and establish which lexical forms are cognates. I then compare the cognate sets to the reconstructions of Proto Ngwi (Bradley 1979) and Proto Burmic (Lolo-Burmese) (Matisoff 2003), using these well-established reconstructions as a guide to the development of Proto Lalo. Once I have identified the regular correspondence sets, I look at irregular occurrences to see if they might be the result of contact-induced change or if they necessitate a further refining of the correspondence sets. Irregularity can be caused by a number of social and cognitive factors, such as lexical borrowing, onomatopoeia, avoidance of homophones, taboo words, and many more (Campbell 1996). In the Lalo situation, there is known contact between East Mountain Lalo and Eastern Lalo, so contact-induced change may be suspected when shared features between the two groups show irregularity. However, in areas where sociolinguistic interviews have established that contact between particular dialects is limited, irregularity points to a need for further delving into possible rules of sound change.

Once cognate sets have been established, I compare the various varieties' reflexes to reconstruct Proto Lalo. The reconstruction process is informed by commonly accepted principles as summarised in Campbell (2004): directionality of change, majority wins, factoring in features held in common, and economy (i.e., Occam's razor). Like Baxter's (1992: 20) reconstruction of Old Chinese, I strive for a reconstructed phonological system that is plausible from a synchronic viewpoint. After reconstructing the proto-phonemic system, I then reconstruct approximately 1,000 Proto Lalo morphemes, given in Appendix E.

The comparative method uncovers shared innovations, which I then use as isoglosses, revealing the geographic distribution of specific linguistic variables. The reconstruction of Proto Lalo enables the identification of unique shared innovations among Lalo varieties in lexicon, phonology and morphosyntax. Retentions are rejected as a basis for subgrouping. Innovations that are the result of drift, independent development, or contact, are also inadequate for subgrouping and are filtered out by requiring innovations for subgrouping to meet certain criteria, described below. This research focuses on innovations in lexicon and phonology. Phonological innovations are especially useful for classifying Lalo varieties, because as analytic languages they show a paucity of morphological marking. Lexical change that innovates both syllables in a compound word is also valuable for subgrouping (Bradley 2004).

Toulmin (2006, 2009) argues for a methodology of reconstruction and subgrouping that incorporates both linguistic and sociolinguistic factors. As I also seek to present an integrated picture of the linguistic and sociolinguistic relationships between Lalo regional varieties, I adopt Toulmin's three main criteria for evaluating shared innovations: 1) linguistic complexity of the innovation, 2) ecological distinctiveness of the innovation, and 3) sociohistorical plausibility. All three of these criteria are called on for substantiating the diachronic subgrouping of Lalo varieties given in Chapter 6.

Toulmin's first criterion refers to the principle that the more complex the conditioning of a change, the less likely the change developed independently. Morphologically conditioned phonological changes or changes that involve whole paradigms are especially valuable. Nichols (1996) refers to these types of changes as 'individual-identifying,' meaning that they have a low probability of happening independently, and thus they identify a unique proto-language. While Kessler (2001) criticises the statistical validity of Nichols' method for establishing the probability of a certain change occurring, the principle remains that more complex changes have a higher value for subgrouping than common or phonetically natural changes do. LaPolla (2000) suggests paradigmatic change in person-marking as a useful standard in Tibeto-Burman languages, but Lalo, like other Ngwi languages, does not mark person. Paradigmatic change in pronouns as a set and whole tone systems are examined. For example, the innovative suffix *-tsa*^{33} marking the plural form in the personal pronoun paradigm, with concurrent tonal assimilation of the preceding syllable to mid pitch, serves to group C, E, and W Lalo together.

The innovations identified in the subgrouping of Lalo, while substantial, are not at the same level of complexity required for grouping an entire phylum of languages together. The reconstruction and subgrouping process for Lalo varieties is at a micro-comparative level, that is, within a collection of closely related varieties/languages, as opposed to macro-comparison, which seeks to define relationships between far more disparate and distantly related languages, as in the Tibeto-Burman phylum (Matisoff 2001). The time depth for the diversification of Lalo varieties is relatively shallow, most likely within the past 500 years. As such, the standard of complexity for innovations that are individual-identifying for Lalo dialect groups is lower than it would be for a phylum of many distinct languages.

Toulmin's second criterion, the ecological distinctiveness of the innovation, refers to the uniqueness of the innovation in the context of the other languages of the area. If the innovation goes against the grain of the general areal trends, it is more ecologically distinctive. Most Lalo speakers show high levels of bilingualism in the superstrate language, Yunnanese Mandarin, and Lalo linguistic ecology is characterised by diglossia between the two languages. Innovations in Lalo varieties that show features shared with Yunnanese Mandarin are therefore less compelling evidence for shared history. For example, Yunnanese Mandarin has neither preglottalised sonorants nor harsh phonation. The loss of these features in Lalo varieties is widespread, found in almost all dialect groups, and may be construed as structural convergence with SW Mandarin. Given the sociolinguistic ecology, the diagnostic value of the loss of preglottalised sonorants and harsh phonation is low.

Toulmin's third criterion, sociohistorical plausibility, is based on the supposition that the occurrence of an innovation should co-occur with speakers' face-to-face interactions. Speaker interaction may be proven or reasonably posited through geographic contiguity and/or patterns of social interactions. The sociohistorical conditions must be attested by non-linguistic evidence, to avoid the circularity of arguing that because a group shares a particular innovation, they must have had a shared history, which then validates the use of that particular innovation in question.

Pittayaporn (2007a) and Toulmin (2006) both emphasise the importance of the relative chronology of innovations when proposing subgrouping criteria. Toulmin identifies three main ways for sequencing innovations: linguistic, textual, and sociohistorical. As Lalo does not have a textual tradition, linguistic and sociohistorical factors must be relied on for relative chronology of innovations. When a change feeds or bleeds the environment for another change, the two changes can be ordered relative to one another. For example, preglottalised sonorants blocked the development of Tone *1's low-rising tone split in W Lalo. The loss of preglottalisation must therefore be ordered after Tone *1's split. Sound change in loanwords can also help date sound changes. Dates of migration out of the Lalo homeland of Weishan/Nanjian are also useful for relative chronology. Ancestors of the peripheral group Eka left the Lalo homeland approximately

300-400 years ago, according to their oral history and Chinese sources such as Zhao (1995). The changes that characterise the Core Lalo group, which are not found in Eka, can therefore be dated as happening within the past three or four hundred years.

1.4.3 Dialectometry

While the comparative method is sufficient for establishing phylogenetic relations, a synchronic picture of how the varieties relate to each other is also useful, particularly one that is validated through perceptual experiments. Phonetic distance between varieties, as measured by Levenshtein distance, provides this alternate perspective. Levenshtein distance has been validated as approximating both speakers' perception of difference and levels of cross-dialectal intelligibility (Gooskens & Heeringa 2004, Gooskens 2006). Phonetic distance groupings should not be interpreted as phylogenetic groupings, although they may match the true phylogenetic tree, but rather as phenograms, diagrams that depict 'taxonomic relationships…based on overall similarity...without regard to evolutionary history or assumed significance of specific characters' (Dictionary.com). I therefore use phonetic distance as a complement to the comparative method. This perspective is helpful when considering the linguistic and sociolinguistic factors that go into language planning.

The traditional way of using isoglosses defines dialect groups categorically: either they possess a distinguishing feature or not. Cumulative patterns of phonological and lexical isoglosses are used as evidence of dialect borders. However, there are also isoglosses with complex distributions that muddy the picture. While isoglossic bundles suggest dialect borders, partial matches disrupt the border. The inability to deal effectively with partial matches has been identified as one of the primary weaknesses of traditional dialectology (Chambers & Trudgill 1998).

Another weakness is the subjectivity of the researcher when selecting 'significant' isoglosses to define a dialect area. The criteria for significant innovations described above form a qualitative heuristic, not an objective set of rules. There are also patterns in the dialect data that I have dismissed as insignificant from an historical point of view, but which may have social significance to the speakers.

In response to these criticisms of simplification and subjectivity, Séguy (1971) and Goebl (1982, 1984, 2006) pioneered the new field of dialectometry, which attempts quantitatively to measure aggregate differences between dialects. Nerbonne (2009) argues that aggregation enables more general characterisations of variation, such as the sublinear relationship between linguistic and geographic distance, as well as increased objectivity and external validation. The application of Levenshtein distance as a quantitative measure of phonetic distance grows out of this new perspective.

Levenshtein distance, also called string edit distance, is an algorithm that measures the least cost of transforming one string of information into another (Kruskal 1999, Heeringa 2004). Levenshtein distance aligns the segments of the two strings and computes the least cost of transformation in terms of substitutions, insertions and deletions. One of the advantages of Levenshtein distances over other string edit distance algorithms is that it will always find the alignment with the least cost. In dialectometry, Levenshtein distance measures the least cost of transforming one cognate's pronunciation into that of a cognate from another variety. An illustration of Levenshtein distance applied to Lalo varieties is given in Chapter 2.4.1. Levenshtein distance determines the overall pronunciation distances between pairs of varieties, resulting in a distance matrix.

Aggregative Levenshtein distance complements the weaknesses of subjectivity and ambiguous data. It includes every correspondence set, not just those selected by the researcher, so that overall patterns of variation reveal themselves, rather than the researcher imposing the classification from above. It exhaustively exploits the whole mass of data by measuring aggregate differences across the whole word list.

Kessler (1995) was the first to apply Levenshtein distance as a measure of dialect pronunciation differences in Irish. Heeringa (2004) showed that cluster analysis based on Levenshtein distances agreed remarkably with expert consensus on Dutch dialect groupings. More importantly, Levenshtein distance has also been validated experimentally through its strong correlation with subjective measures of similarity such as dialect perception and intelligibility. Gooskens and Heeringa (2004) found that Levenshtein distance and native speakers' perceptions of dialect difference were highly correlated and highly significant: $r = .67$, $p < .001$ (*r* represents Pearson's correlation coefficient and *p* represents the level of significance). In the perceptual experiment, native speakers of Norwegian listened to recordings of 'North Wind and the Sun' in different dialects and then rated the dialect on a scale of 1 to 10 in terms of difference to one's own dialect. Levenshtein distance was used to measure the distance between the pronunciations of cognates in the various dialects' texts. The resulting high correlation suggests that Levenshtein distance is a good approximation of perceptual distances between dialects.

Not only that, Levenshtein distance also shows a strong negative correlation with intelligibility test results for Scandinavian languages: $r = -.82$, $p < .01$ (Gooskens 2006). The negative correlation shows that the greater the phonetic distance between two varieties, the more difficult it will be for one to understand the other. Furthermore, Gooskens (2006) uses multiple regression analysis to show that phonetic distance is a more important factor in predicting intelligibility than attitudes of listeners or contact.

Previously, the application of Levenshtein distance had been limited to Indo-European languages. However, Yang (2009a) showed that hierarchical clustering based on Levenshtein distance paralleled that of historical-comparative analysis in Nisu, a Tibeto-Burman language. Also, Levenshtein distance showed a strong, significant correlation with intelligibility test results ($r = -.62$, $p < .001$) in Nisu. In Yang and Castro (2008), Levenshtein distance again showed a strong correlation with intelligibility for Bai, ($r = -.75$, $p < .001$) and Hongshuihe Zhuang ($r = -.72$, $p < .001$). These correlations suggest that Levenshtein distance is a good approximation of intelligibility for East Asian tonal languages.

In this book, I apply Levenshtein distance to twenty-four Lalo varieties' shared cognates to obtain a phonetic distance matrix. Data from all nineteen visited Lalo villages are included, plus data from six Lalo villages from Lam and Chan (2009). This distance matrix is then processed with network building and multidimensional scaling software, described in Chapter 2.4.3, to visualise the synchronic groupings of Lalo varieties. I also correlate Levenshtein distance with intelligibility test scores (Chapter 2.5) to provide external validation. Specifics of the Levenshtein distance algorithm are provided in Chapter 2.4.1.

1.4.4 Intelligibility

Another important aspect of the synchronic relationships between Lalo varieties is intelligibility, that is, the level of comprehension speaker A obtains when listening to speaker B. The criterion of 'mutual intelligibility' is often invoked in defining whether varieties are dialects of the same language or related languages (Wardhaugh 1986, Chambers & Trudgill 1998). One key weakness of this criterion is that non-linguistic factors, such as political autonomy, shared written tradition, or contact, are often more influential in determining the classification of 'dialect' vs 'separate language'. In China, Lalo has been classified as the Western dialect of the 'Yi' language, a classification influenced by both linguistic and political factors. Though it is not the purpose of this research to reclassify Lalo in an ethno-political sense, the low level of initial intelligibility between Lalo dialect groups should be acknowledged as a linguistic reality.

The development of intelligibility testing methods such as Casad (1974) was based on the assumption that speakers of dialects of the same language should be able to understand one another the first time they communicate. The ease of understanding is due to the similarity between the two varieties' linguistic systems, which makes it easy for listeners to assimilate the sounds they are hearing into their native system (Heuven 2008). Blair (1990) separates inherent intelligibility, which comes out of the relationship between varieties, and acquired intelligibility, which comes out of the relationship between speakers. Inherent intelligibility is homogeneous across the community, but acquired intelligibility is dependent on the amount of contact listeners have had with the other variety. The intelligibility testing methods used in this research focus on testing inherent intelligibility by screening out participants that have had exposure to the varieties being tested. In cases where contact cannot be factored out, the results may reflect acquired instead of inherent intelligiblity.

Milliken (1988) distinguishes initial intelligibility and long-term intelligibility, depending on the opacity of the sound correspondences that obtain between the two varieties. Some types of sound correspondence patterns do not obstruct comprehension, others may temporarily obstruct, while yet others cause major obstacles to long-term intelligibility. As speakers from dialect A are exposed to dialect B, they form hypotheses linking the variants they are hearing with their own phonological system. These hypotheses may or may not have to be revised; if revision is necessary, intelligibility is slowed down but not necessarily out of reach. When listening to another dialect, speakers link the sounds they hear to the most similar eligible phoneme in their own dialect. But complex correspondence patterns, such as the one illustrated below, render the dialect opaque to listeners from another dialect, no matter how frequent that correspondence set is.

For example, the divergent developments of Proto Lalo rhymes *a and *aŋ contribute to a complex vowel correspondence pattern between Eastern Lalo and Central Lalo, seen in Figure 1-3 below. In Eastern Lalo, *aŋ > /a/ and *a > /o/ in most reflexes but *a is retained as /a/ in high frequency words such as negation marker /ma^{21}/, whereas in Central Lalo, *aŋ > /u/ and *a remains /a/. These diachronic developments are seen in the first two boxes of Figure 1-3. The synchronic correspondences are seen in the third box: Eastern Lalo's /a/ sometimes corresponds to Central Lalo's /a/, but in words whose source had rhyme *aŋ, Eastern Lalo's /a/ corresponds to Central Lalo's /u/. Eastern Lalo's /o/ (from *a) corresponds to Central Lalo's /a/. This sets up an incongruent pattern in which Eastern Lalo's /a/ and /o/ may correspond with Central Lalo's /a/, while Eastern Lalo's /a/ may also correspond to Central Lalo's /u/.

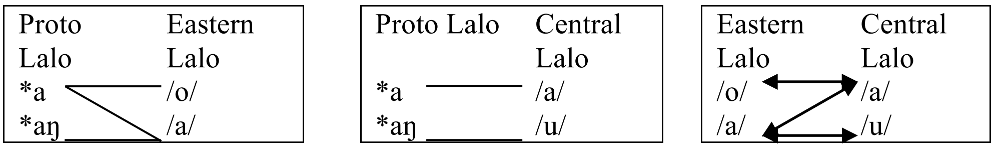


Figure 1-3: Complex vowel correspondence pattern

This complex pattern creates uncertainty during communication, because listeners cannot reliably connect the sounds they hear to their own phonological system. This uncertainty has been found to have a negative impact on cross-dialectal intelligibility (Milliken 1988, Moberg et al. 2007). This may partially explain the low intelligibility between Eastern Lalo and Central Lalo. Imagine the difficulty listeners from E-DC experience when trying to understand a speaker from CW-QY. In the conversation, the CW-QY speaker might say something like 'drink!' [du^{55}], but the E-DC listeners will probably not be able to connect this utterance to their word for 'drink,' [da^{21}] (from *daŋ^{1}). Instead, they may interpret it as 'get out!,' pronounced [du^{33}] in E-DC (from *do̱^{H} 'exit, leave') and similar in pronunciation to CW-QY's 'drink'. C varieties' reflex for 'get out' is harsh du̱^{33} [do̱^{33}], while most other varieties' show modal /du^{33}/ or /do^{33}/. Even if the context of the situation helps E-DC to understand CW-QY's meaning, the complexity of the correspondence patterns throughout the lexicon is such that misunderstandings are bound to arise.

Intelligibility testing, as described in Chapter 2.5, is used in this book as an external validation of Levenshtein distance and as a rough indicator of the impact of cross-dialectal difference on comprehension. The linguistic ecology of Lalo varieties, including their relationship to other languages spoken in the area, encompasses many sociolinguistic factors besides that of intelligibility, such as speaker perceptions of difference, inter-dialectal contact, and ethnolinguistic vitality. Several ecological aspects have already been introduced in §1.2.5. Besides quantitative measures of difference such as intelligibility and phonetic distance, I also use qualitative methods for exploring these factors, as described in Chapter 2.6 and 2.7.

1.5 Outline of the book

In this chapter, I set out the purpose guiding the research: to classify Lalo regional varieties from both a diachronic and synchronic perspective. The remainder of the book consists of seven chapters. Chapter 2 deals with the methodology used to investigate the diachronic and synchronic relationships between Lalo varieties, while Chapter 3 presents phonological sketches of sixteen Lalo varieties, most of which have never been described before. The reconstruction of Proto Lalo is the subject of Chapters 4 and 5: while Chapter 4 presents the reconstruction of Proto Lalo initials and rhymes, Chapter 5 deals with reconstructing Proto Lalo tones and the subsequent tone changes in modern Lalo varieties. Chapter 6 presents the diachronic subgrouping of Lalo varieties, and Chapter 7 presents the synchronic classification, as seen through phonetic distance, intelligibility, perceptions of difference and inter-dialectal contact. The concluding chapter then discusses the contributions and implications of this research. An overview of each chapter is given below.

Chapter 2 describes the methodologies used in order to answer the research question, and covers both data collection and analysis. Data collection includes the location of datapoints, protocols for wordlist recording and selection of participants. Data analysis includes a discussion of the acoustic analysis of tones, the Levenshtein distance algorithm, intelligibility testing, and qualitative methods for investigating speaker perceptions, interactions, and ethnolinguistic vitality.

Chapter 3 presents sketches of the phonological inventories of sixteen Lalo varieties under investigation. Because most Lalo varieties have never been documented before, this phonological analysis is a crucial first step to both the reconstruction of Proto Lalo and the classification of Lalo varieties. Phonologies of selected representative varieties of the four Core Lalo dialect groups (C, E, W, SE) and the four peripheral Lalo varieties are given in detail. Other varieties that affiliate with one of the dialect groups are given in less detail, and comparisons are made between the representative variety and other varieties within that dialect group.

Chapter 4 presents the reconstruction of Proto Lalo segmental phonology, including both initial consonants and rhymes. As this book is the first documentation of Lalo varieties, it is also the first attempt to reconstruct Proto Lalo. The reconstruction of Proto Lalo is a necessary foundation for the process of subgrouping; shared innovations can be distinguished from shared retentions only when the proto-language is reconstructed. My reconstruction of Proto Lalo is based on Bradley's (1979) Proto Ngwi (PN), Matisoff's (1972, 2003) Proto Burmic (PB), and historical-comparative analysis of 1,000-item wordlists from nineteen Lalo varieties. The Proto Lalo syllable template is *(C)VTP, in which one of 44 optional initials or clusters is followed by one of 9 obligatory rhymes, one of three pitch heights, and harsh or non-harsh phonation. Proto Lalo has palatalised labial and velar consonant clusters, alveolar and palatoalveolar affricates, and distinguishes between plain and preglottalised sonorants and fricatives. Its vowel system is fairly symmetrical, with three degrees of height and backness, one rounded front vowel *y and one nasal-final rhyme, *aŋ.

Chapter 5 presents the Proto Lalo tonal system and the subsequent tone changes that occurred in Lalo varieties. Beyond distinguishing Proto Lalo tonal categories, which do not differ substantially from Proto Ngwi, I use acoustic tonal analysis to provide evidence for the phonetic values of Proto Lalo tones. The Proto Lalo tonal system distinguishes three pitch heights (high, mid, low) and two types of phonation, harsh and non-harsh. In describing the tonal changes, I use recent developments in the understanding of the physiological production of tone and phonation types (e.g., Edmondson and Esling (2006)) to provide phonetic and perceptual explanations for the changes that occurred. Parts of this chapter have been published as Yang (2010).

Chapter 6 gives the diachronic Lalo subgroups, based on shared innovations that meet the criteria for subgrouping as described in §1.4.2. Based on innovations in onsets, rhymes, and tones, several lower-level Lalo dialect clusters can be identified: Central (C), Western (W), Southeastern (SE) and Eastern (E). In addition, there are several peripheral Lalo groups who migrated out of the Lalo homeland at various times: Xuzhang Lalu (la^{21}lu^{33}) and Yangliu Lalu (la^{21}lu^{55}pa^{55}) in Baoshan Prefecture, and Mangdi Lalo (lo^{21}lo^{33}pɑ̰^{21}) and Eka (o^{21}kʰa^{21}) in Lincang Prefecture. C, W, SE, and E dialect groups are linked to each other at a higher level that excludes peripheral groups, suggesting a core Lalo homeland in the Weishan/Nanjian area from which peripheral groups migrated outwards in separate waves.

Chapter 7 presents the synchronic classification of Lalo varieties, based on the results of quantitative measures of phonetic distance, intelligibility, and qualitative description of speaker perceptions and interactions. After presenting clusters based on phonetic distance, I also discuss the differences and similarities with the diachronic subgrouping described in Chapter 6. Phonetic distance and intelligibility test scores are found to be highly correlated at a significant level. The division between each of the dialect clusters is substantial enough to lead to low mutual intelligibility, a reality that must be considered in any future language development.

Finally, Chapter 8 discusses the contributions of this research and directions for future research. I first discuss the alarming degree of language endangerment seen in many Lalo varieties, underlining the urgency for further work in this area. I then summarise the big picture on Lalo varieties, recapitulating the correlations and discrepancies between the synchronic and diachronic classifications. The result is an elucidation of the historical and current, as well as linguistic and sociolinguistic, relationships between Lalo regional varieties.

2 Methodology

2.1 Introduction

This chapter presents the methods used to collect and analyse the linguistic and sociolinguistic data relevant to the diachronic and synchronic classification of Lalo varieties. Each method used enables a different piece of the puzzle to be placed; none of the methods are sufficient in themselves for a complete picture. From a diachronic perspective, the comparative method enables the depiction of relative degrees of phylogenetic closeness. From a synchronic perspective, the phonetic distance between varieties gives a snapshot of phonetic similarity that has been shown to approximate speakers' perceptions of difference and intelligibility (Gooskens & Heeringa 2004, Gooskens 2006).

While diachronic and synchronic perspectives provide the linguistic bases for classification, sociolinguistic tools are necessary for a more socially grounded representation. Speaker interactions through social contact and folk history are explored through sociolinguistic group interviews and the village leader interview. Speaker perceptions, such as speakers' ability to comprehend different varieties, are tested functionally through intelligibility tests and explored subjectively through interview questions dealing with perceived difference and prestige. Finally, the ethnolinguistic vitality of each datapoint is assessed by asking speakers about factors identified as critical in language maintenance, such as children's language proficiency and language attitudes (Bradley & Bradley 2002, Brenzinger 2007). The goal is a rich depiction of the language ecology of Lalo, particularly the relative degrees of genetic closeness, phonetic distance, intelligibility, contact, and speaker perceptions of intelligibility, difference, and prestige.

The tools used to answer these questions come from the related fields of historical linguistics and dialectology, as well as relatively new fields such as perceptual dialectology and dialectometry. I use the comparative method to look for systematic correspondences, compare that to the already reconstructed Proto Ngwi (Bradley 1979b) and Proto Burmic (Matisoff 2003), and then reconstruct the Proto Lalo phonological system and a lexicon of approximately 1,000 morphemes. Based on my Proto Lalo reconstruction, I then group varieties based on shared innovations after the Proto Lalo stage.

To gain a synchronic, dialectolometric snapshot of the variation, I use Levenshtein distance (Heeringa 2004), a tool from dialectometry, to measure the phonetic distance between the varieties, and quantitative processing methods such as NeighborNet (Bryant & Moulton 2004) and multidimensional scaling (MDS) to analyse the groupings. I also correlate Levenshtein distance with the intelligibility test results to provide external validation.

I test intelligibility within and across dialect clusters using a revised version of Recorded Text Testing (RTT) methodology (Casad 1974, Kluge 2007). I use sociolinguistic interviews developed from Nahhas, Kelsall and Mann (2005) and Pelkey (2008) to gain an understanding of how dialects and dialect differences are perceived by native speakers (see Appendix C for interview schedules). I ask speakers for their opinions on which varieties are most similar to their own speech and which varieties are the most important or most pleasant sounding, as well as degree of difference and difficulty in understanding. I also ask them what kinds of interactions they have with speakers of other varieties.

Finally, the levels of ethnolinguistic vitality seen in Lalo varieties are placed on an endangerment continuum according to UNESCO's (2003, 2009) and Krauss's (2007) scales of endangerment.

2.2 Data collection

2.2.1 Location of datapoints

Fieldwork conducted during 2008 entailed onsite data collection in nineteen Lalo villages in four prefectures and ten counties. Table 2-1 gives the locations and abbreviations for the Lalo varieties whose linguistic and sociolinguistic data form the basis of this research. East Mountain and West Mountain Lalo are represented by one variety each, CE-YA and CW-QY; other Central varieties are not labeled as West Mountain, since those speakers do not use that loconym. Figure 2-1 shows the locations of all Lalo datapoints, in Dali, Baoshan, Pu'er and Lincang Prefectures.

Tentative datapoints were primarily selected based on areas with a high concentration of Lalo speakers that had not already been the subject of documentation. These tentative datapoints were then discussed with Lalo speakers from the area, especially Lalo speakers from each county's Ethnic Minority and Religious Affairs Bureau (EMRA). Lalo government officials from the EMRA were invaluable in selecting villages that fit the following criteria: 1) varieties with high language vitality, and 2) varieties that differed from the speech of other locations in the same county. Varieties with high language vitality were chosen to ensure there would be available speakers and to provide a benchmark of vitality for the area. If varieties identified as highly vital showed signs of language shift, this implied that areas identified as less vital were even further down the endangerment scale. I also purposely sought varieties that were reported to be maximally different from other varieties in the area in order to access the widest possible range of Lalo dialect diversity.

Table 2-1: Locations of Lalo datapoints

Dialect group	Prefecture	County	Township	Village	Abbrev.
Central (East Mt)	Dali	Weishan	Yongjian	Yong'an	CE-YA
Central (West Mt)	Dali	Weishan	Ma'anshan	Qingyun	CW-QY
Central	Dali	Weishan	Wuyin	Longjie	C-LJ
	Dali	Yangbi	Wachang	Wachang	C-WC
	Dali	Yongping	Shuixie	Leba	C-LB
	Dali	Nanjian	Xiaowandong	Chajiang	C-CJ
	Pu'er	Jingdong	Anding	Qingsheng	C-QS
Eastern	Dali	Dali	Shijiao qu	Diaocao	E-DC
	Dali	Dali	Fengyi	Houshan	E-HS
	Dali	Dali	Taiyi	Taoshu	E-TS
Western	Dali	Yangbi	Taiping	Dutian	W-DT
	Dali	Yangbi	Longtan	Shuizhuping	W-SZP
	Baoshan	Longyang	Wama	Shanglizhuo	W-SLZ
	Dali	Yongping	Changjie	Yilu	W-YL
Southeastern	Dali	Midu	Micheng	Gaoping	SE-GP
Xuzhang	Baoshan	Longyang	Wafang	Xuzhang	XZ
Yangliu	Baoshan	Longyang	Yangliu	Yangliu	YL
Eka	Lincang	Shuangjiang	Heliu	Yijiacun	Eka
Mangdi	Lincang	Gengma	Hepai	Mangdi	MD

Figure 2-1: Location of all Lalo datapoints

2.2.2 Material and participants

Both the comparative method and dialectometric measures of phonetic distance require lexical data from the various varieties being compared, but previously, no linguistic data was available for most Lalo varieties. One contribution of this research is the collection of lexical data from previously undescribed Lalo varieties. The most important instrument for collecting this type of data is the wordlist, in which glosses are arranged in semantic categories and a bilingual speaker is asked to translate from the national language into their native language. To collect the necessary lexical data, I adapted Pelkey's (2011) wordlist, selected participants who were fluent native speakers, and carefully elicited and recorded the translated items.

Pelkey's (2011) wordlist, developed for Southeastern Ngwi languages, was created to be maximally comparable with other already published wordlists such as Bradley (1979), Matisoff (1978b), Chen, Bian, and Li (1985), Sun (1991), and Dai and Huang (1992). Björverud's (1998) wordlist of a Central Lalo variety also informed wordlist development. I added 'tile,' which has been shown to be useful for establishing Central Ngwi membership (Bradley 2004). I also pilot tested the wordlist in consultation with a linguistically trained native speaker of Central Lalo (CW-QY), Cha Shufang. Cha identified glosses that elicited a Chinese loanword in her dialect, as well as separate Chinese prompts in the wordlist that elicited the same word in Lalo; these glosses were eliminated. This process of adapting the tool continued for the first six datapoints. Pelkey's (2008, 2011) wordlist of 1,200 items was pared down to 1,001 items. Although this wordlist is insufficient to do an exhaustive phonological analysis, it is long enough to enable a basic phonological sketch, which is appropriate to the aims of this book.

One valuable contribution of Pelkey's (2011) work is the development of frames or carrier phrases that elicit the lexical item in the context of a complete phrase. This clarifies the meaning of the Chinese prompt for the word list participants by making its form class clear. Frames also enable the researcher to hear the tone of the lexical item in contrast with the tones of the framing words. Framing words on either side of the elicited item were chosen that usually had a mid level tone (e.g., [wu^{33}] 3SG, or [sa^{33}] 'three'), although different varieties did not always have mid tone on those particular words. Frames are useful as they discourage list intonation, in which the tone is changed because the speaker is trying to be careful or formal. When asked to speak a natural sentence, the speaker is more likely to pronounce the tone as it is spoken in natural speech. Because the lexical item is uttered in context of the framing words, tone sandhi may affect the tone, which is also useful for analysis. The ideal situation is to use the same frame on all lexical items, but this was not possible given the elicitation situation and the fact that the words are in various form classes. Pelkey (2008: 52.54) describes in detail the rationale for using multiple frames for different form classes, chosen for semantic plausibility to facilitate the speaker's participation. Appendix B is a reproduction of Pelkey's (2008) table of elicitation frame examples, also used in this research.

Once I arrived in a village, I requested that the village leader find several native speakers to be wordlist consultants. The leaders were asked to find bilingual speakers to ensure ease of communication; since most Lalo speakers are bilingual, this criterion was easily fulfilled. After several people showed up, I screened them with several introductory questions to ensure their availability and suitability for the task. Consultants were required to have parents who were native speakers from that village, to be native speakers themselves, to have been born and grown up in the village, and not lived away from the village for more than ten years. People who had married into the village from another village or township were not invited to continue. Often only men were available and/or willing to participate, although I asked for both men and women to participate. I always asked for two or three people to work together through the whole wordlist. The ideal was to have one person consistently give the lexical item and another give the carrier phrase, but this ideal sometimes clashed with the reality of the field situation. Sometimes only one person had time, or two people took turns giving both the lexical item and the frame. Age and gender of the wordlist participants is given in Table 2-2.

The process of elicitation followed a simple plan: Cha Jishun, my research consultant and a native speaker of Central Lalo, asked the wordlist participants how to say the Chinese prompt in their language, sometimes explaining the prompt in the local variety of Mandarin. The wordlist participants would discuss it among themselves if there was any uncertainty, and then Mr. Cha would begin the recording. He first recorded the ordinal number of the prompt and the Chinese gloss, and then motioned for the speaker to say the word in their native language slowly three times. Then he recorded the Chinese gloss of the frame, and again motioned for the second wordlist consultant to utter the frame slowly three times. The wordlist consultants were provided with a list of the Chinese prompts and frames to help disambiguate the meanings.

During elicitation, I probed for additional cognates and asked perceptual questions. When a form was given which differed from that already collected, I asked if the participants could also say the already collected form. Sometimes this probe got a negative response, e.g., 'No, that is how they say it in Location X;' other times, the consultant affirmed that the form was also in use in that area, with a similar or altered meaning, which I noted in a separate column. When a form was given that I perceived to phonetically match a previously given form, I asked if the participants felt the two forms had the same pronunciation, that is, if the two items were homophones or perhaps minimal pairs. If there was a difference, I recorded the consultant saying the minimal pairs carefully, in isolation and with the frame. This was at times invaluable for identifying contrastive phonemes. Often, as would be expected with isolating languages, the forms were homophonous, and participants would often respond, 'Yes, they sound the same but their meaning is different'. Sometimes this would prompt a whole string of homophones being given, which was also useful.

An Edirol R-09 digital recorder was used to record audio in uncompressed .wav format. Video recordings were also made using a Sony DCR-HC48 1MP MiniDV Handycam. All audio and video recordings, requiring over 100 GB of storage, were backed up on two external hard drives as well as DVDs.

Table 2-2: Biodata of wordlist consultants

Variety	Autonym	Speaker ref.	Citation	Frame	Age	Gender
CE-YA	la̱^{21}lu̱^{33}pa̱^{21}	YA1		✓	20's	M
		YA2	✓		20's	M
CW-QY	la̱^{21}ʔlu̱^{33}pa̱^{21}	QY1	✓	✓	20's	F
C-LJ	la̱^{21}lu̱^{33}pa̱^{21}	LJ1		✓	50's	M
		LJ2	✓		50's	M
C-WC	la^{21}lu̱^{33}pa̱^{21}	WC1	✓	✓	30's	M
C-LB	la̱^{21}lu̱^{33}	LB1		✓	30's	M
		LB2	✓		30's	M
C-CJ	la̱^{21}lu̱^{33}pa̱^{21}, mi^{55}sa^{21}pa̱^{21}	CJ1	✓	✓	40's	M
		CJ2	✓	✓	30's	M
C-QS	mi^{55}sa^{21}pa̱^{21}	QS1	✓	✓	40's	M
		QS2	✓	✓	40's	M
E-DC	la^{42}lu^{33}pu^{42}	DC1		✓	60's	M
		DC2	✓		50's	M
E-HS	la^{21}lɔ^{33}pɔ̱^{21}	HS1		✓	50's	F
		HS2	✓		50's	F
E-TS	la^{21}lu^{33}pɔ̱^{21}	TS1	✓	✓	30's	M
		TS2	✓	✓	50's	M
W-DT	la^{21}lu^{33}po^{45}	DT1	✓	✓	20's	M
		DT2	✓	✓	20's	M
W-SZP	la^{21}lu^{33}pa^{53}	SZP1		✓	40's	F
		SZP2	✓		40's	F
W-SLZ	la^{21}lu^{33}pa^{53}	SLZ1		✓	40's	F
		SLZ2	✓		40's	M
W-YL	la^{21}lo^{33}pa^{53}	WYL1	✓	✓	30's	M
		WYL2		✓	40's	F
SE-GP	o^{33}ti^{21}zo^{21}	GP1	✓	✓	30's	M
XZ	la^{21}lu^{33}	XZ1	✓	✓	40's	M
YL	la^{21}lu^{53}	YL1	✓		18	F
		YL2		✓	50's	M
Eka	o^{21}k^{h}a^{24}	Eka1	✓		60's	M
		Eka2		✓	30's	M
MD	lo^{21}lo̱^{33}pɑ̱^{21}	MD1		✓	40's	M
		MD2	✓		40's	M

Table 2-2 provides the group autonym, age and gender of speakers whose recordings provided the basis for the acoustic analysis (described in §2.3 below). These were the main wordlists consultants at each datapoint.

2.3 Acoustic analysis of tone

Acoustic analysis of synchronic tonal systems provides evidence for the phonological analysis (Chapter 3) and reveals possible phonetic motivations for tone change (Chapter 5). The acoustic analysis presented in this book is based on the utterance medial form, i.e., the form embedded in the carrier phrase. Utterance medial forms were usually preceded by a syllable with mid-level pitch that was unlikely to interact with the target syllable. Also, using utterance medial forms avoided the danger of list intonation, as discussed above in §2.2.2.

Monosyllabic, utterance medial target words were used, with nasal or liquid initials to avoid onset-related effects. For CW-QY, preglottalised initials in Tone 1 were also measured in a separate category to illustrate its Tone 1 allotones, as discussed in Chapter 5.3.1. For each tone, approximately 30 tokens were used (on average 10 lexical items, with three repetitions), for an average of 150 tokens per variety. Fundamental frequency (F0) measured in Hertz (Hz) was extracted using Praat language software (Boersma & Weenick 2009) with the _TimeNormalizeF0.praat script developed by Xu (2009). Xu's script measured F0 at 10 equally spaced locations throughout the vowels' duration, from the vowel onset to the vowel offset. The vowel onset can be distinguished from the preceding sonorant initial by its greater amplitude and relatively more jagged wave structure (Baart 2003). For each tone category, Hertz values were averaged for all tokens at each time point.

Hertz values were then transformed to semitones. The musical semitone scale, a psycho-acoustic scale, is a logarithmic transformation of the Hertz scale, and has been shown to better model speakers' intuitions about pitch difference than the raw acoustic Hz scale (Nolan 2003). The Hertz-to-semitone conversion used here is taken from the Praat 5.1.07 manual: semitones = $[12 \times \ln(H/100)]/\ln 2$, where H is the frequency in Hertz. The mean of Tone 3, the mid-level tone, was defined as the zero level pitch value and thus served as the benchmark for normalised pitch for each speaker, as in (Stanford 2008). In the tonal inventory diagrams, Tone 3 is marked with a dotted line to indicate its status as the pitch reference point.

Xu's script also enables measurement of the duration of the tone span. I began measurement of the tone span from the beginning of the vowel through the duration of the syllable. Pitch values on the initial consonant were excluded. I first averaged the actual durations of all tokens in each tone category for each speaker. I then used a paired two sample t-test for means (two-tailed) to test if differences in duration were statistically significant for the following tone categories: 2 (low) versus L (low, harsh), 3 (mid) versus H (mid, harsh), and 1a (high) versus 1b (low-rising). Shorter duration is a redundant feature of tones with harsh phonation (L and H) in most varieties that preserve the contrast between harsh and non-harsh phonation. Tones 2 and 3 are L and H's modal counterparts, and are thus expected to be longer in duration than L and H. Longer duration is a redundant feature of the low-rising tone in some but not all varieties that have that tone.

Table 2-3 gives the results of the t-test in varieties that were selected for acoustic tonal analysis presented in Chapter 5. 'Yes' indicates that the difference in duration is statistically significant at the $p < .05$ level in a two-tailed t-test. The tone given in the table is the longer of the two tones. Tones in harsh phonation are usually shorter than those in modal phonation, although L is unexpectedly longer than 2 in Eka. 'na' indicates that the tone category is not distinctive in that variety. Even though duration differences are not statistically significant in some varieties, e.g., CE-YA and C-LB, tonal inventories are given with actual time for all varieties for consistency's sake.

In summary, the tonal inventories in Chapter 5 are presented in semitones normalised for mean Tone 3 F0. Tone 3 is marked with a dotted line, and the number of tokens used (N) is given for each tone category. Average actual duration of each tone category is given along the x-axis.

Table 2-3: Statistically significant differences in duration of tone span. Yes indicates $p < .05$ in a paired two sample t-test for means (two-tailed).

	2 (low) vs L (low, harsh)	3 (mid) vs H (mid, harsh)	1a (high) vs 1b (low-rising (lr))
CW-QY	Yes, 2	No	na
MD	No	Yes, 3	na
Eka	Yes, L	Yes, 3	Yes, 1lr
W varieties	No	No	Yes, 1lr
E-DC	Yes, 2	na	No
YL-old	No	No	No
CE-YA	No	No	No
C-LB	No	No	No
XZ	No	No	No

2.4 Measuring phonetic distance

2.4.1 The Levenshtein distance algorithm

Levenshtein distance aligns the phonetic segments of two cognates and computes the least cost of transforming one cognate into another in terms of substitutions, insertions and deletions. Figure 2-2 below illustrates Levenshtein distance between the pronunciations for the word 'tiger' in CW-QY (/la^{21}pa̠^{21}/) and E-DC (/lɔ^{21}pu^{42}/). Tone is represented by onset and following contour (e.g. low-even as LE, mid-falling as MF), as explained in §2.4.2 below. Phonetic distance results are given in §7.2.

Figure 2-2 below demonstrates the phone string comparison method, in which differences are binary: either the sounds are the same, with no transformation cost, or they are different, with a cost of one. Consonants and vowels are kept distinct. Insertions, deletions, and substitutions are all weighted the same. Heeringa, Kleiweg, Gooskens and Nerbonne (2006) and Heeringa (2004) found that using binary segment differences was equally valid with that of using gradual measures of distance between segments (i.e., comparing feature bundles). That is, using binary measures, the correlation to perceptual experiment results was equally high with that of gradual measures.

This is a surprising result if viewed from the perspective of historical linguistics. One would expect that transformations between sounds that are more similar should have less weight, just as they do in historical linguistics. McMahon and McMahon (2005) criticise the phone string comparison for this bluntness. However, the external validation of this method comes from perception experiments, and justification of the method also comes from examining how a native speaker processes differences. Heeringa (2004) suggests that because native speakers are sensitive to very slight differences in pronunciation, this weighting of small differences makes sense in the context of the correlation between Levenshtein distance and speakers' perceptions. As discussed in §1.4.4, small differences impact intelligibility due to the correspondence relations between the two compared phonological systems, not whether the sounds are judged alike or similar by external criteria.

In order to prevent longer words from having undue weight in the calculation of average distance, a normalisation function is used in which the total cost is divided by the longest alignment, as in Gooskens and Heeringa (2004). The distances are then expressed as proportions in decimal form. In Figure 2-2, the total cost of 5 is divided by 9, the alignment length of the two cognates, for a normalised cost of 0.56.

Location	Transcription	Operation	Cost
CW-QY	la^{LE}pa̠^{LE}		
	la^{LE}pa^{LE}	delete _(harsh voice)	1
	la^{LE}pa^{LF}	substitute F for E	1
	la^{LE}pa^{MF}	substitute M for L	1
	la^{LE}pu^{MF}	substitute u for a	1
E-DC	lɔ^{LE}pu^{MF}	substitute ɔ for a	1
		total cost	5
		normalised cost	0.56

Figure 2-2: Operations in calculating Levenshtein distance

The wordlists are processed using the Gabmap dialectometry software package (Nerbonne, Colen, Gooskens, Kleiweg, and Leinone 2011), freely available on the web at http://www.gabmap.nl. The mean Levenshtein distance is calculated for each pair of varieties based on the Levenshtein distances between all cognates in Swadesh's (1955) 200 wordlist, a subset of the 1,001 item wordlist, resulting in a distance matrix. When measuring phonetic distance, lexical variation is filtered out, and only cognates are accepted as data. However, Lalo is an analytic language with many polysyllabic words, in which one syllable may be cognate with other dialects, but the other syllable may not be. To filter out this 'sub-lexical' variation would place the Levenshtein distance at the morpheme level, not the lexical level, thus removing it even further from the context in which communication occurs. Therefore, I chose not to remove the non-cognate syllables in polysyllabic words. When two words had no overlapping syllables, I treated them as different lexemes. I also excluded Chinese loan words and items in which the Chinese gloss elicited a phrase rather than a lexeme. In total, 175 sets of lexical items were compared.

2.4.2 The representation of tone

Contour tone is a distinguishing characteristic of many East Asian language families; the often complex tonal systems found there call for further refining of the Levenshtein distance method. The first question in dealing with tone is: how important is tone in affecting perception and intelligibility? Gooskens and Heeringa (2006) examined dialect data in Norwegian, which only has two level tonemes, and found that prosody in Norwegian as measured by Levenshtein distance showed only a weak correlation with perceived distance ($r=.24$, $p<.01$) and could only explain 6% of the variance. However, in their perceptual experiment with Chinese dialects, Tang and van Heuven (2007) compared natural speech recordings with recordings that had the pitch variations synthetically removed. They found that listeners made better subjective judgments about dialect distance with the tonal recordings than with the recordings that had the tonal information removed. They suggest that for 'full-fledged' tone languages like Chinese, tone has a significant impact on how differences between dialects are perceived.

Yang and Castro (2008) investigated the importance of tone's role in cross-dialectal intelligibility and found it to be significant in both Bai, a Sino-Tibetan language, and Hongshuihe (HSH) Zhuang, a Northern Tai language. We applied Levenshtein distance to word lists from *Bai Dialect Survey* (Allen 2004) and *Hongshuihe Zhuang Dialect Intelligibility Survey* (Castro & Hansen 2009) and correlated the results with intelligibility test scores obtained during the respective surveys. We measured the Levenshtein distances based on tone and segments separately, and then used multiple regression analysis to see whether tone or segments had the greatest relative constribution to intelligibility. Tone was a significant predictor of intelligibility in both Bai and HSH Zhuang, able to explain 56 percent of the variation in Bai and 43 percent in HSH Zhuang. In the case of Bai, tone was a more important variable than segments. This suggests that, in tonal languages, differences in tone have a significant impact on intelligibility.

Since tone has been shown to be a significant factor in intelligibility, using an optimal representation of tone in the transcriptions used for Levenshtein distance is an important question, one addressed in Yang and Castro (2008) with data from Bai and HSH Zhuang. We evaluated six representations of tone by correlating the Levenshtein distance using each tone representation with intelligibility. We then used Meng, Rosenthal and Rubin's (1992) test on correlated correlation coefficients to see if any of the correlations were significantly stronger than the others. Phonetically explicit representations, which include information on tonal onset, contour, and offset, were compared with more phonemic representations of tone such as autosegments and targets.

Phonologists often represent tone as autosegments of H(igh) and L(ow) attached to a tone-bearing unit (Duanmu 1994, Zsiga & Nitisaroj 2007). Contour tones like rising or falling are represented as a sequence of autosegments, LH for rising and HL for falling. Xu and Wang (2001), however, propose a Target Approximation (TA) model, in which targets can be static (register tones, e.g. H or L), or dynamic (contour tones, e.g. R for rising).

A more explicit way of representing tone was also used, which included the tonal onset (H for high, M for mid, L for low), contour shape (R for rising, F for falling), and tonal offset. Concave and convex contours were represented by the sequences FR (concave) or RF (convex). This representation of tone is at a more phonetic level, rather than the more abstract, phonemic level used in autosegmental and target representations. Yang and Castro included two variations of this more explicit representation: onset-contour and contour-offset. Both the autosegment and TA models agree that it is the offset, or target pitch, of the tone that is most salient to the production and perception of native speakers. However, if the listeners operate more as non-native speakers, they may also use tonal onset as a perceptual cue.

Yang and Castro also included Chao's (1930) system of transcription, since this is the most widely used method of transcribing tone in East Asian tone languages. This notation treats tone as a sequence of pitch levels (5 for high, 1 for low), which may not be the optimal representation when modeling intelligibility. The disadvantage of this system is that it treats tone as a series of discrete pitch levels, leaving out explicit information about the contour shape (e.g., rising or falling) that listeners may use in cross-dialectal comprehension.

For both languages, phonetically explicit representations of tone that included information on tonal onset and contour were superior to others. Representations at a more unspecified, phonemic level such as autosegments and targets showed a weaker correlation with intelligibility. This suggests that phonetic detail is important to include in the representation of tone in Levenshtein distance when correlating phonetic distance with cross-dialectal intelligibility.

For Zhuang, onset and contour were essential ingredients for an optimal approximation of intelligibility, while contour-offset was shown to be less than optimal. But for Bai, contour-offset proved superior to autosegment, target, and Chao's pitch numbers. Thus, Yang and Castro could not confirm which is more perceptually salient to cross-dialectal listeners, the onset or the offset. However, given that both Bai and Zhuang show onset-contour as superior, whereas contour-offset is shown only to be optimal in Bai, preference may be given to onset-contour representations.

One explanation for why onset-contour is optimal can be found by examining the types of tonal correspondences that exist between the Bai dialects. The distinguishing innovation for Southern Bai is the mid rising (35) tone corresponding to Central and Northern Bai's high level (55) tone. Both onset-contour-offset (i.e., MRH vs HEH) and onset-contour (MR vs HE) weigh the distance between 35 and 55 at least twice the amount of the other representations. Even though these two tones end up at the same pitch level, they begin at different levels and have different contour shapes, making them difficult for cross-dialectal listeners to assimilate into their own system. Thus, the greater the weight assigned to this kind of difference, the better the inverse correlation with intelligibility.

2.4.3 Analysing the Levenshtein distance matrix

2.4.3.1 NeighborNet network analysis

The output of the selection, coding, and quantification of phonetic data described above is then processed by the network-building program NeighborNet as well as multidimensional analysis (MDS). NeighborNet, first developed by Bryant and Moulton (2004) for use in evolutionary biology, is freely available in the SplitsTree 4 package (Huson & Bryant 2006). Quantitative historical linguist April McMahon and biologist Robert McMahon (2005, 2008) use NeighborNet to give implicit phylogenetic trees based on lexical comparison. Likewise, Pelkey (2008) applies NeighborNet to shared cognate percentages between the more than 20 languages affiliated with the Phula ethnonym.

Lalo varieties, however, are much more closely related to each other than, say, Indo-European languages, or even the Phula languages. The time depth of divergence among Lalo varieties is much shallower than the languages mentioned above. McMahon et al. (2007), in their investigation of English dialects, find that at the level of dialect classification, lexical distance is less useful than phonetic distance, as there is rarely enough lexical difference between vocabularies to reveal fine-grained distinctions. I estimate that most Lalo varieties share between 80% and 100% of their vocabulary. I therefore use Levenshtein distance to measure phonetic distance, and then feed the phonetic distance matrix into the NeighborNet algorithm.

In contrast to lexically-based phylogenetic networks, the use of NeighborNet here is primarily phenetic, not cladistic. Phenetic analysis is based on varieties' overall phonetic similarity, unlike cladistic, which is based on historically significant shared innovations. NeighborNet phenograms (diagrams representing phenetic relations) present a snapshot of cross-varietal relations that includes all synchronic similarity at the phonetic level, whether the similarities are the results of retentions, shared innovations significant for subgrouping, contact-based change, or parallel developments. McMahon et al. (2007) uses NeighborNet in a very similar way to quantify the degree of difference between English dialects, pointing out that the goal in this kind of dialectometry is to reveal synchronic relationships, not diachronic ones. As such, the NeighborNet phenograms presented in this book do not illustrate genetic relatedness; rather, they depict the relative phonetic distance between closely related varieties. The phenograms produced have much in common with the Lalo phylogenetic tree, but are not identical, due to parallel developments, shared retentions, and inter-varietal contact.

Of course, differences in the pronunciation of cognates can arise from historical divergence. However, a regular change that may not be important from a historical perspective, but that affects a large number of words, will have a relatively larger impact on the Levenshtein distance than historically important changes that only affect a few words. For example, the *a rhyme occurs frequently, so that the lexical items in the Central Lalo /a/~ E Lalo /o/ correspondence set are quite numerous (over 10% of the wordlist). Levenshtein distance will count that difference every time it occurs, so this one regular change contributes more to E-C distances than a change that only occurs, say, in 1% of the words. The weight given to this correspondence set is justified from a synchronic perspective, however, because of the resulting complex correspondence pattern's impact on intelligibility and perception of difference.

As McMahon et al. (2007) note, one of the advantages NeighborNet brings is the ability to represent multiple tree structures in a single diagram. If there are similarities that are incompatible with one tree, NeighborNet still represents them through reticulated lines that form a net-like structure. In this way, ambiguities or mixed signals in the data are made explicit, instead of being collapsed into a single line as they are with tree-building programs such as the Neighbor-joining method (Saitou & Nei 1987), also available in the SplitsTree4 package. The Neighbor-joining method first clusters the two nearest varieties, then joins the next closest variety to the first cluster, and so on until all the varieties are added. This method is reviewed positively by Nichols and Warnow (2008) in their evaluation of computational phylogenetic methods. However, the Neighbor-joining method only represents one tree at a time, without reflecting all the ambiguities inherent in Lalo's complex inter-varietal relationships, which include shared history and contact.

NeighborNet, in contrast, has the advantage of representing all the signals in the data, regardless of whether these signals fit in a tree or not.

This advantage is illustrated through comparing Figure 2-3, Figure 2-4, and Figure 2-5 below. This illustration is adapted from McMahon et al. (2007). Figure 2-3 shows a NeighborNet reticulation, or rectangle, joining four Central varieties: WC, LB, QY and LJ. Figure 2-4 shows one of the encapsulated or collapsed trees built by the Neighbor-joining algorithm, and Figure 2-5 shows another. CW-QY and C-LJ share the similarity that they have retained preglottalised initials, and C-WC and C-LB share the innovation of a split in *a resulting in contrastive /a/ and /ɑ/. Thus, Figure 2-4 groups QY-LJ versus WC-LB. On the other hand, QY and WC share the change of *bo > [fi], and LB and LJ share the change of *bo > [dʑi]. Thus, Figure 2-5 groups QY-WC versus LB-LJ. Both Figure 2-4 and Figure 2-5 lose information by forcing the data to fit a tree structure; each tree shows one set of shared similarities between one pair of varieties. In contrast, Figure 2-3 is able to show all sets of similarities between all pairs of varieties. NeighborNet will only produce a tree when the data actually fit a tree-like pattern; it is therefore an optimal way of representing dialect networks, which often have complex, partially conflicting isoglossic patterns.

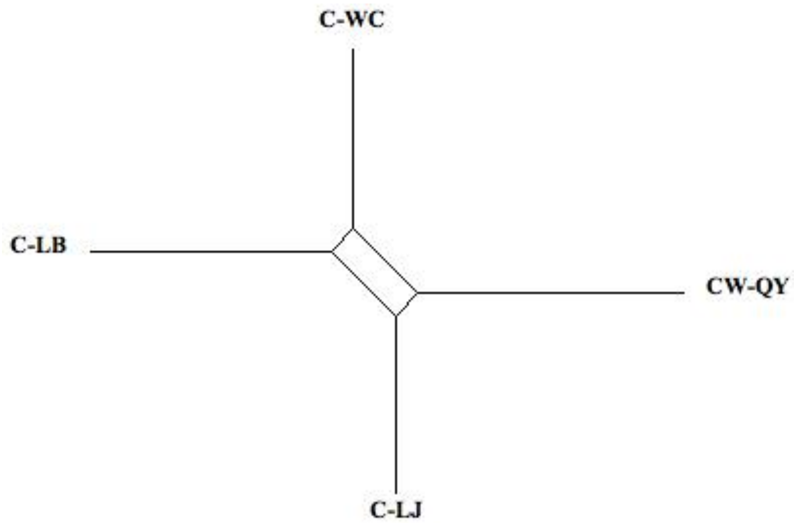


Figure 2-3: NeighborNet reticulated rectangle

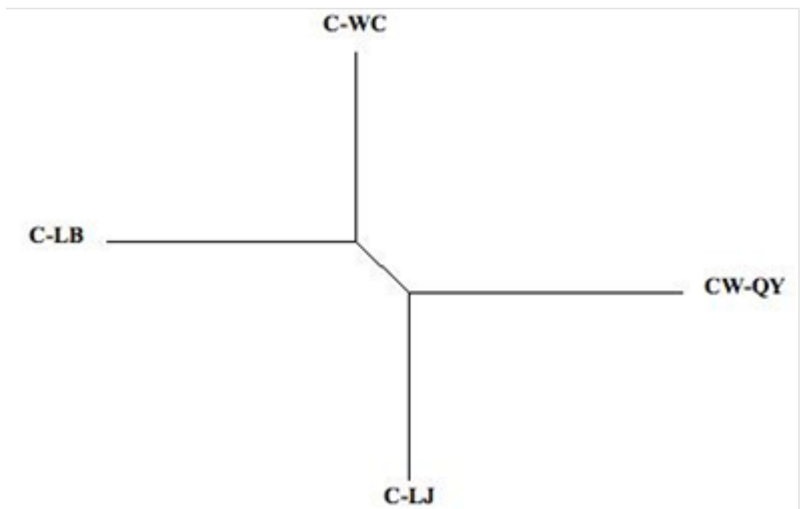


Figure 2-4: Neighbor-joining tree 1

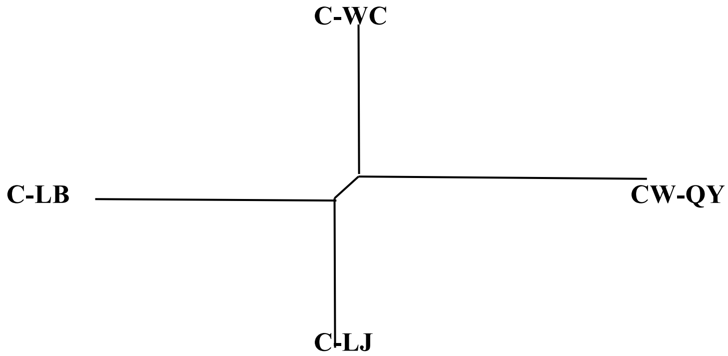


Figure 2-5: Neighbor-joining tree 2

2.4.3.2 Multidimensional scaling

Multidimensional scaling (MDS) is a set of techniques used to assign a position in a low-dimensional space for each element in a distance matrix, so that the relative distance between each element corresponds as closely as possible to the distance matrix (Torgerson 1952, Cox & Cox 2001). In the case of dialectometry, the Levenshtein distance matrix provides the distance between each pair of varieties. MDS represents each variety by a point in a multidimensional space, arranged so that varieties that are more phonetically similar are closer to each other, and varieties that are more dissimilar are further apart. I use two-dimensional, Euclidean space for representing Lalo varieties.

There are several types of MDS, including Classical MDS and Kruskal's (1964) non-metric method. Kleiweg (2004), in his tutorial on the RuG-L04 software, recommends Kruskal's method as often giving the best results. In Kruskal's method, only the rank order of entries in the distance matrix is treated as significant, not the actual distance values (UNESCO 2008). For example, the most distant varieties in the distance matrix should be the most distant in the MDS space, and the most similar varieties should be the closest. Kruskal's method finds a configuration of varieties that best matches the rank order of phonetic distances between Lalo varieties.

MDS, like NeighborNet, provides a way of visualising the relationships between Lalo varieties without forcing them into a tree. MDS does not explicitly cluster the varieties together at all, but instead presents them as they interrelate to all other varieties. Varieties may form a visual cluster by all being located near each other, as is clearly the case with Central varieties (see §7.2.2). In this way, MDS provides yet another perspective on synchronic relationships, in addition to the network model presented by NeighborNet.

2.5 Measuring intelligibility

Recorded Text Testing (RTT), first developed by Casad (1974), measures cross-dialectal intelligibility. An RTT is a short narrative recorded in dialect A and played to a listener from dialect B. The dialect B listener then answers content questions about the narrative, and the percentage of correct answers is interpreted as their comprehension level of dialect A. Blair (1990) and Grimes (1995) provided further updates and revisions, and Allen (2004) and Castro and Hansen (2009) carefully applied RTT procedures to speakers of Bai and HSH Zhuang, respectively. Lalo RTT results are given in §7.3.

Kluge (2007) introduced an important change in the testing procedures by eliminating the question and answer (Q&A) format, which was found to be culturally inappropriate in many field situations. Instead of answering questions formulated by the researcher, listeners were asked to retell the content of the story in their own words, section by section. This method does not suffer from the loss of intelligibility information seen in the Q&A format; however, the retelling format requires a longer time to process than Q&A. The retelling method was used in this research and is described below.

First, a speaker native to the village related a short narrative, typically one to three minutes long, which was recorded and then divided into sections, usually no longer than 10 seconds. A speaker bilingual in Chinese and the Lalo variety in question translated the text, section by section, into Chinese. The text was then pilot tested on native speakers in order to verify that the researcher understood the text in the same way as native speakers and to identify the common elements of the story that were retold by all native speaker participants. Participants in the pilot test were first interviewed to determine their suitability. Participants were selected whose parents were native to the locale, who themselves grew up in the village, and who were fluent, native speakers of the language. Although fluency in Chinese was not a requirement for participation, the rate of bilingualism among Lalo is such that all participants were also fluent in Chinese and thus were able to give their answers directly in Chinese without the use of a translator.

Participants first listened to the whole text, and then listened again section by section. Instead of responding to a question after listening to each section, the listeners were simply asked to retell the section in Chinese. The researcher wrote down their responses. If one response was exactly the same as a previous participant's response, the researcher used a different colored pencil to underline the content that was repeated. The pencil colors were linked to participant identifiers to keep clear who said what. After eight participants pilot tested the text, elements that all of the participants retold were identified and formed the baseline for scoring responses for participants from other varieties. By first pilot testing the text in this way, comprehension levels seen in cross-dialectal listeners scores were comparable to a native speaker's comprehension of the same text. For example, the story collected in CW-QY recounted an incident in which the storyteller was chopping firewood and accidentally cut his leg with his knife. Figure 2-6 below shows how three different responses of the pilot test participants help to identify what are the core elements that are salient to them in their re-telling.

Translation of segment 1:
In the beginning of the fourth month, I went to the hills to put my domestic animals out to pasture and while there to cut firewood.
Participant 1:
In the *fourth month*, I went to the hills to *let my goats graze* and cut firewood.
Participant 2:
On the first day of the *fourth month*, I went to *let my goats graze*.
Participant 3:
On that day in the *fourth month*, I went to the hills to *let my goats graze* and cut firewood, letting my goats graze as I cut firewood.

Figure 2-6: Excerpt from CW-QY RTT: identifying core elements

All of the participants mention the time of the incident ('the fourth month') and what the storyteller's purpose was in going to the hills (to put his domestic animals out to pasture). However, some of them do not mention the incidental goal he had of cutting firewood. Therefore, the element 'to cut firewood' was not included in the baseline score when testing participants from other villages. Although he does not say 'goats,' native listeners interpret the category name 'domesticated animal' to specifically mean goats, as Lalo often raise goats. When testing participants from other villages, goats and any other domesticated animal were accepted as correct answers.

Once the core elements were identified based on the pilot test participants' responses, a score sheet was made that contained the complete translated text divided into the sections used in the test, with the core elements listed in a column beside each section. See Appendix D for an example score chart from CW-QY.

When administering an RTT, the same selection procedures were used as for pilot test participants, with the added stipulation that the participant must not have come in contact with a speaker from the varieties the participant was being tested on. The requirement was that the participant had not lived in the area where the tested variety was spoken for more than one month.

Although this could not eliminate casual contact at a market or festival, it still enabled the screening out of participants who had acquired instead of inherent intelligibility.

After screening, one participant would individually listen to the whole RTT, and then listen again section-by-section. After each section, the participant was asked to retell the content they had just heard in the played section. Sections were never longer than 10 seconds, ensuring that the RTT was not testing their memory but rather their comprehension. If the participant's response contained the core elements, the researcher underlined these on the score sheet. If the participants added some content that was not in the recording, or gave an answer that did not match the content of the translation, their response was written down on the score sheet. After they finished their retelling, their final score was how many of the core elements they mentioned in their answers. A score of 100% indicated that the cross-dialectal listener understood the text to the same extent as that of a native listener, while a lower score indicated a comprehension level lower than that of a native listener.

Table 2-4: Locations of RTT tests

Text: / Listener:	CW-QY	C-LJ	E-HS	E-DC	W-DT	W-YL	CE-YA	C-CJ	C-WC
MD	✓	✓		✓			✓		
Eka	✓								
YL	✓								
W-DT	✓	✓		✓					✓
W-YL	✓	✓			✓				
W-SLZ	✓		✓			✓			
XZ	✓		✓		✓	✓			
E-TS	✓*								
E-DC	✓*		✓						
E-HS	✓*								
SE-GP	✓		✓				✓		
CE-YA	✓			✓					
CW-QY			✓						
C-WC	✓	✓		✓					
C-QS	✓	✓						✓	
C-LJ	✓			✓			✓		
C-LB	✓	✓	✓		✓				
C-CJ	✓	✓							

Table 2-4 above shows the locations of RTT tests, i.e., what texts were tested in what locations. Pilot tests (not included in Table 2-4) were done at almost every datapoint, but only a selection of RTT tests was administered in other villages. This is partly due to the fact that each village was only visited once, and pilot tests could only be conducted during that one visit. Therefore, at each datapoint, only the pilot-tested RTTs from those villages that had already been visited were available for testing. Also, the RTT process was fatiguing for listeners, who were rarely willing to listen to more than three stories. At each datapoint, I chose a subset of two or three RTTs that were most likely to be understood at some level.

CW-QY was tested at almost every location. CW-QY is one of the most conservative varieties in terms of historical change, is spoken in a highly vital community, and has been indicated by a neighboring location (C-LJ) as having higher prestige than other varieties. Because of these factors, CW-QY is a candidate for reference dialect for Central Lalo orthography development. Therefore, the CW-QY RTT was tested in more locations than other varieties. In E Lalo locations, a different CW-QY narrative was tested in Q&A format, since the RTT-retelling narrative had not yet been pilot-tested at the time of fieldwork in E Lalo. This difference is signified in Table 2-4 with an asterisk (*).

2.6 Exploring dialect perceptions and interactions

While phonetic distance obtains objective measures of difference, subjective measures of difference are also useful to gain a more emic perspective. The relevant questions here are: 1) How do Lalo perceive the groupings of Lalo varieties? 2) What is the nature and extent of interactions between Lalo varieties? The tools used to answer these questions were two sociolinguistic interview schedules, one administered to the village leaders and the other administered to groups of native speakers. Nahhas, Kelsall and Mann (2005) list typical goals, research questions, concepts, indicators, and probes used in the design of sociolinguistic questionnaires that address issues such as language use and attitudes. Most of the probes used in the interview schedule were taken from this tool and translated into Chinese. Additional probes were adapted from Pelkey (2011). The village leader interview was administered to an individual, usually the village secretary or director. The group interview was usually administered after assembling a group of three or four RTT participants; often village cadres or guests of the local host would participate. Ideally, the language of investigation should have been Lalo, to avoid any potential pressure on the interviewee to maintain political correctness, a pressure that may have arisen through the use of Chinese, the politically dominant language. Since the questions were not deemed overtly politically sensitive, however, Chinese was used for expediency. Both the leader interview and group interview schedules are given in Appendix C. Results are given in §7.4.

For dialect perceptions, the main indicator is perceived sameness or difference of the speech of various Lalo villages. In the group interview, Lalo villages units within and outside the local township were identified. The group was asked to assess the relative sameness or difference between the variety in the Lalo village in question and their own. Although the questions are in terms of 'exactly the same,' 'a little different' and 'very different,' sometimes the participants would come up with a percentage of sameness or difference. Participants were also asked how well they could understand the variety, and if they felt that variety was 'good' Lalo or not. Another perspective on the question of perception was collected through asking the same perception questions about the speech of any brides that came from that variety and married into the local village. If the brides had trouble understanding the local variety, the question of how long it took them to learn the variety was asked. The same questions were asked about brides from the datapoint who married into other villages.

Another indicator of dialect perception is that of prestige, so the group interview included probes asking which village spoke the best Lalo and which village was the most important. In almost all cases, participants preferred their own variety. However, C-LJ respondents thought that CW-QY sounded better because they used fewer loanwords from Chinese.

The second question of interaction between varieties addresses concepts of contact and history. Social contact was assessed through asking about bride exchange (often reciprocal), participation in periodic markets, shared cultural festivals, and travel between Lalo villages. Participants were asked which Lalo villages they sent brides to and which villages they received brides from, and whether the number of brides was relatively high or low. After participants identified annual festivals, they were asked which Lalo villages and ethnic groups celebrate the festivals with them. The village leader was asked what periodic markets villagers attend, which Lalo villages also attend this market, and what other ethnic groups attend. The village leader was also asked to identify Lalo villages that local people visited, how often they visited, how well they understood the Lalo spoken there and if they had to change their accent to communicate.

Folk history was also explored by asking where the village founders had come from, and more remotely about the location of the origin of the Lalo people. In Weishan and Yangbi, participants often would provide the origin of a Han Chinese ancestor; in the past, soldiers from cities in eastern China such as Nanjing came and married into local groups. In other areas such as MD, where the village had a more recent migration history and recognised Weishan as their traditional homeland, the interview asked about contact with the homeland area.

2.7 Assessing ethnolinguistic vitality

This section presents the methods used to answer the following question: Does it appear likely that Lalo will continue to be spoken by future generations? Indicators and probes were drawn from Nahhas et al (2005) and Pelkey (2011), while the continuum used for classifying the varieties came from UNESCO (2003, 2009) and Krauss (2007).

A key factor in language maintenance is whether children are proficient in the language, which relates to UNESCO's Factor 1, intergenerational language transmission. This is indicated by asking how well children speak Lalo and what opportunities they have for learning Lalo: what language parents speak to their children in, whether children from inter-ethnic marriages still learn Lalo, and what language the school teacher speaks to the children in at the different grade levels. Participants were also asked what language children learn first, whether children could speak Chinese before starting school, and if not at what grade level they are able to speak Chinese fluently. Probes also focused on children's language use, such as what language children use with Lalo and non-Lalo children and their teachers in various domains such as inside and outside the school, and whether they ever speak a non-Lalo language in the home.

Domains of language use for adults were also explored by asking what language the participants used in their home with their parents, siblings, spouse, children, grandchildren, and Lalo and non-Lalo friends. Domains outside the home included speaking with Lalo and non-Lalo people in the village, market, at a funeral or village meeting, and with government cadres at the village and township level. Loss of existing domains is UNESCO's Factor 4.

The use of a language of wider communication was explored by asking village leaders what other languages were spoken in the village and at the periodic markets, and what language they use to address different ethnic groups in the village. In the overwhelming majority of situations, the language of wider communication is a local form of Southwestern Mandarin. Ability or inability to speak local Mandarin by various groups such as elderly people, women and children was also gauged.

Language attitudes have been identified as a key factor in language maintenance (Bradley 2002a). One indicator of an attitude that facilitates language shift is how participants felt about children speaking a non-Lalo language in the home or with other children and about children not being able to speak Lalo. Another attitude, related to their sense of ethnolinguistic identity, was explored by asking what aspects of Lalo culture and tradition participants hoped their children would continue, and what aspects of their culture makes them different.

Another important factor is contact with non-Lalo. The village leader was asked about the population of each ethnic group in the village, whether non-Lalo in the village could speak Lalo, and the numbers of young people migrating to urban areas. Educational policy with regard to language use was also explored by asking what language the teacher uses at different grade levels and how accessible education is for most children (e.g., graduation rates). The village leader was also asked about the community's response to new media, especially the use of the personal video camera and cheap reproduction of VCDs to record the celebration of local events in the local language.

On the basis of the indicators discussed above, it was possible to place each datapoint on the vitality continuum as described in Krauss (2007). On the two extremes of this continuum are the categories 'safe' and 'extinct'. Safe languages, designated by the grade *a+*, are languages that will definitely be spoken in the foreseeable future, and 'extinct,' designated *e*, are languages that are no longer spoken or remembered by anyone. The term 'endangered' encompasses all the languages in between the two extremes and includes 95% of the languages spoken in the world (Krauss, 2007). Subclasses within the endangered category are represented by the grades *a* through *d*, with *a* marking stable languages in which all children are speaking the language in the home. All other subclasses of endangered languages are in decline and range from unstable, definitively endangered, severely endangered, and critically endangered.

Unesco (2009) uses a similar scale, presented in Table 2-5 below:

Table 2-5: UNESCO's (2009) scale of endangerment

safe	language is spoken by all generations; intergenerational transmission is uninterrupted
vulnerable	most children speak the language, but it may be restricted to certain domains (e.g., home)
definitely endangered	children no longer learn the language as mother tongue in the home
severely endangered	language is spoken by grandparents and older generations; while the parent generation may understand it, they do not speak it to children or among themselves
critically endangered	the youngest speakers are grandparents and older, and they speak the language partially and infrequently
extinct	there are no speakers left

Each Lalo datapoint is placed in the Krauss/UNESCO continuum, but Lalo is spoken in so many villages that it is not feasible to place all Lalo-speaking areas on the scale. Some areas such as Ma'anshan township in Weishan are stable, but others such as Fengqing and Yun counties are critically endangered, meaning the language is only spoken by very few, of the great-grandparental generation. Since the study did not do a random sample of all the Lalo villages, this research cannot claim to give a representation of the whole Lalo population. But the trends shown in the datapoints are disturbing enough, because in the datapoint selection process I specifically asked for areas where the language was still spoken by all members of the community. The fact that local officials in the Ethnic Minority and Religious Affairs Bureau still recommended areas that were definitively endangered means that other villages in that township have probably already reached the definitively endangered stage and may even be critically endangered.

3 *Phonological sketches of Lalo varieties*

3.1 Introduction

In this chapter, I present phonological sketches of fifteen Lalo varieties, grouped into regional dialect clusters according to the subgrouping criteria delineated in Chapter 6: Central, Southeastern, Western, and Eastern clusters, as well as MD, Eka, YL and XZ individual varieties. The goal of this chapter is to present the range of phonological systems that have developed from Proto Lalo (PLa), as described in Chapters 4 and 5. The comparative method used to reconstruct PLa feeds on the synchronic variation seen in modern varieties in order to posit a hypothetical ancestral phonological system from which the daughter varieties developed.

The phonological system as spoken in one particular village is chosen to represent each variety: CW-QY for Central, W-YL for Western, SE-GP for Southeastern, E-DC for Eastern, Yijiazhai for Eka, and MD, YL and XZ. While the representative variety is presented in more detail, phonological systems from other varieties within the cluster are presented in abbreviated form, and special focus is given to how they differ from the representative variety. Most of these varieties have never been described before, but when there are existent analyses available, any differences between my analysis and already existing accounts are noted. Although the emphasis in this chapter is synchronic description, diachronic evidence is also called on to explicate and support the analysis.

3.2 Central Lalo: Qingyun (CW-QY)

The description that follows is based on data collected from speakers native to Qingyun Village Cluster, Ma'anshan Township, Weishan County. The wordlist was primarily recorded with Cha Shufang, a female speaker in her twenties living in Xiaguan, with supplementary recording done in Qingyun Village Cluster with two male, middle-aged speakers. Although Ma'anshan Township is located next to Wuyin Township where Björverud (1998) worked, the phonologies are slightly different, as observed below.

The CW-QY syllable template is (C)VTP, in which one of 33 optional initial consonants is followed by one of 10 obligatory vowels with tone (3 pitch heights) and phonation (modal, breathy, or harsh). Additionally, there is NT, in which a syllabic nasal has a tone, but phonation is always modal. CW-QY initials are summarised in Table 3-1 below, with allophones in brackets:

Table 3-1: CW-QY initial consonant inventory

	Labial	Alveolar	StridentA lveolar	Retroflex/ Palatal	Velar	Laryngeal
Stops and Affricates	p	t	ts	tʂ [tɕ]	k	[ʔ]
	pʰ	tʰ	tsʰ	tʂʰ [tɕʰ]	kʰ	
	b	d	dz	dʐ [dʑ]	g	
Fricatives	ʔv		s	ʂ [ɕ]	x [f]	h [h̃]
	v		z	ʐ [ʑ]	ɣ [ɦ]	
Nasals	m	n		ɲ	ŋ	
	ʔm	ʔn				
Approximants	w [j]	l				
		ʔl [ʔʐ]				

This system differs slightly from Björverud's analysis of Longjie Lalo. First, there is no contrastive palatalised velar series /kj kjh/ in CW-QY, as there is in Longjie. This difference is due to the divergent developments of the Proto Lalo palatalised velar consonant cluster series (§4.1.1.1), which was preserved in Longjie in certain environments, but lost in CW-QY. Also, Björverud's palatal affricates /tj tjh dj/ and palatoalveolar fricatives /ʃ/ and /ʒ/ correspond to CW-QY's retroflex /tʂ tʂʰ and dʐ/ and /ʂ ʐ/. CW-QY's retroflexes all have alveopalatal allophones [tɕ tɕʰ dʑ ɕ ʑ] before front vowels /i ɛ y/. Before central and back vowels /ɨ u ə a/, this series is realised as retroflex. The retroflex series contrasts with the alveolar affricate series, and both series occur before all vowels.

Voiceless velar fricative /x/ is realised as labiodental [f] before front vowels /i ɛ/ and syllabic fricative [v̩] (an allophone of the mid central vowel /ə/ found only after /f/) and as [x] before /ɨ u a/. The voiced velar fricative /ɣ/ is realised as [ɣ] before central vowels /ɨ ə/ and as voiced glottal fricative [ɦ] before /i ɛ y a/; unlike the voiceless glottal fricative /h/ [h̃], [ɦ] is not nasalised. The alveolar nasals, both plain /n/ and glottalised /ʔn/, are palatal [ɲ ʔɲ] before close front vowel /i/, resulting in a neutralisation of contrast with palatal /ɲ/ in this environment. Palatal /ɲ/ is itself marginal, only occurring contrastively before /ɛ/ in the wordlists, e.g., [ɲɛ^{55}za̤^{21}] 'younger brother,' from PLa *ɲe^{1}za^{2}; Laura Blackburn (personal communication, June 22, 2010) reports that /ɲ/ also occurs before /a/, as in [ɲa̤^{21}] 'talk too much'. The glottalised lateral approximant /ʔl/ is realised as glottalised retroflex fricative [ʔʐ] before close central vowel /ɨ/ and as [ʔl] elsewhere.

Labiovelar approximant [w] and the palatal approximant [j] are in complementary distribution, with [w] before back vowels /u a/, and [j] before front vowels /i y ɛ/. Björverud (1998) gives evidence of /j/ occurring before /u a/ in particles /ja^{21}a^{55}/ 'moreover' and /ju^{13}ju^{33}ku^{55}/ 'way down there,' which were not elicited in the CW-QY data set. Because the CW-QY data show no evidence of contrast between [w] and [j], these two phones are grouped together as allophones of /w/. There is only a marginal contrast between [w] and [ɣ]. Diachronically in Central and Western Lalo, PLa *g weakened to /ɣ/ before non-close vowels (*ɛ, *o, *a, and *aŋ) and then further weakened to [w] before PCLa *u. As a result, /w/ and /ɣ/ are only distinguished before [a̠], as in /wa̠^{L}/ [wa̠^{21}] 'scold' versus /ɣa̠^{L}/ [ɦa̠^{21}] 'drive animals', and /ɛ/, as in /wɛ^{1}/ [jɛ^{55}] 'right' and /ɣɛ^{2}/ [ɦɛ^{21}] 'wound'.

Syllables without an initial consonant automatically begin with a phonetic glottal stop [ʔ], which is not contrastive; this is found across all Lalo varieties. The glottal fricative /h/ is always realised with the velum lowered, phonetically [h̃], and all vowels following /h/ are nasalised, an example of the phenomenon termed 'rhinoglottophilia' by Matisoff (1975). This type of rhinoglottophilia is found in all Lalo varieties that have a contrastive /h/. Velar fricative /x/ and /h/ contrast before /i ɛ ə a/. Table 3-2 below shows examples of CW-QY's initial consonants. The double dot under vowels represents breathy phonation, which is a phonetic feature of Tone 2, CW-QY's low tone. The underline under vowels represents harsh phonation and is contrastive with non-harsh phonation (modal and breathy).

Table 3-2: CW-QY initial consonant examples

Initial	CW-QY	English	Chinese	Initial	CW-QY	English	Chinese
p	pa̠^{21}	male suffix	公的	v	va̤^{21}	snow	雪
pʰ	pʰa̠^{21}	capable	能干	ʔv	ʔva^{55}	winnow	簸(米)
b	ba̤^{21}	honeybee	蜜蜂	s	sa̠^{21}	sister's child	外甥
t	ta̠^{21}	remain	留下	z	za̤^{21}	son	儿子
tʰ	a^{55}tʰa̤^{21}	knife	刀	ʂ	ʂa̠^{21}	difficult	难
d	da^{55}	fern	蕨草	ʐ	ʐu^{55}ɣɨ^{55}	oil	油
ts	tsa̠^{21}	bud (v.)	发芽	x	xa̤^{21}	meat	肉
tsʰ	tsʰa^{55}	hot	热	ɣ	ɦa̤^{21}	chew	嚼
dz	dza̤^{21}	eat	吃	h	hã^{55}	soul	魂
tʂ	tʂa̠^{21}	feed animals	喂	m	ma̤^{21}	not	不
tʂʰ	tʂʰa^{33}	kick	踢	n	na̤^{21}	rest	休息
dʐ	dʐu^{55}	have	有	ɲ	ɲa̠^{21}	talk too much	
k	ka^{55}	roast	烤	ŋ	ŋa̤^{21}	five	五
kʰ	kʰa̤^{21}	bitter	苦	ʔm	ʔma̤^{21}	teach	教
g	ga̤^{21}	hear	听见	ʔn	ʔna^{55}	listen	听
w	wa̠^{21}	scold	骂	l	la^{55}	come	来
				ʔl	ʔla̤^{21}	pants	裤子

CW-QY has nine monophthongs and one diphthong in native vocabulary, as illustrated in Table 3-3 below, including the various allophones in brackets.

Table 3-3: CW-QY rhyme inventory

	Front	Rounded	Central	Back	Diphthong	Syllabic nasal
Close	i [ɛ̠]	y [ø̠]	ɨ [ɨ̠][ʉ][ɿ][ʅ]	u [o̠]		n̩ [m̩] [ŋ̩]
Mid	ɛ	ø	ə [ə̠][ɣ̩]	o		
Open				ɑ [a̠]	ai	

CW-QY has one phonemic diphthong /ai/, which occurs in Chinese loanwords but only rarely in native vocabulary, e.g., 'door' [a^{55}kʰa̠i^{21}], 'bowl' [a^{55}kai^{21}], and 'spider' [a^{33}mai^{33}]. When occurring after PLa *kj and *kʰj (from PN *ʔ-kr/kl and *kr/kl as described in §4.1.1.1) and before *e or *ɛ, this diphthong is possibly the result of the metathesis of *j and the vowel, with subsequent lowering of the vowel. The probable path of development for CW-QY's diphthong /ai/ is exemplified in 'bowl': PN *a^{1} ʔ-krin^{2} > PLa *a^{55}kje^{21}; the palatal glide then metathesised and the vowel lowered to produce CW-QY's [a^{55}kai^{21}].

Other diphthongs and the velar nasal final -ŋ are also found in CW-QY vocabulary as the result of loanwords and syllable mergers. In loanwords from Chinese, diphthongs /ao ei ia ua uei uai iao/ and syllable-final /-ŋ/ occur. Post-lexical syllable mergers account for other occurrences of diphthongs and /-ŋ/. For example, diphthong [iau] results from a coalescence of rhyme /i/ with a following syllable beginning with /u/, as in 'book,' /tʰi^{21}u^{21}/ > [tʰiau^{21}], from PN *to^{2} yum^{2} (PN reconstruction from David Bradley, personal communication, Dec. 12, 2009). Syllable-final -ŋ occurs through merger of a syllable with a following syllabic nasal, as in 'yesterday' /a^{2}n̩^{33}/ > [aŋ^{33}].

In syllables with harsh phonation, the close vowels /i y u/ are realised as mid [ɛ̠ ø̠ o̠], and the back open vowel /ɑ/ is realised as central open [a̠]. Mid vowels /ɛ/ and /o/ do not occur in syllables with harsh phonation. Both Sun (1991) and Huang and Dai (1992) claim that [a] and [ɑ] are separate phonemes in Nanjian and Wuyin varieties, but in CW-QY this is not the case. The [a] found in Sun (1991) and Huang and Dai (1992)'s wordlists overwhelmingly correspond to CW-QY's harsh [a̰]. Björverud does not report distinctive /a/ and /ɑ/. However, a contrast between /a/ and /ɑ/ is seen in CE-YA and C-CJ, as described in Sections 3.2.1 and 3.2.2 below. Björverud also does not report a contrastive /o/ in Longjie; CW-QY's /o/ is a result of later diachronic changes, e.g., PLa *aŋ > [o] after velars in CW-QY, but > [u] in Longjie (described in §4.3.3.4).

The close-mid rounded phone [ø] is marginal in CW-QY, only occurring in a handful of lexical items, such as [a^{55}ŋø^{55}] 'goose,' [a^{55}jḛ^{33}kø^{55}] 'cockscomb,' [fv̩^{33}kø̰^{21}] 'eggshell;' it only occurs after velar initials. Diachronically, the main source of [ø] is Proto Lalo *o after palatalised velar clusters, e.g., PLa *kjo^{1} 'cockscomb' > [kø^{55}]. Because of other diachronic developments, [i] and [ø] are in complementary distribution. PLa velar clusters became palatal affricates before *i (*kji > [tɕi]), and *i became [ɨ] after velar stops (*ki > [kɨ], so [i] never occurs after velars, while [ø] always occurs after velars. However, despite the historical coincidence that causes them to be in complementary distribution, /ø/ and /i/ are classed as separate phonemes.

The close central vowel /ɨ/ is realised as rounded [ʉ] after bilabial consonants /p pʰ b m/, as [ɿ] after alveolar affricates and fricatives /ts tsʰ dz s z/, and as [ʅ] after retroflex affricates and fricatives /tʂ tʂʰ dʐ ʂ ʐ/. These allophones occur in syllables with both harsh and non-harsh phonation. The vowel /ɨ/ never occurs after alveolar stops, labiodental, or labiovelar initials, but does occur after bilabial, retroflex, and velar initials. The mid central vowel /ə/ is a reflex of PLa *u and is realised as syllabic labiodental fricative [v̩] after labiodental fricatives (e.g., [fv̩] /xə/) and as [ə] elsewhere. The vowel /ə/ never occurs after labials, alveolar affricates or alveolar fricatives. The restrictions on /ə/ and /ɨ/ result in a neutralisation of contrast after labials and alveolar stops, affricates and fricatives, with /ə/ after alveolar stops and /ɨ/ after labials and alveolar affricates and fricatives. However, the two phonemes contrast after velar consonants and the retroflex affricates. Björverud (1998) analyses the apical vowel [ɿ] as an allophone of /i/ after alveolar fricatives and affricates, but in CW-QY [ɿ] contrasts with /i/ after alveolar affricates, e.g., [n̩^{21}tsi^{55}] 'twenty' versus [n̩^{21}tsɿ^{21}] 'hat'. Therefore, [ɿ] is grouped with close central /ɨ/ instead.

The syllabic nasal /n̩/ comes from Proto Lalo plain nasals before close vowels *i and *u. The nasal's place of articulation assimilates to the following syllable's initial consonant in a polysyllabic word, and so has allophones [m̩ n̩ ŋ̍]. Palatal [ɲ̍] has not been observed, as there in only one palatal phone in CW-QY, [j]. If the syllabic nasal is word final or occurs in a monosyllabic word, it is realised as velar [ŋ̍]. Following a stressed syllable, the syllabic nasal loses its syllabicity and merges with the previous syllable, as in 'yesterday' /a^{2}n̩^{33}/ > [aŋ^{33}]. The syllabic nasal never occurs in syllables with harsh phonation. Preglottalised nasals never become syllabic, as syllabic nasals developed only from Proto Lalo plain nasals. The development of syllabic nasals must have happened in CW-QY before the change from rhyme *-aŋ > /u/ and *e > /i/, because syllabic nasals do not occur in words with those Proto Lalo rhymes. So *maŋ^{2} 'old' > [mu^{21}] in CW-QY, and never just m̩. In CE-YA, however, these rhymes do show syllabic nasals, so the relative diachronic rule ordering for this process in CE-YA is later. Table 3-4 below gives examples of each of the vowels in CW-QY:

Table 3-4: CW-QY rhyme examples

Rhyme	CW-QY	English	Chinese
i	tɕʰi^{55}	arrive	到
ø	kø^{21}	cockscomb	冠（鸡冠）
y	ky^{21}	dew	露
ɛ	kɛ^{33}	load, pack	装
ɨ	kɨ^{55}	star	星星
ə	kə^{55}	call	叫
a	ka^{55}	fall, drop	掉
u	a^{55}ku^{33}	father's father	爷爷
o	ko̤^{21}	wild (animal)	野(兽)
ai	a^{55}kai^{21}	bowl	碗

Table 3-5 below summarises CW-QY's reflexes of Proto Lalo tone. Phonetic values are given using Chao's (1930) tone letters, in which 5 represents the highest pitch and 1 the lowest. The CW-QY tonal system is a combination of contrastive pitch heights and harsh versus non-harsh phonation. CW-QY contrasts high, mid, and low level pitches. Tone 1 has two allotones, conditioned by the initial: high rising in syllables with voiced initials, and high level in syllables with voiceless or preglottalised initials. The low tone is realised as low falling in citation form, but is not considered a phonemic contour tone in the CW-QY three-level system. As Yip (2002) suggests, the fall is an automatic transition to the lowest pitch level. In utterance medial form, the low pitch is realised as low level. Non-harsh phonation is seen in modal voice of the high level tone from Proto Lalo Tone *1 and mid level tone from Tone *3, and breathy voice in the low tone from Proto Lalo Tone *2. Harsh phonation is the reflex of laryngealised vocal register, the diachronic result of the PN syllable-final stops conditioning harsh phonation. In CW-QY, the reflexes of PN *H and *L are mid harsh and low harsh, respectively. Chinese linguists refer to harsh phonation as 'tense'; I prefer using the term 'harsh' since 'tense' already has another meaning when referring to vowels. The physiological production of harsh phonation is further discussed in §5.1. CW-QY's tonal system is explained in more phonetic detail in §5.2 on tone change.

Table 3-5: CW-QY reflexes of Proto Lalo tones

Proto Lalo	CW-QY	Chao pitch numbers
*1: High	[High level]/elsewhere	[55]
	[High rising]/[+voi]_	[45]
*2: Low, breathy	Low, breathy	22
*3: Mid	Mid	33
*L: Low, harsh	Low, harsh	31
*H: Mid, harsh	Mid, harsh	33

3.2.1 Central East Mountain: Yong'an (CE-YA):

Shuizilu Village of Yong'an Village Cluster (CE-YA), located in Yongjian Township, Weishan County, Dali Prefecture, is chosen to represent East Mountain Lalo. East Mountain Lalo is a sub-dialect of Central Lalo located mainly in the northeast corner of Weishan County in Yongjian and Dacang townships, but also in the northwest corner of Midu in Hongyan Township and Xinjie Town. Blackburn, Blackburn, and Wa's (2007b) unpublished wordlist of Wajia Village Cluster, also in Yongjian Township, Weishan County, is the only previous documentation of this variety. This phonological sketch is based on data from three native speakers from Yong'an Village Cluster

(Shuizilu Village), all males in their late twenties. The syllable template for CE-YA is similar to Central Lalo, (C)VTP and NT.

CE-YA no longer distinguishes PLa's alveolar and palatoalveolar affricates and fricatives and instead only has one series, which is alveolar before most vowels. These are palatalised before close front vowels /i y/; alveopalatal fricative [ʑ], however, does not occur. Voiceless velar fricative /x/ is realised as [f] before front vowels /i ɛ/ and as [x] elsewhere, including [ə], the reflex of PLa *u. Diachronically, in CE-YA only, Proto Lalo's *f changed to /x/ after *u became /ə/, and so now CE-YA's [xə] corresponds to CW-QY's [fɣ], as in PLa *fu^{3}, 'egg' and Proto Central Lalo *fu^{1}, 'white'. Voiced velar fricative /ɣ/ is realised [w] before /u/, as [ɣ] before /ɨ/, and as [ɦ] elsewhere. Alveolar nasal /n/ is palatalised as [ɲ] before /i/, and /ɲ/ is only contrastive before /ɛ/. Palatal approximant /j/ only occurs before /i ɛ a/, but is still contrastive with all other initials. Table 3-6 gives CE-YA's initial consonant inventory.

Table 3-6: CE-YA initial consonant inventory

	Labial	Alveolar	Strident Alveolar	Palatal	Velar	Laryn-geal
Stops & Affricates	p p^{h} b	t t^{h} d	ts [tɕ] ts^{h} [tɕ^{h}] dz [dʑ]		k k^{h} g	[ʔ]
Fricatives	 v		s [ɕ] z		x [f] ɣ [w] [ɦ]	h [h̃]
Nasals	m	n		ɲ	ŋ	
Approximants		l		j		

Table 3-7 gives CE-YA's rhyme inventory. CE-YA's vowel system is similar to CW-QY's, with the addition of contrastive front open vowel /a/, diphthong /ia/ and nasalised vowels /ĩ/ and /ə̃/. Apical vowel [ɿ] is analysed as an allophone of /i/ after alveolar affricates and fricatives. In CW-QY, /ɑ/ is realised as open back vowel [ɑ] in modal phonation and front open vowel [a̠] in harsh phonation, but CE-YA shows a contrast between /a/ and /ɑ/, seen in the near minimal pair 'sick' /na^{24}/ from PLa *na^{1} and 'listen' /nɑ^{55}/ from *ʔna^{1}. The Proto Lalo preglottalisation seen in 'listen' *ʔna^{1} most likely conditioned the diachronic development of /ɑ/, which became contrastive after the merger of preglottalised and plain sonorants. A related but slightly different development is seen in C-CJ, C-LB, and C-WC, discussed in §3.2.2 below.

Table 3-7: CE-YA rhyme inventory

	Front	Rounded	Central	Back	Diphthong	Nasalised	Syllabic nasal
Close	i [iɛ̠][ɿ][ʅ]	y [y]	ɨ [ɨ̠]	u [o̠]	ia	ĩ	n̩ [m̩] [ŋ̍]
Mid	ɛ [ɛ̠]		ə [ə̠]			ə̃	
Open	a			ɑ [ɑ̠]			

Nasalised vowels /ĩ/ and /ə̃/ are contrastive with oral vowels, but they never occur with initial consonants. They developed from the loss of PLa preglottalised nasals before *i and *u, described in §4.1.5. Most Lalo varieties, excepting CW-QY, also show nasalised vowels from the same diachronic process, although the conditioning vowels vary across varieties. Because of their restricted diachronic source, nasalised vowels occur only rarely in the lexicon. Björverud (1998) notes a contrastive nasal vowel /ĩ/ in the variety spoken in Longjie Village, from the same diachronic source.

CE-YA's tonal system, seen in Table 3-8 below, is slightly different from CW-QY's, in that CE-YA shows the Eastern Lalo type tone split in *1 (see §3.6). In Tone *1, originally a high level pitch, PLa voiced initial consonants conditioned a low-rising pitch, while voiceless initials and preglottalised initials maintained the high level tone; when preglottalised and plain sonorants merged, the tone split became phonemically contrastive. This split is further discussed in §5.3.

Table 3-8: CE-YA reflexes of Proto Lalo tones

Proto Lalo	CE-YA	Chao pitch numbers
*1/elsewhere High	High	55
1/[+voi]_: High	Low-rising	24
*2: Low, breathy	Low	21
*3: Mid	Mid	33
*L: Low, harsh	Low, harsh	$\underline{21}$
*H: Mid, harsh	Mid, harsh	$\underline{33}$

3.2.2 Chajiang (C-CJ)

C-CJ, a Central Lalo variety spoken in Nanjian County, is similar but not identical to the Nanjian variety reported in Chen et al. (1985) and Sun (1991). This phonological sketch is based on data collected from two native speakers, one male in his thirties and one in his forties, in Chajiang Village Cluster, Xiaowandong Township in Nanjian County. The syllable template for C-CJ is similar to Central Lalo, (C)VTP and NT, with 22 initials, 9 rhymes, 3 pitch height contrasts, and harsh versus modal phonation. C-CJ's tonal system is identical to that of CW-QY. C-CJ initial consonant inventory is given in Table 3-9 below.

Like CE-YA, C-CJ has merged the PLa palatoalveolar and alveolar affricates and fricatives to alveolar. Before front vowels /i ɛ y/, alveolar affricates and fricatives are palatalised to alveopalatal position. Chen et al. (1985) and Sun (1991) both report a contrast between alveolar and retroflex affricates and fricatives in their data collected in Nanjian in the 1950's, which is also found in CW-QY and most other Central varieties. C-QS, located just south of Nanjian County in Jingdong County, shows this same merger. C-CJ and C-QS may have undergone the merger in the past 60 years since the collection of data presented in Chen et. al (1985), or perhaps these varieties are different from the variety represented in Chen et al. and Sun (1991).

Table 3-9: C-CJ initial consonant inventory

	Labial	Alveolar	Strident Alveolar	Velar	Laryngeal
Stops & Affricates	p	t	ts [tɕ]	k	[ʔ]
	p^h	t^h	ts^h [tɕ^h]	k^h	
	b	d	dz [dʑ]	g	
Fricatives			s [ɕ]	x [f]	h [ɦ̃]
	v		z [ʑ]	ɣ [ɣ^w]~[w], [j]	
Nasals	m	n		ŋ	
Approximants		l			

Like CW-QY, the voiceless velar fricative /x/ is realised as [f] before /i ɛ y̩/ and as [x] elsewhere; /xy/ does not occur, because PLa *xy > [ɕy] in C-CJ, thus merging *x and *s before *y. Voiced velar fricative /ɣ/ is realised as [j] before /i ɛ y/ and as [w] or [ɣ^w] before back vowel /u/; [w] and [ɣ^w] are in free variation.

Table 3-10 gives C-CJ's rhyme inventory. As in CE-YA, C-CJ contrasts front /a/ and back /ɑ/, as in the near minimal pair 'next year' /na^{21}hi̠^{21}/ from *ʔna^{2}he̠^{L} and 'to stop/rest' /nɑ^{21}/ from *na^{2}, but the contrast is marginal. These phones are almost in complementary distribution, with [ɑ] always in modal voice and [a̠] mostly in harsh voice. However, modal voice [a] is found in syllables immediately preceding or following harsh voice syllables, as seen in 'next year' *ʔna^{2}he̠^{L}

/na²¹hi̠²¹/. Chen et al. (1985) and Sun (1991) analyse [ɑ] and [a] as separate phonemes. C-LB and C-WC also distinguish /a/ and /ɑ/ along similar lines, with the additional condition that Proto Lalo preglottalised sonorants influence the development of front [a], as in 'sick' /nɑ⁵⁵/ from PLa *na¹ and 'listen' /na⁵⁵/ from *ʔna¹. This development is slightly different from that of CE-YA, as discussed in §3.2.1 above, which shows back /ɑ/ after *preglottalised sonorants and /a/ elsewhere.

C-CJ, as many other Lalo varieties, shows the syllabic voiced labiodental fricative /v̩/ operating as a rhyme and appearing after most initials. A reflex of PLa *u, /v̩/ sounds like [u] but is pronounced with lip compression, that is, with the upper teeth resting on the bottom lip, with resulting increased friction.

Table 3-10: C-CJ rhyme inventory

	Front	Rounded	Central	Back	Nasalised	Syllabic consonants
Close	i [iɛ̠]	y [ø̠]	ɨ [ɨ̠][ʅ][ʅ̠]	u [o̠]	ĩ	v̩; n̩ [m̩] [ŋ̍]
Mid	ɛ					
Open	a [a̠]			ɑ		

3.2.3 Longjie (C-LJ)

The variety recorded in Zhanmagulang Village in Longjie Village Cluster is the most similar to the Lalo varieties described in Björverud (1998), Huang and Dai (1992) and YNYF (1984), as C-LJ is located in the same township as the varieties recorded by these sources. Björverud (1998) researched the Lalo variety located in Longjie Village Cluster itself, which at the time was a township seat, while the present phonological sketch is based on data collected in Zhanmagulang Village, 45 minutes by car from Longjie Village Cluster in Wuyin Township, Weishan County. Recordings were collected from two male native speakers, both in their forties.

The syllable template for C-LJ is similar to Central Lalo, (C)VTP and NT, with 33 initials, 9 vowels, 3 pitch height contrasts, and harsh versus modal phonation. The C-LJ tonal system is identical to CW-QY's tonal system. C-LJ's initial consonant inventory is given in Table 3-11.

Table 3-11: C-LJ initial consonant inventory

	Labial	Alveo-l ar	Strident Alveolar	Retroflex/ Palatal	Velar	Laryn- geal
Stops and Affricates	p pʰ b	t tʰ d	ts tsʰ dz	tʂ [tɕ] tʂʰ [tɕʰ] dʐ [dʑ]	k kʰ g	[ʔ]
Fricatives	f v ʔv		s z	ʂ [ɕ] ʐ [ʑ]	x ɣ [w] [ɣʷ]	h [ɦ̃]
Nasals	m ʔm	n ʔn			ŋ	
Approximants		l ʔl		j		

Like CW-QY, C-LJ distinguishes plain and preglottalised initials (ʔv, ʔm, ʔn, and ʔl), and alveolar and retroflex affricates and fricatives. Retroflex initials are palatalised before close front vowels /i y ɛ/. Velar fricative /ɣ/ is realised as [w] before modal /u/ and as ɣʷ before harsh /u/ ([o̠]). Both /f/ and /j/ are marginal, but still contrast with all initials before /ɛ/; /f/ occurs before /ɛ/ and /v̩/, and /j/ occurs before close front vowels /i ɛ y/.

Table 3-12 gives C-LJ’s rhyme inventory. C-LJ’s vowel system is basically identical to CW-QY’s. However, C-LJ has nasalised vowels /ĩ/ and /ỹ̩/, from the diachronic process of nasalisation and loss of preglottalised *ʔn before PLa *i and *u, described in §4.1.5. Also, C-LJ distinguishes harsh /i̠/ [iɛ̠] from harsh /ɛ̠/ [æ̠], whereas CW-QY has merged both to /i̠/.

Table 3-12: C-LJ rhyme inventory

	Front	Rounded	Central	Back	Nasalised vowels	Syllabic consonants
Close	i [iɛ̠]	y [ø̠]	ɨ [ɨ̠][ɿ][ɿ̠][ʅ][ʅ̠]	u [o̠]	ĩ [ĩ̠], ỹ̩	v̩; n̩ [m̩] [ŋ̩]
Mid	ɛ [æ̠]					
Open				ɑ [a̠]		

3.3 Mangdi (MD)

Mangdi (MD) Lalo has never before been documented. The presence of the ‘Menghua’ group is reported in the *Gazetteer of Gengma County* (1995), but no linguistic information is given. This phonological sketch is based on data collected from four native speakers, all middle-aged males, in Mangyou Village, MD Village Cluster, Hepai Township, Gengma County. The syllable template for MD is similar to Central Lalo, (C)VTP, with 28 initials, 8 vowels, 3 pitch height contrasts, and harsh versus modal phonation. Syllable-final nasals are post-lexical, the result of mergers of a syllable with a following syllabic nasal. There is also NT, syllabic nasals, but phonation is not contrastive. MD’s tonal system corresponds to CW-QY’s, distinguishing three levels of pitch height and harsh versus non-harsh phonation. Acoustic analysis is given in §5.2.1 on tone change. MD Lalo initials are summarised in Table 3-13 below:

Table 3-13: MD initial consonant inventory

	Labial	Alveolar	StridentAlveolar	Palatal/ Palatoalveolar	Velar
Stops & Affricates	p	t	ts [tɕ]	tʃ	k
	pʰ	tʰ	tsʰ [tɕʰ]	tʃʰ	kʰ
	b	d	dz [dʑ]	dʒ	g
Fricatives	f		s [ɕ]		x
	v		z [ʑ]		ɣ
Nasals	m	n		ɲ	ŋ
Approximants	w	l		j	

Alveopalatal affricates [tɕ tɕʰ dʑ] only occur before front vowels /i ɛ/ and are analysed here as allophones of the alveolar affricate series /ts tsʰ dz/. However, they could just as easily be analysed as allophones of the palatoalveolar affricates /tʃ tʃʰ dʒ/. The alveolar and palatoalveolar affricates contrast before all vowels except front vowels /i ɛ/; before high front vowels, only alveopalatal affricates [tɕ tɕʰ dʑ] are found. In MD, Proto Lalo palatoalveolar fricatives *ʃ and *ʒ have shifted to alveolar /s z/, thereby merging with the /s z/ reflexes of alveolar fricatives *s and *z. Before high front vowels /i ɛ/, alveolar fricatives /s z/ are usually realised as alveopalatal affricates [ɕ ʑ], although before /ɛ/, [s] and [ɕ] are seen in free variation.

The palatal nasal /ɲ/ contrasts with alveolar nasal /n/, although it occurs rarely, in only a handful of lexical items, such as 'narrow' [ɲɑ³³], from Proto Ngwi *ʔ-nakᴸ. The palatal nasal occurs before rhymes /ɛ a ɑ o/, but not central and back vowels /ɨ ə u/. Before /i/, the contrast between /n/ and /ɲ/ is neutralised, as both nasals are realised as palatal in that environment.

Several initials (/f w j ɣ/) have marginal status and are only found before certain vowels. /f/ and /w/ contrast only before /u/, with /f/ found only before /i ɛ u/, and /w/ only before /a u o/. Likewise, /w/ and /ɣ/ contrast only before /a/, with /ɣ/ found only before /ɨ a/. Finally, the contrast between /w/ and /j/ is marginal, only before /a/, with /j/ occurring only before /i ɛ a/. The restricted distribution of [f w j ɣ] is similar, but not identical, to that found in Lisu (Bradley 2003). Table 3-14 below illustrates contrastive consonant initials in MD:

Table 3-14: MD initial consonant examples

Initial	MD	English	Chinese	Initial	MD	Chinese	English
p	pa̠^{33}	jump	跳	f	fu^{33}	抢	rob; loot
pʰ	pʰɑ^{21}	swell	肿	v	va̠^{21}	搓	rub
b	ba̠^{33}	shoot	射	s	sa̠^{21}	懂	know
t	ta^{33}	cause to drink	给喝	z	zə^{21}	用	use
tʰ	tʰa^{21}	deaf	聋(子)	x	xɑ̠^{33}	赢	win
d	da^{21}	speech	话	ɣ	ɣa^{21}	蔬菜	vegetable
ts	tsɑ̠^{21}	feed	喂	m	ma^{21}	没有	NEG
tsʰ	tsʰa^{55}jo^{21}	person	人	n	na̠^{21}	补	mend
dz	dza^{55}	study	学	ɲ	ɲɑ^{33}	窄	narrow
tʃ	tʃa^{55}	revolve	旋转	ŋ	a^{33}ŋa^{33}	鸟	bird
tʃʰ	tʃʰa^{21}	climb	爬	w	wa^{21}	竹笋	bamboo
dʒ	dʒa^{55}	have	有	j	ja^{33}	中	hit a target
k	ka̠^{21}	dig (v.)	挖	l	la^{33}	等	await
kʰ	kʰa̠^{21}	lack	缺	g	ga^{55}	拉	pull

MD has eight vowels, all monophthongs, seen in Table 3-15 below. Diphthongs only occur in loanwords, such as the Chinese loan ‘grandmother’ [a^{55}nai^{21}], or from the merger of two syllables, such as 'blue' [kʰiu^{55}], from [kʰi^{55}wu^{55}]. Like CW-QY, MD also has a syllabic nasal which assimilates to the place of the following initial, here represented as /n̩/. The source for the syllabic nasal is Proto Lalo nasals before high vowels *i and *u and sometimes from nasal prefixes. MD shows syllabic nasals also after close central vowel *ɨ, as in 'lips' [n̩^{21}la̠^{33}] from PLa *mɨ^{2} (Proto Ngwi *(C)-me^{2}). Occasionally a nasal gets inserted between two syllables if the following syllable begins with a stop, e.g. 'bamboo,' [wan^{21}to^{55}], from *wa^{2} da^{1}.

As in CW-QY, the close central vowel /ɨ/ is realised as apical vowel [ɿ] after alveolar fricatives and affricates, and palatoalveolar affricates (although in CW-QY, the initials corresponding to palatoalveolar affricates are retroflex). All vowels except /ə/ are found with both harsh and modal phonation. The mid central vowel /ə/ corresponds to CW-QY's /y/ (from Proto Lalo *y), but MD's reflexes of Proto Lalo's harsh *y̠ are /ɑ̠/, not /ə̠/. In harsh phonation, vowels are realised as slightly lower than their modal counterparts, as in CW-QY. Unlike CW-QY, high front vowel /i/ is found after velar stops, but not after velar fricatives, the velar nasal or the labiovelar approximant /w/. Close central vowel /ɨ/ is not found after labials /w v f/, the palatal approximant /j/ or the alveopalatal nasal /ɲ/.

Table 3-15: MD rhyme inventory

	Front	Central	Back	Syllabic nasal
Close	i [i̠]	ɨ [ɿ][ɨ̠]	u [u̠]	n̩ [m̩] [ŋ̩]
Mid	ɛ [ɛ̠]	ə	o [o̠]	
Open	a [a̠]		ɑ [ɑ̠]	

Open front vowel /a/ contrasts with back vowel /ɑ/ after most initials, but rarely in modal phonation. This is because the back vowel /ɑ/ is mostly found in syllables with harsh phonation, as its diachronic sources are Proto Lalo harsh syllables such as *-ɣ̰ and *-a̰, although it also shows up in 'bitter' *k^{h}a^{2}, probably due to the influence of the velar initial. Front vowel /a/ occurs freely in both harsh and modal phonation. Table 3-16 below gives examples of the contrastive rhymes in MD:

Table 3-16: MD rhyme examples

Rhyme	MD	English	Chinese
i	bi^{21}	carry	背
ɛ	bɛ^{21}	cleave	劈
a	ba^{55}	lazy	懒
ɨ	bɨ^{21}	taro	芋头
ə	bə^{55}	fly	飞
u	pu^{21}	steam	蒸
o	bo^{21}	thin (2d)	薄
ɑ	xo^{21}sɿ^{21}p^{h}ɑ^{21}	lung	肺脏

3.4 Eka

Like MD, the Eka language has never before been documented. Zhao (1995) mentions the presence of the Eka in the *Gazetteer of Shuangjiang*, but no linguistic information is included. This phonological sketch is based on recordings of two native speakers in Yijiazhai Village Cluster, Mengmeng Town, Shuangjiang County. Speaker Eka1 is a male in his 60's, while Speaker Eka2 is a male in his thirties. Eka's syllable template is (C)V(N)TP and NT, in which the optional initial is one of 22 consonants, an obligatory vowel (one of 11 vowels or 1 syllabic fricative), an optional nasal final /ŋ/, tone (one of 6), and phonation type (harsh or modal). Syllabic nasals are found in modal voice only. Table 3-17 shows the Eka initial consonant inventory.

Table 3-17: Eka initial consonant inventory

	Labial	Alveolar	Strident Alveolar	Velar
Stops & Affricates	p	t	ts [tɕ]	k
	p^{h}	t^{h}	ts^{h} [tɕ^{h}]	k^{h}
	b	d	dz [dʑ]	g
Fricatives	f		s [ɕ]	x
	v		z [ʑ]	ɣ [j]
Nasals	m	n		ŋ
Approximants		l		

Compared to CW-QY (33 initials) and MD (28 initials), the Eka initial inventory is reduced to 22 contrastive initial consonants. Like MD, Eka has collapsed the distinctions between preglottalised and plain sonorants, and between alveolar and palatoalveolar fricatives and affricates. Eka has also merged Proto Lalo's alveolar and palatoalveolar affricate series to the alveolar place of articulation. The alveolar affricates /ts ts^{h} dz/ and alveolar fricatives /s z/ are alveopalatal /tɕ tɕ^{h} dʑ ɕ ʑ/ before close front vowels /i ɛ/.

Both Eka and MD have merged PLa *x and *h to /x/, and thus no longer distinguish /x/ and /h/ as other varieties do. Unlike MD, Eka does not have a labiovelar approximant in any native vocabulary; in the wordlist, [w] appears once, in the Chinese loanword [wai^{24}] 'outside'. Voiced velar fricative /ɣ/ is realised as [ɣ] before close central vowel /ɨ/ and as [j] elsewhere (but neither phone occurs before /u ɣ̩/). Labiodental voiceless fricative /f/ is found only before close or close-mid vowels /i ε ɣ̩/; /f/ contrasts with /x/ and other initials before /i ε/. The velar nasal is also restricted, occurring only with back mid or open vowels /a o ə/. Table 3-18 below gives examples of Eka initials.

Table 3-18: Eka initial consonant examples

	Eka	English	Chin.		Eka	English	Chin
p	pa^{24}tsʰa^{21}	stick	棍子	f	fε^{33}	dry	干
pʰ	pʰa^{21}	skin (v.)	剥皮	v	va^{21}pʰi^{24}	vegetable	蔬菜
b	ba^{33}	rich	富	s	sa^{33}pʰε^{21}	peach	桃子
t	ta^{33}kʰε^{21}	pangolin	穿山甲	z	za^{24}	little	小
tʰ	tʰa^{21}	don't	别	x	xa^{24}	walk	走
d	da^{21}	speech	话	ɣ	ɣɨ^{24}	liquid	水
ts	tsa^{33}pʰε^{33}ni^{24}	day after tomorrow	后天	m	ma^{21}	old	老
tsʰ	tsʰa^{21}bu^{33}	salt	盐	n	na^{24}kʰɣ̩^{21}	nose	鼻子
dz	dza^{24}	self	自己	ŋ	ŋa^{24}	affirmative	是
k	ka^{24}ŋə^{33}	stupid	愚蠢	l	la^{24}	come	来
kʰ	kʰa^{21}	bitter	苦				
g	ga^{24}	pull	拉				

Although Eka's initial inventory is impoverished when compared to CW-QY's, its rhyme inventory is relatively enriched, consisting of seven monophthongs, three diphthongs, syllabic fricative /ɣ̩/ and syllabic nasal /ŋ/. Subphonemic diphthongs [ɨʲ] [aʲ], [oʲ] and [uʲ] occur when the central and back vowels /ɨ a o u/ occur before a syllable beginning with palatal approximant /j/. Syllables with close back vowel /u/ may merge with following syllable /a/, creating subphonemic diphthong [ua]. Some instances of diphthongs /ai ao/ are the result of syllable merger as well. The nasal final -ŋ is contrastive and cooccurs with all monophthongs to form rhymes /-iŋ, -εŋ, ɨŋ, -əŋ, -aŋ, -uŋ, -oŋ/. Rhymes /-ai, -iŋ, -uaŋ, and -iaŋ/ also occur in Chinese loanwords. Table 3-19 below shows Eka rhymes.

Table 3-19: Eka rhyme inventory

	Front	Central	Back	Diphthongs	Nasal final	Syllabic consonants
Close	i	ɨ [ɿ]	u	uε		ɣ̩
Mid	ε [iε][e]	ə	o		-ŋ	ŋ [n̩]
Open		a		ai, ao		

Like CW-QY and MD, the close central vowel /ɨ/ is realised as apical vowel [ɿ] after alveolar fricatives and affricates. If [ɿ] were an allophone of close front vowel /i/, then there would have to be contrastive alveolar affricate and alveopalatal affricate series. However, because alveopalatal affricates may only occur before close front vowels /i/ and /ε/, it is preferable to class them as allophones of the alveolar affricate series. Thus, alveolar affricates may occur with /i/, and [ɿ] is allocated as an allophone of /ɨ/, cf. [tɕi^{21}] /tsi^{2}/ 'sister' with [tsɿ^{21}] /tsɨ^{2}/ 'cough'.

The mid front vowel [ε] after voiceless velar fricative /x/ is realised as diphthong [iε], possibly as a result of palatalisation incurred by the /ε/. However, palatalisation does not occur after other velar initials. Before final nasal /-ŋ/, /ε/ is raised slightly to close-mid allophone [e].

Syllabic consonants are either the voiced labiodental fricative /v̩/ or the syllabic nasal /ŋ/. Syllabic nasal /ŋ/ assimilates to the place of articulation of the following syllable only for alveolar stops, where it is realised as [n̩]. Elsewhere, even before alveolar affricates and bilabial stops, /ŋ/ is realised as [ŋ]. Table 3-20 below shows examples of the contrastive rhymes in Eka.

Table 3-20: Eka rhyme examples

Rhyme	Eka	English	Chinese
i	bi^{21}	split; cleave	劈
ɛ	a^{24}bɛ^{21}	duck	鸭子
ɨ	bɨ^{24}	separate; distribute	分
ə	bə^{24}	gourd reed-organ	芦笙
a	ba^{24}	lazy	懒
u	bu̱^{33}	write	写
o	bo^{24}	burn	焚烧
v̩	pv̩^{21}	steam	蒸
ŋ	ŋ^{21}	two	二
ai	ɛ^{21}dai^{24}	beneath	下面
ao	ɛ^{21}nao^{53}	inside	里面
uɛ	muɛ^{21}	arrow	箭
iŋ	niŋ^{21}	spirit (evil)	鬼
ɛŋ	leŋ^{24}	soldier	兵
ɨŋ	lɨŋ^{55}gao^{33}	forget	忘记
əŋ	bəŋ^{21}	tile (ceramic)	瓦片
aŋ	laŋ^{24}	late	迟
uŋ	luŋ^{24}	bad	坏
oŋ	loŋ^{24}	change	变

Table 3-21: Eka reflexes of Proto Lalo tones

Proto Lalo	Eka	Chao pitch numbers
*1: High	Low-rising /^{1}/	24 [35/55 before 21]
*2: Low	Low falling /^{2}/	21 [33 before 21]
*3: Mid	Mid /^{3}/	33
*L: Low, harsh	Low falling, harsh /^{L}/	21 [33 before 21]
*H: Mid, harsh	Mid, harsh /^{H}/	33
*1/ some voiceless aspirated initials_ *2/ some s/ʃ- prefixed initials_ *L/ *causative s- prefix_ *H/ some ʔ- prefixed initials_	High level /^{4}/	55 [53 word final]

Eka's tonal system is similar to CW-QY and MD, but with a few important distinctions. Table 3-21 above summarises Eka reflexes of Proto Lalo tone. Acoustic analysis is given in §5.3.4 on tone change. In addition to three contrastive pitch heights and two contrastive phonation types, Eka also has a low-rising contour tone. This tone is a result of Proto Lalo Tone *1 (a high level pitch) becoming a low-rising contour in almost all environments. Tone *1's high level pitch is retained in only a few lexical items, all beginning with voiceless aspirated stops or voiceless fricatives, e.g., [pʰɨ^{55}] 'rooster,' from PLa *po^{1}, and [kʰi^{55}] 'leg' from *kʰi^{1}, and [so^{55}lo^{21}] 'cotton' from *sa^{1}la^{2}.

Eka shows splits in *2, *H and *L, in which the *ʔ- or *s- prefix condition, in varying degrees, a high level tone (labeled /^{4}/ in Table 3-21 above). Eka's high level tone is realised as high level word medially and as high falling in word final position. In *L tone syllables preceded by the causative *s-prefix, Eka reflexes show /^{4}/, e.g., [vi̱^{53}] 'to dress (someone)' from Proto Ngwi *səwat^{L} and [xiɛ^{55}(tai^{53})] 'to cause to sleep' from Proto Ngwi *səjip^{L}. The high 55 pitch is also seen as a result of micro-splits in *H and *2 in a few lexical items, usually with *ʔ- or *s- prefix, such as [sɿ^{55}mi^{24}] 'day after tomorrow' from Proto Ngwi *ʔəʃik^{H} and [bɨ^{55}] 'leg' from *ʃ-boŋ^{2}. These tone splits form a chain with the Tone *1 split to low-rising, although it is uncertain which change came first. No other Lalo varietes show these tone splits.

Eka exhibits frequent tone sandhi, in contrast to CW-QY and MD. When low modal [21] or low harsh [21] tone precedes another low modal or low harsh, the preceding syllable is realised as mid pitch, [33] or [33], respectively. This results in the neutralisation of contrast between low modal and mid modal, and between low harsh and mid harsh, when preceding a low tone. For example, zo^{21} 'son' from PLa *za^{2}, is realised as low tone in [zo^{21}pʰɣ̩^{24}] 'son' but as mid tone in [zo^{33}mɛ^{21}] 'daughter'. Low modal before low harsh also shows the alternation, e.g [dɨ^{33}so̱^{21}] /dɨ^{2}so^{L}/ 'unhappy' from PLa *di^{2} 'think/feel' plus *sa̱^{L} 'difficult', cf. [dɨ^{21}] 'think/feel'; and [tɨ^{33}xa̱ʔ^{21}] 'phlegm' but [tɨ^{21}ɣi^{24}]'saliva,' from PLa *ti^{2}. Low harsh [21] before low also undergoes tone sandhi, but merges with mid harsh [33] instead of mid modal, e.g [o^{24}po̱^{33}jo^{21}] /o^{1}po^{L}jo^{2}/ 'frog' from PLa *o^{1} pa^{L} za^{2}, and [a^{35}vi̱^{33}ka̱^{21}] /a^{1}vi^{L}ka^{L}/ 'wild boar,' cf. [a^{35}vi̱^{31}] 'pig'.

Another prevalent tone sandhi pattern is the alternation of the low-rising [24] tone before harsh or modal low tone. Before low, the low-rising tone is realised as aslightly higher mid-rising [35] pitch, e.g. [a^{35}mə^{21}] 'horse' and [kʰɣ̩^{35}dʑɛ^{21}] 'mountain,' cf. [a^{24}mo^{33}] 'father's sister' and [kʰɣ̩^{24}] 'roast (v.)'. If the following low tone syllable begins with palatal approximant /j-/, as in the frequently occurring diminutive marker /-jo^{2}/, the two syllables merge and the resulting tone is high falling pitch [51], e.g. /nɛ^{1}jo^{2}/ 'little brother' is realised as [nɛʲo^{51}], cf. /nɛ^{1}mo^{3}/ [nɛ^{24}mo^{33}] 'little sister'; /a^{1}ki^{1}jo^{2}/ 'star' is realised as [a^{24}kiʲo^{51}], and /so^{1}mu^{1}jo^{2}/ 'flour' as [so^{24}muʲo^{51}].

3.5 Western Lalo: Yilu (W-YL)

Like MD and Eka, W-YL Lalo has never before been documented. The *Gazetteer of Yongping* (1994) identifies the Yi living in Yilu Village Cluster (W-YL) as Lalo, but no linguistic information is included. W-YL is chosen to represent Western Lalo, which also includes the following three datapoints: Dutian Village Cluster (W-DT), Taiping Township and Shuizhuping Village Cluster (W-SZP), Longtan Township, both in Yangbi County, Dali Prefecture; and Shanglizhuo Village Cluster (W-SLZ), Wama Township, Longyang Area in Baoshan Municipality.

This phonological sketch is based on recordings of two native speakers (WYL1, a male in his thirties and WYL2, a female in her forties) in Yilu Village Cluster, Changjie Township, Yongping County. The W-YL syllable template is (C)VT, in which one of 29 optional initial consonants is followed by one of 15 obligatory vowels with one of 5 tones. Additionally, there is NT, in which a syllabic nasal has a tone, but no initial consonant. W-YL Lalo initials are summarised in Table 3-22 below:

Table 3-22: W-YL initial consonant inventory

	Labial	Alveolar	Strident Alveolar	Retroflex/ Palatal	Velar	Laryn-geal
Stops &	p	t	ts	tʂ [tɕ]	k	[ʔ]
Affricates	pʰ	tʰ	tsʰ	tʂʰ [tɕʰ]	kʰ	
	b	d	dz	dʐ [dʑ]	g	
Fricatives	f		s	ʂ [ɕ]	x	h [ɦ̃]
	v		z	ʐ [ʑ]	ɣ [ɣʷ][w][j]	
Nasals	m	n		ɲ	ŋ	
Approximant		l				

Like CW-QY, W-YL has a contrastive series of retroflex affricates and fricatives. Before front vowels /i ɛ y/, the retroflex series is realised as alveopalatal /tɕ tɕʰ dʑ ɕ ʑ/. Alveolar affricates and fricatives may occur before any vowel, although palatalisation before close front vowel /i/ often occurs, thus neutralising the contrast between retroflex and alveolar in that environment. Palatal /ɲ/ contrasts with alveolar /n/ and diachronically comes from Proto Ngwi *ɲ. /ɲ/ occurs rarely, and only before vowels /ɛ a/.

The velar and glottal fricative /x/ and /h/ contrast before /i ɛ o a/. /x/ is realised as [f] before [ɛ] and [y̩]. Voiced velar fricative /ɣ/ has several allophones: [ɣ] occurs before /ɨ a/, [ɣʷ] before /o/, [w] before /u/, and [j] before front vowels /i ɛ y/. In other Western varieties, as discussed in §3.5.1 below, there is a different grouping of allophones: [w] and [j] group together as /w/ in contrast with /ɣ/, and /w/ and /ɣ/ contrast before /ɛ/. Table 3-23 below gives examples of W-YL initial consonants.

Table 3-23: W-YL initial examples

Initial	W-YL	English	Chinese	Initial	W-YL	English	Chin.
p	pa^{44}	jump	跳	f	fɛ^{33}	dry	干
pʰ	ʐo^{53}pʰa^{21}	wife's father	岳父	v	va^{44}	write	写
b	ba^{33}	insipid	没味道	s	sa^{53}	know	知道
t	ta^{53}	put/place	放置	ʂ	ʂa^{53}	difficult	难
tʰ	tʰa^{33}	time	时间	z	zɐ^{21}	son	儿子
d	da^{44}	chop	砍	ʐ	ʐo^{53}mɐ^{33}	wife's mother	岳母
ts	tsa^{53}	weave	编织	x	xa^{55}dɐ^{21}	remember	记得
tsʰ	tsʰa^{33}	pick	摘	ɣ	ɣa^{21}	buckwheat	荞麦
dz	dzɐ^{24}	rice	饭	h	ha^{53}	awake	醒
tʂ	tʂa^{44}	count	数	m	ma^{44}pʰa^{21}	tail	尾巴
tʂʰ	tʂʰa^{44}	kick	踢	n	na^{53}	mend	补
dʐ	kʰv̩^{55}dʐa^{21}	mountain	山	ɲ	ɲa^{33}	sticky	粘
k	ka^{53}	live	活	ŋ	ŋɐ^{21}	five	五
kʰ	kʰa^{21}	bitter	苦	l	la^{453}	lick	舔
g	ga^{44}	stir	搅拌				

W-YL has nine oral monophthongs, five nasal monophthongs, one syllabic fricative and one syllabic nasal. Diphthongs and the velar nasal final only occur in Chinese loanwords. Table 3-24 below summarises the W-YL rhymes inventory, with allophones in brackets.

Table 3-24: W-YL rhyme inventory

	Front	Rounded	Central	Back	Nasalised	Syllabic cons.
Close	i [iɛ]	y [yɛ]	ɨ [ɿ][ʅ]	u	ĩ, ỹ, ɨ̃	v̩
Mid	ɛ	ø [øɛ]		o	ɛ̃	n̩ [m̩] [ŋ̩]
Open	a		ɑ [ɐ][ə]		ã	

When uttered in citation form, close or close-mid front vowels /i y ø/ are realised as diphthongs with an offglide of -ɛ, i.e., [iɛ yɛ øɛ]. When uttered in a carrier phrase, these vowels are realised as monophthongs. The close central vowel /ɨ/ is realised as apical vowel [ɿ] after alveolar affricates and fricatives and [ʅ] after retroflex affricates and fricatives. Mid rounded vowel /ø/ is only contrastive after /m/, where it contrasts with close rounded vowel /y/, as in the minimal pair [mø^{24}] 'mushroom' and [my^{24}] 'to hold in the mouth'. /ø/'s historical sources are Proto Lalo close back vowels after *m, as in *mu^{3} 'powder', and *mo^{1} 'mushroom'. This vowel also occurs after velar stops, but is not contrastive with /y/ in that environment, as /y/ does not occur after velar stops. The open back vowel /ɑ/ is usually realised as [ɐ], and is slightly raised after retroflexes to open-mid schwa [ə]. Diachronically, /ɑ/ is a reflex of Proto Lalo modal vowel *-a, whereas front /a/ is a reflex of Proto Lalo harsh *-a̠. Because harsh phonation has been lost in W-YL, these vowels are now contrastive.

Syllabic fricative /v̩/ contrasts with back vowels /u/ and /o/ and is pronounced with lip compression, the upper teeth resting on the lower lip. Its diachronic source is usually Proto Lalo *-u. /v̩/ never occurs after bilabial initials or any kind of affricate or fricative except labiodentals /f v/. Close back vowel /u/ is a reflex of Proto Lalo *-aŋ, while mid back vowel /o/ is a reflex of Proto Lalo harsh *o̠. In C-LJ, [o̠] is an allophone of /u/, because it is only found in harsh syllables, whereas /u/ is only found in modal syllables. But in W-YL, harsh phonation has been lost, and therefore synchronically /o/ is now fully contrastive with /u/. The syllabic nasal is similar to that found in CW-QY. Table 3-25 gives examples of W-YL rhymes.

Table 3-25: W-YL rhyme examples

Rhyme	W-YL	English	Chinese	Rhyme	W-YL	English	Chinese
i	bi^{44}	full	满	o	bo^{44}	full (stomach)	饱
ɛ	bɛ^{21}	half	半	u	bu^{33}	rich	富
y	by^{21}	collapse	倒塌	ĩ	ĩ^{44}	look at	看
ø	mø^{44}	blow	吹	ɨ̃	ɨ̃^{44}	high	高
a	ba^{44}	insipid	没味道	ỹ	ỹ^{21}	short	短
ɑ	bɐ^{33}	bright	亮	ã	ã^{21}	fish	鱼
ɨ	bɨ^{44}	bud (v.)	发	ɛ̃	ɛ̃^{21}	many	多
ɣ̩	dɣ̩^{24}lɛ^{53}	wing	翅膀	n̩	n̩^{21}dy^{24}	head	头

In contrast to other Lalo varieties discussed above, W-YL and W Lalo varieties in general do not distinguish harsh versus modal phonation. Harsh phonation has been lost, and the resulting system has four contrastive level tones and one contour tone, all in modal voice. As described in more detail in §5.3, the Western Lalo group has undergone a split in Tone *1, a conditioned merger between Tone *1 and *H, and a phonetic change in *L from low to high register. The conditioning for the Tone *1 split is slightly different in W-YL as opposed to other W varieties. In W-YL, voiced initials conditioned a low-rising pitch, and elsewhere Tone *1 is realised as a mid-high level pitch. In other W varieties, as in W-DT (§3.5.1 below), low-rising is the default pitch reflex for Tone *1, and the mid-high level pitch is only found in syllables with PLa preglottalised initials. Table 3-26 summarises W-YL reflexes of Proto Lalo tone. Acoustic tonal analysis is given in §5.3.3.

Table 3-26: W-YL reflexes of Proto Lalo tones

Proto Lalo	W-YL	Chao pitch numbers
*1/*elsewhere and *H	Mid high	44
1/[+voi]_	Low-rising	24 [35 before 21; 34 after 55]
*2	Low	21
*3	Mid	33
*L	High	55 [53 phrase final]

Like Eka, W-YL's low-rising tone undergoes tone sandhi when preceding a low falling tone, and is realised as mid rising tone [35]. For example, [nɛ^{35}zɐ^{2}][1] 'little brother,' cf. [nɛ^{24}mɐ^{33}] 'little sister'. Also, when following a high pitch syllable, the low-rising tone's beginning pitch is raised to mid, thereby reducing the contour, cf. [ɣɨ^{24}] 'liquid' in isolation, but [kɨ^{55}ɣɨ^{34}] 'bile,' (literally 'bile liquid').

3.5.1 Dutian (W-DT)

Dutian Village Cluster (W-DT) is located in Taiping Township, Yangbi County in Dali Prefecture. *A lexical compendium of Yi dialects* (YNYF 1984) contains a wordlist that was collected in the Yangbi County seat that shows a great deal of similarity to W-DT's phonology, although not identical. This phonological analysis is based on recordings of two native speakers, both males in their twenties. W-YL and W-DT's phonologies have a few differences. W-DT's [f], [w] and [j] can be grouped together as /f/: [f] before /ɛ ɣ̩/, [w] before rounded vowels /y u o/, and [j] before /i a/.

/f/, /x/ and /ɣ/ are contrastive, with /x/ and /ɣ/ occurring before /y ɛ ɨ a o/. Table 3-27 gives W-DT's initial consonant inventory.

Table 3-27:W-DT initial consonant inventory

	Labial	Alveolar	Strident Alveolar	Retroflex	Velar	Laryngeal
Stops & Affricates	p pʰ b	t tʰ d	ts tsʰ dz	tʂ [tɕ] tʂʰ [tɕʰ] dʐ [dʑ]	k kʰ g	[ʔ]
Fricatives	f [w] [j] v		s z	ʂ [ɕ] ʐ [ʑ]	x ɣ	h [h̃]
Nasals	m	n [ɲ]			ŋ	
Approximant		l				

Also, W-DT has a contrastive close-mid vowel /e/, which contrasts with /i/ and /ɛ/, while W-YL only has /i/ and /ɛ/. In W-DT, [ø] is in complementary distribution with /y/, occurring only after velars, while W-YL has a contrastive /ø/ phoneme. W-DT has merged the reflexes of *a, *oŋ and *ok to /o/, whereas W-YL keeps the two sets separate as /ɑ/ and /o/. Table 3-28 gives W-DT's rhyme inventory.

Table 3-28: W-DT rhyme inventory

	Front	Rounded	Central	Back	Nasalised	Syllabic consonants
Close	i [iɛ]	y [ø]	ɨ [ɿ][ʅ]	u	ĩ, ɨ̃	v̩
Close-mid	e			o	õ	n̩ [m̩] [ŋ̍]
Mid-open/Open	ɛ		a		ɛ̃	

As explained in §5.3, W-DT's Tone *1 split to mid-high level pitch is only found in syllables with *preglottalised initials, while syllables with all other initials, including voiceless initials, split to low-rising. W-DT's high tone reflex of *L, correponding to W-YL's [55/53] tone, is a high rising tone [45], rather than a level or falling tone. Acoustic analysis is given in §5.3.3.

Table 3-29: W-DT reflexes of Proto Lalo tones

Proto Lalo	W-DT	Chao pitch numbers
*1/*ʔinitials_; *H	High level	44
*1/*elsewhere	Low-rising	24
*2	Low	21
*3	Mid	33
*L	High rising	45

3.5.2 Shuizhuping (W-SZP)

Shuizhuping Village Cluster (W-SZP) is located in Longtan Township, Yangbi County, Dali Prefecture. The phonological analysis is based on recordings of two native speakers, both females in their fifties.

W-SZP has the same inventory of initials and vowels as W-DT. That is not to say the two systems have developed the same way historically. Whereas W-DT's /o/ phoneme is robustly contrastive, due to the merger of *a, *oŋ and *ok, W-SZP's /o/ is marginal, only occurring after velars and /h/. However, /u/ also occurs after velars, a result of the change of *aŋ > /u/, e.g. *glaŋ¹ 'cold' > [gu²⁴]. These two vowels therefore contrast after velars; otherwise [o] would be considered an allophone of /u/ after velars. In W-SZP, PLa rounded vowel *y merges with *aŋ to /u/ after velar initials, which is in contrast with W-SLZ's development, explained below. W-SZP's close mid vowel /e/ is realised as diphthong [ai] after velars.

W-SZP's tonal system is very similar to W-DT, with only a phonetic difference in the realisation of *L reflexes. W-SZP's *L tone category is consistently realised as a convex rising-falling tone, [453], even in utterance medial position. Acoustic analysis is given in §5.3.3.

3.5.3 Shanglizhuo (W-SLZ)

Shanglizhuo Village Cluster (W-SLZ) is located in Wama Township, Longyang Town, Baoshan Municipality. The Lalo at this location report that they migrated from Dali over a hundred years ago. The phonological analysis is based on recordings of two native speakers, one male and one female, both in their fifties.

W-SLZ's phonological system is very similar to W-SZP, both synchronically and diachronically. However, in W-SLZ, PLa rounded vowel *y develops as diphthong [ue] after velars, instead of merging with *aŋ to /u/ as W-SZP does. The diphthong [ue] is not contrastive and is an allophone of /y/ after velars. W-SLZ has a contrastive palatal nasal /ɲ/, from PLa *ɲ, which is contrastive with /n/ before /a/, as shown by the near minimal pair [na^{44}] 'to listen' from *ʔna^{1} and [a^{44}ɲa^{44}] 'bird' from *ɲa̠^{H}. Like W-SZP, close mid vowel /e/ is realised as diphthong [ai] after velars; unlike W-SZP, /e/ is also realised as [ai] after the alveolar affricates. In W-SLZ, velar stops are backed to uvular position before back vowels /o/, /a/ and [ai].

W-SLZ and W-SZP's tonal systems are basically identical. Acoustic analysis is given in §5.3.3.

3.6 Eastern Lalo: Diaocao (E-DC)

Diaocao (E-DC) Lalo is chosen to represent the Eastern Lalo dialect group, which also includes E-HS and E-TS, all within the domain of Dali Municipality, outside of the prefectural capital Xiaguan. A recent description of E-DC phonology is Lam and Lam's (2008) unpublished working paper. Although the analysis here is essentially the same as Lam and Lam (2008), differences are noted below. This phonological sketch is based on data collected from four native speakers, all male, two in their fifties, one in his sixties, and one in his thirties. Recordings were taken in Diaocao Village Cluster, Xiaguan Town, Dali Municipality, Dali Prefecture. The syllable template for E-DC is similar to most Western Lalo varieties: (C)VT. E-DC has 26 initials, 15 rhymes, and 5 contrastive tones. There are also syllabic nasals, which do not combine with initials but do carry a tone. E-DC Lalo initials are summarised in Table 3-30 below:

Table 3-30: E-DC initial consonant inventory

	Labial	Alveolar	StridentAlveolar	Alveopalatal	Velar
Stops &	p	t	ts	tɕ	k
Affricates	pʰ	tʰ	tsʰ	tɕʰ	kʰ
	b	d	dz	dʑ	g
Fricatives	f		s [ɕ]		x
	v		z		ɣ [j, ʝ]
Nasals	m	n [ɲ]			ŋ
Approximants	w	l			

Like Central Lalo, E-DC distinguishes two series of affricates, though in E-DC there are no retroflexes as there are in CW-QY. Instead, there are alveopalatal affricates /tɕ tɕʰ dʑ/ which contrast with alveolar affricates and fricatives /ts tsʰ dz s/. The voiced alveopalatal affricate [dʑ] only occurs before /i/ in native vocabulary, which is the only environment /dz/ and /dʑ/ are contrastive. Alveolopalatal [ɕ] is an allophone of /s/ before /i/ and before diphthongs with the palatal onglide. There is no contrastive voiced alveopalatal fricative /ʑ/; this phone does not occur. The lack of voiced alveopalatal affricates and fricatives differs from Lam and Lam's (2008) analysis, which has /ʑ/. Lam and Lam’s transcription of [ʑ] parallels my transcription of [j]. Since there is no audible friction in most instances of [j] in the recordings, I prefer to transcribe this sound as an approximant. When occurring before close front vowel /i/, however, there is friction and the phoneme is realised as palatal fricative [ʝ]. The main diachronic source for [j] and [ʝ] is Proto Lalo *ʒ, which merged with *z to the alveolar fricative [z] before close vowels *i and *u, and weakened to [j] and [ʝ] elsewhere.

Table 3-31: E-DC initial examples

Initial	E-DC	English	Chinese	Initial	E-DC	English	Chin.
p	na^{21}pa^{55}	ear	耳朵	kʰ	kʰa̤^{21}	bitter	苦
pʰ	pʰa^{21}-	face	脸	g	ga^{31}	drive out	赶
b	na^{21}ba^{21}	earring	耳环	f	fɛ^{33}	dry	干
t	ta^{55}pɨ^{55}	buttocks	屁股	v	va^{33}	round	圆
tʰ	tʰa^{21}	don't	别	s	a^{21}sa^{21}	who?	谁?
d	da^{24}	drink	喝	z	zɔ^{21}	son	儿子
ts	a^{55}tsa^{55}	what?	什么	x	xa^{33}tsɿ^{31}pu^{31}	rat	老鼠
tsʰ	tsʰa^{21}	ginger	姜	ɣ	ɣɔ^{21}	snow	雪
dz	dza^{24}	study	学	m	ma^{21}	old	老
tɕ	tɕa^{55}	fold	折	n	na^{21}pa^{55}	ear	耳朵
tɕʰ	tɕʰɛ^{33}	request	请	ŋ	ŋa^{24}	affirmative	是
k	ja^{33}ka^{31}	wild animal	野兽	l	la^{24}	light	轻
				w	wa^{31}bɔ^{21}tʰɛ^{55}	cliff	悬崖

Unlike Western varieties, /w/, /ɣ/ and /f/ contrast before /ɛ/, although /w/'s occurrence before /ɛ/ is rare, occurring in only two examples in the wordlist. However, [ɣ], [ʝ] and [j] and are in complementary distribution, with [ɣ] before /ɛ ə ɔ/, [ʝ] before /i/, and [j] before /a u/, and are therefore analysed as allophones of /ɣ/. Alveolar nasal /n/ is palatalised [ɲ] before close front vowels /i/ and any diphthong beginning with a palatal onglide, i.e., /iɛ ia iɔ iu/. Like Eka, MD, XZ and YL, E-DC has undergone a merger of PLa *h and *x to /x/. Table 3-31 above gives examples of E-DC initials:

E-DC has a somewhat more complex system of rhymes than CW-QY, with eight monophthongs, six diphthongs and one syllabic nasal. Like W varieties, but unlike C varieties, E-DC distinguishes four levels of vowel height; C varieties only distinguish three. Table 3-32 below illustrates E-DC’s rhyme inventory.

Table 3-32: E-DC rhyme inventory

	Front	Central	Back	Diphthongs			Syllabic nasal
Close	i		u	iɛ	iu	ue	n̩
Close-mid	e [ei]	ə [ɿ][ɨ]	ɤ̠	ia	iɔ	ua	
Open-mid	ɛ		ɔ				
Open		a					

Table 3-33 below gives examples of E-DC rhymes.

Table 3-33: E-DC rhyme examples

Rhyme	E-DC	English	Chinese
i	bi²⁴	pus	脓
e	bei⁴⁴	say	说
ɛ	bɛ²¹	slice in half (v.)	切成两半
ə	bə²¹	insect	昆虫
a	na²¹ba²¹	earring	耳环
u	bu³³	full (stomach)	饱
ɤ	mɤ⁵⁵	do (work)	做 (做工)
ɔ	bɔ²¹	thin (2d)	薄
iɛ	a⁵⁵mə²¹biɛ³¹	lightning	闪电
ia	bia²¹	honeybee	蜜蜂
iɔ	biɔ²⁴	fly	飞
iu	a⁵⁵miu³¹	monkey	猴子
ue	dzue²¹	think	思考
ua	sua³³tɤ²¹	trap (n.)	陷阱
n̩	n̩²¹də²⁴kə³³	head	头

This analysis differs from Lam and Lam (2008) in that there is no contrastive /o/ phoneme. There is no evidence of contrast between [o] and [u] in this data. All instances of [o] in Lam's data correspond to variation of [o] and [u] in my data. Speaker DC2 preferred [o] and Speaker DC1, [u]. Both speakers were older males. The other difference is that what Lam and Lam transcribe as [ɯ], I transcribe as the lower vowel [ɤ̪]. Close-mid back vowel /ɤ/ is realised with the upper teeth touching the lower lip, [ɤ̪], corresponding to W-YL and Eka's syllabic fricative [v̩] and XZ, W-SLZ, and YL's [ɤ̪]. Because there is no audible friction associated with this phone, I prefer to use the symbol [ɤ̪], with the dental diacritic below the segment denoting its co-occurring lip compression.

Close-mid front vowel /e/ [eʲ] contrasts with /i/ and /ɛ/. It is always realised with a close off-glide, even when utterance medial. Historically, /e/ reflects PLa *e. Central vowel /ə/ is realised as apical vowel [ɿ] after alveolar affricates and fricatives.Diphthongs beginning with close front vowel [i], as in /iɛ ia iu iɔ/ are analysed as diphthongs, not glide plus vowel, even though the onglide's main diachronic source comes from Proto Lalo palatalised intials (e.g., *pj and *mj, see §4.2.1.2). Because the onglide [i-] only combines with four vowels /ɛ a u ɔ/, these rhymes are analysed as diphthongs, rather than adding a series of contrastive palatalised initials. Diphthongs /ue ua/ are found in both native vocabulary and Han loanwords. Their occurrence in native vocabulary is rare, especially /ua/, which is found mostly in loanwords. The syllabic nasal /n̩/ behaves similarly to those found in other Lalo varieties.

Like W-YL, E-DC has lost the phonation contrast of harsh versus modal. Instead, E-DC has three contrastive level tones and two contour tones, rising and falling. Table 3-34 below summarises the development of E-DC tones. Like CE-YA (§3.2.1), E-DC shows a split in Tone *1, in which Proto Lalo voiced initial consonants conditioned a low-rising tone. Voiceless initials and preglottalised initials maintained the high level tone; when preglottalised and plain initials merged, the tone split became phonemically contrastive. This split, also seen in XZ and W-YL, is described in further detail in §5.3. In contrast with W-YL, E-DC's *H did not merge with *1/*ʔ_, but rather with *3, resulting in a mid level tone. Whereas harsh phonation conditioned the change from mid harsh to high modal in W-YL, in E-DC harsh phonation simply disappeared, leading to the merger of mid harsh and mid modal. This merger is also seen in other E varieties. A related phenomenon is the development of *L to a mid falling tone. In E-DC, *L did not change to the highest tone in the system, as it did in W-YL and other Western Lalo varieties, but rather to a mid falling tone. In E-DC, harsh phonation conditioned a slightly higher initial pitch in *L, resulting in a pitch that begins at mid and rapidly falls to low.

Table 3-34: E-DC reflexes of Proto Lalo tones

Proto Lalo	E-DC	Chao pitch numbers
*1/elsewhere	High level	55
1/[+voi]	Low-rising	24 [34 after 55]
*2	Low	21
*3 and *H	Mid	33
*L	Mid falling	31

Like W-YL, E-DC's low-rising tone undergoes tone sandhi after the high level tone and is realised as [34] with a slightly higher initial pitch and reduced F0 movement, e.g., [a^{55}dzə^{34}] 'eagle,' but [dzə^{24}] 'bridge'. E-DC does not, on the other hand, show raising of the low-rising tone before the low falling tone, as both W-YL and Eka show. Nor does it show leveling of the low falling tone before another low falling tone, as Eka shows. Acoustic analysis of E-DC's tonal system is given in §5.3.2.

3.6.1 Taoshu (E-TS)

Taoshu Village Cluster (E-TS) is located in Taiyi Township, Dali Municipality, Dali Prefecture, and has never before been documented. The phonological analysis is based on recordings of four native speakers: one male and one female in their fifties and two males in their thirties. The syllable template is similar to CW-QY, (C)VTP and NT. Table 3-35 gives E-TS's initial consonant inventory.

Table 3-35: E-TS initial consonant inventory

	Labial	Alveolar	Strident Alveolar	Palatal/ Palatoalveolar	Velar	Laryngeal
Stops & Affricates	p	t	ts	tʃ [tɕ]	k	[ʔ]
	pʰ	tʰ	tsʰ	tʃʰ [tɕʰ]	kʰ	
	b	d	dz	dʒ [dʑ]	g	
Fricatives			s [ɕ]		x [f]	h [ɦ̃]
	v		z		ɣ [w] [j]	
Nasals	m	n		ɲ	ŋ	
Approx-imants		l				

E-TS, like E-DC, has no retroflex affricates or fricatives, and instead has palatoalveolar affricates that are realised as alveopalatals before close front vowels /i y/. Fricative [ɕ] only occurs before /i y/, and so is grouped as an allophone of /s/, and [ʑ] does not occur at all. Velar and glottal fricative /x/ and /h/ [ɦ̃] contrast before /ə/ and /ɔ/, unlike E-DC, which has merged PLa *x and *h to /x/. [f] is an allophone of /x/ before /ɤ/. E-TS's [ɣ], [w], and [j] are grouped together as allophones of /ɣ/, with the following distributions: [ɣ] occurs before /ɛ ə ɔ/, [w] before /u/, [j] before /i a/. E-TS's /ɲ/ contrasts with /n/ before /a/, as in W-SLZ.

Table 3-36 gives E-TS's rhyme inventory. E-TS's vowel system shares some characteristics with Central varieties like CW-QY. Like Central, E-TS vowels have both modal and harsh phonation, but unlike Central, harsh phonation is only seen in the reflexes of PLa *L and not *H. Like Central, E-TS does not have a contrastive close-mid /e/, but instead has only /i/ and /ɛ/. This is similar to the development of most Central Lalo varieties and W-YL.

E-TS's /y/ is realised as central rounded [ʉ] after labial initials. E-TS's /ə/ corresponds to most other varieties' close central /ɨ/; in E-TS's case, [ɨ] is only found after velar initials, and [ə] occurs elsewhere. Each of E-TS's modal vowels have nasalised counterparts, which occur without any initial consonant. As elsewhere, E-TS's nasalised vowels are the result of the loss of *preglottalised nasals under various conditions, illustrated in §4.1.5.

Table 3-36: E-TS rhyme inventory

	Front	Rounded	Central	Back	Nasalised	Syllabic nasal
Close	i [i̠]	y [y̠][ʉ]		u [u̠]	ĩ, ỹ	n̩
Close-mid			ə [ə̠] [ɨ̠] [ɿ]	ɤ [ɤ̠]	ɛ̃, ə̃	
Open-mid	ɛ [ɛ̠]			ɔ [ɔ̠]	ɔ̃	
Open			a [a̠]		ã	

Table 3-37 gives E-TS's reflexes of Proto Lalo tones. E-TS shares the same basic tonal system as E-DC, with the exception of the retention of harsh phonation in *L. Like E-DC, E-TS has split Tone *1 to low-rising pitch after unprefixed, voiced consonants, and to high level elsewhere. Also like E-DC, E-TS has lost harsh phonation in *H, resulting in the merger of *3 and *H have to mid level pitch in modal voice. However, E-TS has retained harsh voice in *L, which is realised as a low-falling pitch in harsh phonation, similar to Central varieties.

Table 3-37: E-TS reflexes of Proto Lalo tones

Proto Lalo	E-TS	Chao pitch numbers
*1/elsewhere	High level	55
1/[+voi]	Low-rising	24
*2	Low	21
*3 and *H	Mid	33
*L	Low and harsh	2̠1̠

3.6.2 Houshan (E-HS)

Houshan Village Cluster (E-HS) is located in Fengyi Town, Dali Municipality, Dali Prefecture, and has never before been documented. The phonological analysis is based on recordings of five native speakers: one male and two females in their fifties and two males in their thirties. The syllable template is the same as E-TS, (C)VTP and NT. Table 3-38 gives E-HS's initial consonant inventory.

Table 3-38: E-HS initial consonant inventory

	Labial	Alveolar	Strident Alveolar	Palatal/ Alveopalatal	Velar	Laryn-geal
Stops & Affricates	p pʰ b	t tʰ d	ts [tʃ] [tʂ] tsʰ [tʃʰ] [tʂʰ] dz [dʒ] [dʐ]	tɕ tɕʰ dʑ	k kʰ g	[ʔ]
Fricatives	f v		s [ʃ] [ʂ] z [ʒ]	ɕ	x ɣ [w]	h [h̰̃]
Nasals	m	n			ŋ	
Approx-imants		l		j		

E-HS's alveolar series of affricates and fricatives have the following allophones: palatoalveolar before central vowel /ə/, retroflex before the rhotacised vowels /ɛ/ [ɛ˞] and /ɤ/ [ɤ̰˞], and alveolar elsewhere (/i a u ɔ/). The alveopalatal series occurs most frequently before close front vowels /i y/, but also occurs before /a/ and /u/, and so contrasts with the alveolar series before /i a u/. Alveopalatal [ʑ] does not occur, as in E-DC. Velar fricative /ɣ/ has allophone [w] before modal vowel /u/ and harsh vowels /ṵ/ and /a̰/, and [ɣ] before modal vowels /ɛ ɨ ɔ a/. [j] has very restricted distribution, occurring only before modal /i/ and /a/. [f], which only occurs before modal /ɛ ə ɤ/, contrasts with /x/ before /ɛ ə/.

Table 3-39 gives E-HS's rhyme inventory. In E-HS, only /i ɛ a ɔ/ occur in harsh phonation, in contrast with E-TS, where all vowels may occur in harsh phonation. E-HS also has fewer nasalised vowels than E-TS. Like E-DC, E-HS has diphthongs /ia/ and /ua/ in native vocabulary, though E-DC additionally has /iɛ iɔ iu ue/ in native vocabulary. Like E-TS, but in contrast with E-DC, E-HS does not have a contrastive close-mid front vowel /e/. E-HS's /ə/ corresponds to E-DC's /ə/ and to Central Lalo's /y/ and /ɨ/; /ə/ is realised as close central vowel [ɨ] after velars, palatoalveolars and labiodental fricatives.

Table 3-39: E-HS rhyme inventory

	Front	Central	Back	Diphthongs	Nasalised vowels	Syllabic nasal
Close	i [i̠][ɿ]		u	ia , ua		n̩
Close-mid		ə [ɨ]	ɤ		ɤ̃	
Open-mid	ɛ [ɛ̰]		ɔ [ɔ̰]		ɛ̃, ɔ̃	
Open		a [a̰]				

E-HS and E-TS share the same tonal system, as seen in Table 3-40 below. Like E-DC and E-TS, E-HS has split Tone *1 and merged *3 and *H. Both E-HS and E-TS have retained harsh voice in *L.

Table 3-40: E-HS reflexes of Proto Lalo tones

Proto Lalo	E-TS	Chao pitch numbers
*1/elsewhere	High level	55
1/[+voi]	Low-rising	24
*2	Low	21
*3 and *H	Mid	33
*L	Low and harsh	<u>21</u>

3.7 Southeastern Lalo: Gaoping (SE-GP)

Southeastern Lalo phonology is represented here by the variety spoken in Dashuping Village, Gaoping (GP) Village Cluster, Micheng District, Midu County, Dali Prefecture; Although the SE-GP variety has never before been documented, Lam and Chan (2009) collected 200-item wordlists in two SE Lalo villages: Majiefang Village in Runze Village Cluster, Miaojie District, and Duoyucun Village in Ziyou Village Cluster, Nanzhao District, both in Weishan County, Dali Prefecture. Lam and Chan (2009) report that SE Lalo is also spoken in Fulong Village, Tianze Village Cluster, Miaojie District, and Sanjiacun Village, Gucheng Village Cluster, Nanzhao District, both in Weishan County, as well as Shijia, Waze, and Duogu villages in Midu County. Lam and Chan estimate the speaker population for SE Lalo is around 12,000.

This phonological sketch is based on recordings of five native speakers, two female and two male speakers in their thirties and one male speaker in his forties in Dashuping Village, Gaoping Village Cluster, Micheng District, Midu County. The SE-GP syllable template is (C)VTP, in which one of 30 optional initial consonants is followed by one of 12 obligatory vowels with one of 5 tones. Additionally, there is NT, in which a syllabic nasal has a tone. SE-GP Lalo initials are summarised in Table 3-41 below:

Table 3-41: SE-GP initial consonant inventory

	Labial	Alveolar	Strident Alveolar	Retroflex/ Palatal	Velar	Laryngeal
Stops & Affricates	p pʰ b	t tʰ d	ts tsʰ dz	tʂ [tɕ] tʂʰ [tɕʰ] dʐ [dʑ]	k kʰ g	[ʔ]
Fricatives	f v		s z	ʂ [ɕ] ʐ [ʑ]	x ɣ [ɣʷ]	h [h̃]
Nasals	m	n [ɲ]			ŋ	
Approximant	w	l		j		

SE-GP's alveolar affricates and fricatives only contrast with the retroflex series before the close central vowel /ɨ/. Elsewhere, alveolar affricates are found only before back vowels (/u, o, a/), retroflexes are found before the front vowel /ɛ/, and alveopalatals are found before other front vowels and diphthongs with a close front onset (/i, y, ia, iao/). Alveopalatal affricates and fricatives could be considered as allophones of either the alveolar or retroflex series, since they are in complementary distribution with both.

Approximants /w/ and /j/ and voiced velar fricative /ɣ/ contrast before back vowels, but none of them occur before front vowels. /f/ is contrastive with /x/ before /ɛ/ and /u/. /x/ and /h/ contrast before both front and back vowels, and /h/ always occurs with nasalization ([h̃]). /n/ is palatalised [ɲ] before /i/ and diphthongs /ia, iao/. Table 3-42 below gives examples of SE-GP initials:

Table 3-42: SE-GP initial examples

Initial	SE-GP	English	Chinese	Initial	SE-GP	English	Chin.
p	la^{55}pa^{44}	ear	耳朵	f	fɛ^{33}	dry	干
pʰ	ha^{55}pʰa^{21}	Han	汉族	v	va^{21}	vegetable	菜
b	la^{55}ba^{21}	earring	耳环	s	a^{21}sa^{21}	who?	谁?
t	ta^{33}	feed animals	喂	z	kʰɨ^{21}za^{33}	hide self	躲
tʰ	tʰa^{21}	don't	别	ʂ	ʂʅ^{44}	gold	金
d	da^{44}	drink	喝	ʐ	ʐʅ^{21}mɛ^{21}	daughter	女儿
k	ka^{44}	hang	挂	x	xa^{21}	send off	送
kʰ	kʰa̤^{21}	bitter	苦	ɣ	ɣɨ^{33}	count	数
g	ga^{33}	grind	磨	h	a^{44}ha^{33}	rat	老鼠
ts	tsa^{21}pʰɨ^{44}	wet	湿	m	ma^{21}	NEG.	不
tsʰ	tsʰa^{21}	ginger	姜	n	na^{33}	swallow	咽
dz	dza^{44}	study	学	ŋ	ŋa^{44}	affirmative	是
tʂ	tʂʅ^{44}	hide thing	藏	l	la^{44}	come	来
tʂʰ	tʂʰʅ^{44}	lard	猪油	j	ja^{44}mɨ^{21}	mosquito	蚊子
dʐ	dʐʅ^{21}	eat	吃	w	a^{44}wa^{44}	mother	母亲

SE-GP has seven monophthongs and five diphthongs, along with a syllabic nasal. Table 3-43 below illustrates SE-GP's rhyme inventory. As with E-DC, diphthongs beginning with close front vowel [i], as in /iɛ ia iao/ are analysed as diphthongs, not glide plus vowel. Diphthongs /ou ua/ are found in both native vocabulary and Han loanwords, though their occurrence in native vocabulary is rare. The syllabic nasal /n̩/ behaves similarly to those found in other Lalo varieties.

Table 3-43: SE-GP rhyme inventory

	Front	Front rounded	Central	Back	Diphthongs	Syllabic nasal
Close	i	y	ɨ	u	iɛ, ia, iao, ua	n̩
Open-mid	ɛ			o	ou	
Open			a			

Table 3-44 below gives examples of SE-GP rhymes:

Table 3-44: SE-GP rhyme examples

Rhyme	SE-GP	English	Chinese
i	bi̠³³	say	说
ɛ	bɛ²¹	slice in half (v.)	切成两半
ə	bɨ²¹	insect	昆虫
a	la²¹ba²¹	blanket	被子
u	bu⁴⁴	pus	脓
o	bo²¹	thin (2d)	薄
iɛ	miɛ⁴⁴	see	看见
ia	bia³³	insipid	没味道
iao	a²⁴mia̠o̠²¹	monkey	猴子
ua	dua²¹wu³³	start	开始
ou	ou²¹pɨ³³	burp	打嗝
n̩	n̩²¹	two	二

Table 3-45 below shows SE-GP's reflexes of Proto Lalo tones. SE-GP stands out from other Lalo languages in showing tone splits in *2 and *L that are similar to those found in Lolo and Lisu. In SE-GP, Proto Lalo voiceless unaspirated initials (from PN *ʔ- prefixed initials) triggered a split to high pitch in *2; in *L, all voiceless initials (from PN *ʔ- prefixed initials or *C- prefixed initials) conditioned the change to high pitch. *ʃ (but not *s) is an additional condition for the *2 split, which must have occurred before the conditioned merger of *ʃ and *s, because *s does not take part in the split. *ʃ and *s merged with the following conditions: *ʃ and *s > ʂ/_*ɛ, *ʃ > ʂ/_*i, *ʃ > s/elsewhere. Tone *H syllables with PLa preglottalised sonorants merge with *1 to mid-high level pitch; in all other environments, *H merges with *3 to mid-level pitch. Acoustic analysis of SE-GP's tonal system is given in §5.3.5.

Table 3-45: SE-GP reflexes of Proto Lalo tones

Proto Lalo	SE-GP	Chao pitch numbers
*1 and *H/*ʔ[+sonorant]_	Mid high level	44
*2/*ʃ, *ʔ_, *[-voi, +sg]__ *L/*[-voi]__	High	55
*2/elsewhere	Low	21
*3 and *H/elsewhere	Mid	33
*L/[+voi]___	Low falling, harsh	21

3.8 Yangliu (YL)

The YL Lalo variety has never before been documented, although the presence of a distinct type of Lalo in this area of Baoshan is mentioned in several sources (BSSZ 1993, BSDQY 1998, and Hattaway (2003) based on Pelkey (1999)). This phonological sketch is based on recordings of three native speakers: one male in his fifties and two females, one 18 years old and the other in her thirties. The recordings took place in Gangou Village, Yangliu Village Cluster, Yangliu Township, Longyang Town, Baoshan Municipality.

The YL Lalo syllable template is (C)V(N)T, in which the optional initial is one of 25 consonants, an obligatory vowel (one of 11 vowels or 1 syllabic fricative), an optional nasal final /-ŋ/, and tone (one of 3 or 4, depending on speaker's age). All tones are in modal phonation. Syllabic nasals are also found. This template is similar to Eka's, in that final -ŋ is found within a syllable boundary in slow speech (i.e., is not a merger of open syllables and the syllabic nasal in fast speech, as is found in CW-QY). Table 3-46 gives YL's initial consonant inventory.

Table 3-46: YL initial consonant inventory

	Labial	Alveolar	Strident Alveolar	Palatal	Velar	Laryn-geal
Stops & Affricates	p	t	ts [tʂ] [tɕ]		k	[ʔ]
	p^h	t^h	ts^h [$tʂ^h$] [$tɕ^h$]		k^h	
	b	d	dz [dʐ][dʑ]		g	
Fricatives	f		s [ʂ][ɕ]		x	h[ɦ̃]
	v		z [ʑ]		ɣ [w]	
Nasals	m	n		ɲ	ŋ	
Approximants		l		j		

Like Eka, YL has merged the alveolar and palatoalveolar affricate and fricative series to the alveolar position. Alveolars are realised as retroflex before the rhotacised mid-open vowel /ɛ/ [ɛ˞], and as alveoalatal before close front vowels /i/ and /y/. Similar to W-SLZ, YL has a contrastive palatal nasal, which occurs before /ɛ a o/. Velar fricative /ɣ/ is realised as [w] before back vowels /u v̩/, and as [ɣ] elsewhere. /f/ and /j/ contrast before /ɛ/, but /f/ is very restricted in its distribution, occurring only before /ɛ/ and /v̩/, while /j/ occurs before /i ɛ a/.

Table 3-47 gives YL's rhyme inventory. Like some Western varieties, YL distinguishes mid /e/ from lower mid /ɛ/. Unlike Western, however, YL has an additional contrastive diphthong /ai/ and a nasal final -ŋ. The nasal final -ŋ, which occurs rarely, appears in rhymes /-aŋ/ (as in [aŋ^{21}] 'fish') and /-əŋ/ (as in [nəŋ^{53}] 'snot') in native vocabulary, and /-iŋ/ and /-oŋ/ in loan words. YL's /ə/ corresponds to Western and Central Lalo's close rounded vowel /y/.

Table 3-47: YL rhyme inventory

	Front	Cen-tral	Back	Diphthong	Nasalised	Nasal final	Syllabic consonants
Close	i	ɨ [ʅ]	u		ĩ		v̩
Close-mid	e		o		õ	-ŋ	n̩ [m̩] [ŋ̩]
Mid/open	ɛ˞	ə	ɑ	ai			

Table 3-48 shows the tonal inventories of Speaker YL1 (18 years old) and Speaker YL2 (over 50 years old), respectively:

Table 3-48: YL reflexes of Proto Lalo tones

Proto Lalo	Older	Chao #	Younger	Chao #
*1/elsewhere	Low-rising	24	Mid	33
1/[-voi]_ *3	Mid	33		
*2	Low	21	Low	21
*H and *L	High falling	53	High falling	53

The analysis shows a difference between older and younger speakers. While Speaker YL2, the older speaker, shows a split in Tone *1, the younger speaker has merged all Tone *1 and Tone *3 reflexes to a mid level [33] pitch. In the older speaker's speech, Tone *1 is reflected as a mid level pitch for syllables with voiceless initials, and a low-rising pitch elsewhere. This generational difference suggests that YL younger speakers have undergone a merger of Tone *1's low-rising reflexes with the already merged Tone *1 [voiceless initial] and Tone *3 categories. Acoustic analysis of the two tonal systems is given in §5.3.5.

3.9 Xuzhang (XZ)

XZ Lalo has never before been documented. Several sources (BSSZ 1993, BSDQZ 1998, Pelkey 1999, Hattaway 2003) state that XZ and YL Lalo are distinct groups, which is corroborated by the linguistic evidence. This phonological sketch is based on recordings of two native speakers, both males in their forties. The recordings took place in Xuzhang Village Cluster, Wafang Township, Longyang Town, Baoshan Municipality. Table 3-49 gives XZ's initial consonant inventory.

XZ Lalo shares the same syllable template as YL: (C)V(N)T, in which the optional initial is one of 30 consonants, an obligatory vowel (one of 13 vowels or 1 syllabic fricative), an optional nasal final /-ŋ/, and tone (one of 4). All tones are in modal phonation. Syllabic nasals are also found.

Unlike YL, XZ has not merged the Proto Lalo palatoalveolar and alveolar affricate series. Retroflex affricates and fricatives are realised as alveopalatal before close front vowels /i/ and /y/. There are no examples of voiced retroflex initial plus /y/ (/ʐy/) in the data set. Velar fricative /ɣ/ is realised as approximant [w] before close back vowel /u/, and contrasts with /j/ before /a/ and /o/. [f] and [j] are in complementary distribution, with [f] before /v̩/ and /ɛ/, and [j] before /a o/. Palatal nasal /ɲ/, like YL's, is contrastive with /n/ before /ɛ a o/, but the contrast is neutralised before /i/, where both initials are realised as palatal.

Table 3-49: XZ initial consonant inventory

	Labial	Alveolar	Strident Alveolar	Retroflex/Palatal	Velar	Laryngeal
Stops & Affricates	p	t	ts	tʂ [tɕ]	k	[ʔ]
	pʰ	tʰ	tsʰ	tʂʰ [tɕʰ]	kʰ	
	b	d	dz	dʐ [dʑ]	g	
Fricatives	f [j]		s	ʂ [ɕ]	x	h [h̃]
	v		z	ʐ [j]	ɣ [w]	
Nasals	m	n		ɲ	ŋ	
Approximants		l				

Table 3-50 gives XZ's rhyme inventory. Like W-SLZ, close mid vowel /e/ is realised as diphthong [ai] after velars and the alveolar affricates. Also like W-SLZ, diphthong [ue] is an allophone of /y/ after velars. Like YL, XZ has a nasal final /-ŋ/: /-aŋ, -ɨŋ, -oŋ/ in native vocabulary and /-iŋ, -iaŋ/ in Chinese loanwords. The nasal final in PLa *aŋ is often retained in Tone 2, e.g. in [tʰaŋ^{21}] 'pine tree' and 'pangolin' from *tʰaŋ^{2}, [haŋ^{21}] 'rotten (meat)' from *haŋ^{2}, but not in [ma^{21}] 'old', from *maŋ^{2}. XZ's nasalised initials developed compensatorily from the loss of *preglottalised initials, as in other Lalo dialects and described in §4.1.5.

Table 3-50: XZ rhyme inventory

	Front	Rounded	Central	Back	Nasalised	Nasal final	Syllabic consonants
Close	i	y [ue]	ɨ [ʅ]	u	ĩ, ỹ, ṽ̍		v̩
Mid	e [ai]			o	õ	-ŋ	n̩ [m̩] [ŋ̍]
Mid/open	ɛ˞		a		ã		

XZ shows a conditioned split in Tone *1 along the same lines as Eastern Lalo and W-YL. The high tone is usually realised as a high rising falling pitch [453] in a monosyllabic utterance. XZ shows loss of harsh phonation in *H and *L, a change which enabled the three way merger of *3, *H, *L. Unlike any other Lalo variety, XZ has merged *3, *H, *L to the mid level tone [33]. The resulting system contrasts four tones: High, Mid, Low, and Low-rising, as seen in Table 3-51 below. Acoustic analysis of the tonal system is given in §5.3.5.

Table 3-51: XZ reflexes of Proto Lalo tones

Proto Lalo	XZ	Chao pitch numbers
*1/elsewhere	High	55 [453]
1/[+voi]_	Low-rising	24
*2	Low	21
*3, *H, *L	Mid	33

3.10 Summary

This chapter provides a brief overview of fifteen Lalo varieties' phonologies, grouped into the Lalo subgroups as described in Chapter 6. The synchronic descriptions of these varieties provide the basis for the reconstruction of Proto Lalo given in Chapter 4. The divergent tonal developments of Lalo varieties are more fully explored in Chapter 5.

4 *Proto Lalo segments*

4.1 Introduction

This chapter presents a reconstruction of Proto Lalo (PLa) segments. The reconstruction of PLa tone is presented in Chapter 5. PLa is reconstructed by comparing Lalo varieties' cognate sets to each other and by tracing PLa's development from Proto Ngwi (PN) (Bradley 1979b) and Proto Burmic (Proto Lolo-Burmese) (PB) (Matisoff 1972, 2003). This chapter is divided into two main sections, initial consonants followed by rhymes. In each section, I present the relevant PLa phonological system, describe how PLa developed from PN/PB, and present the reasoning and evidence for my reconstruction.

All cited PN reconstructions are based on Bradley (1979) unless followed by (PB), which indicates the reconstruction comes from Matisoff's (2003) Proto Burmic. A number following the gloss, e.g., 'book-1' PLa *tʰo², indicates the order in which the reconstructed syllable occurs in a compound word, as in 'book' PLa *tʰo² ɣu².

4.2 Proto Lalo initials

The Proto Lalo syllable template is *(C)V(ŋ)TP, in which one of 48 optional initials was followed by one of 9 obligatory rhymes. The rhyme system included eight monophthongs and one nasal final rhyme *-aŋ. The syllable carried one of 5 tones with either harsh or non-harsh (i.e., modal or breathy) phonation. PLa was mostly monosyllabic with some disyllabic compound words, unlike its ancestor PN, which was sesquisyllabic (i.e., weak syllable + strong syllable structure, a term coined by Matisoff (1973)). In PLa, PN prefixes sometimes pre-empted the initial of the strong syllable, but more often they influenced the initial's development in some way and then dropped off (e.g., the *s- prefix's devoicing of resonants, §4.2.3). PLa's preglottalised initials are the result of coalescence of the PN *ʔə- prefix with the following initial.

Table 4-1 presents PLa's initial consonant inventory. The proposed system includes 32 obstruents and 16 sonorants. Voiceless unaspirated, voiceless aspirated, and voiced stops and affricates are found at labial, alveolar, palatal, and velar places of articulation. Voiced and voiceless fricatives are also found at these places, with the addition of a voiceless glottal fricative, *h, which was probably nasalised [h̃]. Proto Lalo has palatalised labial and velar consonant clusters, i.e., *pj, *pʰj, *bj, *mj, *ʔmj, *kj, *kʰj, *gj, *ŋj, *ʔŋj, and labiovelar nasal *ŋw. Preglottalised *ʔŋw is unattested, but theoretically possible given the symmetry between preglottalised and plain initials. Proto Lalo distinguishes preglottalised and plain sonorants at labial, alveolar, palatal, and velar places of articulation, i.e., *ʔm, *ʔmj, *ʔn, *ʔɲ, *ʔŋ, *ʔŋj, and *ʔl, each with a plain counterpart, and two preglottalised fricatives, *ʔv and *ʔx, contrasting with plain *v and *x. In the following sections, the initials are divided into stops (including affricates and consonant clusters), fricatives, resonants, and nasals.

Compared to modern Lalo varieties, the Proto Lalo onset system is considerably more complex. Only a few Lalo varieties (i.e., E-DC, E-HS) preserve palatalised labial clusters, and only Longjie Lalo (from Björverud (1998)) preserves palatalised velar clusters. Also, most Lalo varieties have lost distinctive preglottalised initials, and those varieties that preserve them (CW-QY, C-LJ) only do so at labial and alveolar places of articulation. Distinctive correspondence sets provide evidence of the initials that are now found only rarely or not at all.

Table 4-1: PLa initial consonant inventory

*p	*pj	*t	*ts	*tʃ	*k	*kj		
*pʰ	*pʰj	*tʰ	*tsʰ	*tʃʰ	*kʰ	*kʰj		
*b	*bj	*d	*dz	*dʒ	*g	*gj		
*f			*s	*ʃ	*x			*h
*v			*z	*ʒ	*ɣ			
*ʔv					*ʔx			
*m	*mj	*n		*ɲ	*ŋ	*ŋj	*ŋw	
*ʔm	*ʔmj	*ʔn		*ʔɲ	*ʔŋ	*ʔŋj	*ʔŋw	
		*l						
		*ʔl						

4.2.1 Stops

Table 4-2 below shows the development of manner of articulation of stops and affricates from PN to PLa, using the bilabial place of articulation (p and b) as cover symbols for all stops and affricates, but not including consonant clusters, which are addressed in §4.2.1.2. PN has two main syllable types: closed syllables ending in a stop, and non-closed syllables ending in a vowel (V) or nasal (N) (Bradley 1979b). Sometimes these syllable types affect the development of manner of the initial, as described below. *C is a cover symbol for the Proto Tibeto-Burman voiced consonantal prefixes *b, *d, *g, *r, *l, which sometimes affect the development of PN initials and tones (Bradley 1979b). By the Proto Ngwi stage, the *s- and *ʔ- prefixes had merged before stops, represented here as *ʔ-.

Like most other Ngwi languages, plain *p and *C-p in all syllable types developed into voiceless aspirated initials. *ʔ-b in non-closed syllables and *ʔ-p in all syllable types developed into voiceless unaspirated initials. *ʔ-b in stopped syllables, prenasalised *mp and *mb, *C-b, and plain *b in all syllable types developed into voiced initials. PN's *C-prefixed stops and plain stops develop in the same way, with the voiceless stop becoming voicless aspirated and the voiced stop remaining voiced; in other words, *C had no effect on the voicing of the stop. These developments parallel Lisu (Bradley 1979b). Matisoff (2003: 113) finds no surviving evidence for a contrast of voicing in preglottalised obstruents in syllables ending in a vowel or nasal at the PN stage, although there may be languages still awaiting documentation that may prove the contrast. There was a voicing contrast in closed syllables, as evidenced by the split into *L and *H (Matisoff 1972). Lahu has merged the voicing distinction in both syllable types, but PLa preserved the voicing distinction, with *ʔ-p becoming voiceless unaspirated, and *ʔ-b remaining voiced in closed syllables. In PLa non-closed syllables, both *ʔ-p and *ʔ-b have merged to voiceless unaspirated.

Table 4-2: Development of manner of PLa stops and affricates

PN	PLa
*p, *Cp	pʰ
*ʔp *ʔb/_V, N	p
*ʔb/_stop *mp,*mb *b, *Cb	b

Table 4-3 below gives examples of PN stops and affricates' development of manner. In Central and Western Lalo, PLa *g weakens to voiced velar fricative [ɣ] before PLa back, non-high vowels *a, *aŋ, and *o̰, but not before high vowels *i, *y, *ɨ and *u. This later development is described in §6.5.

Table 4-3: Examples of PN stops' development of manner

PN	PN ex.	Gloss	PLa	CW-QY	MD	Eka	W-YL
*p	pe^{1}	gray	pʰε^{1}	pʰε^{55}	pʰa^{55}	pʰə^{24}	pʰε^{44}
*Cp/_stop	C-pak^{L}	leaf	pʰe̱^{L}	pʰε̱^{21}	pʰε^{21}	pʰi̱^{21}	pʰε^{53}
*Cp/_V, N	C-pi^{2}	pepper	pʰe$^{2/1}$	/	pʰi^{21}	pʰi^{24}	/
*ʔb/_V, N	ʔ-di^{2}	to pound	te^{2}	ti^{21}	tε^{21}	tε^{21}	tε^{21}
*ʔp	ʔ-pa^{2}	frog	pa̱^{L}	pa̱^{21}	pɑ̱^{21}	po̱^{21}	pa^{53}
*ʔb/_stop	ʔ-dak^{H}	ascend	de̱^{H}	dε̱^{33}	dε^{33}	di^{33}	dε^{44}
*mp	m-pok^{H}	shoot	bε̱^{H}	ba̱^{33}	ba̱^{33}	ba̱^{33}	ba^{44}
*mb	m-di^{2}	think	di^{2}	di̤^{21}	dɨ^{21}	dɨ^{21}	di^{21}
*Cb/_stop	C-grak^{H}	cold	gre̱^{H}	/	gε̱^{33}	gi̱^{33}	dʑε^{44}
*Cb/_V, N	C-ga^{2}	flute	gy^{2}	gy^{21}	də^{21}	/	dʑy^{21}
*b	ba^{2}	thin	ba^{2}	ba̤^{21}	bo^{21}	bo^{21}	bɐ^{21}

PN rhyme-initial syllables (represented with *∅) usually added a fricative, either *f before *u, *ɣ before *o, or *ʒ before *e, e.g., PN *u^{3} 'egg' > PLa *fu^{3}, PN *o^{1} 'water buffalo' > PLa *ɣo^{1}, PN *ay^{1} 'go' > PLa *ʒe^{1}. This parallels the development in Lisu. In closed syllables, no initial fricative was added, as in PN *ut^{L} 'belch' > PLa *ɨ̱^{L}. PN initial *ʔ lost its contrastive status with *∅ after fricatives were added to the beginning of PN *∅-initial syllables. In all modern Lalo varieties, any syllable without an initial consonant predictably has an initial glottal stop, so the initial glottal stop is never contrastive. Many of these syllables are inherited from syllables beginning with PN *ʔ, such as PLa nominal prefix *a- from PN *ʔə-, found before animal names and kinship terms. Examples are given in Table 4-4.

Table 4-4: Development of PN *ʔ and *∅ in PLa

Gloss	PN	PLa	MD	Eka	E-DC	W-YL	CW-QY
nominal prefix	ʔə-	a	[ʔ]	[ʔ]	[ʔ]	[ʔ]	[ʔ]
belch	ut^{L}	ɨ̱^{L}	[ʔ]	[ʔ]	[ʔ]	[ʔ]	/
egg	u^{3}	fu^{3}	f	f	f	f	f
water buffalo	o^{1}	ɣo^{1}	ɣ	x	ɣ	v	v
go	aj^{1}	ʒe^{1}	/	j	j	/	j

4.2.1.1 Affricates

PLa distinguishes two affricate series, alveolar *ts, *tsʰ, and *dz, and palatoalveolar *tʃ, *tʃʰ, and *dʒ. Table 4-5 gives examples. The alveolar series is a direct inheritance from PN *ts and *dz, and the palatoalveolar series is a development from Bradley's palatal stops *c and *j (which correspond to Matisoff's palatal affricates *tš and *dž). In most Core Lalo varieties (C-W-E), the palatoalveolar affricates developed into retroflex *tʂ, *tʂʰ, and *dʐ. In Eka and E-DC, the *palatoalveolar and *alveolar affricates merged to alveolar; in MD, the *palatoalveolar affricates remained palatoalveolar. Before PLa close-mid front vowel *e, the *palatoalveolar affricates are realised as alveopalatal across all Lalo varieties, as in PN *can^{1} 'unhulled rice,' but alveopalatals are not phonemically contrastive with palatoalveolars. No Lalo variety makes a three way distinction between retroflex, alveolar, and alveopalatal.

Table 4-5: Development of PLa *ts, *tʃ, and *tʃʰ

Gloss	PN	PLa	MD	Eka	E-DC	W-YL	CW-QY
hat	*ʔ-tsi^{2}	*tsi^{2}	tsu^{21}	tsu^{21}	/	tsɿ^{21}	tsɿ^{21}
lard	*tsi^{1}	*tsʰɛ^{1}	tsʰɛ^{55}	/	tsʰɛ^{55}	tsʰɛ^{44}	tsʰɛ^{55}
ramie		*dzi^{2}	dʑi^{21}	dzɿ^{21}	dʑi^{21}	dzɿ^{21}	dzɿ^{21}
pull out		*tʃi̱^{H}	tɕi̱^{55}	/	tsɿ^{33}	tʂʅ^{44}	tʂʅ̱^{33}
widow	*co^{2}	*tʃʰo^{2}	tʃʰu^{21}	tsʰɿ^{21}	tsʰɿ^{21}	tʂʰʅ^{21}	tʂʰʅ^{21}
goat	*(k)-cit^{L}	*tʃʰi̱^{L}	tɕʰi̱^{21}	tɕʰio^{42}	tsʰɿ^{42}	tʂʰʅ^{53}	tʂʰʅ̱^{21}
rice	*can^{1}	*tʃʰe^{1}	tɕi^{55}	tɕi^{24}	tɕʰi^{55}	tɕʰi^{44}	tɕʰi^{55}
liquor	*nji^{1}	*dʒi^{1}	dʑi^{55}	dʑi^{24}	dzɿ^{24}	dʐʅ^{24}	dʐʅ^{45}

4.2.1.2 Consonant clusters

PN *labial and *velar stops combined with the medials *-r-, *-j- and *-l- to form consonant clusters *pr, *pj, *pl and *kr, *kj and *kl. Table 4-6 and Table 4-9 below shows the development of the PN clusters in PLa and their reflexes in Lalo dialects; the voiceless unaspirated serves as a cover symbol for PLa voiced, voiceless, and aspirated manners. Nasal clusters *mj, *ʔmj, *ŋj, and *ʔŋj are described in §4.2.4 below on nasals, in Table 4-23 and Table 4-25. PN *kj merged with PLa palatal affricate *tʃ, and *kr and *kl merged to PLa *k before PLa close vowels (*y, *ɨ, *u) and to *kj before non-close vowels *e, *ɛ, *a, *aŋ. PN *pj was retained as PLa cluster *pj, while *pr and *pl merged to PLa *p, as summarised in Table 4-6 below.

Table 4-6: Development of PN labial clusters in PLa

PN	Conditioning	PLa
pj	all rhymes	pj
pr, pl	all rhymes	p

Table 4-7 gives examples of PN *pj in PLa and modern Lalo varieties. Examples of PLa plain *p that form minimal or near minimal pairs with the *pj examples are given directly below the relevant *pj example, to illustrate the different correspondence sets resulting from the contrast between *pj and *p in PLa. The reflexes of *pj that differ from *p are encircled.

Table 4-7: Examples of PN *pj's development in PLa

Gloss	PN	PLa	Eka	MD	YL	E-DC	E-HS	CW-QY
clothing		pʰja(ŋ)^{1}	pʰa^{24}	pʰa^{55}	pʰa^{33}	pʰia^{55}	pʰa^{55}	pʰu^{55}
male ancestor		pʰa^{2}	/	/	pʰa^{21}	pʰɔ^{21}	pʰɔ^{21}	pʰa^{21}
bee	bja^{2}	bja^{2}	bo^{21}	bo^{21}	ba^{21}	bia^{21}	bia^{21}	ba^{21}
moon	bəla^{3}	ba^{3}	bo^{33}	bo^{33}	ba^{31}	bɔ^{33}	bɔ^{33}	ba^{33}
lightning	b-lyap^{L}	bja̱^{L}	ba̱^{21}	ba̱^{21}	bɛ^{53}	biɛ^{31}	bia̱^{21}	ba̱^{21}
male	ʔ-pa^{2}	pa̱^{L}	po̱^{21}	pɑ̱^{21}	pa^{53}	pu^{31}	pɔ̱^{21}	pa̱^{21}
to fly	b-jam^{1}	bjy^{1}	bə^{24}	bə^{55}	bɨ^{33}	biɔ^{24}	bi^{24}	by^{24}
to divide	baj^{1}	by^{1}	bə^{24}	bə^{55}	bɨ^{33}	bə^{24}	bə^{24}	by^{24}
comb (n.)	gwi^{2}	pjɨ^{2}	pɨ^{21}	pɨ^{21}	pai^{21}	pə^{21}	pə^{21}	pɨ^{21}
to dare		pɨ^{2}	pɨ^{21}	/	pu^{21}	pə^{21}	pə^{21}	pɨ^{21}
banana	bjaw^{2}	bjo^{2}	/	dʑi^{21}	/	/	/	/
to carry	bo^{2}	bo^{2}	bɨ^{21}	bi^{21}	bi^{21}	bə^{21}	bə^{21}	vi^{21}

E-DC is especially helpful for distinguishing PLa *pj from *p because it has preserved the PN medial *-j-, which along with the rhyme now forms diphthongs with a close front vowel onset, as seen in *pʰja^{1} ‘clothing,’ *bja^{2} ‘honeybee,’ *bja̱^{L} ‘lightning,’ and *bjy^{1} ‘to fly’. YL distinguishes *pjɨ ‘comb’ and *pɨ ‘to dare’, as seen in the different rhyme reflexes: *pjɨ^{2} > [pai^{21}], while *pɨ^{2} > [pu^{21}]. In PN, ‘comb’ is *gwi^{2} (PB *ʔ-gwəj^{2}), an example of unitary labiovelar phonemes in PN, which are discussed below with the velar clusters. For ‘comb,’ the labiovelar glide may have become a palatal glide, i.e., *gwi^{2} > PLa *pjɨ^{2}. In MD, the palatal glide conditioned affrication in *bjo^{2} ‘banana,’ as seen in its reflex [dʑi^{21}], which differs from the development of *bo^{2} ‘to carry,’ which becomes [bi^{21}].

Table 4-8 gives examples of PN *pr and *pl in PLa and Lalo varieties. As in Table 4-7, the PLa plain stop example is given below for comparison. Unlike *pj, both *pr and *pl have completely merged with the plain stop. This can be seen by the identical correspondence sets of PN *pre^{1} ‘untie’ and PB *pəj^{2} ‘to rot’, both PLa *pʰɨ; PN *m-bliŋ^{3} ‘full’ and PN *bi^{2} ‘insect,’ both PLa *bi; and PN *plu^{1} ‘white’ and *pwaŋ^{3} ‘open,’ both PLa *pʰu. *pwaŋ^{3} is given as an example of a plain stop because PN medial *-w- acted as part of the rhyme after most initials, without effect on the initial, though there is evidence of unitary PB labiovelar phonemes, discussed below.

PLa close back vowel *u is reflected in many varieties as [v̩], with substantial lip compression. Lip compression, in which the lower lip pushes upward to the upper lip, often results in the upper teeth resting on the lower lip, which led to the vowel becoming the PLa syllabic labiodental fricative *v̩. The increased friction in lip compression may have lead to the interesting developments seen in Lalo dialects’ reflexes of PLa *pʰu^{1} ‘white,’ *pu^{1}, ‘porcupine’ and *pu^{2} ‘to steam’. PLa aspirated *pʰu became a labiodental fricative in all Central, Eastern, and some Western Lalo (W-SZP, W-SLZ), merged with the labial stop in Eka, MD and YL, and shows either a velar affricate (W-YL) or labial affricate (W-DT, XZ) in other non-Central varieties. Aspiration made it more likely for the initial to become a fricative or affricate. The unaspirated *pu, on the other hand, seen in ‘porcupine’ and ‘steam,’ shows a slightly different development. Most Central (except CW-QY) and non-Central (except W-DT) core varieties show an unaspirated velar stop for this cluster. Eka, MD and YL again merge the cluster with bilabial stop. XZ does not use the cognate for either ‘porcupine’ or ‘steam’.

Table 4-8: Examples of PN *pr and *pl’s development in PLa

Gloss	PN	PLa	Eka	MD	E-DC	W-DT	C-CJ	CW-QY
untie	pre^{1}	pʰɨ^{1}	pʰɨ^{24}	pʰɨ^{55}	pʰə^{55}	pʰɨ^{55}	pʰɨ^{55}	pʰɨ^{55}
to rot	pəj^{2} (PB)	pʰɨ^{2}	/	/	/	pʰɨ^{21}	pʰɨ^{21}	pʰɨ^{21}
to dare		pɨ^{2}	pɨ^{21}	/	pə^{21}	pɨ^{21}	pɨ^{21}	pɨ^{21}
tears	m-brəj^{1} (PB)	bi^{1}	bi^{24}	bi^{55}	/	dzʅ^{24}	dzʅ^{55}	/
full	m-bliŋ^{3}	bi^{3}	bi^{33}	bɨ^{33}	bi^{33}	dzʅ^{33}	dzʅ^{33}	vi^{33}
pus	m-bliŋ^{1}	bi^{1}	bi^{24}	bi^{55}	bi^{24}	dzʅ^{24}	dzʅ^{55}	vi^{55}
insect	bi^{2}	bi^{2}	/	bi^{21}	/	dzʅ^{21}	dzʅ^{21}	/
porcupine	ʔ-plu^{2}	pu^{1}	pv̩^{55}	pu^{24}	kɤ^{55}	pv̩^{24}	kv̩^{55}	/
to steam		pu^{2}	pv̩^{21}	pu^{21}	kɤ^{21}	/	kv̩^{21}	pv̩^{21}
white	plu^{1}	pʰu^{1}	pʰv̩^{24}	pʰu^{55}	fɤ^{55}	pʰv̩^{24}	fv̩^{55}	fv̩^{55}
open	pwaŋ^{3}	pʰu^{3}	pʰv̩^{33}	pʰu^{55}	/	pʰv̩^{33}	fv̩^{33}	fv̩^{33}

Table 4-9 below summarises the development of the PN velar clusters in PLa. PN velars plus medial *-j- merged with PLa’s *palatoalveolar affricates before all rhymes (with ‘sew’ PN *gjup^{L} as the one exception). PN velar clusters *kr and *kl merged with PLa plain velar stops before all PLa close vowels except front vowel *i and back vowel *o (i.e., PN *kr, *kl > PLa *k /PLa *y, *ɨ, and *u_). PN *kr and *kl show distinct developments only before PN *e and *o (which became PLa *i and *o, respectively, in that environment). Elsewhere (i.e., before *e, *ɛ, *a, *aŋ), PN *kr and *kl merged to PLa velar clusters *kj, *kʰj, *gj, which were distinct from PLa plain velar stops. In other words, PN *kl > PLa *k /before close vowels except *i and > *kj /elsewhere, while PN *kr > PLa *k /before all close vowels and *o, and > *kj /elsewhere. Harsh vowels have the same conditioning effect on the initial as their modal counterparts.

Table 4-9: Development of PN velar consonant clusters in PLa

PN	Conditioning	PLa
kj	all rhymes	tʃ
kr	before PLa *i and *o	k
kl	before PLa *i and *o	kj
kr, kl	before PLa close vowels *y, *ɨ, *u	k
kr, kl	before PLa non-close *e, *ɛ, *a, *aŋ	kj

Table 4-10 gives examples of PN velar clusters' reflexes in PLa and Lalo varieties. *kj and *gj merged with the *tʃ by the PLa stage, and in Eka and E-DC later merged with the alveolar affricate. The one exception is 'sew' PN *gjup^{L}, which shows PLa *g. The close back vowel in the rhyme probably influenced *gj in this environment to merge with *g instead of *dʒ.

Table 4-10: Examples of PN voiceless velar clusters' development in PLa

Gloss	PN	PLa	C-CJ	C-LB	W-DT	E-DC	Eka	MD
	*kj	*tʃ						
sweet	kjo^{1}	tʃʰɨ^{1}	tʂʰ	tʂʰ	tʂʰ	tsʰ	tsʰ	tsʰ
revolve	ʔ-gjaŋ^{1} (PB)	tʃaŋ^{1}	tʂ	tʂ	tʂ	ts	ts	tʃ
vegetable	ʔ-gjak^{L} (PB)	tʃe̠^{L}	tɕ	/	tɕ	/	/	/
stab	gja^{2}	dʒe̠^{L}	/	dʑ	/	dz	dʑ	/
sew	gjup^{L}	gu̠^{L}	g	g	g	g	g	g
	*k, *kr	*k						
fence	kram^{1}	kʰy^{1}	tɕʰ	tɕʰ	kʰ	/	k	kʰ
leg	kre^{1}	kʰi^{1}	kʰ	kʰ	kʰ	tɕʰ	kʰ	kʰ
daughter-in-law	krwe^{2}	kʰɨ^{2}	kʰ	kʰ	kʰ	tɕʰ	kʰ	kʰ
horn	kro^{1}	kʰo^{1}	kʰ	kʰ	kʰ	kʰ	kʰ	kʰ
manure	ke^{2}	kʰɨ^{2}	kʰ	kʰ	kʰ	/	kʰ	kʰ
	*kr, *kl	*kj						
excrement	kle^{2}	kʰji^{2}	tɕʰ	tsʰ	tsʰ	tɕʰ	kʰ	kʰ
scratch	m-krak^{H}	kje̠^{H}	tɕ	tɕ	tɕ	/	k	k
inside	klo^{1}	kʰjo^{2}	tɕʰ	tɕʰ	kʰ	kʰ	/	/
star	C-graj^{1}	kjɛ^{1}	tɕ	k	k	k	k	k

As seen with the labial clusters, Eka and MD completely merge all PLa velar clusters with their respective plain stops, even before close front vowels. This is somewhat similar to the development in Lahu, in which PN *kr > k, but a merger of plain stops and clusters is prevented by Lahu's *k > q. In other Lalo varieties, PLa velar clusters become palatal affricates before close front vowels, as in 'excrement' PLa *kʰji^{2}. The different reflexes seen between Eka/MD and all other Lalo suggest that the clusters became affricates after the ancestors of Eka and MD emigrated out of the Lalo homeland area. Eka speakers report this migration to have occurred 300-400 years ago, around the beginning of the Qing dynasty, a date which is also reported in the *Gazetteer of Shuangjiang County* (Zhao 1995). MD speakers claim to have left some 400-500 years ago, but the *Gazetteer of*

Gengma County (GMXZ 1995) reports the migration to have occurred more recently, around 200 years ago.

In Lalo varieties besides Eka/MD, there is a partial merger of PN *kr with plain stops before PLa close vowels (*i, *y, *ɨ, *u) and *o, as seen in 'leg' PLa *kʰi^{1}, 'fence' PLa *kʰy^{1}, 'daughter-in-law' PLa *kʰɨ^{2}, 'horn' PLa *kʰo^{1}, 'thunder' PLa *go^{2} and 'tendon' PLa *gu^{2}. In PN, these etyma all have medial *-r-, but in modern Lalo varieties, their initial reflexes are the same as those of PN plain stops. *kl occurs very rarely, and usually shows parallel developments with *kr, implying a partial merger. Yet *kl and *kr show different developments before PLa *i and *o: *kr becomes *k in this environment, while *kl becomes *kj, e.g., PN *kre^{1} 'leg' > PLa *kʰi^{1}, but PN *kle^{2} 'excrement' > PLa *kʰji^{2}, and PN *kro^{1} 'horn' > PLa *kʰo^{1}, but *klo^{1} 'inside' > PLa *kʰjo^{2}. Before all other PLa rhymes (i.e., *e, *ɛ, *a, *aŋ), *kl and *kr merge to PLa *kj, which was distinct from PLa plain velar stops.

In many Lalo varieties, PLa velar clusters tend to become affricates before PLa front vowels (*i, *e, *ɛ), whereas PLa plain stops remain stops. For example, the allofams (i.e., variant forms of the same word family (Matisoff 1978a)) PN *ke^{2} 'manure' and *kle^{2} 'excrement,' show different developmental paths: *ke^{2} > PLa *kʰɨ^{2}, with the initial reflected as [kʰ] across Lalo varieties, versus *kle^{2} > PLa *kʰji^{2}, with the initial reflected as an alveolar or postalveolar affricate in all varieties except Eka and MD. These two correspondence sets (*kʰɨ and *kʰji) also contrast with the development of *kre^{1} 'leg' (> PLa *kʰi), reflected by a velar stop in all varieties except E-DC, which shows [tɕʰ], a result of palatalisation before PLa *i. Initials in both 'scratch' PN *m-krak^{H} and 'cold (weather)' PN *C-grak^{H} show the same development to palatoalveolar affricates as the *kle^{2} 'excrement' (PLa *kʰji^{2}) reflexes. The difference between PLa *kjɛ^{1} 'star' and 'PLa *kɛ^{1} hang' can be seen in C-CJ's reflexes [tɕɛ^{55}] 'star' versus [kɛ^{55}] 'hang'; again, the cluster led to affrication, while the plain stop is retained.

Table 4-11 demonstrates the development of PN voiced velar clusters in PLa, which follows the same pattern as the voiceless velar clusters. However, unlike PLa *kj and *kʰj, *gj shows little evidence of a specifically palatal medial. While the palatal medial in *kj and *kʰj often conditions palatalisation, no such palatalisation is seen with *gj. Therefore, *gj could alternately be reconstructed as *gr, but to preserve symmetry with the other velar clusters, the voiced velar cluster is reconstructed *gj.

Table 4-11: Examples of PN voiced velar clusters' development in PLa

Gloss	PN	PLa	C-CJ	C-LB	W-DT	E-DC	Eka	MD
	*g, *gr	*g						
wound		gɛ^{2}	ɣ	ɣ	g	g	g	g
thunder	go^{2}	go^{2}	ɣ	ɣ	g	g	/	g
bracelet	goŋ^{1}	go^{1}	ɣ	ɣ	g	g	g	g
bend	gok^{L}	go̱^{L}	ɣ	ɣ	ɣ	g	g	g
buckwheat	ŋ-ga^{2}	ga^{2}	ɣ	ɣ	ɣ	g	g	g
drive cattle	ŋ-gak^{L}	ga̱^{L}	ɣ	ɣ	ɣ	g	g	g
pull	ŋ-gaŋ^{1}	gaŋ^{1}	ɣ	ɣ	ɣ	g	g	g
skin	ʔkri^{1}	gi^{1}	g	g	g	g	g	g
tendon	(ʃ)-gru^{2}	gu^{2}	g	g	g	g	g	g
	*gr, *gl	*gj						
run		gjɛ^{2}	g	g	g	g	g	g
fear	(sə)-grok^{H}	gjo̱^{H}	g	g	g	g	g	g
hear	gra^{2}	gja^{2}	g	g	g	g	g	g
cold	m-glaŋ^{1} (PB)	gjaŋ^{1}	g	g	g	g	g	g

Before non-close vowels *ɛ, *o, *a, *aŋ, in both harsh and modal phonation, PLa *g weakens to *ɣ in the C-W subgroup, as seen in ‘wound’ PLa *gɛ^{2}, ‘thunder’ *go^{2}, ‘to bend’ *go̠^{L}, ‘buckwheat’ *ga^{2}, ‘drive cattle’ *ga̠^{L} and ‘pull’ *gaŋ^{1}. W-DT’s conditioning for the weakening is slightly different than other W varieties, only occurring before rhymes with open back vowel *a (i.e., *a and *aŋ). In all other C and W varieties, the vowel change of PLa *o > [u] after velars must have happened after the lenition, since these varieties show [ɣ] instead of [g] for ‘thunder’ PLa *go^{2} and ‘bracelet’ PLa *go^{1}, both of which have subsequently become /ɣu/.

In contrast, PLa *gj before *ɛ, *a, *o, and *aŋ does not undergo weakening in C and W varieties. Therefore, at the PLa stage, *gj and *g must have been contrastive before these vowels, hence their different developments. After *g > /ɣ/ before non-close vowels in C and W, PLa *gj merged with the remnant of PLa *g, giving the /g/ seen across all Lalo varieties today. *gj’s merger with *g must be placed in counter-feeding order with *g > ɣ, because PLa *gj does not take part in the C-W *g > /ɣ/ change. PN *grok^{H} ‘to fear’ appears to be an exception to the rule that PN *kr > PLa *k before *o, since *grok^{H} > PLa *gjo̠^{H}, not *go̠^{H}.

Matisoff (2003, p. 24) posits Proto Burmic labiovelar unit phonemes *kʷ, *gʷ and *ŋʷ. In Lahu, these phonemes often become labial stops; in other Central Ngwi languages like Lisu and Lalo, they became either velar or bilabial stops. PLa shows a velar stop for PB *kʷ, as in *kʷəj^{2} ‘dog,’ *kʷəj^{1} ‘nest,’ as shown in Table 4-12 below. Bradley (2005, 2008) provides additional reconstructions, such as *C-ŋwi^{1}, the autonym for Proto Ngwi from the Tibeto-Burman word for ‘silver’ *d-ŋul^{1}, which Proto Lalo does not retain, along with *ʔkʷok^{L} ‘do skillfully,’ *kʷa^{2} ‘be born,’ and *ʔkʷut^{L} ‘evening’. All show a merger with the plain velar in PLa. The only example of the plain voiced labiovelar, *gʷja^{2}, ‘chew’ shows a merger with PLa *g, becoming a velar fricative in C-W Lalo subgroup and a velar stop in all other Lalo varieties. However, for the preglottalised *ʔ-gʷ, as in ‘comb,’ PLa has a bilabial stop with a palatal glide. In contrast to PLa’s simplification of labiovelar stops, PLa retains the labiovelar nasal intact, as seen in ‘tile,’ PLa *ŋwɛ^{2}. *ŋw is discussed in more detail in §4.2.4.3 on nasals.

Table 4-12: PB/PN labiovelar phonemes’ development in PLa

Gloss	PB	PLa	CW-QY	W-YL	W-DT	E-DC	Eka
dog	kʷəj^{2}	kʰɨ^{2}	kʰɨ^{21}	kʰɨ^{21}	kʰɨ^{21}	tɕʰi^{21}	/
nest	kʷəj^{1}	kʰɨ^{1}	kʰɨ^{55}	kʰɨ^{44}	kʰɨ^{24}	tɕʰi^{55}	kʰi^{24}
comb	ʔ-gʷəj^{2}	pjɨ^{2}	pɨ^{21}	pɨ^{21}	pɨ^{21}	pə^{21}	pɨ^{21}
to chew	m-gʷja^{2}	ga^{2}	ɣa^{21}	ɣa^{21}	ɣo^{21}	gɔ^{21}	go^{21}
do skillfully	ʔ-kʷok^{L} (PN)	kɨ̠^{L}	/	/	/	kə^{42}	/
be born	kʷa^{2} (PN)	ka^{2}	ka^{21}	ka^{21}	ko^{21}	/	/
evening	ʔkʷut^{L} (PN)	kʰɨ̠^{L}	kʰɨ̠^{21}	kʰɨ^{55}	kʰɨ^{55}	kʰə^{42}	kʰɨ̠^{21}
tile	ŋwa^{2}	ŋwɛ^{2}	vɛ̤^{21}	vɛ^{21}	ŋɛ˞^{21}	ŋɛ^{21}	/

4.2.2 Fricatives

PN has the following initial fricatives: *s, *z, *ʃ, *ʒ, *x, *h, all of which are reconstructed for PLa. In terms of prefixes, neither the *ʔ- nor the *s- prefix are found on fricatives, and only *C-s, *C-ʃ, *C-x and *k-z are reconstructed for PN (Bradley, 1979). However, in two lexical items, the prefix *ʔə- before *ʃ affects the development of the tone and/or initial, as discussed below in §4.2.2.2. For fricatives only, the *C- cover symbol includes the nasal prefix as well. All prefixed fricatives merged with their plain initial counterparts by the PLa phase, except for *C-ʃ, which merged with *x before close front vowels.

Fricatives are relatively stable when compared to resonants, with most modern reflexes of PN fricatives remaining unchanged. Exceptions are noted with each initial. Palatalisation of *s, *ʃ and *x to alveopalatal fricative [ɕ] before close front vowels is common, resulting in a partial merger of these three protophonemes.

4.2.2.1 Alveolar fricatives

Table 4-13 below shows the development of PN *s in PLa, with examples from modern Lalo varieties. *s and *C-s merge to PLa *s across all Lalo varieties. In Eka, MD, and several Central Lalo varieties, palatalisation to [ɕ] occurs before PLa front vowels (*i, *y, *e, *ɛ), while most other varieties maintain the [s] in this environment. In all Lalo varieties, [ɕ] is not contrastive, but rather an allophone of /s/ and /ʂ/ before close front vowels, which results in a neutralisation of contrast in this environment.

Table 4-13: Development of PN *s in PLa

Gloss	PN	PLa	Eka	YL	XZ	E-DC	E-HS	W-YL	C-CJ	CW-QY
blood	swe^{2}	si^{2}	ɕ	s	s	s	s	s	s	s
tooth	swa^{2}	sy^{2}	ɕ	s	s	s	s	ɕ	ɕ	s
choose		se^{1}	ɕ	s	s	s	s	s	ɕ	s
fruit	si^{2}	sɛ^{2}	ɕ	s	s	s	s	s	ɕ	s

Table 4-14 shows the development of PN *z in Lalo. Both *z and *k-z merge to PLa *z across all Lalo varieties.

Table 4-14: Development of PN *z in PLa

Gloss	PN	PLa	Eka	MD	E-TS	YL	XZ	W-YL	C-CJ	CW QY
leopard	k-zik^{L}	zi̲^{L}	/	/	z	z	z	z	z	z
barley	zi^{1}	zi^{3}	/	/	z	z	z	z	z	z

4.2.2.2 Palatoalveolar fricatives

Table 4-15 below shows the development of PN *ʃ in Lalo. In Eka, E-DC, and YL, *ʃ has merged with *s. In MD, *ʃ has been retained as palatoalveolar, but for all other varieties of Lalo, *ʃ has developed into the retroflex fricative [ʂ]. PN *ʃ and *C-ʃ become PLa velar fricative *x before PN close front vowel rhymes *i, *e, and *ik, as in *C-ʃik^{L}, 'new,' *C-ʃi^{2} 'seven,' and *ʃe^{2}, 'die'. No other Central Ngwi language shows this development, but all Lalo languages, including peripheral varieties such as MD and Eka, show this unique innovation. This change does not occur with *ʔəʃik^{H}, 'day/year before the present day/year', leading to the hypothesis that the *ʔə- prefix blocked the change of the initial. In every Lalo variety except E-DC, the PN rhymes *i, *e, and *ik merge to close central vowel [ɨ] in this environment. The close central vowel may have been the conditioning factor in the change from PN *ʃ to PLa *x. In E-DC, these rhymes merge to close front vowel [i], with subsequent palatalisation of the *x to [ɕ], resulting in a partial merger with *s, discussed below. In 'sister's child,' which developed from PN *ʔə-ʃa^{2} 'brother's child', E-DC and CW-QY both unexpectedly show the alveolar fricative. Since these two varieties are the only ones who still retain the reflex for PN *ʔə-ʃa^{2}, the PLa reconstruction is PLa *sa̲^{L}. The change in tone from *2 to *L is an example of the Lalo Tone *2 split, described in §5.2.

Table 4-15: Development of PN *ʃ in PLa

Gloss	PN	PLa	MD	Eka	YL	XZ	E-DC	E-HS	W-YL	C-CJ	CWQY
before last	ʔə-ʃik^{H}	ʃi̠^{H}	ʃ	s	s	ʂ	s	ʂ	ʂ	ʂ	ʂ
new	C-ʃik^{L}	xɨ̠^{L}	x	x	x	x	ɕ	x	x	x	x
seven	C-ʃi^{2}	xɨ^{2}	x	x	x	x	ɕ	x	x	x	x
die	ʃe^{2}	xɨ^{1}	x	x	x	x	ɕ	x	x	x	x
sister's child	ʔə-ʃa^{2}	sa̠^{L}	/	/	/	/	su̠^{L}	/	/	/	sa̠^{L}

Table 4-16 below shows the development of PN *ʒ, which merges with the PLa alveolar fricative *z in all environments. PN *ʒa^{2} 'son' > PLa *za^{2}, *ʒum^{2} 'use' > PLa *zy^{2}, and *ʒak^{L} 'descend' > PLa *ze̠^{L}. Palatalisation occurs before some PLa close front vowels in the same varieties that show palatalisation of PLa *s. The reconstructed *ʒ in *ʒaŋ^{2} '3S' does not fit the overall pattern. This item might better be constructed in PLa with variation between no initial and PLa *ʒ. Varieties reflecting *ʒ shows weakening to either [j] or [w], depending on the rhyme ([j] before a, [w] before u). The varieties that reflect no initial at all (e.g., Eka, W-YL, and most Central varieties) show the non-contrastive [ʔ] before the initial vowel.

Table 4-16: Development of PN *ʒ in PLa

Gloss	PN	PLa	MD	Eka	E-DC	E-HS	YL	XZ	W-YL	C-CJ	CWQY
3S	ʒaŋ$^{2/3}$	(ʒ)aŋ^{2}	j	[ʔ]	j	j	j	j	[ʔ]	[ʔ]	w
son	ʒa^{2}	za^{2}	z	z	z	z	z	z	z	z	z
use	ʒum^{2}	zy^{2}	z	/	z	ʒ	z	z	ɟ	ɟ	z
descend	ʒak^{L}	ze̠^{L}	j	ɟ	z	ɟ	z	z	ɟ	ɟ	z

4.2.2.3 Velar and glottal fricatives

Table 4-17 below shows the development of PN *x in Lalo. Across all Lalo varieties, *x in Lalo is retained. Before PLa close front vowel *y, as in 'iron' PLa *xy^{1}, palatalisation to [ɕ] occurs, as it does for *s, as discussed above. Before PLa *e, as in 'louse' PLa *xe^{1}, palatalisation is seen in almost all Lalo varieties except Eka and MD.

Table 4-17: Development of PN *x in PLa

Gloss	PN	PLa	MD	Eka	E-DC	E-HS	YL	XZ	W-YL	C-CJ	CWQY
	x, C-x	x	x	x	x	x	x	x	x	x	x
pick fruit	C-xak^{L}	xa̠^{L}	x	x	/	/	/	x	/	/	/
iron	xam^{1}	xy^{1}	x	x	x	x	x	x	ɕ	ɕ	ɕ
louse	xan^{1}	xe^{1}	x	x	ɕ	ɕ	ɕ	ɕ	ɕ	ɕ	ɕ

Table 4-18 shows the development of PN *h in Lalo. PLa, like PN, had a contrast between voiceless velar *x and a voiceless nasalised glottal fricative *h (realised as [h̃]). PLa *h comes from PN *h and *C-, *ʔ- or *ʃ- prefixed resonants *r, *y, and *w, discussed in §4.2.3. In contrast, the source of PLa *x is PN *x and *C-ʃ before close front vowels, as discussed in §4.2.2.2. In Central varieties, the PLa *x-*h distinction remains along these lines, but several Lalo varieties have merged the distinction to varying degrees. Eka, MD, and E-DC completely merge *x and *h to /x/, and do not have a voiceless nasalised glottal fricative at all. YL, XZ and W-SLZ merge *x and *h in most environments. The loss of [h̃] may have been influenced by contact with Southwest Mandarin, which has no nasalised [h̃].

Table 4-18: Development of PN *h in PLa

Gloss	PN	PLa	Eka	YL	XZ	E-DC	E-HS	W-YL	W-DT	C-CJ	CWQY
to yawn	ha^{1}	ha^{1}	x	x	x	x	h	h	h	h	h
Han	hjak^{L}	he̠^{L}	x	x	/	x	h	/	h	h	h

4.2.3 Resonants

PN resonants *r, *l, *y, *w developed in complicated ways in PLa, influenced by the presence and type of prefix and the rhyme. Except for *l, which remained a liquid, PN resonants became voiced, preglottalised, and voiceless fricatives *v, *ʔv, *ʒ, *ɣ, *f, *ʃ, and *h in PLa.

4.2.3.1 PN *r > PLa *ɣ, *ʃ, *h

Table 4-19 shows the development of PN *r in PLa and modern Lalo dialects. By the PLa phase, *r had already become a voiced velar fricative *ɣ, a common development across many Ngwi languages. Both *r and prefixed *k-r merged to *ɣ by the PLa phase; there is no distinction between these two initials in any Lalo language. After the PLa phase, the C-W group show a partial merger of PLa *ɣ and *g before non-close vowels *ɛ, *a, *o, and *aŋ, described in §6.5. Besides *r, another source of PLa *ɣ is *∅ before *o, e.g., PN *o^{1} 'water buffalo' > PLa *ɣo^{1}, discussed in §4.2.1.

The *ʔ- and *s- prefix often conditioned devoicing of the initial, resulting in voiceless fricatives. *s- pre-empted the initials *r and *y, resulting in PLa palato-alveolar fricative *ʃ, as in 'difficult' PN *s-ra^{2} > PLa *ʃa̠^{L} and 'ashamed,' PN *s-rak^{L} > PLa *ʃe̠^{L}, seen in the table below. *ʔ-conditioned devoicing to the PLa voiceless glottal fricative *h, which later merges with *x in some Lalo varieties, as seen in 'to stand' PN *ʔ-rjap^{L} > PLa *hy̠^{L} and 'night' PN *ʔ-rak^{L} > PLa *he̠^{L}.

In general, the *C- and *k- prefix did not affect the development of the initial, and so the initial develops to PLa *ɣ, the same as unprefixed *r, as in *C-raŋ^{2} 'vegetable', *k-rwaŋ^{2} 'sell' and *g-rap^{L} 'needle'. In *k-r-wak^{H}, 'rat,' and *C-ra^{1} 'hundred,' however, the *k- and *C- prefix seem to have conditioned PLa *h, similar to the effect of the *ʔ- prefix.

Table 4-19: Development of PN *r in PLa

Gloss	PN	PLa	Eka	E-DC	E-HS	YL	XZ	W-YL	W-DT	C-CJ	CW QY
	r, k-r	ɣ	ɣ	ɣ	ɣ	ɣ	ɣ	ɣ	ɣ	ɣ	ɣ
difficult	s-ra^{2}	ʃa̱^{L}	s	s	s	s	ʂ	ʂ	ʂ	ʂ	ʂ
ashamed	s-rak^{L}	ʃe̱^{L}	s	s	s	s	ʂ	ʂ	ʂ	ʂ	ʂ
night	ʔ-rak^{L}	he̱^{L}	x	x	h	x	x	h	h	h	h
stand	ʔ-rjap^{L}	hy̱^{L}	x	x	h	x	x	h	h	h	h
rat	k-rwak^{H}	hɛ̱^{H}	/	x	h	h	h	h	h	h	h
hundred	C-ra^{1}	ha^{1}	x	x	h	h	h	h	h	h	h
strength	ra^{2}	ɣa^{2}	v	ɣ	ɣ	/	ɣ	ɣ	ɣ	ɣ	v
big	k/ʔ-ri^{2}	ɣɛ^{2}	j	ɣ	ɣ	ɣ	ɣ	ɣ	ɣ	ʑ	v
chicken	k-rak^{H}	ɣe̱^{H}	j	j	j	j	j	j	j	j	j
cliff	ʔ-rak^{L}	ɣɛ̱^{L}	v	v	v	/	ɣ	v	ɣ	v	v
needle	g-rap^{L}	ɣy̱^{L}	ɣ	ɣ	w	ɣ	w	∅	w	j	j
vegetable	C-raŋ^{2}	ɣaŋ^{2}	v	j	ɣ	w	ɣ	w	ɣ	w	w
sell	k-rwaŋ^{2}	ɣu^{2}	v	ɣ	∅	v	v	v	v	/	v
ant	p-rwak	ʒu̱^{H}	/	j	z	/	ʐ	ʐ	ʐ	ʐ	ʐ

The subsequent development of PLa *ɣ in various Lalo varieties is heavily influenced by the rhyme. The merger of PLa *g and *ɣ which takes place in the C-W subgroup probably occurred before these later developments, as the C-W *g > /ɣ/ set shows the same lenition process as found in original PLa *ɣ. Before lower modal PLa vowels *ɛ and *a, *ɣ remains velar across most varieties, but higher vowels tend to condition shifts to [j], [v] or [w], depending on the quality of the vowel. Before PLa harsh front vowel *e̱, from PN rhyme *ak, *ɣ became palatal glide [j] across Lalo varieties, as seen in 'chicken,' CW-QY [a^{55}je̱^{33}], PLa *ɣe̱^{H} from PN *k-rak^{H}. Before harsh *ɛ̱, many varieties show [v], as in 'cliff' PN *ʔ-rak^{L} > PLa *ɣɛ̱^{L}. Before harsh *y̱, as in 'needle' PLa *ɣy̱^{L}, *ɣ either remained [ɣ], as in Eka, YL, and E-DC; lenited to [w] if *y̱ became back vowel /u/ as in XZ and E-HS; or lenited to [j] if *y̱ remained /y/, as in C-CJ and CW-QY. In W-YL, the initial disappears altogether, and in W-DT, the initial becomes /w/ before /y/.

Before rhyme *aŋ, which became /u/ in Central and W varieties and /a/ elsewhere, *ɣ's development is again influenced by the vowel. If the Lalo dialect develops [a] from *aŋ, then *ɣ usually stays a fricative, as in XZ, E-HS, and Eka (where *ɣ becomes [v]). If *aŋ becomes [u], on the other hand, as it does in W-YL, CW-QY, and C-CJ the *ɣ lenites to the labiovelar approximant [w]. Before PLa *u, which became syllabic fricative [v̩] in many varieties, *ɣ becomes [v], as in PN *k-rwaŋ^{2} 'sell' > PLa *ɣu^{2}. Before PN rhyme *-wak, which became PLa harsh *u̱, PN *r became PLa *ʒ, as in 'ant' PN *p-rwak > PLa *ʒu̱^{H}, reflected in many varieties as /ʐ̩/.

4.2.3.2 PN *j > PLa *ʒ, *ʃ, *h

The resonant *j shows a similar pattern of development as *r in many ways. Table 4-20 shows the development of PN *j in Lalo. Like *r, unprefixed *j is usually reflected as a voiced fricative, and is the main source for PLa *ʒ. In varieties that distinguish palato-alveolar from alveolar fricatives (MD, W-DT, W-YL, CW-QY, C-CJ, XZ), *ʒ is reflected as palatoalveolar or retroflex. In those varieties that have merged the palatoalveolar and alveolar fricatives (Eka, YL, E-DC), *ʒ is reflected by alveolar fricatives, seen in PN *ja^{1} 'right' and *jet^{L} 'drunk', etc. These developments suggest that PN *j became [ʒ] or [ʑ] by the PLa phase. In CW-QY, the *ʒ is weakened to [j] before PLa *e, much the way *ɣ weakened to [w] before close back vowels. In E-DC, *ʒ has weakened to [j] in all environments, with the exception of 'sleep' PLa *ʒi̱^{L}. In E-HS, PN *j is dropped completely in PLa *harsh syllables, 'strangled to death' by the glottal constriction inherent in harsh voice. This same process probably accounts for the loss of the initial across all Lalo varieties in reflexes of PN *jak^{L} > PLa *i̠^{L} ‘current’, which appears in the compound words for ‘today’ (PLa *i̠^{L} ʔni^{3}), ‘this evening’ and ‘this morning’. PN *j before *u, as in ‘to take’ PN *ju^{1}, probably became *w (David Bradley, personal communication, June 3, 2010), which in PLa became fricative *v. The [ɲ] in YL’s reflection of ‘sheep,’ PLa *ʒaŋ^{1}, is unexpected; the etymon is probably cognate, as rhyme and tone reflexes are regular. One explanation is that, in this variety only, *jaŋ (from TB, also found in Mandarin) underwent metathesis of the final *-ŋ with the intial *j and vowel -a, i.e., *jaŋ > ŋja^{1} > [ɲa^{33}].

Table 4-20: Development of PN *j in PLa

Gloss	PN	PLa	Eka	E-HS	YL	XZ	W-YL	W-DT	C-CJ	CWQY
	j	ʒ	z	z	z	ʐ	ʐ	ʐ	z	ʐ
right	ja^{1}	ʒa^{1}	/	z	/	ʐ	/	ʐ	z	j
sheep	jaŋ (PTB)	ʒaŋ^{1}	z	j	ɲ	j	ʐ	ʐ	z	ʐ
drunk	jet^{L}	ʒe̠^{L}	/	∅	z	ʐ	ʐ	ʐ	z	j
sleep	jip^{L}	ʒi̠^{L}	/	∅	z	ʐ	ʐ	ʐ	z	ʐ
male	g-jok^{L}	ʒo̠^{L}	/	∅	z	ʐ	ʐ	ʐ	z	ʐ
today	jak^{L}	i̠^{L}	∅	∅	∅	∅	∅	∅	∅	∅
take	ju^{1}	vu^{1}	v	v	v	v	v	v	v	v
twist	s-jøk^{L}	ʃɨ̠^{L}	s	s		ʂ	/	ʂ	/	/
eight	C-jet^{L}	he̠^{L}	x	h	x	x	h	h	h	h
raise animals	m-ju^{1}	hu^{1}	f	h	ʂ	ʂ	/	ʂ	h	h
house	k-jim^{1}	he^{1}	x	h	h	h	h	h	h	h
to fly	b-jam^{1}	bjy^{1}	b	b	b	b	b	b	b	b
short	ʔ-n-jum^{1}	ʔɲy^{2}	n	/	n	∅	∅	n	n	ʔn
small	n-jaj^{1}	ɲa^{1}	/	/	ɲ	ɲ	/	/	/	/

*s- prefixed *j and *r develop in exactly the same way, with *s-r and *s-j becoming PLa *ʃ, suggesting an early merger of *j and *r in this environment. The data set does not contain any examples of *ʔ-j, so it is not possible to compare this with *ʔ-r. As with *r, *C- sometimes conditions devoicing to PLa *h, but *C-j is only seen in two examples: *C-jet^{L} ‘eight,’ which devoices to PLa *he̠^{L}, and *g-jok^{L}, ‘male,’ which behaves the same way as unprefixed *j, becoming PLa *ʒo̠^{L}. For *m-ju^{1} ‘to raise animals,’ the initial also devoices to PLa *hu^{1}. The rhyme *u, which became [v̩] in most varieties, has conditioned the labiovelar initial [f] in Eka and E-DC and the retroflex fricative [ʂ] in YL, XZ, and W-DT. The initial in ‘house,’ PN *jim^{1}, also shows devoicing to PLa *h; Matisoff’s (2003) PTB reconstruction of this word has prefix *k-, which may explain the devoicing of the initial.

Preemption of prefixed *j also occurs with *b-j becoming PLa *b, as in ‘to fly’ (see Table 4-7) and *ʔ-n-j becoming PLa *ʔɲ, as in ‘short’ PN *ʔ-n-jum^{2} > PLa *ʔɲy^{2}. Even though all Lalo varieties now show alveolar [n] or [ʔn] in ‘short’, contrastive *ʔɲ is detectable by its effect on the vowel in YL and MD, where *ʔɲy^{2} > [ni^{21}]. The expected reflex for *ʔny in these varieties is [nə]; instead, the vowel *y has been palatalised by the palatal nasal *ʔɲ, moving *y to [i]. Other varieties do not show this palatalisation; instead, there is a merger of *ʔɲ and *ʔn in this environment. For the word ‘small’ *(n)-jaj^{1}, the nasal prefix pre-empts in YL and XZ to PLa *ɲa^{1}, but the cognate is not seen in other varieties, which instead reflect PLa *(ʒ)aŋ^{1}.

4.2.3.3 PN *w > PLa *v, *ʔv, *f

Like *j and *r, PN *w develops into a fricative in PLa, and is reconstructed as *v when unprefixed or *k- prefixed. Table 4-21 shows the development of *w in Lalo. Unprefixed *w and *k-w are reflected as a labiodental fricative [v] across most Lalo varieties, with rhymes conditioning additional subsequent developments in some varieties. Eka and MD consistently show a [v] for unprefixed *w, regardless of the rhyme. YL usually has [v], but also shows a tendency to strengthen to [b] before central vowel [ə].

XZ, E-DC, and W-DT show a voiced velar fricative before *a, as in PN *wa^{2} 'snow' > PLa *va^{2} > [ɣo^{21}], also seen in 'bamboo' and 'trap'. The change from *v > ɣ occurs only in those varieties that share the change *a > /o/, with the close back vowel [o] providing the conditioning environment for the backing of *v to [ɣ]. XZ, W-DT, but not E-DC, also show *v > [ɣ] before PLa *ɛ, as in *vɛ^{1}, 'to buy'. A similar process of backing, this time to [w], occurs in E-HS, W-YL, and most Central varieties before rhyme *aŋ, which became close back vowel [u] in these varieties, as in 'earring' PLa *vaŋ^{2}. Palatalisation of the *v to palatal approximant [j] occurred in W and Central Lalo varieties before PLa *i and harsh *i̱, respectively, as in 'far' *vi^{2} and 'to wear' *vi̱^{L}. For 'to wear', the initial in E-HS is lost due to the influence of the laryngealised rhyme *i̱, similar to the developments seen for PN *j in §4.2.3.2. When *v occurs before PLa *e/*e̱, palatalisation does not occur, as seen in 'pig' PLa *a^{1}ve̱^{L} and 'leech' PLa *ɣi^{1}ve̱^{L}, which both retain the [v] across all Lalo varieties. The prefix sequence *k-d-w, seen only *k-d-wam^{1}, 'bear,' shows a velar fricative [ɣ] across Lalo, thus merging with PN unprefixed *r to PLa *ɣ, with further weakening to [j] in Central Lalo before close front rounded vowel [y]. The prefix sequence *m-r-w, seen only *m-r-we^{1}, 'snake,' shows the exact same development as *s-rwe^{1}, 'yellow/gold,' to PLa *ʃ.

Two additional PLa protophonemes developed from *C-, *ʔ- and *s- prefixed *w: *ʔv and *f. Preglottalised fricative *ʔv developed from PN *C-w, as in PN 'left side' *b-waj^{2} > PLa *ʔvɛ^{2}, *ʔ-w, as in 'to winnow' and *s-w, as in 'to bloom'. PLa *f developed from *ʔ-w, as in 'wide,' and *s-w, as in 'dry'. However, in *ʔ-wik^{L} 'stomach,' the initial became voiceless glottal fricative *h. There are too few examples of *ʔv and *f to precisely pinpoint the conditioning factors that lead to the distinction of the two protophonemes. However, *v, *ʔv and *f are contrastive in PLa, as evidenced by the minimal pairs set of 'left' *ʔvɛ^{2}, 'to buy' *vɛ^{2} and 'dry' *fɛ^{3}, as well as 'wolf' *ve^{1} (< PB *wan^{1}) and 'wide' *fe^{1} (< PB *ʔ-wan^{1}). Another source of PLa *f is *∅ before PN *u, as described in §4.2.1.

CW-QY and C-LJ are the only varieties to preserve the preglottalised *ʔv. All other varieties either drop the preglottalisation, leaving plain [v] (E-HS, W-YL, C-CJ), or, as in 'to winnow' *ʔva^{1}, the preglottalisation takes over the initial completely, resulting in loss of the fricative (in Eka, YL, XZ, W-DT). A combination of preglottalisation and harsh phonation, seen in 'to bloom' *ʔve̱^{H}, may have conditioned the initial to strengthen to [b] in Eka and MD, while remaining as [v] or [ʔv] in other varieties.

Table 4-21: Development of PN *w in PLa

Gloss	PN	PLa	MD	Eka	E-DC	E-HS	YL	XZ	W-DT	C-LJ	CW QY
	w, k-w	v	v	v	v	v	v	v	v	v	v
snow	wa^{2}	va^{2}	/	v	ɣ	v	v	ɣ	ɣ	v	v
to buy	waj^{1}	vɛ^{1}	v	v	v	v	v	ɣ	ɣ	v	v
earring	k-waŋ^{2}	vaŋ^{2}	/	v	b	w	v	b	v	w	w
far	we^{2}	vi^{2}	v	v	v	v	v	j	j	j	j
wear	wat^{L}	vi̱^{L}	v	v	v	∅	v	j	j	∅	j
pig	wak^{L}	ve̱^{L}	v	v	v	v	v	v	v	v	v
leech	k-r-wat^{L}	ve̱^{L}	v	v	v	v	v	v	v	v	v
stomach	ʔ-wik^{L}	he̱^{L}	x	x	x	h	x	x	h	h	h
bear	k-d-wam^{1}	ɣy^{1}	ɣ	ɣ	/	/	ɣ	ɣ	ɣ	j	j
snake	m-r-we^{1}	ʃɛ^{1}	ʃ	s	s	s	s	ʂ	ʂ	ʂ	ʂ
left	b-waj^{2}	ʔvɛ^{2}	v	/	v	v	/	∅	∅	ʔv	ʔv
to winnow	ʔ-wa^{1}	ʔva^{1}	∅	∅	∅	v	∅	∅	∅	ʔv	ʔv
bloom	s-wat^{H}	ʔve̱^{H}	b	b	v	v	v	v	v	v	ʔv
wide	ʔ-wan^{1}	fe^{1}	f	/	/	/	/	/	/	f	/
dry	s-we^{2}	fɛ^{3}	f	f	f	f	f	f	f	f	f

4.2.3.4 PN *l > PLa *l, *ʔl, *ʔx, *h

PN *l is reconstructed as PLa *l when unprefixed and is reflected as [l] throughout Lalo varieties, regardless of the following rhyme. Table 4-22 shows the development of *l in Lalo. *C-l and *ʔ-l develop into PLa's preglottalised liquid *ʔl. *k-l and *m-l merged with *l usually, but before PN close vowels they also developed into *ʔl, e.g., *k-lup^{H} 'shake' > PLa *ʔlṵ^{H}, *m-le^{2} 'son's child' > PLa *ʔle^{2}, and *m-liŋ^{1} 'neck' > PLa *(ʔ)li^{1}. CW-QY and C-LJ are the only varieties to preserve the preglottalised *ʔl. However, preglottalised initials are detectable in other varieties by their effect on the development of Tone *1. In Western Lalo varieties, preglottalisation blocks the development of the low-rising tone, so preglottalisation must have still been present at the time of Western Lalo's Tone *1 split, as discussed in §5.3.3.

Rhymes of close front vowels *i and *e condition the development of *ʔl into a retroflex fricative [ʔʐ] or [ʐ] in some varieties (e.g., CW-QY, W-DT, XZ). In CW-QY, [ʔʐ] is an allophone of /ʔl/ before close central vowel /ɨ/ ([ʅ]); [ʔʐ] is not contrastive. In W-DT, W-SLZ, XZ, and E-TS, the earlier phonetic realisation of *ʔl was probably also [ʔʐ] in this environment; with the loss of preglottalisation, [ʔʐ] became plain [ʐ], merging with the phoneme /ʐ/. In other Lalo varieties (E-HS, W-YL, YL, CE-YA, C-LJ, C-LB), the preglottalisation 'devours' the rest of the initial, leaving a glottal stop, which is not contrastive before vowels. In two words, *(ʔ)li^{2} 'heavy' and *(ʔ)li^{1} 'neck', preglottalisation appears variably. For *(ʔ)li^{1} 'neck,' the prefix does not appear in W-SZP, W-DT, XZ, E-DC and E-HS, and the Tone *1 split therefore occurs. Yet in CE-YA and two other Central varieties (C-LB, C-WC), the preglottalisation results in the replacement of the initial with a glottal stop. For *(ʔ)li^{2} 'heavy,' preglottalisation has an effect in most Lalo varieties, influencing the development of ʐ in CW-QY, W-DT, W-YL, and XZ, but in E-HS, preglottalisation does not appear. In CW-QY, both 'heavy' and 'neck' show plain ʐ instead of ʔl [ʔʐ], suggesting a development to [ʔʐ] and a later loss of preglottalisation. CW-QY may be experiencing an ongoing change in the loss of distinctive preglottalisation, a phenomenon reported for nearby Longjie (Björverud 1998).

*s-l, on the other hand, becomes PLa's preglottalised *ʔx, possibly going through transitional stages such as *s-l > *sɬ > *ʔɬ > *ʔx. Evidence for PLa's *ʔx comes from SE-GP and other SE varieties, which show [kʰ] as a reflex for PN *s-l, while all other Lalo varieties show either [x], [h], [ɕ] or [f], depending on the influence of the following rhyme. This is a distinct correspondence set from PLa *ʔl, as can be seen by comparing the reflexes of PLa *ʔl and *ʔx in Table 4-22. *n-l develops into PLa voiceless glottal fricative *h, which remains [h̃] in most Lalo varieties, except Eka, MD, and E-DC. Additional evidence from SE varieties is needed to establish whether *n-l may have possibly developed into PLa *ʔx, since SE-GP does not show the cognate for *n-li^{2} 'penis'. The *b- prefix pre-empts the initial in the example *b-lyap^{L}, 'lightning,' across all Lalo varieties.

Table 4-22: Development of PN *l in PLa

Gloss	PN	PLa	SE-GP	E-HS	YL	XZ	W-YL	W-DT	CW QY	C-CJ
	l, k-l, m-l	l	l	l	l	l	l	l	l	l
butterfly	C-lu^{3}	ʔlu^{3}	l	l	l	l	l	l	ʔl	l
tongue	ʔ-l(y)a^{1}	ʔla^{1}	l	l	l	l	l	l	ʔl	l
shake	k-lup^{H}	ʔlu̠^{H}	l	l	l	l	l	ʐ	[ʔʐ]	l
old	ʔ-li^{1}	ʔli^{1}	l	∅	∅	ʐ	∅	ʐ	[ʔʐ]	l
grandchild	m-le^{2}	ʔle^{2}	l	l	∅	ʐ	∅	ʐ	[ʔʐ]	l
heavy	C-li^{2}	(ʔ)li^{2}	l	l	j	ʐ	ʐ	ʐ	ʐ	l
neck	m-liŋ^{1}	(ʔ)li^{1}	l	l	j	l	l	z	ʐ	l
spirit	s-la^{1} (PB)	ʔxa^{1}	kʰ	h	h	h	h	h	h	h
moon	s-la^{3} (PB)	ʔxa^{3}	kʰ	x	x	∅	x	∅	x	x
wind	s-ləy^{1} (PB)	ʔxy^{1}	kʰ	h	h	h	ɕ	h	ɕ	ɕ
to rob		ʔxu^{3}	kʰ	f	/	h	f	h	h	h
penis	n-li^{2}	hɛ^{2}	/	h	/	h	h	h	h	h
lightning	b-lyap^{L}	bja̠^{L}	b	b	b	b	b	b	b	b

4.2.4 Nasals

PN nasals *m, *n, *ɲ, and *ŋ, like fellow sonorants *w and *l, develop into preglottalised initials when *ʔ-prefixed. Unlike *w and *l, however, *C-prefixed nasals pattern with plain initials and do not develop into preglottalised nasals. This is not surprising, since most Ngwi languages, excepting Bisu, do not distinguish *C-prefixed and plain nasals. Unlike *s-l, the *s prefix with nasals patterns with the *ʔ prefix, resulting in preglottalised nasals, instead of causing a change to voiceless fricative. Although the same basic pattern holds for all nasals, they are dealt with separately to highlight specific differences in their development.

4.2.4.1 PN *m > PLa *m, *ʔm, *mj, *ʔmj

PN plain *m and *C-m are reconstructed as PLa *m and are reflected as [m] throughout Lalo, regardless of the following rhyme. Table 4-23 shows the development of *m in Lalo. Consonant clusters of *mr, *ml, and *mj all merge to *mj in most environments and to *ʔmj when *ʔ-prefixed. PLa *mj is seen most clearly in E-DC and E-HS, which retain the palatal glide. This parallels the development of labial stops *pj and *bj, as discussed in §4.2.1.2. E-HS shows *mj for rhymes *a and *aŋ, but not *o̠. PLa *mj is reflected in CW-QY and CE-YA by its fronting influence on the rhyme *-a (i.e., 'arrow' PN *mla^{2} > [mi^{21}]). *(C)-mjak^{H} 'eye' becomes *ʔmje̠^{H}, with a slightly different rhyme correspondence set from *ʔme̠, as in /ʔme̠^{L}/ 'son-in-law'. In W-DT and YL, the palatal glide in 'eye' conditions a change to [i], whereas 'son-in-law' shows [e]. Davies (1909), a traveller in the early 1900's, also reports the presence of medial *-j- for 'eye,' which he transcribes as 'myet'.

Table 4-23: Development of PN *m in PLa

Gloss	PN	PLa	Eka	E-DC	E-HS	YL	W-DT	C-CJ	CW-QY
m, C-m	m, C-m	m	m	m	m	m	m	m	m
many	C-mja^{2}	mja^{2}	m	miɔ	mi	m	m	m	m
see	mraŋ^{1}	mjaŋ^{1}	m	mia	mia	m	m	m	m
monkey	mjok^{L}	mjo̱^{L}	m	miu̱	m	m	m	m	m
arrow	C-mla^{2}	mja^{2}	m	m	m	m	m	m	mi
eye	C-mjak^{H}	ʔmje̱^{H}	mi	mi	mi	mi	mi	mɛ̱	ʔmɛ̱
son-in- law	ʔ-mak^{L}	(ʔ)me̱^{L}	mɨ	me	mi	me	me	mɛ̱	mɛ̱
soldier	C-mak^{L}	(ʔ)me̱^{L}	/	me	mi	me	me	/	mɛ̱
mushroom	s-mo^{1}	(ʔ)mo^{1}	m	m	m	m	m	m	m
earth	ʔ-mre^{1}	(ʔ)mi^{1}	m	m	m	m	m	m	m
tail	ʔ-mri^{2}	ʔmɛ^{2}	m	m	m	m	m	m	ʔm
teach	s-ma^{2}	ʔma^{2}	m	m	m	m	m	m	ʔm
brood	ʔ-mu^{2} (PB)	ʔmy^{2}	m	m	m	m	~	m	ʔm
cooked	s-miŋ^{3}	ʔmi^{1}	m	m	m	m	~	m	ʔm
high	ʔ-mroŋ^{1}	ʔmju^{1}	m	~	~	~	~	m	~

Although the pattern of PN *ʔ-m and *s-m merging to PLa *ʔm is clear, there are a number of words that show protovariation regarding the presence of preglottalisation, e.g., *s-mo^{1} 'mushroom,' *ʔ-mre^{1} 'earth,' *C-mak^{L} 'soldier' and ʔ-mak^{L} 'son-in-law'. For most Lalo varieties that have lost preglottalisation, the only way to detect its previous presence is whether it blocked the development of low-rising tone in Tone *1. The effect of preglottalisation is seen clearly in XZ and CE-YA's high level tone reflex in 'mushroom' and 'earth'. However, most Western, Eastern, and Central varieties show no evidence of preglottalisation for these words. For *C-mak^{L} 'soldier' and *ʔ-mak^{L} 'son-in-law,' CW-QY shows a plain nasal, but data from Huang and Dai (1992) and Björverud (1998) from neighboring Wuyin township show a preglottalised initial. For harsh syllables, the likelihood of misperceiving the preglottalised initial as simply harsh phonation may help explain the loss of preglottalisation in CW-QY for these words. In W-DT and W-SLZ, preglottalisation results in the loss of the nasal initial and nasalisation of the vowel before close vowels *i, *y, and *u. The same process happens in most Lalo varieties, except Eka and C-CJ, in the word *ʔmju^{1} 'high'. Loss of the nasal with resulting nasalisation on the vowel is more widespread in the case of PLa *ʔn, discussed below.

4.2.4.2 PN *n > PLa *n, *ʔn; PN *ɲ > PLa *ɲ, *ʔɲ

Table 4-24 below shows the development of PN *n and *ɲ in Lalo. PN *ɲ and the *n-j prefix sequence becomes PLa *ɲ, which is distinct from PLa *n. The distinction between PLa *ɲ and *n can be seen from near minimal pairs 'younger sibling' PLa *ɲe^{1} and 'few' PLa *ne^{2}, which have distinct correspondence sets. PLa *ɲ merges with *n before *i, but remains distinct before *a̱, *y, and *e. PN *ɲ conditioned the back vowel *o to move forward to PLa *i, seen in *s-ɲo^{1}, 'finger' and *ʔ-ɲo^{1}, 'green,' which both become PLa *ʔni^{1}.

Table 4-24: Development of PN *n and *ɲ in PLa

Gloss	PN	PLa	MD	E-DC	E-HS	YL	XZ	W-YL	C-CJ	CWQY
younger sibling	ʔəɲi^{1}	ɲe^{1}	ɲ	ɲ	ɲ	/	ɲ	ɲ	n	n
few	naj^{2}	ne^{2}	n	n	n	/	n	/	/	ʔn
deep	ʔ-nak^{L}	ʔne̱^{L}	n	n	n	n	n	n	n	ʔn
finger	s-ɲo^{1}	ʔni^{1}	n	n	n	~	~	~	n	ʔn
red	ʔ-ni^{1}	ʔni^{1}	n	n	n	~	~	~	n	ʔn
barrel	/	ʔnu^{1}	/	~	~	~	~	~	~	~
sticky	ʔ-njak^{L} (PB)	ʔɲa̱^{L}	ɲ	/	/	ɲ	ɲ	ɲ	n	/
short	ʔ/s-n-jum^{1}	ʔɲy^{2}	ɲ	/	/	ɲ	~	~	n	ʔn

Like other PN nasals, *n and *C-n merge to PLa *n, while *ʔ-n and *s-n merge to *ʔn. Before close vowels *i and *u, there is loss of the nasal stop and nasalisation of the vowel in many Lalo varieties. Loss of initial is especially widespread before *u, e.g., *ʔnu^{1} 'barrel'> [ỹ̩^{55}] in most varieties. An interesting development in the opposite direction is PLa's insertion of *n before the ∅-initial *u^{2} in 'head': PN *u^{2} > PLa *nu^{2}, now often reflected as syllabic [n̩]. The insertion of *n in 'head' happens in every variety except E-HS, CE-YA, C-QS and C-CJ.

4.2.4.3 PN *ŋ > PLa *ŋ, *ʔŋ, *ŋj, *ʔŋj; PN *ŋw > PLa *ŋw

Table 4-25 below shows the development of PN *ŋ in Lalo. PN *ŋ and *C-ŋ merge to *ŋ in PLa, and *s-/*ʔ-prefixed *ŋ becomes PLa *ʔŋ. Before rhyme *a, preglottalisation conditions loss of the nasal initial and following nasalisation of the vowel, as seen in *ʔŋa^{2} 'borrow' and 'fish'. In some varieties such as CW-QY and YL, loss of initial did not occur; instead, metathesis between the initial and rhyme occurs, i.e., *ʔŋa^{2} > [aŋ^{21}]. Compensatory nasalisation is also seen for *ʔm and *ʔn, but usually only before close vowels *i and *u. There are no examples of *ʔŋ before *i and *u, so it is not known whether initial loss also occurred with close vowels. Before close vowel *y, as in 'fir tree' PLa *ʔŋy^{1}, compensatory nasalisation only occurs in W-DT, E-TS, and C-WC. In other varieties, the initial is retained or, as in most Central varieties, becomes [ʔn]. The low-rising tone in W varieties suggest a loss of preglottalisation before the Tone *1 split to low-rising (see §5.3).

The velar clusters *ŋj, *ʔŋj, and *ŋw are the least well attested of all PLa initials, and *ʔŋw is unattested, but theoretically possible. However, distinctive correspondence sets support the reconstruction of *ŋj, *ʔŋj, and *ŋw. The source of *ŋj and *ʔŋj is PN *ŋj and *s-ŋj, seen in PN *ŋjak^{H} PLa *ŋja̱^{H} 'bird,' and *s-ŋak^{H} PLa *ʔŋja̱^{H} 'banana'. The palatal [ɲ] seen in reflexes of 'banana' suggest that the PN reconstructed form should be *s-ŋjak^{H}. *ŋj and *ʔŋj become palatal [ɲ] in YL, XZ, W-SLZ, E-DC, E-TS and [n] in most other varieties, suggesting a merger with PLa *ɲ. However, velar [ŋ] is retained in E-HS, C-QS and MD, making this correspondence set distinct from PLa *ɲ. Evidence for preglottalisation in 'banana' *ʔŋja̱^{H} is seen in the [ʔn] reflex of some C varieties, and the loss of initial and compensatory nasalisation that occurs in C-LJ. Unfortunately, none of the three varieties that retain the velar nasal have a cognate form for 'banana'. However, in varieties where cognates are available, the pattern matches that of 'bird,' with preglottalisation in those varieties that preserve it in this environment.

Table 4-25: Development of PN *ŋ in PLa

	PN	PLa	MD	YL	E-DC	E-HS	W-SLZ	W-DT	C-QS	C-LJ
five	ŋa^{2}	ŋa^{2}	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
cry	ŋo^{1}	ŋo^{1}	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ	ŋ
fish	ŋa^{2}	ʔŋa^{2}	õ^{21}	aŋ^{21}	õ^{21}	õ^{21}	ã^{21}	õ^{21}	ɑ̃^{21}	aŋ^{21}
lend	s-ŋa^{2}	ʔŋa^{2}	õ^{21}	aŋ^{21}	o$^{2\tilde{1}}$	õ^{21}	ã^{21}	õ^{21}	ɑ̃^{21}	aŋ^{21}
fir		ʔŋy^{1}	/	/	ŋə	ŋə	/	ỹ	/	ʔny
bird	ŋjak^{H}	ŋja̠^{H}	ŋ	ɲ	ɲ	ŋ	ɲ	n	ŋ	n
banana	s-ŋak^{H}	ʔŋja̠^{H}	/	/	ɲ	/	ɲ	n	/	ĩ
tile	ŋwa^{1}	ŋwɛ^{2}	bə^{21}	/	ŋɛ^{2}	vɛ^{2}	ɛ^{21}	ŋɛ^{21}	vɛ^{21}	vɛ^{21}
goose	ŋa-n (PST)	(ʔ)ŋwa^{1}	ŋo^{55}	aŋ^{53}	õ^{24}	õ^{55}	ŋue^{44}	wy^{44}	ŋə^{55}	ny^{55}

PN *ŋw, reconstructed in Bradley (2005), is retained in PLa, although there is only one clear example, i.e., 'tile' PN *ŋwa^{2}pi^{2} > PLa *ŋwɛ^{2} p^{h}e^{2}, probably an early loan from Chinese (Bradley 2004). While C varieties show [v], a handful of varieties (E-DC, E-TS, W-DT) show [ŋ] and two (W-SLZ, XZ) show loss of the initial, making this correspondence set distinct from both PLa *v and *ŋ. Bradley (2003) suggests that [ŋ] reflects the earlier loan, but the [v] in C varieties reflects a later loan from Chinese (now pronounced [wa^{214}]). However, the rhyme [ɛ] seen across C varieties matches the PLa reconstruction, but does not match the more recent Chinese form, suggesting that [vɛ] reflects the original PLa form. Another example, 'goose' PLa *(ʔ)ŋwa^{1}, is a descendant from Proto Sino-Tibetan *ŋa-n (Matisoff 2003). Other Ngwi languages do not offer conclusive evidence for *ŋw in this word (e.g., Lisu and Lolo's [õ^{33}] (Bradley 2004)), but the rounded vowel in the second syllable of Hani's o^{31}ŋø^{55} (Sun 1991) is suggestive of the influence of a labiovelar approximant. In Lalo, the [-w-] medial influences the rhyme to become rounded [y] in the C-W group, but not in E or peripheral varieties, which show simplification to an intermediate form *ʔŋa (the [a] later became [o] in MD, E, and XZ). This rhyme correspondence set is distinct from both PLa *y and *a, cf. *ʔŋy^{1} 'fir tree' and *ʔŋa^{2} 'fish'. Reflexes of 'goose' in W and E varieties suggest preglottalisation, *ʔŋwa^{1}, as Tone *1 syllables with preglottalised initials remained high ([44] in W, [55] in E-HS) while their plain counterparts became low-rising. Also, E varieties show loss of initial and compensatory nasalisation, of the type commonly found in preglottalised syllables, e.g., in *ʔŋa^{2} 'fish'/'to lend'. These factors support reconstructing preglottalisation for 'goose'. However, no C variety preserves the preglottalisation, and E-DC shows a low-rising tone instead of a high level tone, suggesting that the preglottalisation was variable (cf. 'mushroom' in §4.2.4.1 for another example of variable preglottalisation).

4.2.5 Summary of initials

Table 4-26 gives a summary of PN sources of PLa stops' manner of articulation. The PN sources are represented with the labial stop as a cover symbol for all stops and affricates.

Table 4-26: Summary of PN sources of PLa stops' manner of articulation

Voicing	PLa	PN source
Voiceless unasp.	*p, t, k, ts, tʃ, pj, kj	*ʔp; *ʔb/_vowel, nasal
Voiceless aspirated	*p^{h}, t^{h}, k^{h}, ts^{h}, tʃ^{h}, p^{h}j, k^{h}j	*p , *C-p
Voiced	*b, d, g, dz, dʒ, bj, gj	*b, *ʔb/_stop, *m-p, *m-b, *C-b

Table 4-27 summarises the PN sources of PLa individual initials. PLa initials that exactly match their PN source are not listed. Aspirated, voiceless, and voiced stops at each place of articulation are included together, with awareness that the VOT (voice onset timing) of stops was conditioned as summarised in Table 4-26 above.

Table 4-27: Summary of PN sources of PLa initials

PLa	PN
*pʰ, *p, *b	*p, *pr, *pl, *b, *b-l, including *ʔ/-s and *C-
*pʰj, *pj, *bj	*pj, *b-j
*tʃʰ, *tʃ, *dʒ	*c, *kj, *ʔ-c, *ʔ-gj, *j
*kʰ, *k, *g	*k; *kr/_PLa *i & *o; *kl & *kr/_PLa *y, *ɨ, *u; *gj/_*up
*kʰj, *kj, *gj	*kl & *kr/_PLa *e, *ɛ, *a, *aŋ; *kl/_PLa *i & *o
*v	*w, *y/_*u
*ʔv	*C-w, *ʔ-w, *s-w
*f	*ʔ-w, *s-w; *∅/_*u
*ʃ	*ʃ, *s-r, *s-j, *m-r-w
*ʒ	*ʒ, *y, *p-rwak^{H}, *∅/_*e
*x	*x; *ʃ/_*ik, *i,*e
*ʔx	*s-l
*ɣ	*r, *k-d-w; *∅/_*o
*h	*ʔ-r, *C-r, *C-y, *m-y, *k-rwak^{H}, *ʃ-w, *n-l
*ʔl	*ʔ-l, *C-l; *k-l & *m-l/_*close vowels
*l	*l; *k-l & *m-l/elsewhere
*m	*m, *C-m
*ʔm	*ʔ-m, *s-m
*mj	*mr, *mj, *ml
*ʔmj	*ʔ-mr/y/l, *s-mr/y/l
*n	*n, *C-n; *ɲ & *C-ɲ/_*i
*ʔn	*ʔ-n, *s-n; *ʔ-ɲ, *s-ɲ, & *ʔ-n-j/_*i
*ɲ	*ɲ, *n-j
*ʔɲ	*ʔ-ɲ, *s-ɲ, *ʔ-n-j
*ʔŋ	*ʔ-ŋ, *s-ŋ
*ŋj	*ŋ-y
*ʔŋj	*s-ŋ-y
*ʔŋw	some evidence in 'goose,' from PST *ŋa-n

4.3 Proto Lalo rhymes

This section traces the development of Proto Lalo rhymes from the PB/PN rhyme system, which had vowel-final, nasal-final, and stop-final rhymes. Rhymes are treated as units, as in Bradley (1979) and Matisoff (2003). In general, Bradley's (1979) reconstruction of Proto Ngwi is used, but Matisoff's (2003) reconstructions are utilised as well to clarify some issues. Although the two systems are mostly compatible, notable differences in the reconstruction of rhymes are explored below.

Proto Lalo's system of nine rhymes is presented in Table 4-28. Proto Lalo distinguished three levels of vowel height (close, close-mid, and open-mid/open), and three levels of backness (front, central, and back). PLa had one close front rounded vowel *y, with all other front vowels unrounded. Vowels in harsh phonation mirror their modal counterparts. There is only one nasal-final rhyme in PLa, *aŋ, impinging on the symmetry of the system. However, it is necessary to reconstruct this rhyme for several reasons: 1) Some varieties (XZ and E-HS) retain *aŋ in some monosyllabic words, an environment in which the loss and subsequent addition of a velar nasal is unlikely; 2) the divergent development of *aŋ (> /u/ in Central and some W varieties, but elsewhere *aŋ > /a/) requires a distinct PLa rhyme whose subsequent developments should be accounted for as simply as possible, and 3) *aŋ is the only PLa rhyme that has no harsh phonation counterpart, suggesting that *aŋ existed outside PLa's monophthong system at the time of the formulation of the PLa rhyme system. Any hypothetical PLa monophthongs developing from PN *aŋ, such as *ɔ or *ɑ, cause more problems than they solve. Further discussion of PLa *aŋ is given in §4.3.3.4.

Table 4-28: Proto Lalo rhymes

*i	*y	*ɨ	*u	
*e			*o	
*ɛ			*a	*aŋ

Table 4-29 below gives Matisoff's (2003) interpretation of Benedict's (1972) Proto Sino-Tibetan monophthongs and diphthongs. Matisoff divides these rhymes based on primary, more common rhymes, which were diphthongs, and secondary, or rare rhymes, which were mostly monophthongs. Matisoff's monophthong-diphthong distinction can also be thought of as a vowel length distinction. Matisoff finds that *e, *o, *ew and *oy are marginal, with only a handful of etyma to support their reconstruction. No examples of these rhymes are found in the Lalo data.

Table 4-29: Matisoff's (2003) interpretation of Benedict's (1972) Proto Sino-Tibetan monophthongs and diphthongs

Primary:		
*əj		*əw
*ej		*ow
*aj		*aw
*a:j	*a	*a:w

Secondary:	
*i	*u
*e	*o
(*ew)	(*oy)

Bradley's (1979b) reconstruction of Proto Ngwi rhymes is presented in Table 4-30:

Table 4-30: Proto Ngwi finals (Bradley, 1979b: 118)

vowel-final:		*i		*u
	*we	*e		*o
	*waj	*aj	*a	*aw
			*wa	

nasal-final:									
	*im		*um	*in		*un	*iŋ		*uŋ
		*am			*an			*aŋ	
		*wam			*wan			*waŋ	
stop-final:									
	*ip		*up	*it		*ut	*ik		*uk
				*et			*ek	*ök	*ok
		*ap			*at			*ak	
		*wap			*wat			*wak	

Table 4-31 compares Benedict/Matisoff's PB system with Bradley's PN system to clarify the few differences between them. Key differences include Matisoff's distinction between *ej and *i, which Bradley does not make, the overlapping correspondence of Matisoff's *əj with Bradley's *i and *e, and a difference in notation (Matisoff's *əw ~ Bradley's *o). I suggest a further distinction between *u and *ow at the PB level, which Matisoff (2003: 222) reconstructs only at the PTB level but considers reconstructing at the PB level.

Table 4-31: Comparison of Benedict/Matisoff's PB and Bradley's (1979b) PN open vowels

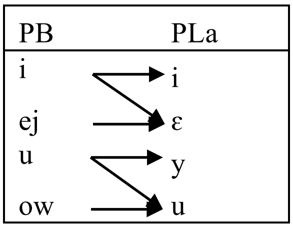
Matisoff's PB (2003)	Bradley's PN (1979)
*əj	*i, *e
*ej	*i
*a(:)j	*aj
*wəj	*we
*wa(:)j	*waj
*u	*u
*ow (PTB)	*u
*əw	*o
*a(:)w	*aw

Evidence from Lalo supports Matisoff's distinction between *ej and *i at the PB level, even though both Written Burmese (WB) and Lahu have merged them to i (Matisoff, 2003: 159). Bradley (1979b) and Matisoff's (1972) earlier reconstructions of PB do not make a distinction between primary (long/diphthong) and secondary (short/monophthong) rhymes, and Bradley (1979b: 176) states that the vowel length distinction of PST/PTB disappeared by the PB/PN stage. However, Matisoff (2003: 206) reconstructs *ej as a separate rhyme at the PB stage, using evidence from Lalo. Unlike WB and Lahu, Lalo did not merge *i and *ej after alveolars: PB *i after alveolars remains PLa *i, but PB *ej after alveolars > PLa *ɛ, as discussed in Sections 4.3.1.1 and 4.3.1.2. Bradlej's reconstruction of PN *i correponds to Matisoff's *ey and *i, but because of evidence from Lalo, I use Matisoff's separate *ej and *i.

Likewise, Lalo offers evidence to support the reconstruction of separate *ow and *u at the PB level. As with *ej and *i, WB and Lahu merge *ow and *u, but Proto Lalo keeps their developments separate. Again, the distinction is made clear after alveolars: PB *u becomes PLa *y after alveolars, but PB *ow becomes PLa *u in the same environment, as discussed in 4.3.2.2 and 4.3.2.3. Matisoff (2003: 222) mentions in a footnote the desirability of reconstructing *ow at the PB level, given the *i/ej distinction in the front vowels. Since most Ngwi languages merge *ow and *u, Matisoff has no concrete evidence for a PB distinction, resulting in a somewhat asymmetrical vowel system. Lalo furnishes the evidence to confirm Matisoff's hunch. Additionally, several varieties of Lolo and Lipo also keep *ow and *u distinct, with *ow > u and *u splitting to ɤ and u with the same conditioning as Lalo. For example, Nanhua Lolo (CXMW 1988) shows PTB *now 'soft' > [nu^{21}] and *tow 'thick' > [t^{h}u^{33}], but PN *ʔ-du^{2} 'head' > [dɤ^{33}] and *su^{2} 'same' > [sɤ^{55}]. All Lipo varieties reported in CXMW (1988) show the same distinction.

The behavior of the PB close back vowels *u and *ow parallels that of the close front vowels *i and *ej. Monophthongs *i and *u both split, moving to more open or more front positions depending on the conditioning of the initials: *i > PLa *ɛ after *r, *tsj, *dzj, *kj and remains *i elsewhere, while *u > PLa *y after labials and alveolars and remains *u in other environments. Diphthongs *ej and *ow, with many fewer lexical items, do not split but instead only adjust their position slightly: *ej > PLa *ɛ, and *ow > *u. The result is a partial merger of *i with *ej and *u with *ow, as shown in Figure 4-1.

Figure 4-1: Partial mergers of *i with *ej and *u with *ow



Another difference between the two systems is that Bradley's *i and *e, a distinction based on evidence from Burmese (David Bradley, personal communication, June 4, 2010), corresponds to Matisoff's *əj. Matisoff's *əj usually corresponds to Bradley's *e, but after alveolar affricates, Matisoff's *əj corresponds to Bradley's *i. PN *i and *e both merge to PLa *i after alveolar affricates, so this difference between the two systems does not impact the discussion of PLa development.

Finally, Matisoff's *əw corresponds to Bradley's *o, a notational difference that does not affect the interpretation of PLa development.

Matisoff's nasal-final rhymes and stop final rhymes usually correspond to Bradley's, with a few differences. Matisoff makes vowel length distinctions of long *i: versus short *i before alveolar finals *-n and *-t, but Bradley does not. Lalo data supports the vowel length distinction, with long *i:n and *i:t becoming PLa *i and *i̠, and short *in and *it becoming PLa *e and e̠. Matisoff's vowel length distinction of *u versus *u: before *-k corresponds to Bradley's *ok and *uk, merely a notational difference. These differences are summarised in Table 4-32 below:

Table 4-32: Comparison of Matisoff's (2003) PB and Bradley's (1979b) PN nasal and stop final rhymes

Matisoff's PB (2003)	Bradley's PN (1979b)
*in, *i:n	*in
*it, *i:t	*it
*uk	*ok
*u:k	*uk

4.3.1 PN front vowels *i, *e, *ej, *aj, *waj, *we

Table 4-33 below summarises the development of PB/PN front vowels in Written Burmese (WB) and Lahu (Matisoff 2003), and Proto Lalo. Details of Proto Lalo's development are given in the following sections.

Table 4-33: Development of PB/PN front vowels in Written Burmese, Lahu, and PLa

PB	WB	Lahu	Proto Lalo
i	i	i	i /default; e/labial stops_; ɛ /r, tsj, dzj, kj_
ej	i	i	ɛ
əj	e	ɨ/default; i/labials; ɔ/complex laterals	i /default; ɨ /labials, r, kj_
a(:)y	ai	e	ɛ /default; e /alveolars_
wəj	we	ɨ/default; i/labials	ɛ /default; ɨ /aspirated velar stops_
waj	wai	e	ɛ

4.3.1.1 PN *i > PLa *i, *e, *ɛ, *ɨ

Table 4-34 summarises the development of PN *i in PLa; following each PLa vowel in parentheses is the number of cognates in the wordlist that show that vowel. PN *i developed into

PLa *i, *e, *ɛ, *ɨ, and *y, with conditioning by the initial. Of the 31 lexical items reflecting PN *i, 19 of them retain *i in PLa, three become *e, seven *ɛ, one *ɨ, and one *y.

Table 4-34: Development of PN *i in PLa

Change	Conditioning	Results
*i > e	labial initials (p, b, m)	e (3), i (2), ɛ (1)
*i > i	alveolar and palatal initials (t, d, n, ɲ, l, ʔn, ʔɲ, ʔl) alveolar and postalveolar affricates and fricatives	i (11) i [ɿ/ʅ] (6)
*i > ɛ	alveolar affricates plus medial -y- r, mr, kj	ɛ (2) ɛ (4)
*i > ɨ	ʃ > PLa x_	ɨ (1)
*i > y	m-d	y (1)

Table 4-35 gives examples of PN *i's development in PLa. With labial stops, *i > PLa *e, as in *pi^{1} 'spicy,' 'piece of tile'> PLa *p^{h}e^{1} and *ʔ-bi^{2} 'old' > PLa *be^{2}. Although these etyma are reflected in only a handful of varieties, the correspondence set of PLa *e is still identifiable, with MD's [ɛ], E-DC and W-DT's [e], and Central's [i]. CE-YA is the only variety that has retained the PN cognate *ʔ-bi^{2} 'old,' and the [i] may reflect either PLa *i or *e, as Central varieties merged the two rhymes. However, assuming that all labial stops developed in the same way, I reconstruct this etyma as PLa *be^{2}. Labial nasal *m shows variation between PLa *i and *ɛ, as in PN *C-mi^{2} 'woman' > PLa *mɛ^{2}, but *C-mi^{1} 'field' and *mi^{1} 'nighttime'> PLa *mi^{1}.

For *ʔ-prefixed labial stops, the development is ambiguous because of uncertainties in the PN/PB reconstruction. In both examples of PN *ʔpi ('chin' and 'comb'), *i becomes close central *ɨ, as in PN *ʔpi^{1} 'chin' > PLa *pɨ^{1} and *ʔpi^{2} 'comb' > PLa *pjɨ^{2}. However, Matisoff (2003, p. 196) reconstructs 'comb' as PB *ʔ-g^{w}i(y)^{2}, with the parenthetical (y) in *i(y) reflecting protovariation between *i and *əj for this cognate. Matisoff's *əj usually corresponds to Bradley's *e. After labial initials, *e/əj > PLa *ɨ, as discussed in §4.3.1.3, so Lalo appears to reflect PN *ʔpe/əj for 'chin' and 'comb,' not *ʔpi.

In syllables with alveolar and palatal initials (*t, *d, *n, *ɲ, *l, *ʔn, *ʔɲ, *ʔl), *i is retained, as in PN *di^{1} 'insect' > PLa *di^{1}. In syllables with the aspirated alveolar stop, the initial became palatalised in most Lalo dialects except Eka, as seen in PN *ti^{2} 'one' > PLa *t^{h}i^{2}, Eka /t^{h}i^{2}/, MD /tʃ^{h}i^{2}/ and CW-QY /tʂ^{h}ɨ^{2}/. PN *m-di^{2} 'yeast,' yields PLa *dy^{2}, suggesting an alternate PN reconstruction of *m-du^{2} as the origin. Alveolar initials with Bradley's *i that are reconstructed as *ej in Matisoff are discussed in §4.3.1.2 below.

Syllables with initial *r or *nasal plus medial *-r- show PLa *ɛ, as in *k-ri^{2} 'big'> PLa *ɣɛ^{2}, and *ʔmri^{2} 'tail' > PLa *mɛ^{2}. For *k-ri^{2} 'big,' W-YL, C-LJ, and C-LB show /ɣɨ^{2}/ instead of /ɣɛ^{2}/, but this is a subsequent vowel raising due to the velar initial. Other initial consonants that show PN *i > PLa *ɛ are *n-l, which becomes PLa *h (e.g., *n-li^{2} 'penis'> hɛ^{2}), and *kj, which becomes PLa *tʃ^{h} (e.g., *kji^{2} 'raise' > tʃ^{h}ɛ^{2}). In PN, *i does not occur after velars, except for after *kj.

Table 4-35: Examples of PN *i's development in PLa

Gloss	PN	PLa	MD	Eka	W-DT	E-DC	CE-YA	C-LJ
spicy	pi^{1}	pʰe^{1}	ɛ	i	/	e	i	i
tile	ŋwa^{1}pi^{1}	pʰe^{1}	ɛ	/	e	/	/	i
old	ʔ-bi^{2}	be^{2}	/	/	/	/	i	/
woman	C-mi^{2}	mɛ^{2}	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ
insect	di^{1}	di^{1}	i	i	i	i	i	i
one	ti^{2}	tʰi^{2}	i	i	ʅ	ɿ	ʅ	ʅ
big	k-ri^{2}	ɣɛ^{2}	ɛ	ɛ	ɛ	ɛ	ɛ	ɨ
raise	kji^{2}	tʃʰɛ^{2}	ɛ	ɛ	/	/	/	/

With most alveolar and postalveolar affricates and fricatives, PLa retains *i, as seen in Table 4-36 below. PLa *i after alveolar and palatoalveolar affricates and fricatives was probably realised as apical vowel [ɿ], a situation still seen synchronically in varieties such as YL, although in other varieties such as CW-QY, the subsequent development of initials and finals caused the [ɿ] to be rephonologised as an allophone of close central vowel /ɨ/ (see §3.2). In *tsi^{2} 'lung,' W dialects show [tsʰɛ^{21}ma^{33}fy̩^{21}], whereas other dialects show [tsʰɿ^{21}fy̩^{21}], reflecting possible protovariation in PLa. With PLa palatoalveolar affricates, Eka and MD show [i], and other Lalo varieties show apical vowel [ɿ] or [ʅ], depending on the subsequent development of PLa palatoalveolar affricates to alveolar or retroflex.

Two exceptions to this trend are seen in the development of PLa *ɛ in syllables with alveolar affricates plus a medial *-y-, as in 'lard/fat,' PB *tsyi^{1} and 'to ride,' PB *dzyi^{2}, seen in Table 4-36 below. Bradley reconstructs these etyma as PN *tsi^{1} and *dzi^{2}, respectively, but these items do not fit the pattern of *i retention as described above. Although the effect of a medial *-y- in lowering the vowel to *ɛ is rather counter-intuitive, Matisoff's reconstruction is adopted here to explain the distinct developments of *tsyi^{1} 'fat' and *tsi^{1} 'lung'.

Before PN *i, *ik and *e, palatoalveolar fricative *ʃ became PLa velar fricative *x across all Lalo varieties, and the vowel became PLa *ɨ, i.e., PN *ʃi/ik/e > PLa *xɨ. PLa *i is often reflected by apical vowel [ɿ], and it is possible that the apical vowel [ɿ] moved slightly back to close central vowel *ɨ and then conditioned the palatoalveolar initial to move back to velar position.

Table 4-36: Further examples of PN *i's development in PLa

Gloss	PB	PN	PLa	MD	E-DC	W-DT	CW-QY
barley	*zəj^{2}	*zi^{3}	*zi^{3}	/	ɿ	ɿ	ɿ
urine	*m-(d)zyəj^{2}	*m-zi^{2}	*zi^{2}	/	ɿ	ɿ	ɿ
lung	*tsəj^{2}	*tsi^{2}	*tsʰi^{2}	/	ɿ	ɛ	ɿ
hat		*ʔ-tsi^{2}	*tsi^{2}	u	ɿ	ɿ	ɿ
liquor	*m-dzəj^{1}	*m-dʒi^{1}	*dʒi^{1}	i	ɿ	ʅ	ʅ
to ride	*dzyi^{2}	*dzi^{2}	*dzɛ^{2}	ɛ	ɛ	ɛ	ɛ
fat	*tsʰ(y)i^{1}	*tsi^{1}	*tsʰɛ^{1}	ɛ	ɛ	ɛ	ɛ
seven	*ʃi^{2}	*ʃi^{2}	*xɨ^{2}	ɨ	ɨ	ɨ	ɨ

4.3.1.2 PN *ej > PLa *ɛ

Matisoff's *ej corresponds to some etyma with Bradley's *i, but evidence from Lalo suggests that *i and *ej were distinct PB vowels that developed into PLa *i and *ɛ, respectively. Whereas *i mostly remained *i in PLa but split to *ɛ after certain initials (i.e., *r, *kj, *tsj, *dzj), *ej became PLa *ɛ in all environments. The result is a conditioned, partial merger of PN *i and *ej, as illustrated by Figure 4-1 above. The distinction between PB *ej and *i is especially clear after alveolar initials, as exemplified in Table 4-37 below. After alveolars, *i consistently yields PLa *i, while *ej consistently yields PLa *ɛ. In the table below, Matisoff's reconstructions without tone markers are at the PTB level.

Table 4-37: Examples of PN *ej and *i's development in PLa

Gloss	PB/PTB	PN	PLa	Lalo (Central)
insect	*di^1		*di^1	di^{55}
red	*ʔ-ni^1	*ʔ-ni^1	*ʔ-ni^1	ʔni^{55}
hunk/lump	*m-dej^1		*dɛ^1	dɛ^{33} (Björverud, 1998)
plant	*ʔ-dej^1	*ʔ-ti^3	*ʔ-dɛ^1	tɛ^{55}
hit	*dip	*m-di^2	*dɛ^2	dɛ̤^{21}
fruit	*sej	*si^2	*sɛ^2	sɛ̤^{21}
sharpen		*si^2	*sɛ^2	sɛ̤^{21}
near	*s-na:y X s-nej	*b-ni^2	*nɛ^2	nɛ̤^{21}
younger sibling	*nyej	*ʔəɲi^1	*ɲɛ^{1}za^2	nɛ^{55}za̤^{21}
penis	*m-lej X *m-li	*(n)-li^2	*hɛ^2	hɛ̤^{21}
tail	*r-mej	*ʔ-mri^2	*mɛ^2	ʔmɛ̤^{21}

4.3.1.3 PN *e > PLa *i, *ɨ, *ɛ

Table 4-38 below shows the development of PN *e in PLa, with number of supporting examples in parentheses. Bradley's PN *e usually corresponds to Matisoff's (2003) *əj, except after alveolar and post-alveolar affricates and fricatives, where Matisoff's *əj corresponds to Bradley's *i. Out of 29 lexical items in the wordlist with PN *e, twenty show PLa *i, seven show PLa *ɨ, and two show PLa *ɛ.

Table 4-38: Development of PN *e in PLa

Conditioning	Results
alveolar sonorants (ʔn, l, b-l, s-l, m-l)	i (5)
alveolar and postalveolar affricates (ts, dʒ)	i (3), ɛ (1)
r, k plus medial r, l, w, y	i (11), ɨ (1)
labial initials (p, ʔp, pr, br, m)	ɨ (5), i (1)
ʃ> PLa x_	ɨ (1)
s-w > PLa f_	ɛ (1)

Table 4-39 gives examples of the development of PN *e in PLa. PLa shows a merger of PN *e and *i to PLa *i in many environments, such as following alveolar and postalveolar initials. PN *e and *i also show parallel development after *ʃ, merging to PLa *ɨ, as in 'die' PN *ʃe^2, PLa *xɨ^1. The distinction between *e and *i is maintained, however, after *labial initials, *r, and *kj. After labial initials, *i > PLa *e, but PN *e becomes PLa *ɨ, e.g., PN *pe^2 'rotten' > PLa *p^{h}ɨ^2. After labial stop plus medial -r-, PN *e varies between PLa *i and *ɨ, e.g., PN *pre^1 'untie' > PLa *p^{h}ɨ^1, but PB *m-brəj^1 'tears' > PLa *bi^1. After *kj, PN *i > PLa *ɛ, but PN *e > PLa *i, as in *kje^2 'borrow' > PLa *tʃ^{h}i^2. While PN *i after *r > PLa *ɛ, PN *e > PLa *i in the same environment, as in 'water' PN *re^1 > PLa *ɣi^1.

After *r and velar stops plus medials *-r- and *-l-, PN *e becomes PLa *i, as seen in 'foot/leg' *kre^1, 'bile' *C-ʔ-kre^1, and 'skin' *m-k-re^1. PLa *i shows subsequent developments after these velar initials in different varieties of Lalo: *i is reflected as /i/ in MD, Eka, and E-DC, but in most other varieties, the velar initial has conditioned the movement of the vowel back to close central /ɨ/. After labiovelar initial *w, PN *e becomes PLa *i, as in 'far'. However, after *s-w, PN *e develops into PLa *ɛ, as in *s-we^{2} 'dry' > PLa *fɛ^{3}. The rounded /y/ seen in CW-QY's [a^{55}m̩^{21}ɕy^{55}] reflex of PLa *hi^{1} 'wind' may be due to the labial nasal in the preceding syllable of the the compound *a^{1}mo^{2}hi^{1}, literally 'sky wind'.

Table 4-39: Examples of PN *e's development in PLa

Gloss	PN	PLa	E-DC	Eka	MD	YL	XZ	W-DT	C-CJ	CWQY
rotten	pe^{2}	pʰɨ^{2}	/	/	/	/	ɨ	ɨ	ɨ	ɨ
untie	pre^{2}	pʰɨ^{2}	ə	ɨ	ɨ	u	ɨ	ɨ	ɨ	ɨ
die	ʃe^{2}	xɨ^{1}	i	ɨ	ɨ	ɨ	ɨ	ɨ	ɨ	ɨ
tears	m-brəj^{1} (PB)	bi^{1}	/	i	i	/	ɿ	ɿ	ɿ	/
borrow	kje^{2}	tʃʰi^{2}	ɿ	ɿ	i	/	ʅ	ʅ	ɿ	ʅ
day	ʔne^{3}	ʔni^{3}	ɛ	i	i	i	i	i	i	ɛ
wind	s-le^{1}	hi^{1}	i	i	i	e	i	i	i	y
grandson	m-le^{2}	ʔli^{2}	i	i	u	i	i	i	i	i
four	b-le^{2}	ʔli^{3}	i	i	ɨ	i	i	i	i	i
leg	kre^{1}	kʰi^{1}	i	/	i	ɛ	ɨ	ɨ	ɨ	ɨ
bile	ʔkre^{1}	ki^{1}	i	i	i	/	ɨ	ɨ	ɨ	ɨ
skin	m-k-re^{1}	gi^{1}	i	i	i	/	ɨ	ɨ	ɨ	ɨ
water	re^{1}	ɣi^{1}	i	ɨ	ɨ	ɨ	ɨ	ɨ	ɨ	ɨ
far	we^{2}	vi^{2}	ei	u	ə	ai	i	i	i	i
dry	s-we^{2}	fɛ^{3}	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ

4.3.1.4 PN *aj > PLa *ɛ, *e, *y

Table 4-40 below shows the development of PN *aj in PLa, with number of supporting examples in parentheses. In general, *aj split to PLa *ɛ and *e, with *ɛ as the default and *e developing after alveolar initials. Of the sixteen lexical items showing PN *aj, nine develop into PLa *ɛ, six into PLa *e, and one to *y.

Table 4-40: Development of PN *aj in PLa

Conditioning	Results
labial initials, both stops and nasals (p, ʔp, m)	ɛ (4), y (1)
r, kr	ɛ (3)
w	ɛ (2)
alveolar initials (ʔd, dz, ts, ʔts, n)	e (5)
no initial > PLa ʒ_	e (1)

Table 4-41 below illustrates the correspondence sets that reflect PN *aj. The usual reflex after labials is PLa *ɛ, as in 'tie' PN *paj^{1} PLa *pʰɛ^{1}. One example, 'to divide' PN *baj^{1}, shows an irregular development to PLa *by^{1}. The PTB reconstruction for this word is *bral (Matisoff, 2003), so there may be a more accurate PN reconstruction for this word other than *baj^{1}. After PLa *kj and *ɣ, CW-QY, C-WC, C-LJ, and C-LB show a subsequent development to close central vowel /ɨ/, conditioned by the velar position of the PLa initials. After alveolar stops, affricates, and nasals, PLa *e develops, which is retained in most Lalo varieties except Central (i.e., in E-DC, YL, XZ, all

W varieties except W-YL). In Eka, MD, and W-YL, PLa *e and *ɛ merge to [ɛ], while in all Central varieties, PLa *e and *i merge to [i]. If there is no initial present, as in ‘go,’ PN *aj^1, then *aj also develops as *e, with insertion of the palatoalveolar fricative *ʒ, discussed in §4.2.1.

Table 4-41: Examples of PN *aj’s development in PLa

Gloss	PN	PLa	MD	Eka	YL	E-DC	XZ	W-DT	C-CJ	CW QY
divide	baj^1	by^1	ɨ	ɨ	ɨ	ə	y	y	y	y
tie	paj^1	pʰɛ^1	/	/	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ
star	ʔgraj^1	kjɛ^1	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	ɨ
laugh	raj^1	ɣɛ^1	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	ɨ
pound	ʔdaj^2	te^2	ɛ	ɛ	/	e	e	e	i	i
hoe	ʔtsaj^2	tse^2	ɛ	i	e	e	e	e	i	i
ten	tsaj^1	tsʰe^1	ɛ	ɛ	e	e	i	e	i	i
few	naj^2	ne^2	/	ɛ	e	e	e	e	/	i
go	aj^1	e^1	ɛ	i	i	i	i	i	i	i

4.3.1.5 PN *waj > PLa *ɛ

PN *waj merges with *aj to PLa *ɛ in all environments, as shown in Table 4-42 below. In a subsequent development, C-LJ merges PLa *ɛ with *a after retroflex affricates, as in ‘tusk,’ PN *dʒwaj^1 PLa *dʒɛ^1. The same correspondence is also seen in ‘pot’ PLa *tʃɛ^1, ‘dragonfly’ *dʒɛ^2, and ‘grasshopper’ *tʃɛ^1. The PN reconstruction for these words could be *aj or *waj, since there are no examples of PN *dʒaj or *tʃaj in the data to negate *aj as a possible source.

Table 4-42: Examples of PN *waj’s development of in PLa

Gloss	PB	PLa	MD	Eka	YL	E-DC	XZ	W-DT	CW QY	C-LJ
chaff	pwaj^2	pʰɛ^2	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ
easy	lwa(:)j	lɛ^1	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ
tusk	dʒwaj^1	dʒɛ^1	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	a
pot		tʃɛ^1	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	a

4.3.1.6 PN *we > PLa *ɛ, *ɨ

PN *we merges with *aj and *waj to PLa *ɛ in most environments, except after non-prefixed velar stops, as shown in Table 4-43 below. After velars *k and *kr, which both merge to PLa *kʰ in this environment, PN *we > PLa *ɨ. PLa *ɨ is reflected as /ɨ/ in all varieties, except in E-DC, where PLa *ɨ merged with *i to /i/ after velars. Whereas PN *we becomes PLa *ɨ after velar stops, PN *e > PLa *i in the same environment, as described in §4.3.1.3. MD and Eka provide the crucial evidence for the different development of PN *e and *we after velars. In MD/Eka, ‘leg’ PN *kre^1 > PLa *kʰi^1, reflected as /kʰi^1/, but ‘dog’ *kwe^2, ‘nest’ *kwe^1, and ‘daughter-in-law’ *krwe^2 > PLa *kʰɨ, reflected as /kʰɨ/. In most other varieties, both PLa *kʰi and *kʰɨ merge to /kʰɨ/, and in E-DC only, PLa *kʰi and *kʰɨ merge to /tʃʰi/. Surprisingly, ‘sweat’ PN *ʔkrwe^2 yields PLa *kɛ^2, with subsequent raising of the vowel to /kɨ/ in some Central varieties.

For other initials, *we predictably develops as PLa *ɛ, as in *pɛ^1 ‘gray’, * ʃɛ^1 ‘gold’ and *sɛ^2 ‘charcoal’. However, PN *swe^2 ‘blood’ instead shows PLa *i, reflected as the apical vowel [ɿ] in most varieties, but as [i] in MD. The initial alveolar fricative may have conditioned the rhyme's change to apical vowel [ɿ], although it did not have the same effect in ‘charcoal’. In the Burmese loan for ‘half’ [kʰwɛ^{53}], *wɛ becomes PLa rounded vowel *y.

Table 4-43: Examples of PN *we’s development in PLa

Gloss	PN	PLa	E-DC	MD	Eka	YL	XZ	W-DT	CW QY	C-LJ
dog	kwe^{2}	kʰɨ^{2}	i	/	/	ɨ	ɨ	ɨ	ɨ	ɨ
nest	kwe^{1}	kʰɨ^{1}	i	ɨ	i	ɨ	ɨ	ɨ	ɨ	ɨ
daughter-in-law	krwe^{2}	kʰɨ^{2}	i	ɨ	ɨ	ɨ	ɨ	ɨ	ɨ	ɨ
sweat	ʔkrwe^{2}	kɛ^{2}	ɛ	ɛ	ɨ	ɛ	ɛ	ɛ	ɨ	ɨ
gray	pwe^{1}	pɛ^{1}	ɛ	a	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ
gold	srwe^{1}	ʃɛ^{1}	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	a
charcoal	swe^{2}	sɛ^{2}	a	ɛ	i	a	a	ɛ	ɛ	ɛ
blood	swe^{2}	si^{2}	i [ɿ]	i	i	i [ɿ]	i [ɿ]	i [ɿ]	ɨ [ɿ]	i [ɿ]
half	[kʰwɛ^{53}]	kʰy^{2}	/	ə	ə	/	/	y	y	y

4.3.2 PN central and back vowels *a, *u, *ow, *o, *a(:)w, *wa

Table 4-44 below summarises the development of PB/PN central and back vowels in Written Burmese (WB) and Lahu (Matisoff 2003), and Proto Lalo.

Table 4-44: Development of PB/PN central and back vowels in Written Burmese, Lahu, and PLa

PB	PN	WB	Lahu	Proto Lalo
a	a	a	a	a
u	u	u	u	y/alveolars_; u/elsewhere
ow	u	u	u	o/b_; u/elsewhere
əw	o	ui	ɔ; u/ labials	i/alveolars_; o/elsewhere
a(:)w	aw	au	o	o/labial stops_; u/elsewhere
wa	wa	wa	u	y/alveolars_; a/velars

4.3.2.1 PN *a > PLa *a

*a is by far the most frequent rhyme in the data, comprising over 10% of the rhymes in the Lalo wordlist. Table 4-45 gives examples. PN *a remained *a in PLa. Several Lalo varieties (Eastern, W-DT, XZ, Eka, and MD) raise *a to [o], part of a chain shift with the change *aŋ > [a]. However, some very frequent words still show /a/ in these varieties, such as the first syllable in the autonym ‘Lalo’ *la^{2}lu̠^{H}, as well as ‘to come’ *la^{1}, the negative marker *ma^{2}, the negative imperative *tʰa^{2}, and ‘what?’ *a^{1}tsa^{1}.

After PN labials plus medial *-y-, PN *a is retained as PLa *a, but the glide has influence on the subsequent development of the rhyme. The glide is reflected as a palatal onset in diphthongs [-ia] or [-iɔ] in E-DC and E-HS. In some Central varieties (CW-QY, C-WC, CE-YA), the medial has replaced the rhyme after *m, as in PN * C-mja^{2} ‘many’ > PLa mja^{2}, reflected in CE-YA as /mi^{2}/.

Table 4-45: Examples of PN *a's development in Proto Lalo

Gloss	PN	PLa	E-DC	MD	Eka	XZ	W-DT	YL	CWQY	CE-YA
thin (thing)	ba^2	ba^2	ɔ	o	o	o	o	a	a	a
fern	m-da^1	da^1	ɔ	o	o	y	o	a	a	a
many	C-mja^2	mja^2	iɔ	o	o	o	o	a	/	i
to plow		mja^2	ia	o	o	o	o	a	i	i
late		mja^3	iɔ	/	/	o	o	a	i	i
bee	bya^2	bja^2	ia	o	o	o	o	a	a	a

4.3.2.2 PN *u > PLa *u, *y, *o

PN *u becomes PLa *y after most labials and alveolar initials and is retained as *u elsewhere, as illustrated in Table 4-46. After labial initials (except *b), and alveolar stops, nasals, affricates and fricatives, PN *u becomes PLa *y, reflected as [y] in most varieties, and as [ə] in E-DC, MD, Eka, and YL. There are some exceptions to this general pattern, seen in 'vulva' PB *s-tu^2 and 'nephew' PB *m-du^1, which both reflect PLa *u, not *y. These two words behave the same way as words reconstructed with PB *ow, discussed in 4.3.2.3 below. Also, the voiced labial stop conditioned a merger with PLa *o, which phonetically was probably closer to *[wɨ], as discussed in 4.3.2.4 below. 'Crow (v)' PB *mbu^1 shows identical reflexes with *bo^2 'carry. 'Owe,' no published reconstruction available, was probably *bu^3, given Lisu's reflex of it as [bu^{33}] and not [bo^{33}].

Table 4-46: Examples of PN *u's development in PLa

Gloss	PTB/PB	PN	PLa	E-DC	MD	Eka	XZ	W-YL	C-QS
vulva-1	s-tu^2		tu^2	ɤ	u	ʏ̩	ɤ	ʏ̩	ə
nephew	m-du^1	m-du^1	du^1	ɤ	u	ʏ̩	ɤ	ʏ̩	ə
crow (v)	mbu^1		bwɨ^1	ə	i	ɨ	ɨ[ʅ]	ɨ[ʅ]	i
owe	bu^3		bwɨ^3	ə	i	/	ɨ[ʅ]	ɨ[ʅ]	i
brood	ʔ-mu^2		ʔmy^2	ə	ə	ə	y	y	m̩
gourd	pu^2	pu^2	pʰy^2	ə	ə	ə	y	y	y
bury	s/m-du	səm-du^2	ty^2	ə	ə	ə	y	y	y
head-2		ʔdu^2	dy^1	ə	ə	ə	y	y	y
awn	ʔ-/s-nu^1		ʔny^1	ə	ə	ə	y	y	y
same	su^2		sy^2	ə	ə	ə	y	y	y
face		pju^2	pʰy/aŋ^2	a	ɛ	a	a	u	y
white	plu^1	plu^1	pʰu^1	ɤ	u	ʏ̩	ɤ	ʏ̩	ʏ̩
butterfly		C-lu^3	ʔlu^3	ɤ	u	ʏ̩	ɤ	ʏ̩	ʏ̩
chopstick		jyu^3	dʒu^3	ɤ	u	ʏ̩	ɤ	ʏ̩	ʏ̩
tendon		gru^2	gu^2	/	u	ʏ̩	ɤ	ʏ̩	ʏ̩

After PN labial clusters *pl and *bl, resonants *r, *l, *y, *w, palatal initials like *j, and no initial, PN *u merges with PN *ow to form PLa's *u. PLa *u is reflected as syllabic fricative /ʏ̩/ in most Lalo varieties, but also as /u/ in MD, as /ɤ/ with lip compression in E-DC, YL, XZ, W-SLZ, and as /ə/ in CW-QY and CE-YA.

PN *pju^2 'face' shows some unexpected reflexes: only C-QS and CE-YA reflect PLa *pʰy^2; all other varieties instead reflect *pʰaŋ^2, suggesting protovariation.

4.3.2.3 PB *ow > PLa *u

In Matisoff's and Bradley's previous reconstructions of PB/PN, *ow was not reconstructed, because PB languages such as WB, Lahu, and Lisu merge PTB *ow and *u. Matisoff (2003, p. 222) reconstructs *ow at the PTB level and considers reconstructing *ow at the PB level in a footnote. Lalo, Lolo and Lipo keep correspondence sets for *ow and *u distinct, suggesting that these vowels were in fact distinct in PB/PN, with *ow > u and *u splitting to [ɤ] and [u] with the same conditioning as Lalo. Nanhua Lolo (CXMW 1988) shows PTB *now 'soft' > [nu²¹] and *tow 'thick' > [tʰu³³], but PN *ʔ-du² 'head' > [dɤ³³] and *su² 'same' > [sɤ⁵⁵]. In Lalo, PB *ow becomes PLa *u in all environments, whereas PB *u splits to PLa *y after labials and alveolars, and to *u elsewhere. The result is a partial merger of *u and *ow, somewhat similar to the PB *i/ej partial merger, as illustrated in Figure 4-1 above.

The development of PB *ow to PLa *u is illustrated in Table 4-47. In a later change, all Central varieties merge *u and *ɨ after the labial nasal to /ɨ/, realised as [ʉ] in CW-QY, as seen in 'to work' PLa *mu¹. After alveolar affricates, as in 'fat' and 'boil,' MD and Eka retain PLa *u, reflected as /u/ in MD and as syllabic fricative /v̩/ in Eka. All other varieties merge *u and *i in this environment to apical vowel [ɿ].

Table 4-47: Examples of PN *ow's development in PLa

Gloss	PTB	PN	PLa	E-DC	MD	Eka	XZ	W-DT	CW-QY
work	mow		mu¹	ɤ	u	/	ɤ	v̩	ɨ[ʉ]
thick	tow	tu¹	tʰu¹	ɤ	u	v̩	ɤ	v̩	ə
fat	tsow	tsu¹	tsʰu¹	/	u	v̩	/	ɿ	/
boil	tsyow		tsu¹	ɿ	u	v̩	ɿ	ɿ	ɿ
soft	now	C-nu²	nu²	ɤ	u	v̩	ɤ	v̩	ə

4.3.2.4 PN *o > PLa *o, *i, *ɨ, *[wɨ]

PN *o developed into PLa *i after alveolars and palatals, to *ɨ after palatoalveolars, to *wɨ after bilabial stops, and was retained as PLa *o elsewhere. After the PLa stage, *o continued to develop in complex ways, to the extent that no Lalo variety retains [o] as a reflex of PN/PLa *o. PLa *o changes to central vowel [ə] or [ɨ] in E-DC, E-HS and Eka. In other varieties, PLa *o splits to /v̩/ (/ɨ/ in MD) and /i/, depending on the initial. Table 4-48 gives examples of PN *o's development in PLa.

After alveolar affricates and and palatal nasals, PN *o merged with PN *i and *e to PLa *i. After alveolar affricates and fricatives, PLa's *i was probably pronounced as apical vowel [ɿ]. In most varieties, [ɿ] is as allophone of /i/ in this environment, even though later changes caused [ɿ] to rephonologise as an allophone of close central vowel /ɨ/ in some varieties. In PLa, there is no contrast between *tsi and *tsɨ. After PLa palatoalveolars, PN *o > PLa *ɨ, as in 'sweet' PN *kjo¹ > PLa *tʃʰɨ¹. After palatoalveolars, there is a contrast between PLa *i and *ɨ, with *ɨ often reflected as retroflex apical vowel [ʅ], as seen in the PLa minimal pair *tʃʰi² 'borrow money,' reflected as MD [tɕʰi²¹] and PLa *tʃʰɨ¹ 'sweet,' reflected as CW-QY [tʂʰʅ⁵⁵].

PN *o after the alveolar stop is retained as PLa *o rather than merging with PN *i, as in 'book/paper' PN *to² yum² > PLa *tʰo²ɣu². For this correspondence set, *o > [a] in E varieties, XZ and W-DT, and becomes [i] in other varieties.

After labial stops, PN *o experienced two ordered changes: 1) phonetic unpacking to *wɤ, followed by 2) fronting of the second sound to *wɨ. The phonetic unpacking of PN *o > *wɤ probably began with the insertion of a transitional labiovelar glide between the initial bilabial stop and the vowel. The fronting of *wɤ to *wɨ occurred at the PLa stage, as every Lalo variety shows some degree of fronting, either to /ɨ /or /i/. In most Lalo varieties, the second segment of *wɨ remained at /ɨ/, but some varieties experienced subsequent fronting to /i/. In E-DC and E-HS, *wɨ simplified to /ɨ/, merging with the reflexes of PLa *ɨ. In C-W varieties, XZ, and E-TS, the *w became a fricative v, which then affected the changes in initials that are described in §6.5. In YL and MD, *wɨ moved all the way to the front to [i]. The change *o > *wɨ was not a phonological change, as PLa *o and *wɨ never contrasted, and *wɨ did not merge with *ɨ at the PLa stage, only later in some varieties. Noting this phonetic change, however, helps explain the later, more complex changes in initials, described in §6.5.

C, W, and XZ varieties show a partial merger with PLa *u after *m (often reflected as syllabic [m̩]) and after velars, reflected as [v̩], or as [ə] in CW-QY.

Table 4-48: Examples of PN *o's development in PLa

Gloss	PB	PN	PLa	E-DC	Eka	MD	XZ	W-DT	C-CJ	CW QY
meet		dzo^{1}	dzi^{1}	i[ɿ]	/	/	/	ɨ[ɿ]	ɨ[ɿ]	ɨ[ɿ]
cough		tso^{2}	tsi^{2}	i[ɿ]	i[ɿ]	ɨ[ɿ]	ɨ[ɿ]	ɨ[ɿ]	ɨ[ɿ]	ɨ[ɿ]
finger		s-ɲo^{1}	ʔni^{1}	i	i	i	i	i	n̩	i
sweet	kjəw^{1}	kjo^{1}	tʃʰɨ^{1}	i[ɿ]	i[ɿ]	ɨ[ɿ]	ɨ[ʅ]	ɨ[ʅ]	ɨ[ʅ]	ɨ[ʅ]
book-1	to^{2} yum^{2}	to^{2}	tʰo^{2}	a	/	/	a	a	i	i
carry	bəw^{2}	bo^{2}	bwɨ^{2}	ə	ɨ	i	ɨ[ɿ]	ɨ[ɿ]	i	i
price	pəw^{2}	pʰo^{2}	pʰwɨ^{2}	ə	ɨ	i	ɨ[ɿ]	ɨ[ɿ]	i	i
sky	məw^{2}	mo^{2}	mo^{2}	ə	i	i	v̩	v̩	v̩	m̩
mushroom	ʔməw^{1}	ʔmo^{1}	ʔmo^{1}	ə	ɨ	ɑ	m̩	v̩	m̩	v̩
steal	kəw^{2}	ko^{2}	ko^{2}	ə	ɨ	ɨ	v̩	v̩	v̩	ə
horn	krəw^{1}	kro^{1}	kʰo^{1}	ə	ɨ	ɨ	v̩	v̩	v̩	ə
cry	ŋəw^{1}	ŋo^{1}	ŋo^{1}	ə	ɨ	ɨ	v̩	v̩	v̩	ə

After velar initials, PN *o is also retained as PLa *o rather than merging with other vowels, because modern reflexes show a correspondence set distinct from all other PN vowels. E-DC, MD and Eka consistently reflect PLa *o as [ɨ] or [ə] in this environment. All other varieties show a subsequent merger with PLa *u, seen in the [v̩] reflexes in most varieties and [ə] in CW-QY. The [ə] seen in CW-QY is a fairly recent change that affects all reflexes of PLa *u, and is not a shared innovation with E-DC's development of [ə] from PLa *o. In CW-QY, all PLa *u > ə, but in E-DC, *u > /ɤ/ (with lip compression).

4.3.2.5 PN *aw > PLa *u, *o

In contrast with *a, *aw is rare, occurring in only a few examples in the Lalo wordlist, as seen in Table 4-49 below. After labials, there are only examples with medial *-y-, *-yaw. When *aw is seen without the medial *-y-, as in 'to call' PN *kaw^{1} and 'to stir-fry' PN *ʔ-raw^{1}, the rhyme merges with PLa *u, becoming either syllabic fricative [v̩], mid back vowel [ɤ] with lip compression, or mid central vowel [ə], depending on the variety. PN *(k)-raw^{1}, 'to count' is also reconstructed with *aw, but Matisoff's reconstruction of *rəj$^{1/3}$ is more consistent with the PLa reflex of *ɣɨ^{3}, as in E-DC /ɣə^{3}/.

The two examples of *-yaw after labial stops, *p(y)aw^{2} 'fart-1' and *b(y)aw^{2} 'banana-2,' both became PLa *bjo^{2}, with subsequent changes in the initial in some varieties, e.g., to [v] or [dz], a change described further in §6.3. PLa *bjo^{2} in 'banana' occurs as the second syllable in the PLa compound *ʔŋja̱^{H} bjo^{2} be^{3} and merged with PLa *bo^{2} in most dialects except MD. MD keeps the two correspondence sets distinct: *bjo^{2} > [dzɨ^{2}] or [vi^{2}], while *bo^{2} (and *bi^{2}) > [bi^{2}]. PN *p(y)aw^{2} 'fart-1' occurs as the first and third syllable in the PLa compound *bjo^{2} tsʰi^{2} bjo^{2}, with the second syllable *tsʰi^{2} consistently reflected as [tsʰɿ^{2}] across most Lalo varieties. The voicing of PN *p to PLa *b, seen across Lalo varieties in this etymon only, is unexpected. The initial syllable *bjo^{2} should become /dzi^{2}/ in W varieties and XZ, but instead shows /zi^{2}/, an irregularity probably due to dissimilation of manner of the initials of the first and second syllables, i.e., /dz/ and /ts^{h}/. Central varieties should show /vi^{2}/, as seen in CE-YA, but surprisingly C-WC shows /zi^{2}/, possibly through contact with W varieties.

Table 4-49: Examples of PN *aw's development in PLa

Gloss	PN	PLa	E-DC	MD	Eka	YL	XZ	W-DT	C-WC	CE-YA
call	kaw^{1}	ku^{1}	ɤ	u	/	ɤ	ɤ	ʏ̩	ʏ̩	ə
stirfry	ʔ-raw^{1}	ʔlu^{1}	ɤ	u	u	ɤ	ɤ	ʏ̩	ʏ̩	ə
fart	p(y)aw^{2}	bjo^{2}	bi^{21}	vi^{21}	/	zʅ^{21}	zʅ^{21}	zʅ^{21}	zʅ^{21}	vi^{21}
banana	b(y)aw^{2}	bjo^{2}	/	dʑi^{21}	bɨ^{21}	/	dzʅ^{21}	dzʅ^{21}	vi^{21}	/

4.3.2.6 PN *wa > PLa *y, *a

PN *wa became PLa *y after PLa alveolar initials and *a after PLa velar or cavity initials, as shown in Table 4-50 below. For 'chew' and 'rain', which develop into PLa *ga^{2} and *ha^{1} respectively, the rhyme merges with PLa *a, subsequently moving to o in several varieties. After alveolar initials, as in 'tooth' *swa^{2} and 'handspan' *twa^{1}, the rhyme merges with other PN rhymes such as *am and *wan to form the close rounded PLa vowel *y, which subsequently moves back to [ə] in E-DC, MD and Eka (with some irregularity seen in 'tooth').

Table 4-50: Examples of PN *wa's development in PLa

Gloss	PB	PN	PLa	E-DC	MD	Eka	XZ	W-DT	CW QY
chew	m-g^{w}ya^{2}	ga^{2}	ga^{2}	ɔ	o	o	o	o	a
rain	rwa (PTB)	r-ywa/we^{1}	ha^{1}	ɔ	o	o	o	o	a
tooth	swa^{2}	swa^{2}	sy^{2}	ə	o	i	y	y	y
handspan	twa^{1}		t^{h}y^{2}	ə	ə	ə	y	y	y

4.3.3 PN nasal-final rhymes

The only nasal-final rhyme to be retained in Proto Lalo is *aŋ, which subsequently becomes [u] in Central and some W varieties, and [a] elsewhere. All other nasal-final rhymes merge with PLa open vowels. Most rhymes ending in *-m (*am, *um, *wam) and/or with the labiovelar approximant medial (*wam, *wan), merge to PLa *y. Most rhymes with close front vowel *i (*im, *i:n, and *iŋ) merge to PLa *i, while *in and *an merge to PLa *e. Finally, most rhymes ending with velar nasal *-ŋ (*waŋ, *oŋ) and/or close back vowels (*oŋ, *un) merge to PLa *u.

Matisoff retains a vowel length distinction in PB between nasal-final rhymes *in and *i:n, seen in different reflexes in WB and Lahu. Lalo offers some support for this distinction in PB, as discussed in §4.3.3.3.

4.3.3.1 PN *am, *wam, *wan, *um > PLa *y

The rhymes *am, *wam, *wan, and *um are discussed together, since they all merge to Proto Lalo *y, as illustrated in Table 4-51 and Table 4-52 below. In E-DC, MD, Eka, and YL, PLa *y becomes [ə] or [ɨ], with varying conditioning in each variety. In E-DC, *y > [ə] everywhere except after palatalised labial clusters. E-DC preserves the palatal glide, which then influences the development of the rhyme, e.g., PN *byam^{1} 'to fly' > PLa *bjy^{1} > E-DC [biɔ^{24}]. In YL, *y > [ə] after alveolars and > [ɨ] elsewhere, whereas in MD and Eka, *y > [ɨ] after [ʏ] (and after [s] in MD but not in Eka) and > [ə] elsewhere. In all other Lalo varieties, PLa *y is retained, though some varieties show a later merger with *u after velars or the labiovelar approximant, seen in XZ's reflex for 'iron,' [xv̩^{55}] and 'bear' [wv̩^{24}].

Table 4-51: Examples of PN *am, *wam, and *wan's development in PLa

Gloss	PN	PLa	E-DC	MD	Eka	YL	XZ	W-DT	C-CJ	CWQY
*am										
to fly	byam^1	bjy^1	iɔ	ə	ə	ɨ	y	y	y	y
flame	ʔ-lam^1	ʔly^1	ə	ə	ə	/	y	y	y	y
to smell	nam^2	ny^2	ə	ə	ə	ə	y	y	y	y
iron	xam^1	xy^1	ə	ə	ə	ɨ	v̩	y	y	y
*wam										
belly	p-wam^2 (PB)	py^1	ə	ə	ə	ɨ	/	y	y	y
bear	k-d-wam^1	ɣy^1		ɨ	ɨ	ɨ	v̩	y	y	ə
*wan										
hawk	dzwan^1	dzy^1	ə	ə	ə	ə	y	y	y	y
garlic	swan^1	sy^1	ə	ɿ	ə	ɿ	y	y	y	y

*um follows the same basic pattern as above, as seen in Table 4-52 in 'warm,' 'short,' and 'use,' but there are a few exceptions. In 'dull' PN *dum^2, Lalo varieties that have this cognate instead reflect PLa *u, not *y. In 'three' PN *C-sum^2, influence from Mandarin Chinese /sɑn^{55}/ has resulted in PLa *a, an irregular development for this rhyme.

Table 4-52: Examples of PN *um's development in PLa

Gloss	PN	PLa	E-DC	YL	MD	Eka	XZ	W-SLZ	C-QS	CWQY
*um										
warm	lum^1	ly^1	ə	ue	ə	ə	y	y	y	y
short	ʔ-n-jum^2	ʔɲy^2	e	i	i	ɨ	y	y	y	y
use	ʒum^2	ʒy^2	ə	ə	ə	/	y	y	y	y
dull	dum^2	du^2	/	ɤ	/	/	/	ɤ	v̩	ə
three	C-sum^2	sa^1/^{3}	ɔ	a	a	o	o	a	a	a

4.3.3.2 PN *im, *iŋ > PLa *i

In general, PN nasal-final rhymes *im and *iŋ both merge to PLa *i, although both rhymes show some additional splits. There are only a few examples of *im in the data, given in Table 4-53 below. PN *im split into PLa *i after alveolars, *ɨ after PN *r, and *e after PN *y. 'Dusk,' which Matisoff reconstructs at the PTB level as *rim, is reflected in PLa as *ɣɨ^1. In most Lalo varieties *ɨ and *i merged to /ɨ/ after velars and thus are useless for distinguishing PLa *i in that environment. However, in MD, Eka, and E-DC, the rhymes remained distinct as [i] and [ɨ] or [ə]. Based on E-DC's reflex of [ə], 'dusk' is reconstructed with PLa *ɨ, since E-DC's [ə] is a regular reflex of PLa *ɨ, whereas in 'sun,' PLa *ɣi^1, E-DC shows [i]. In 'house,' PN *yim^1, the vowel is lowered to PLa *e, which is retained in E-DC, YL, and most W varieties, but merges with PLa *i or *ɛ in others.

Table 4-53: Examples of PN *im's development in PLa

Gloss	PN	PLa	MD	Eka	E-DC	YL	XZ	W-SLZ	C-QS	CWQY
cloud	C-dim^{1}	di^{1}	/	/	i	/	i	/	i	i
low	ʔ-n-jim^{3}	ʔni$^{1/3}$	i	/	i	/	/	i	i	/
raw	dʒim^{2} (PB)	dzi^{2}	i[ɿ]	i	i	i[ɿ]	i[ɿ]	i[ɿ]	i[ɿ]	i[ɿ]
dusk	rim (PTB)	ɣɨ^{1}	/	/	ə	/	ɨ	ɨ	ɨ	ɨ
house	yim^{1}	he^{1}	ɛ	i	e	e	i	e	i	i

PN *iŋ consistently becomes PLa *i, as shown in Table 4-54 below. The two exceptions to this are seen in 'release,' PB *pr/yiŋ$^{1/2}$, which becomes PLa *p^{h}jy^{2} instead of *p^{h}i^{2}, and 'nail,' PN *siŋ^{2}, which becomes PLa *sɛ^{2} instead of *si^{2}. The combination of labial initial plus medial *-r-/-y- in 'release' is the most likely culprit for conditioning the rhyme to *y. Matisoff (2003) reconstructs 'nail' as *sin^{2}, not *siŋ^{2}; even if *sin^{2} is the correct reconstruction, PLa still shows an unexpected development of *ɛ instead of *e for *-in, cf. E-DC /se^{2}/ from PN *sin^{2} 'liver,' versus /sɛ^{2}/ 'fingernail'.

Other examples of PN *iŋ are regularly /i/ in all Lalo varieties. In all varieties except E-DC, MD, and Eka, PLa *i > /ɨ/ after velars, as seen in 'thread' and 'sun'.

Table 4-54: Development of PN *iŋ in PLa

Gloss	PN	PLa	MD	Eka	E-DC	YL	XZ	W-YL	C-CJ
release	pr/yiŋ$^{1/2}$ (PB)	p^{h}jy^{2}	ə	ə	e	y	y	y	y
nail	siŋ^{2}	sɛ^{2}	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ	ɛ
pus	m-bliŋ^{1}	bi^{1}	i	i	i	i	i[ɿ]	i[ɿ]	i[ɿ]
ripe	s-miŋ$^{1/3}$	mi^{3}	i	i	i	i	y	i	i
name	ʔ-m(y)iŋ^{1}	ʔmi^{1}	i	/	i	i	/	/	i
long	s-riŋ^{1}	ʃi^{1}	i	i	i[ɿ]	i[ɿ]	i[ʅ]	i[ʅ]	i[ɿ]
neck	liŋ^{1}	li^{1}	ɨ	/	i	i	i	i	i
thread	kriŋ^{1}	k^{h}i^{1}	i	i	/	ɨ	ɨ	ɨ	ɨ
sun	riŋ (PB)	ɣi^{1}	/	/	i	/	/	ɨ	ɨ

4.3.3.3 PN *in, *an > PLa *e; PB *i:n > PLa *i

PN finals *in and *an are grouped together since they both merge to PLa *e. Matisoff (2003) maintains a distinction between *in and *i:n at the PB level, supported by the separate reflexes for these rhymes in WB and Lahu, given in Table 4-55. PLa also shows separate reflexes (albeit tenuously), giving further evidence for a distinction in PB: *in > PLa *e and *i:n > PLa *i.

Table 4-55: Development of PB *in and *i:n in Written Burmese, Lahu and PLa

PB	WB	Lahu	Proto Lalo
in	aɲ	ɛ	e
i:n	in	ɨ	i

The tenuous nature of the distinction between *in and *i:n is partly due to the scarcity of examples in the data, given in Table 4-56 below. There is only one example of *i:n, PTB *kji:n 'to weigh,' which becomes PLa *tsi^{1}. Another confounding factor is the subsequent partial merger of PLa *i and *e in several Lalo varieties. Central Lalo varieties merge PLa *e and *i to /i/ in most environments. Non-Central Core varieties (E and W) merge *e and *i to /i/ after palatoalveolar affricates, as in ‘sour’ *tʃe^{1} and alveolar fricatives, as in ‘liver’ *se^{2} and ‘host/owner’ *se^{2}. After alveolar affricates, as in ‘hoe’ PLa *tse^{2} and ‘ten’ *tsʰe^{1}, non-Central Core varieties usually show /e/. The expected reflex in YL, XZ and W-SZP for ‘tree’ is /dze^{1}/, parallel to the reflex of ‘hoe’ from PLa *tse^{2}. The development of [ɿ] in ‘tree’ seen in these varieties is probably due to the influence of the preceding syllable *si̠^{H} in the compound *sik^{H} dzin^{1} ‘tree’ > /sɿ̠^{H} dzɿ^{1}/.

Given these confounding variables, there is still evidence for a distinction between *in and *i:n, seen in MD, W-SZP, XZ and E-DC. MD usually shows /ɛ/ as a reflex of PLa *e after alveolar affricates, as in ‘ten’ and ‘hoe,’ but for ‘weigh,’ MD shows /i/. Likewise, W-SZP and XZ usually show /e/ for PLa *e after alveolar affricates, but for ‘weigh’ they show /i/ realised as [ɿ]. While E-DC consistently shows /e/ from *in, as seen in ‘bowl,’ ‘tree’ and ‘liver,’ it shows the unexpected reflex [tʃʰue^{55}] for *kji:n, ‘weigh’.

Table 4-56: Development of PN *in and *i:n in PLa

Gloss	PN	PLa	MD	Eka	E-DC	YL	XZ	W-SZP	C-LJ	CWQY
ten	tsaj^{1}	tsʰe^{1}	ɛ	ɛ	e	e	i	e	i	i
hoe		tse^{2}	ɛ	i	e	ai	e	e	i	i
*in										
tree	dzin^{1}	dze^{1}	ɛ	i	e	i[ɿ]	i[ɿ]	i[ɿ]	i[ɿ]	i[ɿ]
liver	(ʃ)-sin^{2}	se^{2}	i[ɿ]	i	e	i[ɿ]	i[ɿ]	i[ɿ]	i[ɿ]	i[ɿ]
host	sin (PB)	se^{2}	i	i	i[ɿ]	i[ɿ]	i[ɿ]	i[ɿ]	i[ɿ]	i[ɿ]
sour	ʔ-kjin^{1}	tʃe^{1}	i	i	i	e	i	i	i	i
bowl	krin^{2} (PB)	kre^{2}	ɛ	i	e	ai	e	e	ɛ	ai
*i:n										
weigh	kji:n (PTB)	tsi^{1}	i	i	ue	ue	i[ɿ]	i[ɿ]	i[ɿ]	i[ɿ]

PN *an becomes PLa *e in all environments, as seen in Table 4-57 below. There are a few unexpected developments of *an, seen in ‘louse’ PLa *xe^{1}, ‘field’ PLa *de^{1}, and ‘quickly’ PLa *mje^{1}. In ‘louse’ and ‘field,’ non-Central varieties such as XZ, YL and W-SLZ should show [e], but instead they show [i]. The rhyme in ‘field’ *de^{1} is probably assimilating to the rhyme of the following PLa syllable *mi^{1}, from the PN compound *ʔ-dan^{3} C-mi^{1}, usually seen as /di^{1}mi^{3}/ in non-Central Lalo varieties. In ‘quickly’ PLa *mje^{1}, MD shows the expected reflex of *e (/ɛ/), but other varieties reflect PLa *y, not *e. Much like the example of ‘release’ *priŋ^{2} above, the combination of labial plus medial *r (> PLa medial *-j-) conditions rounding of the vowel. In this example, however, MD reflects *e, not *y, so the development of *y is probably a subsequent change.

Table 4-57: Examples of PN *an's development in PLa

Gloss	PB	PLa	MD	Eka	E-DC	YL	XZ	W-SLZ	C-WC
louse	xan^{1} (PN)	xe^{1}	/	i	i	i	i	i	i
wolf	wan^{1}	ve^{1}	/	i	e	e	e	e	i
spirit	nan^{2}	ne^{2}	/	i	e	ai	/	e	
braid	pan^{2}	p^{h}e^{2}	/	ɨ	e	ai	e	e	i
field	ʔ-dan^{3} (PN)	de$^{1/3}$	ɛ	ɛ	/	i	i	i	i
stretch	dʒan^{3}	dʒe$^{2/3}$	/	ɛ	i	ai	i[ʅ]	i	i
finish	bran^{1}(PN)	be^{1}	/	/	/	ai	/	e	/
quickly	mran^{1}(PN)	mje^{1}	ɛ	/	/	ə	y	y	y

4.3.3.4 PN *aŋ > PLa *aŋ

PN nasal-final *aŋ is the only nasal-final rhyme to be retained in PLa. In PLa, *aŋ becomes [u] in all Central varieties, plus YL, W-YL, W-SZP and W-SLZ, and becomes [a] elsewhere (E varieties, W-DT, MD, Eka), as seen in Table 4-58 below. The change to [u] in many varieties comes after PLa *u's development of lip compression as an articulatory feature, because [u] and [y̩] remain distinct in these varieties. In general, PN *aŋ and *u do not merge, but after voiceless velar stops, as in 'mountain,' 'nose,' PN *kaŋ^{2}, and 'marrow' PB *ʔ-glaŋ^{1}, PN *aŋ and *u merge to PLa *u, reflected as [y̩] or [ɤ] with lip compression in most varieties, e.g., ky̩^{55} 'marrow,' from Björverud (1998).

YL typically shows [u] for *aŋ, but also shows [a] after PLa alveolar stops *d and *t^{h} (but not *t) and velar cluster *gj, as seen in 'drink,' 'pine tree,' and 'cold'. Both YL and W-SLZ show [a] for the third person singular pronoun (3S), instead of the expected [u]. A number of W and C varieties show reflections of PLa *u after alveolar sonorants *ʔl and *n, as in 'wait' and 'swallow,' but not for *l, as in 'valley'. Both MD and Eka later change PLa *a > ɛ after palatal approximant [j], as seen in 3S [jɛ^{2}].

A few common animal names, as in 'rabbit' and 'horse,' all show unexpected developments or variation between PLa *aŋ and open rhymes. For 'rabbit,' most varieties reflect PLa *a, but Eka and C-LB show reflexes of *aŋ. Variation between PLa *aŋ and *u is also seen in 'horse'. MD, Eka, XZ, E varieties, and W-DT, all varieties where *aŋ > a, reflect PLa *mu^{2}, but in varieties where *aŋ > u, regular reflexes of *aŋ (/u/) are seen. 'Horse' is not reconstructed as PLa *mu^{2} across all varieties, because PLa *mu is reflected as /y̩/ in W varieties or /ɨ/ in CW-QY, cf. 'labour' PLa *mu^{1} (from PTB mow), W-SLZ /my̩^{24}/ and CW-QY /mɨ^{55}/. The correspondence sets for 'horse' and 'see' also do not match, even though both descend from PN *mraŋ. 'See' reflects PLa *mjaŋ^{1} across all varieties; the glide is retained in E-DC's /ia/ and merges with *aŋ in all other varieties.

Table 4-58: Examples of PN *aŋ's development in PLa

Gloss	PN	PLa	MD	Eka	E-HS	XZ	YL	WSLZ	CLB
hill	kaŋ^{1}	kʰu^{1}	u	v̩	ɤ	ɤ	/	ɤ	v̩
drink	m-daŋ^{1}	daŋ^{1}	a	a	a	a	a	u	u
pine tree	taŋ^{2}	tʰaŋ^{2}	u	a	/	aŋ	a	u	u
ashamed	ʔ-daŋ^{1}	taŋ^{1}	a	a	/	a	u	u	u
revolve	ʔ-gjaŋ^{1} (PB)	tʃaŋ^{1}	a	/	a	/	ue	u	u
pull	ŋ-gaŋ^{1}	gaŋ^{1}	a	a	a	a	u	u	u
cold	ŋ-glaŋ^{1} (PB)	gjaŋ^{1}	/	/	a	a	a	u	u
wait	(ʔ)-laŋ^{1} (PB)	ʔlaŋ^{1}	a	a	/	a	u	ɤ	v̩
swallow		naŋ^{3}	/	/	aŋ	aŋ	/	ɤ	v̩
valley	laŋ^{1}	laŋ^{1}	a	a	a	a	i	u	u
3S	ʒaŋ^{2}	(ʒ)aŋ$^{2/3}$	ɛ	ɛ	a	a	a	a	u
rabbit	taŋ^{2}	tʰaŋ^{3}~ tʰa^{3}	/	a	o	o	a	a	u
horse	mraŋ^{2}	maŋ^{2}~mu^{2}	u	ə	m̩	ɤ	u	u	u
see	mraŋ^{1}	mjaŋ^{1}	a	a	ia	a	u	u	u

4.3.3.5 PN *waŋ, *oŋ, *un > PLa *u

PN nasal-final rhymes *waŋ, *oŋ and *un all merge to PLa *u, as seen in Table 4-59; the two exceptions are 'bracelet' PN *goŋ^{1} > PLa *go^{1}, and 'flour' PN *ʔ-mun$^{1/3}$, whose reflexes variably show PLa *u, as in MD, and PLa *y, as in W-DT. Matisoff's *uŋ corresponds to Bradley's *oŋ, although *uŋ and *oŋ show different developments after the voiced velar stop, e.g., 'body' PB *guŋ^{1} > PLa *gu^{1}, but 'bracelet' PN *goŋ^{1} > PLa *go^{1}. After preglottalisation, as in 'high' PLa *ʔmu^{1}, the nasal initial disappears, leaving a nasalised vowel in its place. The nasalised vowel does not usually show lip compression, as the regular reflex of PLa *u does. 'Fog' *mu^{1} also shows some unexpected developments of /i/ and /ə/ in various dialects.

Table 4-59: Examples of PN *waŋ, *oŋ and *un's development in PLa

Gloss	PN	PLa	MD	Eka	E-DC	XZ	YL	W-DT	C-LJ
*waŋ									
open	pwaŋ^{3}	pʰu^{3}	u	v̩	/	ɤ	u	v̩	v̩
sell	rwaŋ^{2}	ɣu^{2}	u	v̩	o	ɤ	ɤ	v̩	v̩
well	dwaŋ^{2} (PB)	du^{2}	u	/	ɤ	/	/	v̩	
*oŋ									
wing	doŋ^{1}	du^{1}	/	v̩	ɤ	ɤ	ɤ	v̩	v̩
bark	loŋ^{1}	lu^{3}	u	ə	/	ɤ	ɤ	v̩	v̩
high	ʔ-mroŋ^{3}	ʔmu^{1}	u	u	ɤ̃	ɨ̃	ɤ̃	ɨ̃	ə̃
fog	muŋ (PTB)	mu^{1}	i	ə	ə	ɤ	i	/	u
body	guŋ^{1} (PB)	gu^{1}	ɨ	/	ə	ɤ	ɤ	v̩	v̩
bracelet	goŋ^{1}	go^{1}	u	v̩	ɤ	o	o	v̩	u
powder	ʔ-mun$^{1/3}$ (PB)	mu^{3} ~ my^{3}	u	u	/	/	m̩	y	y

4.3.4 PN stop-final rhymes> PLa harsh vowels

PN stop-final rhymes develop into the PLa harsh phonation vowel system seen in Table 4-60 below. Harsh phonation is preserved in Central Lalo, Eka, MD, and partially in E-TS and E-DC. The PLa harsh phonation system mirrors the modal vowel system, without the nasal-final rhyme *aŋ. There are several parallels between the development of the stop-final rhymes and the nasal-final rhymes. Rhymes ending in labial consonants, whether *-p or *-m, develop into the close front rounded *y/y̠. Also, rhymes with *i tend to merge to PLa *i/i̠, except short *i before alveolar consonants *-n or *-t, which becomes *e/e̠.

Table 4-60: PLa harsh vowels

*i̠, [ʅ̠]	*y̠	*ɨ̠	*u̠
*e̠			*o̠
*ɛ̠			*a̠

4.3.4.1 PN *ip, *it, *i:t, *ik > PLa *i̠

All stop final rhymes with front vowel *i, except some examples of *it, merge to PLa harsh *i̠, as summarised in Table 4-61. After alveolar affricates and fricatives, PLa harsh *i̠ is often reflected as apical vowel [ɿ̠], and after palatoalveolar affricates and fricatives, as [ʅ̠]. Only MD, Eka, and E-DC retain the original i̠ and not the apical vowel.

Table 4-61: Development of PN *ip, *it, *i:t, *ik in PLa

PN	Conditioning	PLa
ip	all (examples: *s, *y, *s-j)	i̠ (3)
it	after alveolar affricates and fricatives	i̠ (3)
	elsewhere (examples: *ʔr, *n, *y, *tʃ)	e̠ (4)
i:t	all (examples: *m, *r, *tʃ)	i̠ (3)
ik	PLa *h	e̠ (1)
	elsewhere (examples: *p, *n, *x, *s, *z, *ts, *dz, *ʃ)	i̠ (8)

As with *in and *i:n, Matisoff (2003) suggests a vowel length distinction between PB *it and *i:t, and Lalo appears to support this distinction. PB *i:t becomes PLa *i̠, while *it becomes PLa *e̠ except after alveolar affricate and fricatives, as seen in the examples of Table 4-62. Though there are only three examples of PB *i:t in the wordlist, there is a PLa minimal pair of *tʃʰi̠^{L} 'goat,' from PN *C-tʃi:t^{L} and *tʃʰe̠^{L} 'to rip' from PN *m-dʒit^{L} (the development of aspirated initial is irregular). In W-YL, *tʃʰi̠^{L} 'goat' > [tʂʰʅ̠^{53}], while *tʃʰe̠^{L} 'to rip' > [tɕʰɛ̠^{53}]; the vowels in both words are regular reflexes of PLa *i̠ and *e̠, respectively. This suggests that *it and *i:t were distinct in PB and developed into PLa *e̠ and *i̠, respectively. This is the same pattern as that seen for PB *i:n (> PLa *i) and *in (> PLa *e), as discussed in §4.3.3.3. PB *it becomes PLa *i̠ after alveolar affricates and fricatives, as seen in *ʔ-tsit^{H} 'beard,' which is reflected by the apical vowel [ɿ] throughout Lalo. MD, Eka, and E-DC surprisingly show [ɿ] after PLa *ts, whereas after PLa *s they show [i].

PN *ik in most environments becomes PLa *i̠, but after PB *ʔ-w shows *e̠. PB *ʔ-wik^{L} 'stomach,' becomes PLa *he̠^{L}, a homophone with 'eight,' PN *C-yet^{L} > PLa *he̠^{L}, shown by parallel reflexes with 'eight' in all Lalo varieties. All other environments show PLa *i̠. For example, PB *ʔ-bik^{L} 'insect' becomes PLa *pi̠^{L}, seen in C-CJ's wu^{55}pi̠^{21}, and possibly in W varieties' reflex [dzɿ^{53}]. PB *s-nik^{H} 'heart' becomes PLa *ʔni̠^{H}, seen in CW-QY's ʔni̠^{33}.

Table 4-62: Examples of PN *ip, *it, *i:t, *ik's development in PLa

Gloss	PN	PLa	MD	Eka	E-DC	E-HS	YL	W-DT	C-LJ
*ip									
thirsty	C-sip^{L}	si̱^{L}	i̱	i̱	i	ɿ̱	ɿ	ɿ	ɿ̱
put to sleep	səjip^{L}	ʃi̱^{L}	i̱	iɛ	/	ɿ̱	/	/	ʅ̱
sleep	yip^{L}	ʒi̱^{L}	i̱	/	ɿ	i̱	ɿ	ʅ	i̱
*i:t									
blink	mi:t^{L} (PB)	mi̱^{H}	i̱	i̱	i	i	i̱	/	/
reap	ri:t^{L} (PB)	ɣi̱^{L}	ɨ̱	/	i	ɨ̱	ɨ	ɨ	ɨ̱
goat	C-tʃi:t^{L} (PB)	tʃʰi̱^{L}	i̱	i	ɿ	ɿ̱	ɿ	ɿ	ʅ̱
*it									
beard	ʔ-tsit^{H}	tsi̱^{H}	ɿ̱	ɿ̱	ɿ	ɿ	ɿ	ɿ	ɿ
pinch	s-nit^{L}	ne̱^{H}	ɛ̱	i	ə	i	i	e	i̱ɛ
eight	ʔ-rit^{L} (PB)	he̱^{L}	ɛ̱	ɛ	e	i	ai	e	æ̱
drunk	yit (PB)	ʒe̱^{L}	/	/	i	i	ai	i	i̱ɛ
rip	m-dʒit^{L} (PB)	tʃʰe̱^{L}	/	/	/	/	i	i	i
*ik									
stomach	ʔ-wik^{L} (PB)	he̱^{L}	ɛ̱	ɛ	/	i	ai	e	æ̱
heart	s-nik (PB)	ʔni̱^{H}	/	i̱	i	ĩ	i	i	ĩ̱
new	C-ʃik^{L}	xi̱^{L}	ɨ̱	ɨ̱	i	ɨ̱	ɨ	ɨ	ɨ̱
tree	sik^{H}	si̱^{H}	i	i	i	ɿ	ɿ	ɿ	ɿ̱
leopard	zik^{L}	zi̱^{L}	/	/	i	ɿ̱	ɿ	ɿ	ɿ̱
day before yesterday	ʔəʃik^{H}	ʃi̱^{H}	i	ɿ	ɿ	ɿ	ʅ	ʅ	ʅ̱

4.3.4.2 PN *et, *ek, *øk > PLa *ɛ̱

PN rhymes with close-mid vowels *e and *ö (*et, *ek, and *øk) all merge together by the PLa stage to *ɛ̱, as seen in the examples in Table 4-63. Lalo provides no evidence for the PN distinction between *ek and *øk, unlike Southern Ngwi languages such as Hani and Akha. PB *b(j)et^{L} 'vulva-2' > PLa *bjɛ̱^{L}, shows a different correspondence set from *ɛ̱ because of the influence of the palatal glide in *bj. This etyma also shows variation between *L and *2: *2 is seen in Eka, MD and YL's [21] reflex, but XZ's [33] reflex reflects *L. After *s-j, which became PLa palatoalveolar fricative *ʃ, *øk becomes PLa close central vowel *ɨ̱, which is reflected as apical vowel [ɿ̱] in MD and Eka. This correspondence set is in contrast to PLa *i̱, which is reflected as [i̱] in MD and Eka, as shown in Table 4-62 above. Lalo reflexes for *ʔ-bok^{H} 'jump' and *m-kok^{H} 'stir' suggest PLa *ɛ̱, which is an unexpected development for PN *ok but fits the pattern perfectly for PN *øk. Matisoff (2003, p. 378) reconstructs 'jump' as PB *ʔpøk^{H} and 'stir' as *C-krøk^{H} (p. 144).

Table 4-63: Examples of PN *et, *ek, and *øk's development in PLa

Gloss	PN	PLa	MD	Eka	E-DC	XZ	YL	W-DT	C LJ
*et									
to chip	C-ket^{L} (PB)	kʰɛ̱^{L}	a̱	a̱	ɛ	ɛ	ɛ	ɛ	a̱
vulva-2	b(y)et^{L} (PB)	bjɛ̱$^{L/2}$	i	i	/	ɛ	i	/	/
*ek									
kick	tek^{H}	tsʰɛ̱^{H}	a̱	a̱	ɛ	ɛ	ɛ	ɛ	a̱
*øk									
twist	s-jøk^{L}	ʃɨ̱^{L}	ɿ	ɿ	/	/	/	ʅ	/
shoot a gun	m-pøk^{H}	bɛ̱^{H}	a̱	a̱	ɛ	ɛ	ɛ	ɛ	a̱
slice	ʔ-døk^{H}	dɛ̱^{H}	a̱	a̱	ɛ	ɛ	ɛ	ɛ	a̱
jump	ʔ-bok^{H}	pɛ̱^{H}	a̱	a̱	ɛ	ɛ	ɛ	ɛ	a̱
stir	m-kok^{H}	gɛ̱^{H}	a̱	a̱	ɛ	ɛ	ɛ	ɛ	a̱

4.3.4.3 PN *up, *ut, *uk, *ok > PLa *u̱, *o̱, *y̱, *ɨ̱

Rhymes with back vowels have multiple mergers and splits, as summarised in Table 4-64. After alveolar and palatoalveolar affricates and fricatives, *up and *uk merge to close central vowel *ɨ̱; *up becomes PLa *u̱ elsewhere, while *uk becomes PLa *o̱ elsewhere. *ut becomes PLa *y̱ after the bilabial nasal, and merges to *ɨ elsewhere. after all initials. *ok, a more frequent rhyme than *uk, shows a split to PLa *u̱ after prefixed alveolar sonorants (i.e.,*k-prefixed *l and *ʔ/*s-prefixed *n) and to *o̱ elsewhere.

Table 4-64: Development of PN rhymes with close back vowels *u and *o

PN	Conditioning	PLa
up, uk	after alveolar/palatoalveolar affricates and fricatives	ɨ̱
up	elsewhere (examples: *k-l, *gj)	u̱
ut	after labial nasal elsewhere	y̱ ɨ̱
uk	elsewhere	o̱
ok	after *k-l, *ʔ-n, *s-n elsewhere	u̱ o̱

Table 4-65: Examples of PN rhymes with close back vowels *u and *o

Gloss	PN	PLa	MD	Eka	E-HS	XZ	YL	W-SZP	CWQY
*up									
breast/suck	C-tʃup^{L} (PB)	tʃʰi̱^{H}	ɿ̱	i	ɿ	ʅ	ɿ	ʅ	ɿ̱
sew	gjup^{L}	gu̱^{L}	i̱	ɨ̱	ɣ̺	ɣ̺	ɣ̺	ʏ	ə̱
shake	k-lup^{H}	ʔlu̱^{H}	/	/	ɣ̺	ɣ̺	ɣ̺	ʏ	ʅ
*ut									
sweep	sut^{H}	sɨ̱^{H}	ɿ̱	ɿ̱	ɿ	ɿ	ɿ	ɿ	ɿ̱
evening	(C)-kut^{L}/^{H}	kʰɨ̱^{L}	ɨ̱	ɨ̱	ə	/	ɨ	ɨ	ɨ̱
hiccup	ʔut^{H}	ɨ̱^{H}	/	/	ə	/	ɨ	/	/
belch	ut^{L}	ɨ̱^{L}	ə̱	ə̱	/	ɨ	ɨ	ɨ	/
blow	s-mut^{H}	ʔmy^{H}	i̱	ɨ̱	ə	i	y	ʏ	y
*uk									
smoke	(C)-ʃuk^{H}/^{L}	ʃɨ̱^{L}	ɿ̱	/	ɿ	/	/	/	ʅ̱
wear a hat	kuk (PB)	kʰo̱^{H}	u̱	u̱	o	u	/	o	u̱[o̱]
burn	ʔ-duk^{L}	to̱^{L}	u̱	u̱	o̱	o	u	u	u̱[o̱]
weed	C-mruk^{L}	mo̱^{L}	u̱	u	/	o	u	u	u̱[o̱]
*ok									
stone	k-lok^{L}	ka^{1}lu̱^{H}	u̱	u̱	o	/	u	u	ə̱
brains	(C)-nok^{L}	ʔnu̱^{L}	u̱	u̱	o̱	u	o	u	ə̱
bean	s-nok^{H}	nu̱^{H}	u̱	u̱	o	u	u	u	ə̱
graze	ʔ-lok^{L}	ʔlo̱^{L}	u̱	u̱	o̱	u	/	u	u̱[o̱]
male	g-yok^{L}	ʒo̱^{L}	/	/	/	/	u	u	u̱[o̱]

The merger of *up and *uk can be seen in the examples ‘breast/suck’ (*C-tʃup^{L} (PB) > PLa *tʃʰi̱^{H}) and ‘smoke’ (*(C)-ʃuk^{H}/^{L} > PLa *ʃɨ̱^{L}), as seen in Table 4-65 above. These show distinct correspondence sets from PLa *tʃʰi̱ and *ʃi̱, where MD, Eka and E-DC show [i], not [ɿ]. PLa *ɨ̱ in this environment is reflected as [ɿ] or [ʅ] across all varieties. *ok did not participate in this merger, as seen in the development of ‘male’ PN *g-yok^{L}, which becomes PLa *ʒo̱^{L}, not *ʒɨ̱^{L}. *ut becomes PLa *ɨ̱ in all environments except after *m, resulting in a partial merger with *up and *uk after *s, seen in ‘sweep’ PN *sut^{H} > PLa *sɨ̱^{H}. After the labial nasal, the rhyme becomes rounded vowel *y, as in ‘to blow’ PN *s-mut^{H} > PLa *ʔmy^{H}.

*up and *ok undergo a partial merger to PLa *u̱ in certain environments. *up becomes PLa *u̱ in ‘sew’ *gjup^{L} and ‘shake’ *k-lup^{H}, and *ok > PLa *u̱ after prefixed alveolar sonorants (i.e., PN *k-lok^{L} ‘stone’ > PLa *ka^{1}lu̱^{H}, *(C)-nok^{L} ‘brains’ > ʔnu̱^{L}, and *s-nok^{H} ‘bean’ > *nu̱^{H}). The difference between PLa *o̱ and *u̱ is seen in the development of the syllabic fricative or lip compression for *u̱, in contrast to the reflex of plain [u] or [o̱] for *o̱. CW-QY shows ə̱ for *u̱, as it shows ə for PLa *u. Although there are only a few examples of PLa *u̱, there is a near minimal pair of ‘shake’ *ʔlu̱^{H} from PN *k-lup^{H}, which shows the syllabic fricative or lip compression in most varieties, and ‘to graze animals’ *ʔlo̱^{L}, PN *ʔ-lok^{L}, which shows [u] or [o̱]. CW-QY is the only variety that maintains the distinction between *u̱ and *o̱ after *nasals and k-prefixed *l, as in ‘stone’ PLa *ka^{1} lu̱^{H}, ‘brains’ *ʔnu̱^{L} and ‘bean’ *nu̱^{H}, where it shows ə̱. Other varieties have merged with *o̱ in these environments.

4.3.4.4 PN *ap, *wap > PLa *y̱; *at > PLa *e̱; *wat > PLa *ɛ̱, *ɨ̱

Rhymes with open back vowel *a- develop into a plethora of different vowels in PLa, as summarised in Table 4-66. Both *ap and *wap merge to PLa harsh *y̱, with the exception of PN *b-lyap^{L} 'lightning' > PLa *bja̱^{L}, in which PN *-ap becomes PLa *a̱, and the pre-empting prefix *b- and the medial *-y- become PLa *bj. A more regular example is PN *ʔ-ryap^{L} 'to stand,' which becomes PLa *hy̱^{L}. *at becomes PLa *e̱ after all initials, except after PN *w- where it shows variation between *i̱ and *e̱. The two examples of *-at with medial *-w- (PN *ʔ-tʃwat^{H} 'to pick fruit' and *C-mwat^{L} 'hungry') become either *ɛ̱ or *ɨ̱, depending on the initial.

Table 4-66: Development of PN *ap, *wap, *at, *wat

PN	Conditioning	PLa
ap, wap	all initials after PN *b-ly	y a̱
at	after PN *w elsewhere	i̱ ~ e̱ e̱
wat	after PN *ts after PN *m	ɛ̱ ɨ̱

Table 4-67 below gives examples of the development of rhymes with *a (except before *-k) in PLa. MD interestingly shows harsh ɑ̱ as a development of PLa *y̱, but every other variety shows the expected reflex for harsh *y̱, which is the same as that for modal *y. MD is the only variety that has different developments of harsh *y̱ and modal *y. Eka and YL show [ɨ̱/ɨ] after velars instead of the [ə̱/ə] that occurs elsewhere as a reflection of harsh *y̱. PN *b-lyap^{L} 'lightning' becomes PLa *bja̱^{L}, with the palatal glide and the rhyme *a̱ preserved in E-DC, E-HS, and XZ, and merging with PLa *ɛ̱ in all other varieties. *at consistently shows development into PLa *e̱, except for 'wear' PN *wat^{L}, which becomes PLa *ve̱^{L} in most varieties, but *vi̱^{L} in XZ, C and W varieties. The two examples of *at with medial *-w- both show different developments. PB *ʔ-tʃwat^{H} 'to pick fruit' > PLa *ts^{h}ɛ̱^{H}, seen only in Core Lalo (E-W-C), and *C-mwat^{L} 'hungry'> PLa *mɨ̱^{L}, reflected in all Lalo varieties.

Table 4-67: Examples of PN *ap, *wap, *at, *wat's development in PLa

Gloss	PN	PLa	MD	Eka	E-DC	YL	XZ	W-DT	C-LJ
*ap									
snot	ʔ-nap^{L}	ʔny^{L}	ɑ̱	ə̱	ə	ə	y	y	y
needle	g-rap^{L}	ɣy^{L}	ɑ̱	ɨ̱	ə	ɨ	u	y	y
dry in sun	ʔ-lap^{L} (PB)	ʔly^{L}	ɑ̱	ə̱	ə	ə	y	y	y
*wap									
swell	pwap^{L}	pʰy^{L}	ɑ̱	ə̱	ə	ə	ɨ	y	y
*yap									
lightning	b-lyap^{L}	bja̱^{L}	a̱	a̱	iɛ	ɛ	iɛ	ɛ	a̱
stand up	ʔ-ryap^{L}	hy^{L}	ɑ̱	i̱	ə	ə	y	y	y
*at									
vomit	C-pat^{L}	pʰe̱^{L}	ɛ̱	i̱	e	ai	e	e	æ̱
kill	C-sat^{L}	se̱^{L}	ɛ̱	/	e	ai	e	e	æ̱
wear	wat^{L}	ve̱^{L} ~ vi̱^{L}	ɛ̱	i̱	e	ai	i	i	i̱
*wat									
pick fruit	ʔ-tʃwat^{H} (PB)	tsʰɛ̱^{H}	/	/	/	/	/	ɛ	a̱
hungry	C-mwat^{L}	mɨ̱^{L}	ɨ̱	ɨ̱	ə	u	ɨ	ɨ	ɨ̱

4.3.4.6 PN *ak > PLa *e̱, a̱, *wak > PLa *u̱, *jak > PLa *e̱

The velar-final *-ak becomes PLa *e̱ in most environments and *a̱ after velars, but also becomes *i̱ and *ɛ̱, depending on the initial. With medial *-y-, *-ak also develops into *a̱ after velars and *e̱ elsewhere, with exceptions after PLa *h and *l. *wak becomes PLa *u̱, , a parallel development to PN *waŋ becoming PLa *u (§4.3.3.5). Table 4-68 below summarises the development of *-ak, *-wak, and *-jak.

Table 4-68: Development of PN *ak, *wak, *jak in PLa

PN	Conditioning	PLa
wak	all initials	u̱
ak	after r, y	i̱
	after k-r-w (PLa h)	ɛ̱
	after velars	a̱
	elsewhere	e̱
jak	after h	e̱ ~ a̱
	after l	ɛ̱
	after velars	a̱
	elsewhere	e̱

Table 4-69 gives examples of *ak, *wak, and *jak. The two examples of *wak show a consistent reflex of PLa *u̱ across all Lalo varieties. *ak is found in many examples in the wordlist, and splits into PLa *ɛ̱ after PN *(k)-r-w, seen in 'rat,' and to PLa *i̱ after PN *k-r and *y, as in 'chicken' and 'today'. In most other environments, *ak develops into PLa *e̱. After velars, however, *ak becomes PLa *a̱, as in 'village'/expensive' PN *kak^{H} PLa *kʰa̱^{H}, 'bird' PN *ŋjak^{H} PLa *ŋja̱^{H} and 'banana-1' PN *s-ŋak^{H} PLa *ʔŋja̱^{H}. Medial *-y- influences the rhyme's development after *l, as in 'lick' *m-ljak^{L} > PLa *ɛ̱. *(C)-mjak^{H} 'eye' > PLa *ʔmje̱^{H}, with the medial *-y- becoming a glide on the initial and influencing the rhyme to move to [i] or [i̱] in most varieties; this is a different rhyme correspondence set from *e̱ after plain initials, in which XZ, YL, and most W varieties preserve [e]. Finally, Central Lalo shows reflexes for PLa *a̱ for *hjak^{L} 'Han', but other varieties show reflexes of PLa *e̱.

Table 4-69: Examples of PN *ak, *wak, *jak's develoment in PLa

Gloss	PN	PLa	MD	Eka	E-DC	YL	XZ	W-DT	C-LJ
*ak									
rat	(k)-r-wak^{H}	hɛ̱^{H}	/	a	ɛ	ɛ	ɛ	ɛ	a̱
chicken	k-rak^{H}	ɣi̱^{H}	i̱	i̱	i	i	i	i	i̱
today	jak^{L}	i^{2}	i	i	i	i	i	i	i
night	ʔ-rak^{L}	he̱^{L}	ɛ̱	ɛ̱	e	ai	e	e	æ̱
son-in-law	ʒəmak^{L}	me̱^{L}	/	ɨ̱	e	ai	e	e	æ̱
ascend	ʔ-dak^{H}	de̱^{H}	ɛ̱	i̱	e	i	e	e	æ̱
breathe	C-sak^{L}	se̱^{L}	ɛ̱	i̱	e	ai	e	e	æ̱
village	kak^{H}	kʰa̱^{H}	a̱	a̱	a	a	a	a	a̱
*wak									
exit	ʔ-dwak^{H}	du̱^{H}	o̱	u	u	u	u	u	u̱
ant	p-rwak^{H}	ʒu̱^{H}	/	/	u	/	u	u	u̱
*jak									
banana-1	s-ŋjak^{H}	ʔŋja̱^{H}	/	/	ɲa	/	ɲa	na	ĩ̱
bird	ŋjak^{H}	ŋja̱^{H}	ŋa̱	/	ɲa	ɲa	ɲa	nɛ	ni̱
lick	m-ljak^{L}	lɛ̱^{H}	a̱	a̱	ɛ	ɛ	ɛ	ɛ	a̱
navel	C-kjak^{H}	tʃʰe̱^{H}	/	i	/	ai	i	/	i
eye	(C)-mjak^{H}	ʔmje̱^{H}	i	ɨ	i	i	i	i	æ̱
Han	hjak^{H}	he̱^{L} ~ ha̱^{L}	ɛ̱	iɛ	e	ai	e	e	a̱

4.3.5 Summary of rhymes

Table 4-70 summarises the PN sources of PLa individual rhymes. Most rhymes with close front vowel *i (*i, *im, *i:n, *iŋ, *ip, *i:t, *ik) merge to PLa *i or *i̱. Short rhymes with *i- and *a- before alveolar finals *-n and *-t, along with *ak in most environments, merge to *e or *e̱. Rhymes with *e or *aj (*ej, *aj, *waj, *et, *ek) tend to merge to PLa *ɛ or *ɛ̱. Rhymes ending in labial *-m (*am, *um, *wam) or *-p (*ap, *wap) and/or with the labiovelar approximant medial (*wa, *wan) tend to merge to PLa *y or *y̱. PLa *ɨ/ɨ̱ is the least frequent of the rhymes, descending from *ut and from splits of rhymes containing close vowels (*i, *e, *up *uk), conditioned by labial, alveolar or palatoalveolar initials. Most rhymes with *u or final *-w (*u, *un, *up, *ow, *aw), or ending with velar nasal *-ŋ (*waŋ, *oŋ) merge to PLa *u or *u̱. PLa *o descends from PN *o, and *o̱ from rhymes with close back vowels and a final velar stop (*ok, *uk). PLa *a descends from PN *a, while *a̱ comes from *ak after velar initials. *aŋ descends solely from PN *aŋ.

Table 4-70: Summary of PN sources of PLa rhymes

PLa	PN source
*i	*i & *o/alveolar and palatal initials_; *e/elsewhere; *im, *iŋ, *i:n
*e	*i/labial stops_; *e/w_; *aj/alveolar or no initial_; *in, *an
*ɛ	*i/tsy, dzy, r, mr, kj_; *ej; *aj/elsewhere; *waj, *we
*y	*u/labial and alveolar initials_; *am, *wam, *wan, *um
*ɨ	*i & *e/ʃ_; *e/labial initials_
*u	*u/elsewhere; *ow; *aw; *waŋ, *oŋ, *un
*o	*o; *-yaw
*a	*a; *wa/velar or cavity initials_
*aŋ	*aŋ
*i̱	*ip, *it/alveolar fricatives and affricates_; *i:t, *ik
*e̱	*it/elsewhere; *at; *ak & *jak/elsewhere
*ɛ̱	*et, *ek, and *øk; *wat/ts_
*y	*ap, *wap, *ut/m_
*ɨ̱	*up & *uk/alveolar & palatoalveolar affricates and fricatives_; *ut
*u̱	*up/elsewhere; *ok/k-l, ʔ-n, s-n_; *wak
*o̱	*uk; *ok/elsewhere
*a̱	*ak & *jak/velars_

5 *Proto Lalo tones and tone changes*

5.1 Phonetic motivations for tone change

In this chapter, I reconstruct the Proto Lalo tonal system and examine subsequent tone changes in Lalo varieties. After briefly reviewing the phonetic bases for tonogenetic and tone change mechanisms, I summarise how the Proto Lalo tonal system developed from its ancestor, Proto Ngwi (Bradley 1977). I use acoustic analysis of several Lalo varieties to posit phonetic values for Proto Lalo tones (§5.2.1), and describe a uniquely Lalo tonal innovation (§5.2.2). In §5.3, I describe how tone in Lalo languages has developed diachronically from Proto Lalo in C, E, and W dialect groups, as well as XZ, YL, and Eka varieties. Section 5.4 is a discussion of how the findings broaden the current understanding of tone change. Tone change in E Lalo and several other varieties shows a variation of the classic voiced-low principle: voiced prevocalic consonants lower the pitch onset of Tone *1 (a high, level pitch), creating a rising contour tone. Tone changes in W Lalo, XZ and YL illustrate how harsh phonation conditioned raising of pitch height in Proto Lalo's *L and *H tones, resulting in various phonetic changes and mergers. Parts of this chapter appear in Yang (2010).

While classic models of tonogenesis (Haudricourt 1954, Matisoff 1973) and Thurgood's (2002) revision are well-attested and phonetically plausible (Hombert et al. 1979), secondary tone change is less well understood. I use Ohala's (1993a, 2003) phonetically grounded framework of sound change, which focuses on the central role of the listener's misperception of subphonemic synchronic variation as the initiation of sound change. In 'mini-sound changes,' the listener either fails to correct for contextual influence (hypocorrection) or wrongly ascribes an inherent property of the phoneme to context (hypercorrection). This is not to negate the cognitive factors that influence systemic changes, such as chain shifts, that may take place after the initiation of sound change (see, for example, Labov 2010). I draw from Kingston (2005), Edmondson & Esling (2006), Pittayaporn (2007b) and Yip (2001) to explore the phonetic motivations of the observed tone changes.

Haurdicourt's (1954) influential model of tonogenesis in Vietnamese and Matisoff's (1973) explanation of the model in a Tibeto-Burman context established basic principles that are still widely accepted. In Haudricourt's (1954) analysis of Vietnamese (also relevant to Old Chinese (Baxter 1992)), two mechanisms happen sequentially: 1) laryngeals in the coda (-ʔ and -h) condition pitch contours, which then become contrastive rising and falling tones when the laryngeals are lost; 2) prevocalic segments condition pitch height, which result in contrastive high and low registers when the contrast between voiced and voiceless prevocalic consonants is lost. Physiologically, laryngeal features of prevocalic segments affect pitch predictably: the lowered larynx and relaxed cricothyroid muscles of voiced obstruents depress F0 (fundamental frequency), while the engaged cricothyroid muscles of voiceless obstruents raise F0 (Hombert et al. 1979, Löfqvist et al. 1989, Honda 2004). In Tang's (2008) survej of tone languages, the pattern of voiced-low, voiceless-high holds in the overwhelming majority of cases.

Thurgood (2002) introduces an important refinement to Haudricourt's model, replacing the classic model's consonantal basis with a laryngeal one. Thurgood (2002: 334) holds that it is not segments themselves that condition tone, but rather that 'laryngeal gestures associated with voice qualities are the primary mechanism for pitch assignment'. In Thurgood's view, segments condition the phonation type of the vowel, which then conditions pitch; segments do not directly affect pitch. One weakness of the consonantal model, which Thurgood points out, is the fact that even though tonogenesis usually results in level pitches, prevocalic segments' effects on pitch do not last through the whole duration of the syllable (Hombert et al. 1979). Thurgood argues instead that voiced obstruents result in breathy phonation, which in turn results in a low pitch that holds over the entire syllable. Final stops may co-occur with glottal closure, leading to a constricted larynx, which can then result in either a falling or rising pitch contour depending on the degree and timing of glottal constriction. Thurgood therefore suggests that the role of segments in tonogenesis is mediated through the phonation types they engender.

Thurgood improves the classic model by explicitly placing the locus of tonogenesis in the larynx. Tone is often not just phonemic pitch, but also phonation, duration, vowel quality, etc. Two of these aspects, i.e., pitch and phonation, are controlled in the larynx, so a segment's laryngeal features are kej in explaining the development of tones. Thurgood's laryngeally-based model is now often called on, for example in re-interpreting proto-Vietic (Honda 2005) or in observing a shift from a register language to a tonal language (Abramson et al. 2007).

However, tonogenesis does not necessarily have to pass through an intermediate phase in which phonation types (whether subphonemic or contrastive) affect pitch. In cases of ongoing tonogenesis, such as Korean (Silva 2006), Kammu (Svantesson & House 2006) and Kurtöp (Hyslop 2009), there is no evidence to suggest that vowel phonation as opposed to segment voicing plays a role. The above reports, based on rigorous acoustic analysis and perceptual experiments, identify an ongoing change in which the voice quality of the prevocalic segments themselves have influenced pitch, not phonation of the vowel. Thurgood's central insight holds: laryngeal gestures influence pitch. I argue that those laryngeal gestures may belong solely to the prevocalic segment or be shared by both the segment and the following vowel (i.e., the entire syllable). I therefore adapt Thurgood's laryngeally-based model of tonogenesis in order to better explain the tone changes seen in Lalo varieties.

The term 'tonogenesis,' originally coined by Matisoff, has sometimes been used to include both the birth of contrastive tone into a language and also subsequent tone splitting (Abramson 2004). For example, Matisoff (2003: 475) and Wayland and Guion (2005: 55) both describe 'tonogenetic mechanisms' for languages that are undergoing tone splits and mergers, not the introduction of tone into a language. The phonetic interactions undergirding both tonogenesis and tone change are a product of human physiology, and are therefore universal and unlikely to differ whether a language is already tonal or not. However, the perception and therefore the outcomes of the phonetic interactions between pitch, segments, and phonation are likely to be different in the process of tonogenesis versus tone change. As Thurgood (2002: 345) notes, the outcome of tonogenesis is almost always a dichotomy, presumably of phonemically level pitches, whereas tone change can result in a myriad of contrasts in pitch height and contour. For example, as shown in §5.3.2, the microprosodic effect of voiced initials conditioned a tone split to a low-rising contour, a result that rarely happens in original tonogenesis. Since Proto Lalo is already a tonal language, I will refer to the subsequent diachronic tonal development in Lalo varieties as tone change, not tonogenesis.

A laryngeally-based model of tone change must include the phonetics of phonation types and pitch and the physiological connection between the two. The correlations between distinct phonation types and pitch provide clues as to what happens when listeners may shift their perception of contrastive phonation to contrastive tone. This will be especially helpful in explaining the W Lalo change of *L to high, and *H to mid-high, discussed in §5.3.3.

Ladefoged (1971) introduced the view that phonation types can be organised along a one dimensional continuum, according to the degree of openness of the aperture between the arytenoid cartilages. Figure 5-1 shows a laryngoscopic view of the glottis, in which the aperture between the arytenoid cartilages is seen at the bottom of the image. The arytenoid cartilages are a pair of pyramid-shaped cartilages located at the back of the larynx, as seen in Figure 5-2; they connect to the posterior end of the vocal folds, and their adduction causes the posterior opening between the vocal folds to decrease (Gray 1918 [2000]). Most open are voiceless sounds; the opening then decreases through breathy, modal, and creaky voice, until ending at complete closure with the glottal stop (Gordon & Ladefoged 2001).

More sophisticated laryngoscopic photography has enabled a more precise picture of how muscles and cartilages simultaneously engage to produce phonation. Instead of a one-dimensional continuum of increasing tension in the glottis, Edmondson and Esling (2006) find that register, stress, and pitch are controlled by six valves of the throat that work together. This three dimensional model enables new insight into the production of register, the pitch correlates of various registers, and thus the impact phonation types may have on pitch and subsequently on tone change. Edmondson and Esling (2006) identify Valve 1 as the vocal folds, which can either adduct or abduct, as explained above. Valve 2 is the ventricular folds, located on either side of the vocal folds, as seen in Figure 5-1. The ventricular folds move medially towards the vocal folds, coming up over them and dampening their oscillation, resulting in increased tension. Valve 3, known as the laryngeal sphincter, is the thyroarytenoid muscle complex contracting to pull the arytenoids and aryepiglottic folds forward towards the epiglottis. The thyroarytenoid muscle, also called the vocalis muscle, runs parallel to the vocal folds, seen in Figure 5-3. Valve 4, not relevant to Lalo, is the retraction of the tongue and epiglottis, engaged in faucalised ('yawning') voice. Valve 5 is larynx height, controlled by the suprahyoid muscle group (located above the hyoid bone, seen in Figure 5-2). Valve 6, also not relevant to Lalo, is pharyngeal narrowing.

Figure 5-1: Laryngoscopic view of the larynx. Top of the image is the front of the larynx. (Gray 1918 [2000])

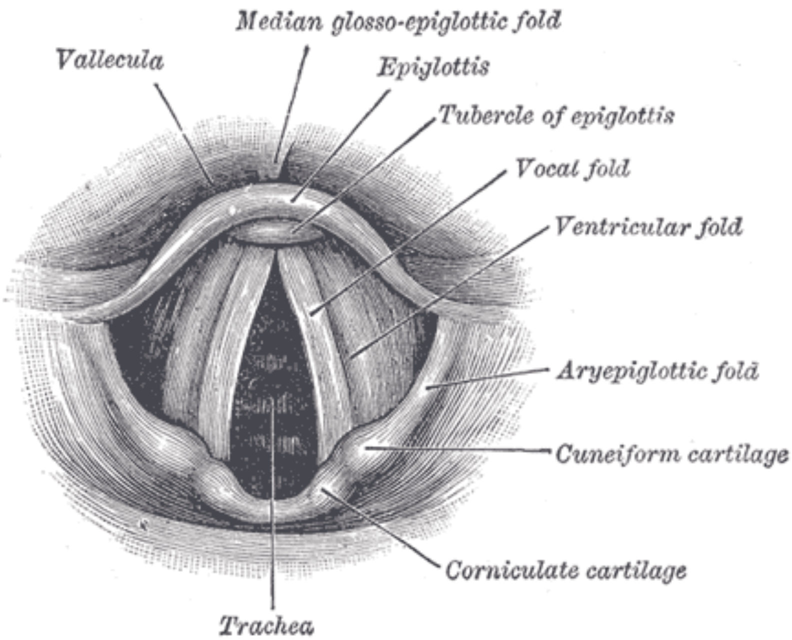


Figure 5-2 Side view of the larynx (Gray 1918 [2000])

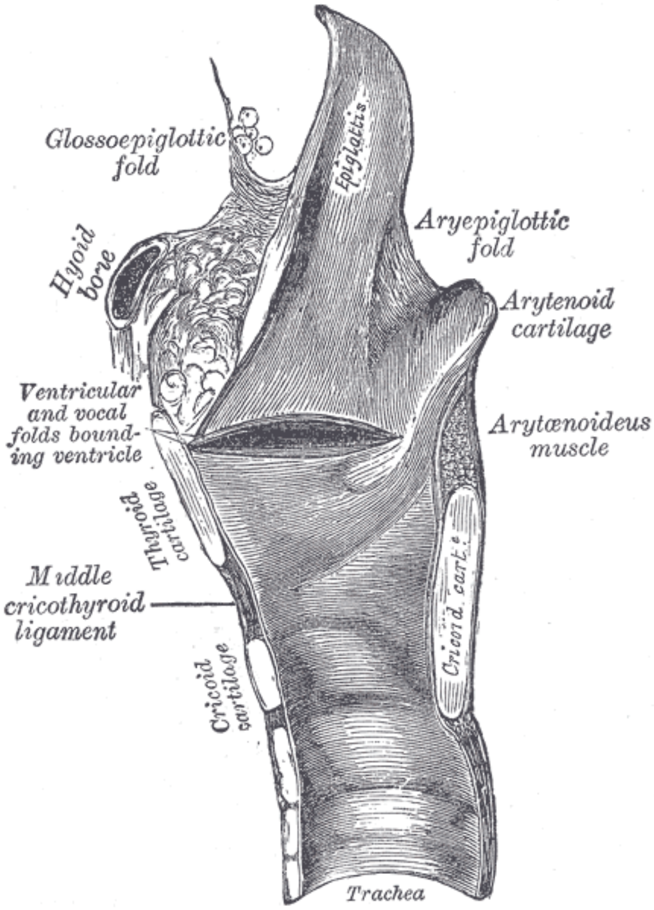
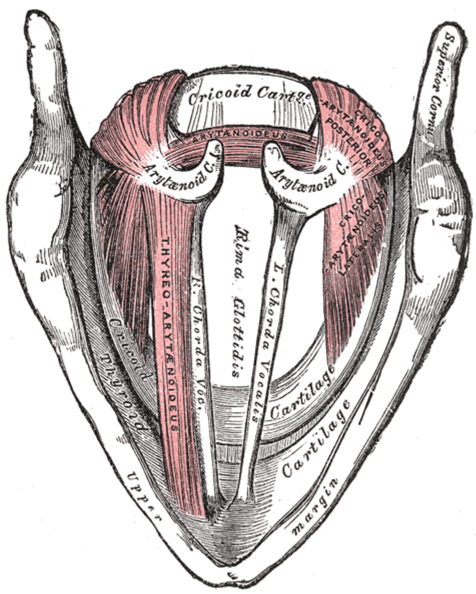


Figure 5-3: Thyroarytenoid muscle (Gray 1918 [2000])



Pitch is controlled primarily by tension in the vocal folds (Honda 2004). While the arytenoid cartilages move the vocal folds laterally, increasing aperture and affecting phonation, the cricothyroid (CT) muscles contract to stretch the vocal folds longitudinally, increasing their tension and raising the pitch (Edmondson & Esling 2006). The cricothyroid muscles connect the cricoid and thyroid cartilages, seen in Figure 5-2. The contraction of the CT muscles rotates and translates the cricothyroid joint, pulling the vocal folds forward and down (Honda 2004). Stretching the vocal folds increases their tension and therefore increases pitch. As shown in Kingston (2005), the thyroarytenoid muscle is also involved in increasing vocal fold tension, although its contraction serves to shorten the vocal folds. Besides activities in the glottis itself, lowering the larynx indirectly lowers pitch by rotating the cricothyroid joint down but not translating it forward, thus shortening the length of the vocal folds (Honda 2004).

Kingston (2005) explicitly connects the phonetics of phonation types to tonogenesis as he explains why syllable-final glottal closure led directly to both high tone in some Athabaskan varieties and low tone in others. He posits that the postvocalic glottal stop conditioned tense (harsh) phonation in some varieties, leading to high tone, and creaky phonation in others, resulting in low tone. His key insight identifies the related but somewhat independent mechanisms involved in producing tense (harsh) voice and creaky voice. With tense voice, both the thyroartenoid muscle and the cricothyroid muscle contract. As the thyroarytenoid contracts, the vocal folds are shortened but also stiffened; the increased tension results in higher pitch. With creaky voice, only the cricothyroid muscles contract, so the vocal folds are still loose enough for slow and undulating vibrations, resulting in lower pitch. Kingston (2005) presents a detailed description of the different muscles involved in tense voice versus creaky. However, he limits the scope of description to muscles in the glottis itself, whereas Edmondson and Esling's (2006) laryngoscopic studies show that phonation is controlled through a complex system of valves in the throat, described above.

Phonation types, including creaky and harsh, are distinguished by the valves engaged in their production, as seen in Table 5-1 below. In modal voice, the vocal folds engage as they adduct. In breathy voice, none of the valves are engaged: the vocal folds are slack and abducted, creating a posterior aperture (Edmondson & Esling 2006). In creaky voice, the vocal folds are engaged but not the ventricular folds; thus the vocal folds are loose enough to emit periodic pulses at low frequency. Catford (1964:32) describes the effect as 'like a stick being run along a railing'. The engagement of Valve 3 in both creaky and harsh voice results in their inclusion in Edmondson and Esling's laryngealised vocal register. In harsh voice, Valves 1, 2, and 3 are engaged. The ventricular folds adduct, coming up over the vocal folds and dampening their oscillation, in some case completely covering the vocal folds. The difference between creaky and harsh is only the addition of Valve 2; the ventricular folds are engaged in harsh voice, but not creaky.

Harsh phonation is found in Lalo, a diachronic development from the loss of Proto Ngwi syllable-final stops *-p, *-t, and *-k. Most other Ngwi languages, e.g., Nosu, Hani, Lolo, etc., also have harsh phonation. Maddieson & Ladefoged (1985) describe 'tense' phonation in two Ngwi languages, Hani and Nasu, along with Jingpo and Wa. Harsh phonation in another Ngwi language, Nosu, and Bai, a Sino-Tibetan language of western Yunnan, is described in detail through laryngoscopic studies by Edmondson et al. (2001) and Esling and Edmondson (2002). Connecting a model of tone change to the physiology of both pitch and phonation is important, because the muscles and cartilages involved in phonation also affect pitch.

Each phonation type has a pitch correlate (seen in Table 5-1 below), because different valves' engagement impact tension in the vocal folds. In breathy voice, the slack vocal folds allow high-velocity airflow through the glottis, which lowers subglottal pressure and therefore the pitch (Hombert et al. 1979). In creaky voice, the ventricular folds do not adduct over the vocal folds, leaving them slack enough to allow slow, undulating movements at a lower frequency. In harsh voice, however, the ventricular folds incur over vocal folds, causing increased tension and therefore increased pitch.

The differing impact of phonation types on pitch enables a new understanding of the interaction between phonation and tone change. Of course, phonation does not directly determine pitch; e.g., Burmese's breathy tone (Tone 2) has a higher onset [42] than the modal tone (Tone 1) [22]. However, listeners' misperception of the subphonemic pitch correlate as the salient perceptual cue may lead to either a shift from a register language to a tone language, or to tone change in an already tonal language. As shown in Sections 5.3.3 and 5.3.4, W Lalo and YL listeners probably reinterpreted the subphonemic higher pitch associated with harsh phonation as phonemic, leading to changes in *L and *H as these tone categories shifted from a system of phonation and pitch to contrastive pitch alone.

Table 5-1: Phonation types, pitch correlates, and active valves of the throat. Adapted from Edmondson and Esling (2006)

Phonation type	Pitch correlate	Valve 1: vocal folds	Valve 2: ventricular folds	Valve 3: laryngeal sphincter	Valve 5: larynx height
modal	none	+	-	-	-
breathy	low	-	-	-	Lowered or neutral
creaky	low	+	-	+	Raised
harsh	high	+	+	+	Raised

Xu and Wang's (2001) Target Approximation (TA) model contributes to the understanding of tone production and perception, and therefore to tone change. Xu and Wang (2001) developed the TA model to explain the various contextual variations in tone realisation observable in Mandarin, which are best interpreted as occurring predictably as pitch targets are approached. Pitch targets serve as the smallest articulatorily operable unit for tone; they are to tone what phones are to phonemes (Xu & Wang 2001, Xu 2004). As Xu (2006: 6) summarises, 'each tone is associated with a pitch target in the form of a simple ideal pitch pattern'. These pitch patterns may either be static (as in level tones) or dynamic (as in contour tones). Xu (2004) integrates articulatory constraints into the TA model, such as constraints on the time needed to change pitch and synchronisation of target approximation and concurrent supralaryngeal movements.

Pittayaporn (2007b) builds on Xu's (2004) TA model and other phonetic studies of tone to introduce a model of the directionality of tone change. He proposes three main mechanisms that govern tone change: segment-tone interaction, contextual variation, and perceptual maximisation. All three mechanisms are seen in Lalo varieties' tone changes. Segment-tone interaction predicts that prevocalic segments' local perturbation of the vowel's F0 affects only the pitch onset, not the pitch offset, and therefore any resultant changes in contour shape are an incidental consequence of the change in tonal onset. In E Lalo, voiced consonants' depression of the tonal onset results in a change from a high level pitch to a low-rising one, described in §5.3.2. Contextual variation predicts that frequent, contextually influenced contours result in subphonemic variants getting mistaken for the phonemic pitch target. For example, articulatory constraints, like the time needed for pitch change, result in peak delay (Xu 2004). Pittayaporn therefore predicts that peaks will show a tendency to slide to the right. As the peak slides, the contour changes from high falling to convex and then to rising. Various stages of peak sliding are seen in different W Lalo varieties, discussed in §5.3.3. Perceptual maximisation refers to the enhancement of contrast between tones through greater pitch excursion (i.e., the difference between peak and trough of the pitch trajectory) in contour tones. Pittayaporn predicts that, if a contour tone has contextually influenced variants that differ in the value of the pitch onset, the variant with the greatest pitch excursion is the one most likely to be generalised. Perceptual maximisation may be one of the factors behind E Lalo's enhancement of the F0 excursion in the Tone *1 split, described in §5.3.2.

5.2 Proto Lalo tones

In order to posit meaningful phonetic motivations for tone changes in Lalo varieties, it is first necessary to establish the phonetic values of Proto Lalo tones. In this section, I trace the development of the Proto Lalo tonal system from Proto Ngwi and reconstruct the phonetic values for Proto Lalo tones.

The PB/PN tonal system had a three-way tone contrast in syllables ending in vowels or nasals: Tones *1, *2, and *3 (Bradley 1977). Matisoff (2002, 2003) speculates that PB tones *1 and *2 may have been differentiated by phonation differences rather than pitch, with Tone *1 in modal voice and Tone *2 in breathy voice. Indeed, CW-QY retains breathy phonation in Tone *2, along with low pitch. Given breathy voice's pitch correlate of low (as seen in Table 5-1 above), the low pitch of Tone *2 seen in many Ngwi languages is not surprising. Based on tonal reflexes in several Ngwi languages, Bradley (1977) posits the following pitch values for these proto-tones: *1 was high, *2 was low, and *3 was mid. Identical pitch values for these tone categories are still seen today in Hani, Central Lalo, Talu (Zhou 2004), and Talu-related languages such as Kuansi (Castro et al. 2010), all of which have kept the Proto Ngwi tonal categories relatively intact. For other languages such as Lisu, Lahu and Sani, evidence for the phonetic values of the Proto Ngwi categories is not as clear, as numerous conditioned splits and tonal innovation chains have drastically rearranged the systems. However, the modern tonal reflexes of all Ngwi languages can still be reasonably traced back to Bradley's hypothesised phonetic values of the Proto Ngwi tone categories.

In syllables ending in final stops *-p, *-t, and *-k, Proto Ngwi underwent a distinctive innovation wherein the voicing of the initial caused a split into two distinct tone categories, *Low-stopped and *High-stopped (Matisoff 1972). The basic rule for the split follows closely along the lines of the voiced-low principle. In general, a voiced *initial or a voiced *prefix conditioned a lower pitch, and voiceless initials conditioned a higher pitch. When changes in the initials (e.g., loss of the *C- prefix) destroyed the conditioning environment, the different pitches became phonemically contrastive.

Voiced stops (including affricates) conditioned entry into the *Low-stopped category, and voiceless initials into the *High-stopped. Voiced, non-nasal prefixes (*b, *d, *g, *r, *l, using *C as a cover symbol) conditioned voiceless stops to enter the *Low-stopped category. The nasal prefix had no effect on the tonal development of syllables with stop initials; neither did the glottal stop prefix, which was a merger of the Proto Burmic *s- and *ʔ- before stops. For fricative initials, both the *C and the nasal prefix pushed syllables into Low-stopped (the glottal stop prefix did not occur before fricatives). For nasal initials, the *s- prefix conditioned *High-stopped, and other prefixes and non-prefixed initials conditioned *Low-stopped. For resonant initials, only those syllables preceded by loosely-bound voiceless prefixes became *High-stopped, with the rest becoming Low-stopped.

In most Ngwi languages, excluding Bisoid, syllable-final *stops merged to a glottal stop, which conditioned laryngealised vocal register on the vowel. Proto Ngwi *High-stopped reflexes are usually a mid pitch with harsh phonation across Central and Southern Ngwi languages. Proto Ngwi *Low-stopped reflexes are often a low, harsh tone in Central Ngwi languages, unless prefixed with the PN glottal stop or *C- prefix. Most Northern Ngwi languages, excluding Eastern Nasu, underwent the change *Low-stopped > high, an independent development from Western Lalo's similar change, but probably also motivated by harsh phonation's higher pitch correlate.

Table 5-2 below shows the development of tones from Proto Ngwi to Proto Lalo. The Proto Lalo tonal system distinguished three pitch heights (high, mid, low) and two types of phonation, harsh and non-harsh. Proto Lalo, like Proto Ngwi, had a three-way pitch height contrast in syllables ending in vowels or nasals: *1, high; *2, low; and *3, mid. Proto Ngwi syllable-final stops merged to glottal stop with harsh phonation on the vowel by the Proto Lalo stage. In Proto Lalo *L and *H, harsh phonation and syllable-final glottal stop were probably concurrent, as is still seen in several varieties, and harsh syllables were probably shorter in duration than their non-harsh counterparts *2 and *3.

For a Central Ngwi language, Proto Lalo is conservative in its tonal development. Central Ngwi languages such as Lisu, Lahu, Lipo and Lolo all show the *ʔ- and *s- prefixes conditioning splits in Tone *2. Also, most Central Ngwi languages show an additional conditioned split in *Low-stopped, conditioned by the *ʔ- and *C- prefix (Bradley 1977, 2004). Proto Lalo shows no evidence of a conditioned split in *L. However, Proto Lalo does show a micro-split in Tone *2, discussed in §5.2.2. Tone *2 syllables preceded by the *ʔ- prefix with *obstruent initials and open back vowel *-a, as in*ʔ-ba^2 ‘male suffix,’ ‘frog,’ *ʔ-da^2 ‘put down,’ and *ʔ-dza^2 ‘feed,’ moved to the *L tone category.

Table 5-2: Proto Ngwi and Proto Lalo tones

Proto Ngwi (Bradley, 1977)	Proto Lalo
*1: High	*1: High
*2: Low	*2: a) Low, breathy b) > *L / ʔ-obstruent+a_
*3: Mid	*3: Mid
*L: Low, stop-final	*L: Low, harsh, ʔ-final, shorter duration
*H: Mid, stop-final	*H: Mid, harsh, ʔ-final, shorter duration

5.2.1 Evidence for PLa tone system from Central Lalo and MD

Proto Lalo, with the exception of the Tone *2 split discussed below, basically retains the Proto Ngwi tonal system. Likewise, the Proto Lalo tone system is retained with few changes in most Central varieties and in MD. Evidence for the phonetic values of Proto Lalo tones is most clearly seen in these varieties. Phonetic motivations for the subsequent tonal innovations described in §5.3 can often be clearly linked to the hypothesised phonetic values of PLa tones. Table 5-3 below shows the tonal systems in CW-QY, C-LB, and MD. Phonetic values are given using Chao’s (1930) tone letters, in which 5 represents the highest pitch and 1 the lowest. Phonation is modal unless otherwise noted.

Table 5-3: Tonal development in Central Lalo and MD

PLa	CW-QY	C-LB	MD
*1: High	[45]/[+voi]_; [55]/elsewhere	55	55
*2: Low, breathy	11, breathy	21	11
*3: Mid	33	33	33
*H: Mid, harsh,-ʔ	44, harsh	44(ʔ), weakly harsh	44(ʔ), weakly harsh
*L: Low, harsh,-ʔ	31, harsh	21(ʔ), weakly harsh	11(ʔ), weakly harsh

Figure 5-4, Figure 5-5 and Figure 5-6 below show the tonal inventories of CW-QY, C-LB, and MD, respectively, based on the acoustic analysis described in §2.3. Tone *1 has remained intact as the highest pitch in the system in most Central varieties and MD. In CW-QY, voicing of the initial has synchronically conditioned two Tone 1 allotones, shown separately in Figure 5-4. In syllables with voiceless initials and preglottalised initials, the Tone 1 allotone (marked Tone 1 allotone/elsewhere in Figure 5-4) is a high, level pitch, found at the top of the speaker’s range. The Tone 1 allotone in syllables with voiced initials (marked Tone 1 allotone/[+voi]_) shows a considerably lower pitch onset with a gradual rise in pitch through the midpoint and slight fall at the end of the syllable. The synchronic variation is predictable and not contrastive in native vocabulary. However, Laura Blackburn (personal communication, June 22, 2010) gives examples of Chinese loanwords with voiceless initials in *yangping* tone (2nd tone in Mandarin, a high rising pitch) that are incorporated into Lalo with the high rising allotone, e.g., [fy̩^{45}] from Mandarin [fu^{35}] 服 ‘to serve’. Whether the high rising allotone becomes fully contrastive in CW-QY remains to be seen. In §5.3.1, I argue that these allotones serve to enhance the contrast between plain and preglottalised initials. In contrast, C-LB and MD, which have lost preglottalised initials, show only slight microprosodic effects of the initial consonant, with voiced initials synchronically conditioning a slightly lower pitch onset than voiceless initials.

Tones *2 and *3 are the most stable of PLa tones, showing no change in any Lalo variety. Tone *2 is reflected as the lowest pitch across all Lalo varieties. In CW-QY, breathy phonation is a subphonemic feature of this tone. Proto Lalo probably retained the breathy phonation of PB Tone

*2, similar to Burmese (Bradley 1980, 1982). C-LB's Tone *2 shows a slight drop in pitch [21], but Yip (2002) suggests that the drop may be an automatic transition to a low pitch. In a system with all level tones, as C-LB is, I do not analyse [21] as a contour tone but rather a low level tone. Tone *3 is reflected as a mid level pitch with modal phonation in all Lalo varieties.

In CW-QY's tonal system, seen in Figure 5-4, *H and *L are pronounced with harsh phonation without a syllable-final glottal stop. Harsh phonation serves to distinguish *H, a mid level pitch from *3, its modal voiced counterpart, and *L from *2. Harsh phonation, through increased tension in the vocal folds (as described in §5.1), conditions raising of the pitch of *H and *L above their modal counterparts *3 and *2 in most Central varieties and in MD. In CW-QY's *L, harsh phonation has raised the pitch onset, giving the pitch a falling contour. The falling contour may not be perceptually salient for listeners, since harsh phonation is the contrastive feature with *2, but perceptual experiments are needed to test this. CW-QY's *L is significantly shorter in duration than *2, enhancing the contrast, while *2 in turn is significantly shorter than *3. *H and *3 do not differ significantly in duration. Harsh phonation's influence on tone change in W Lalo, XZ and YL is further discussed in §5.4.2.

Harsh phonation is auditorily weaker in C-LB and MD than in CW-QY, but still phonemically contrastive. In Figure 5-5 and Figure 5-6 below, showing C-LB and MD's tonal systems, Tone *H in both C-LB and MD is slightly higher than *3, but *L and *2 are indistinguishable in pitch height. Both *H and *L are sometimes heard in citation form with a postvocalic glottal stop, a retention from Proto Lalo. In MD, *H is shorter in duration than *3 at a statistically significant level; *L and *2 are not significantly different, even though *L appears longer in Figure 5-6. In C-LB, there is no significant difference in duration between harsh and modal syllables. In utterance medial form, the contrast between harsh and modal is often neutralised in both MD and C-LB. Neutralisation of harsh versus modal in utterance medial form is also reported to occur in Phola, one of the Phula languages described in Pelkey (2011).

Figure 5-4: CW-QY tonal inventory. Normalised for mean Tone 3 pitch; Tone 3 marked with dotted line; Tones L and H marked with triangles. N=176.

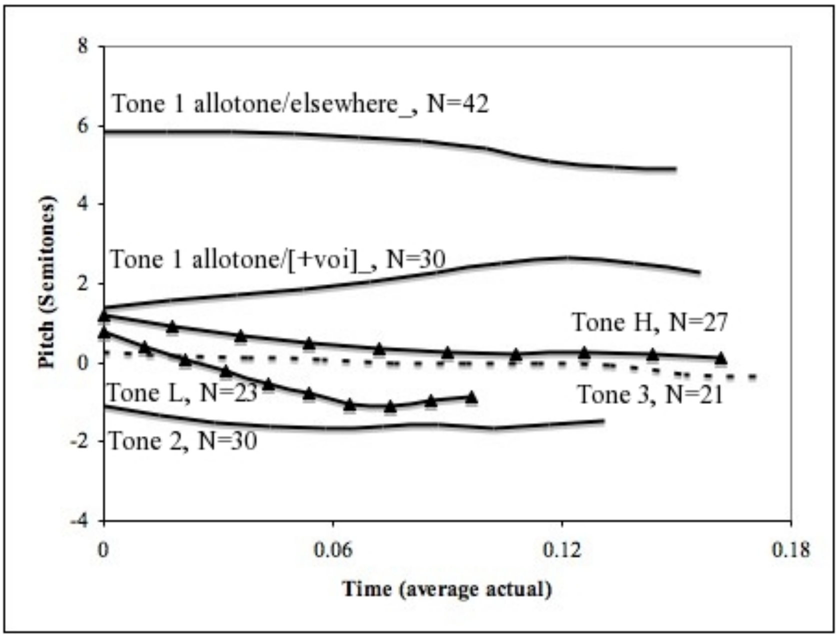


Figure 5-5: C-LB tonal inventory. Normalised for mean Tone 3 pitch; Tone 3 marked with dotted line; Tones L and H marked with triangles. N=154.

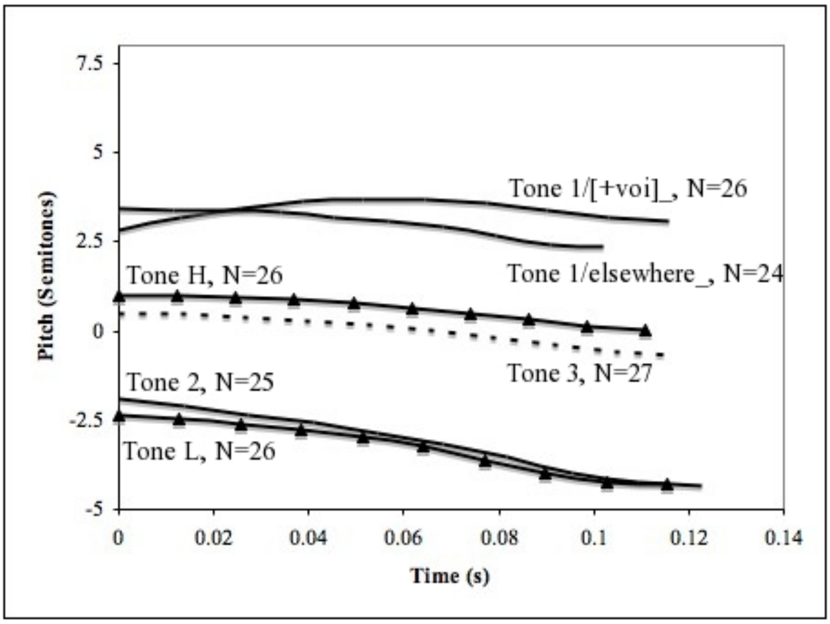
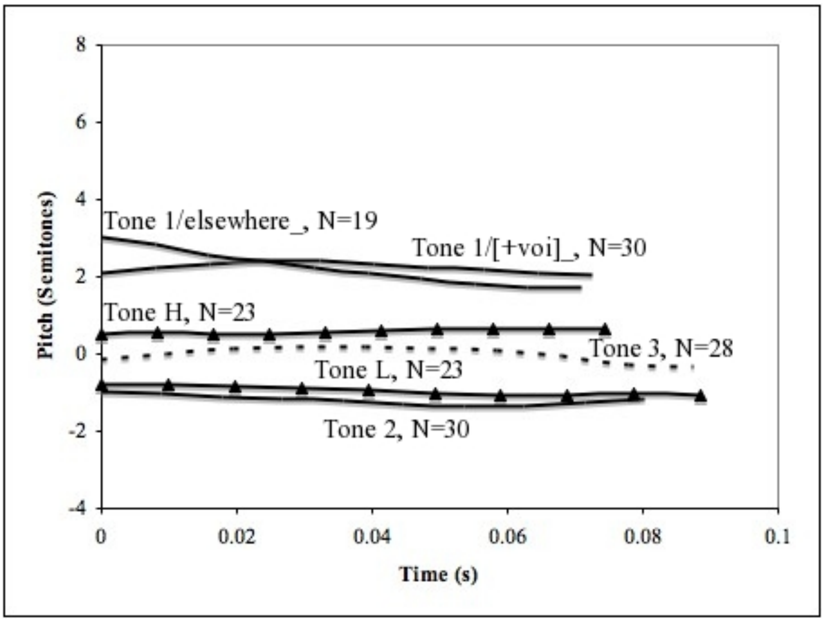


Figure 5-6: MD tonal inventory. Normalised for mean Tone 3 pitch; Tone 3 marked with dotted line; Tones L and H marked with triangles. N=153.



5.2.2 Proto Lalo's Tone *2 split

One of the defining innovations of Proto Lalo is the unusual split in Tone *2, in which Tone *2 syllables preceded by the *ʔ- prefix with *obstruent initials and open back vowel *-a moved to the PLa *L tone category. Examples are given in Table 5-4 below. Harsh phonation is denoted by an underscore under the vowel. Although there are only one or two examples for each obstruent initial, there are examples for almost all PLa places and manners of obstruents: labial, alveolar, and velar stops, alveolar affricates, and alveolar, palatal, and velar fricatives, i.e., PN *b, *d, *g, *dz, *s, *ʃ, and *r. PN *r, though technically classified as a resonant in PN, was probably already a fricative by the time of Proto Central Ngwi, given *r's reflex as /ɣ/ or /v/ in many Central Ngwi languages.

Cental Lalo varieties reflect the split to *L with a low, harsh tone, their usual reflex of *L, instead of a low, breathy tone, the usual reflex of *2. E-DC has mid-falling [31] its usual reflex of *L, SE-GP shows the high pitch reflecting *L in syllables with voiceless initials, and W-SZP shows the high rising-falling pitch typical of its *L reflexes.

Table 5-4: Examples of PLa Tone *2 split

Gloss	PN/PB	PLa	CW-QY	E-DC	SE-GP	W-SZP
frog	*k-ʔ-pa^{2}	u^{1}pa̱^{L}	ə^{55}pa̱^{21}	u^{55}pu^{31}	o^{21}poŋ^{55}	om^{24}pa^{453}
male suffix	*ʔ-pa^{2}	pa̱^{L}	pa̱^{21}	pu^{31}	po^{55}	pa^{453}
to put/place	*ʔ-ta^{2}	ta̱^{L}	ta̱^{21}	/	to^{55}	ta^{453}
between	*ʔ-gla^{2} (PB)	ka̱^{L}	ka̱^{21}	/	/	ka^{453}
feed	*sədza^{2}	tʃa̱^{L}	tʂa̱^{21}	tsu^{31}	tso^{55}	tʂa^{453}
sister's child	*ʔəʃa^{2}	sa̱^{L}	sa̱^{21}	su^{31}	/	/
sad	*ʔ/s-ra^{2}	ʃa̱^{L}	ʂa̱^{21}	sɔ^{31}	so^{55}	ʂa^{453}

Three conditioning factors in PN must be met for the split to take place: a PN *ʔ- prefix, an obstruent initial, and the low back vowel *a. By the Proto Lalo stage, *ʔ- prefixed stops had become voiceless unaspirated; this also occurs in other Central Ngwi languages like Lisu, but not in Lahu. Table 5-5 below gives examples of lexical items that fail to meet these specific conditions, and therefore do not undergo the split in PLa. Obstruent initials that did not have the *ʔ- prefix, as exemplified by *xa^{2} 'meat' and *ka^{2} 'bitter,' remain in the Tone *2 category. Sonorants preceded by the *ʔ- prefix, as in *ʔ-la^{2} 'trousers,' did not take part in the split either, even if the rhyme was *a. Finally, *ʔ- prefixed obstruents with any other rhyme, such as in *ʔ-gʷəj^{2} 'comb,' also did not take part in the split, and instead remained in the Tone *2 category in PLa. SE-GP's Tone *2 split later expanded to include all voiceless unaspirated and preglottalised initials (though preglottalisation was later lost).

Table 5-5: Lexical items failing to meet the conditions for the Tone *2 split

Gloss	PN/PB	PLa	CW-QY	E-DC	SE-GP	W-SZP
meat	*xa^{2}	xa^{2}	xa^{21}	xɔ^{21}	xo^{21}	xa^{21}
bitter	*ka^{2}	kʰa^{2}	kʰa^{21}	kʰa^{21}	kʰa^{21}	kʰa^{21}
trousers	*ʔ-la^{2}	ʔla^{2}	ʔla^{21}	lɔ^{21}	lo^{55}	la^{21}
comb	*ʔ-gʷəj^{2} (PB)	pjɨ^{2}	pɨ^{21}	pɨ^{21}	pɨ^{55}	pɨ^{21}

Given the fact that PLa voiceless unaspirated stops descend from PN *ʔ- prefixed stops, one would therefore not expect to find any voiceless unaspirated stops followed by *-a in Tone *2 in PLa. While this is true for labial and alveolar stops, there are a few examples of PLa *ka^{2}, shown in Table 5-6: 'armpit,' 'back' and 'to live'. PLa *ka^{2} in 'armpit' may descend from PN *ʔ-ga^{3}, although the tone reflex of PLa *2 is irregular. PLa *ka^{2} in 'back' appears to descend from PB *ka^{2}, but the PLa initial has unexpectedly not become aspirated, and shows protovariation between PLa *kaŋ^{2} and *ka^{2}. PLa *ka^{2} in 'to live,' from PN *kʷa^{2} (Bradley 2008), has also failed to become aspirated, and shows variation between *ka^{2} and *ka̱^{L}. Some C and E varieties reflect *ka̱^{L}, as seen in E-DC's mid-falling reflex, but others, as in CW-QY and all W varieties, reflect *ka^{2}.

Table 5-6 shows two more puzzles of the PLa Tone *2 split, in 'bow' PB *ʔ-da^{1} and 'to know' PB *sey^{2}. For 'bow,' C and E Lalo show reflexes of PLa *ta̱^{L}nɛ^{3}, suggesting descent from PB *ʔ-da^{2}, possibly a competing variant with *ʔ-da^{1}. W Lalo varieties reflect a Proto W form of *ta^{2}nɛ^{1}, a subsequent innovation from PLa *ta̱^{L}nɛ^{3}. This subsequent change in W varieties may be a result of Proto W tone sandhi in this compound word, in which the low tone of the first syllable depressed the pitch onset of the second syllable, resulting in a low-rising pitch which was then perceived as belonging to the Tone *1 split to low-rising, so PLa *ta̱^{L}nɛ^{3} > P-W *ta^{2}nɛ^{1}. Harsh phonation in the first syllable must have been lost prior to the W change of *L > high, destroying the environment for the *L > high change and therefore remaining low. PLa *sɛ̱^{L} 'to know' may also have taken part in the split, i.e., PB *sey^{2} > *sɛ̱^{L}, or it may be reflecting the allofam *set^{L}, a not unreasonable suggestion given the abundance of this type of allofamy in Proto Tibeto-Burman. The homophone 'fruit,' also PB *sey^{2}, becomes PLa *sɛ^{2}, not *sɛ̠^{L}. The fact that 'fruit' did not participate in the split suggests that 'to know' reflects allofam *set^{L}.

Table 5-6: Puzzles of the PLa Tone *2 split

Gloss	PN/PB	PLa	CW-QY	E-DC	SE-GP	W-SZP
armpit	ʔ-ga^{3}	ka^{2}	/	ku^{21}	/	ka^{21}
back	ka^{2} (PB)	ka(ŋ)^{2}ta(ŋ)^{3}	ku^{21}	kɔ^{21}	/	ko^{21}
to live	kʷa^{2}	ka^{2}/ka̠^{L}	ka^{21}	ka^{31}	ko^{55}	ka^{21}
bow	ʔ-da^{1} (PB)	ta̠^{L}nɛ^{3}, P-W: ta^{2}nɛ^{1}	ta̠^{21}na^{33}	tɛ^{42}nɛ^{33}	/	ta^{21}nɛ^{24}
know	sey^{2} (PB)	sɛ̠^{L}	sa̠^{21}	sɛ^{42}	ʂʅ̠^{55}	sɛ^{53}

The Proto Lalo Tone *2 split provides an interesting example of both consonants and vowels interacting with tone. The PN glottal prefix and low vowel *-a were conditioning factors in the tone split. How did these two factors lead listeners to 'mistake' syllables in that environment as belonging to Tone *L, and not *2? A possible phonetic motivation for this split begins by examining the Central Lalo tonal system, given in Figure 5-4. *L and *2, though both in the lower register, differ acoustically in their F0 slope, with *L's F0 slope much steeper than *2's. *L's pitch onset begins much higher than *2 and falls rapidly, while *2 is more or less a level tone. The acoustic differences between *L and *2 are partly due to harsh phonation's effect of raising the pitch onset of *L, an effect that may also have been present in Proto Lalo.

If the acoustic differences between *L and *2 were also present in Proto Lalo, it is possible that the Tone *2 split's conditioning environment led listeners to misperceive the affected syllables as belonging to *L, not *2. In Tone *2, the combination of glottal stop prefix and low vowel may have affected the pitch contour in such a way as to increase the F0 slope, making the affected word's F0 slope more similar to *L than to *2. The glottal stop prefix, through increased tension in the vocal folds, led to an higher pitch onset, while the intrinsically lower F0 of the low vowel -a may have led to a lower pitch offset. At the pitch onset, prevocalic glottalisation increases vocal fold tension and raises the pitch. At the pitch offset, the low vowel's instrinsic F0 lowers the pitch (Whalen & Levitt 1995, Connell 2002). This leads to a steeper F0 slope, making the pitch contour more similar to *L's. While the *glottal stop prefix remained, this variation in F0 slope would have been subphonemic, but once *ʔ- dropped off, the subphonemic variation became phonemic, leading to a reinterpretation of the affected syllables' tone category as *L, not *2.

The Tone *2 split did not affect syllables with *ʔ- prefixed sonorants, because the glottal stop was preserved before sonorants and developed into the Proto Lalo preglottalised initial series. Therefore, for PLa preglottalised initials, the conditioning environment was never destroyed, and so the effect of the glottal stop remains subphonemic to this day, preventing the syllables from changing phonemic tone categories. The effect of preglottalisation on the initial pitch of Tone *2 syllables was acoustically measured by comparing the average initial pitch of preglottalised syllables with the -a rhyme to those with plain sonorants and the -a rhyme (n=14 for each category). Preglottalised syllables were found to have a significantly higher initial pitch ($p < .05$) when compared to syllables with plain sonorants.

The complexity of the conditioning environment makes this an unusual change, valuable for classifying languages whose affiliation with Lalo is unclear. This is especially useful for the two Lalo languages in Lincang, the Eka (/o^{21}kʰa^{24}/) and the MD Lalo (/lo^{21}lo^{33}pa̠^{21}/), whose autonyms either do not reflect the PLa autonym *la^{2}lo̠^{H}pa̠^{L}, (i.e., the Eka) or may be easily confused with the Lolo (/lo̠^{21}lo^{33}/) (i.e., the MD Lalo). Table 5-7 illustrates the PLa Tone *2 split in Eka and MD. Both Eka and MD retain harsh phonation, often accompanied by a postvocalic glottal stop. A low, harsh tone is the expected reflex of PLa *L, not *2, and so the harsh phonation seen in the examples prove that MD and Eka share this unusual and distinctly Lalo tonal innovation.

Table 5-7: PLa Tone *2 split in MD and Eka

Gloss	PN/PB	PLa	CW-QY	MD	Eka
frog	*k-ʔ-pa^{2}	u^{1}pa̱^{L}	ə^{55}pa̱^{21}	u^{55}pɑ̱^{21}	o^{24}po̱^{21}jo^{21}
to put	*ʔ-ta^{2}	ta̱^{L}	ta̱^{21}	to^{33}	to̱^{21}
feed	*sədza^{2}	tʃa̱^{L}	tʂa̱^{21}	tsɑ̱^{21}	tsuɛ̱^{21}
sad	*ʔ/s-ra^{2}	ʃa̱^{L}	ʂa̱^{21}	sɑ̱^{21}	so̱^{21}
meat	*xa^{2}	xa^{2}	xa^{21}	xo^{21}	xo^{21}
trousers	*ʔ-la^{2}	ʔla^{2}	ʔla^{2}	lo^{2}	lo^{2}

5.3 Tone change in Lalo varieties

Section 5.2 proposed phonetic values for Proto Lalo tones and used synchronic, acoustic analysis of Lalo varieties' tonal inventories as supporting evidence. This section uses the PLa tonal system as the jumping-off point to a discussion of subsequent tone change in Lalo varieties. Assuming that diachronic change arises from synchronic variation, I compare Lalo varieties' synchronic, acoustic tonal analysis in order to hypothesise phonetic motivations for the observed tone changes.

Central Ngwi languages typically show a conditioned tone split in Proto Ngwi Tone *1, albeit with varying conditioning environments (Bradley 1979, 2004). In Lisu, *ʔ- and *s- prefixed syllables have a mid-high level pitch reflex 44 (Lisu Tone 3), and elsewhere shows a mid-level pitch 33 (Lisu Tone 4). In Lahu, voiceless initials condition a mid-level pitch 33 (Lahu Tone 5), and voiced initials a low-falling pitch 21 (Lahu Tone 2) (Bradley 1979b). Interestingly, most Central Lalo varieties do not show any split in Proto Ngwi Tone *1, unlike other Central Ngwi languages. Other Ngwi languages that do not split Tone *1 are Hani (*1 > [55]), a Southern Ngwi language, and Nosu and Nasu (*1 > [33]), both Northern Ngwi languages (Bradley 1979b).

Several other Lalo varieties, in contrast with C Lalo, do have a conditioned tone split in *1, resulting in the creation of a contrastive, low-rising tone. In E Lalo, along with XZ, W-YL and CE-YA, the conditioning is a combination of the two conditioning environments that caused the splits in Lisu and Lahu, respectively, i.e., voicing and *ʔ-/*s- prefixes. Crucially for this split, Proto Lalo retained the Proto Ngwi *ʔ- prefix before sonorants, resulting in a distinctive series of preglottalised sonorants and fricative, e.g., *ʔm, *ʔn *ʔl, and *ʔv (*ʔv comes from Proto Ngwi *ʔw). Syllables with *preglottalised *and* *voiceless initials retain the high level pitch, but plain, non-prefixed *voiced initials conditioned a low-rising pitch. All E Lalo varieties show this combination of environments for the Tone *1 split. I use E Lalo as the prototype for this split, referring to this conditioning set as the 'Eastern-type' Tone *1 split, even when it is seen in non-E Lalo varieties such as CE-YA. In W varieties, only preglottalised syllables retain the high level pitch, with low-rising seen in all other environments. When preglottalisation was lost in these varieties, the low-rising pitch became a contrastive tone.

As an overview of tone change in Lalo varieties, Table 5-8, Table 5-9, and Table 5-10 below shows the range of tonal development in Lalo varieties. Table 5-8 gives the tonal systems of some W, E, and C varieties, and MD. CE-YA, the only Central Lalo variety to show the Eastern-type Tone *1 split, is discussed in §5.3.1, and E Lalo tone changes are discussed in §5.3.2. Core W and W-YL varieties show a tonal innovation chain, resulting in the reorganisation of Tones *1, *L and *H in the tonal space, which is further discussed in §5.3.3. Table 5-9 summarises SE Lalo's tonal development, notably the voicing conditioned tone splits in *2 and *L, discussed in §5.3.4.

Table 5-10 below shows the tonal development of YL, XZ and Eka, all peripheral Lalo varieties. These peripheral varieties show a range from the fewest contrastive tones of any Lalo variety (i.e., YL young speakers with three) to the most tone categories (i.e., Eka, with six). The various tonal changes seen in YL, XZ and Eka are discussed in §5.3.4. Comparison of the tonal systems in younger and older speakers in YL reveals a change in apparent time. Older speakers show a unique variation of the Tone *1 split, with PLa *voiced and *preglottalised initials showing a low-rising pitch, and *voiceless initials show a mid pitch, merging with *3. Young speakers have merged the low-rising pitch reflex with *3's mid pitch. XZ shows the Eastern-type Tone *1 split, and then a three way merger of *H, *L and *3 to mid pitch. Eka's Tone *1 reflex is low-rising in all environments, but all other tones basically reflect PLa's tonetic values. However, various conditioning of *1, *2, *H and *L results in the creation of a newly contrastive high level tone (see §3.4).

Table 5-8: Tonal development in W, E, C Lalo and MD

PLa	W-core	W- YL	E-DC	E-TS & HS	CE-YA	CW-QY	C-LB	MD
*1/ *+voi	24	24	24	24	24	[45]	55	55
*1/ *-voi		44	55	55	55	[55]		
*1/ *ʔ_	44							
*H			33	33	33	33	33	33
*3	33	33			33	33	33	33
*L	(4)53	53	31	21	21	31	21	21
*2	21	21	21	21	21	21	21	21

Table 5-9: Tonal development in SE-GP

PLa	SE-GP
*1	44
*3 and *H	33
*2/*ʃ, *[-voi, +sg]__ *L/*[-voi]__	55
*L/[+voi]_	21
*2/elsewhere	21

Table 5-10: Tonal development in YL, XZ and Eka

PLa	YL young	YL old	XZ	Eka
*1/ *+voi		24	24	24
*1/ *ʔ_	33			
*1/ *-voi		33	55	
*3				33
*H	53	53	33	33
*L				21
*2	21	21	21	21
Eka only: various conditioning of *1, *2, *H, *L				55

5.3.1 Tone change in C Lalo

Table 5-11 below summarises the development of Proto Lalo tones in the Central Lalo dialect cluster. CW-QY and C-LB have retained the phonetic values of the Proto Lalo tone system, while other C Lalo varieties have undergone some minor changes. CW-QY's tonal acoustic analysis is seen in Figure 5-4 in §5.2.1 above. In CW-QY and C-LJ, voicing of the initial has synchronically conditioned two Tone 1 allotones, [45] with voiced initials and [55] with voiceless and preglottalised initials. C-LB (acoustic analysis given in Figure 5-5) and all other C Lalo varieties excepting CE-YA, do not show the allotonic variation of CW-QY; these varieties have also lost the distinction between preglottalised and plain initials. In CE-YA, voiced initials conditioned a tone split to low-rising [24] pitch, which became a distinctive tone when preglottalisation was lost.

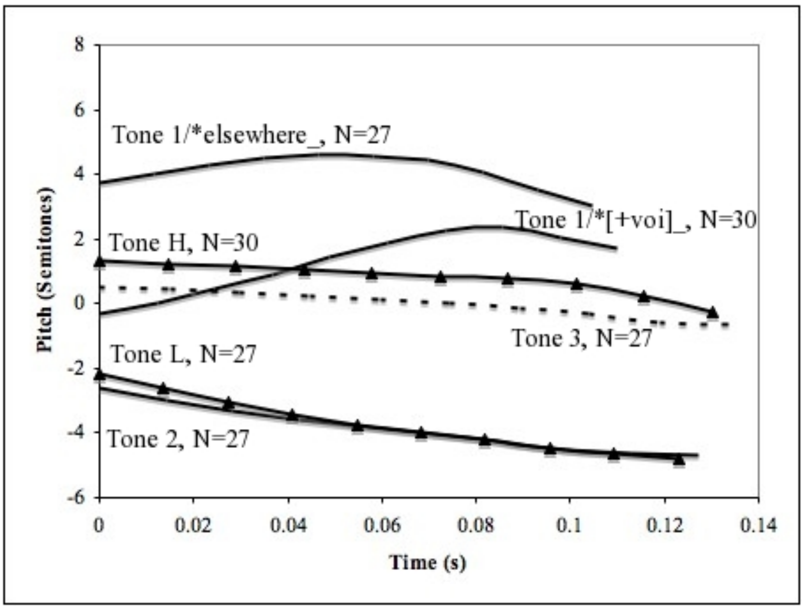
CE-YA's conditioning of the Tone *1 split exactly parallels the synchronic, subphonemic variation seen in CW-QY.

Table 5-11: Tonal development in Central Lalo

Proto Lalo	CW-QY & C-LJ	C-LB, others	CE-YA
1: High/[+voi]_	[45]	55	24
*1: High/*elsewhere	[55]		55
*2: Low	11, breathy	21	21
*3: Mid	33	33	33
*H: Mid, harsh	33	33	33
*L: Low, harsh	31	21(ʔ), weakly harsh	21, weakly harsh

Figure 5-7 below shows the tonal inventory of CE-YA. The Tone *1 reflex with *voiceless and *preglottalised initials (marked Tone 1/*elsewhere) is found at the highest pitch level for Speaker CE-YA1. The Tone *1 reflex for syllables with *voiced initials (marked Tone 1 split/*[+voi]_) has a pitch onset that begins lower than the mid pitch but steadily rises past the midpoint of the syllable before a slight drop off at the end. The depression of the pitch onset is greater in CE-YA than CW-QY's high rising allotone; in CE-YA, the pitch begins in the lower register and rises into the higher register. Because CE-YA has lost *preglottalisation (e.g., *ʔm, *ʔl, *ʔv > m, l, v), Tone *1's high pitch reflex is now seen on syllables with voiced sonorants and the voiced fricative /v/. The Tone *1 split to low-rising is also seen on syllables with voiced sonorants and fricative (from Proto Lalo *plain sonorants and *v). Thus, the high level and low-rising pitch reflexes of Tone *1 are now phonemically contrastive. The loss of *preglottalised fricative and sonorants in E Lalo triggered the change from subphonemic variation to a phonemic tone split.

Figure 5-7: CE-YA tonal inventory. Normalised for mean Tone 3 pitch; Tone 3 marked with dotted line; Tones L and H marked with triangles. N=168.



Besides phonetic factors, social factors also played a role in CE-YA's Tone *1 split. CE-YA is located in Yongjian Township in Weishan County, just to the south of Dali Municipality and right on the border between C and E Lalo. Ties between the CE-YA and E Lalo speakers through marriage, family and friendship result in frequent, sustained contact. Most other innovations in initials and finals, however, identify CE-YA as a Central Lalo dialect, not an Eastern one. CE-YA is underlyingly a Central dialect, but in close contact with Eastern Lalo, and is the only C Lalo variety to show a phonemic Tone *1 split. As shown in §5.3.2, E Lalo's Tone *1 split exactly parallels CE-YA's.

Other East Mountain varieties vary as to whether they show the split or not. Edwin Lam (personal communication, August 27, 2009) reports that while villages in Yongjian (e.g., CE-YA) and northwest Dacang (e.g., Xinsheng) districts show the split, villages just to the south of this area do not. Speakers in Caochang Village in Miaojie District, to the south of Dacang, claim their ancestors first moved to that location from northwest Dacang (Xinsheng) 200 years ago. Caochang speakers do not show the split, and instead have a high level tone for the entire Tone 1 category. This implies that the Tone *1 split has happened in the past 200 years in those East Mountain varieties located closest to Eastern Lalo. The sociolinguistic contact situation between CE-YA and E Lalo, as well as the geographical distribution of the tone split within the East Mountain area, suggest diffusion from Eastern Lalo, rather than shared innovation.

Splits are not usually the result of diffusion, according to Labov's (2007) model of transmission and diffusion. However, given the synchronic variation in CW-QY and the probable presence of the same allotonic variation in CE-YA, the Tone *1 split is actually a phonetically natural result of the merger of *preglottalised and *plain initials. Also, given the intermarriage of the CE-YA and E Lalo speakers, children are exposed from birth to both varieties, a sociolinguistic factor which may have influenced CE-YA's development of a phonemically contrastive low-rising tone.

CW-QY and C-LJ are the only Lalo varieties in this study to preserve the distinction between preglottalised and plain initials. The allotonic variation seen in these varieties is a natural result of contrast enhancement (Gussenhoven 2004), that is, the use of redundant features to augment the distinctiveness of the contrastive phonetic feature. In this case, variation in F0 is a redundant feature used to enhance the contrast between preglottalised initials and plain initials. The rising and level allotones of Tone *1 are not contrastive, but rather predictable based on the initial. The difference between the two allotones aids the perception of the contrast between preglottalised and plain initials, but is not yet a contrastive feature in these varieties.

Either this enhancement effect on subphonemic pitch was present in Proto Lalo, or is an innovation in CW-QY and C-LJ. I argue that the allotones were probably already present in Proto Lalo. While no one will ever be able to do acoustic analysis on Proto Lalo, the principle of economy, a.k.a. Occam's razor, leads to this hypothesis. I posit that the simplest path of development in all Lalo varieties is the most likely. The Tone *1 split, variations of which are seen in C, W, and E clusters and XZ and YL, is predicated upon this subphonemic variation. The allotonic variation is the necessary seed for the Tone *1 split seen widely across Lalo varieties, as described in the following sections. Proto Lalo also distinguished preglottalised and plain initials, and so the reason for the enhancement was already present in Proto Lalo. CW-QY and C-LJ, the only varieties to preserve the distinction, naturally also preserve the contrast enhancement that aids the perception of the distinction.

As an illustration of the different developments in C Lalo varieties, Figure 5-8, Figure 5-9 and Figure 5-10 show the pitch trajectories of the Proto Lalo minimal pair *ʔna^{1} 'hear' and *na^{1} 'sick' in C-LJ, C-WC, and CE-YA, respectively. The vowel onset, considered the tonal onset of the syllable, is marked with a line on each syllable's pitch trajectory. In C-LJ, seen in Figure 5-8, *ʔna^{1} 'listen' and *na^{1} 'sick' are distinguished by the initial: /ʔna^{1}/ [ʔna^{55}] 'listen' versus /na^{1}/ [na^{45}] 'sick'. In 'sick' /na^{1}/, the pitch onset is depressed by the voiced initial, resulting in the high-rising allotone characteristic of this environment.

Figure 5-9 shows the same minimal pair in C-WC, a variety that has lost distinctive preglottalisation, merging *ʔm and *m, *ʔn and *n, etc., to the plain initial manner. The minimal pair now has identical initials and pitch trajectories, and is distinguished only by the vowel: /na^{1}/ [na^{55}] 'listen' versus /nɑ^{1}/ [nɑ^{55}] 'sick'. The vowel change from PLa *a [ɑ] to front [a] may have been conditioned by the preglottalisation, although other vowels do not show parallel changes conditioned by preglottalisation. Contrast enhancement is not seen in C-WC or any other Central Lalo variety that has merged preglottalised and plain initials, excepting CE-YA. Since distinctive preglottalisation has already been lost, enhancement would be pointless.

CE-YA's Tone *1 split is exemplified in Figure 5-10. The Proto Lalo minimal pair *ʔna^{1} 'hear' and *na^{1} 'sick' is now distinguished by tone and vowel, not by initial: [nɑ^{55}] /nɑ^{1a}/ 'hear' versus [na^{24}] /na^{1b}/. Like C-WC, preglottalisation may have played a role in the vowel's development, although with a different effect than that seen in C-WC. CE-YA, like C-WC, has lost distinctive preglottalisation. C-WC and other Central Lalo varieties that have lost preglottalisation, but did not undergo the split, do not have close contact with E Lalo speakers as CE-YA speakers do. Instead of simply losing the allotonic variation as C-WC does, CE-YA shows a phonemic tone split accompanied by an increase in the F0 excursion of the new low-rising tone. The merger of preglottalised and plain initials is the linguistic tipping point for CE-YA's phonemicisation of the low-rising tone, and contact with E Lalo speakers is probably the key social factor that influenced the spread of the sound change.

Figure 5-8: Pitch trajectories for PLa minimal pair 'listen' vs 'sick' in C-LJ.

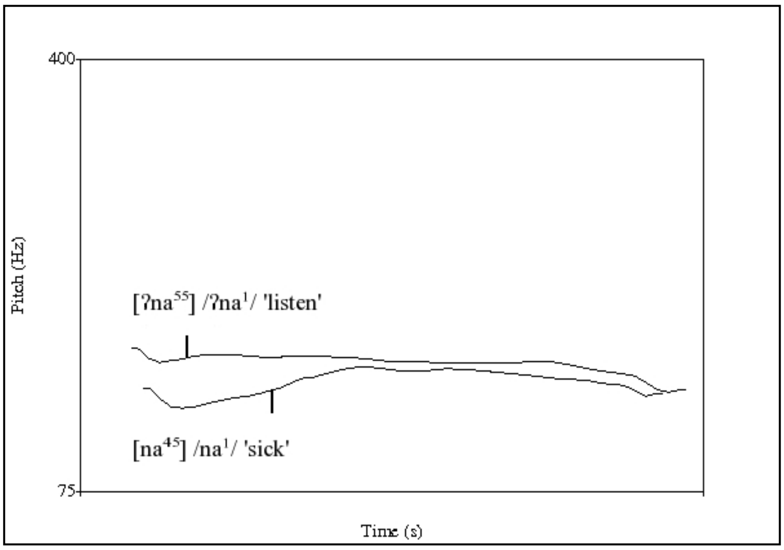


Figure 5-9: Pitch trajectories for PLa minimal pair 'listen' vs 'sick' in C-WC.

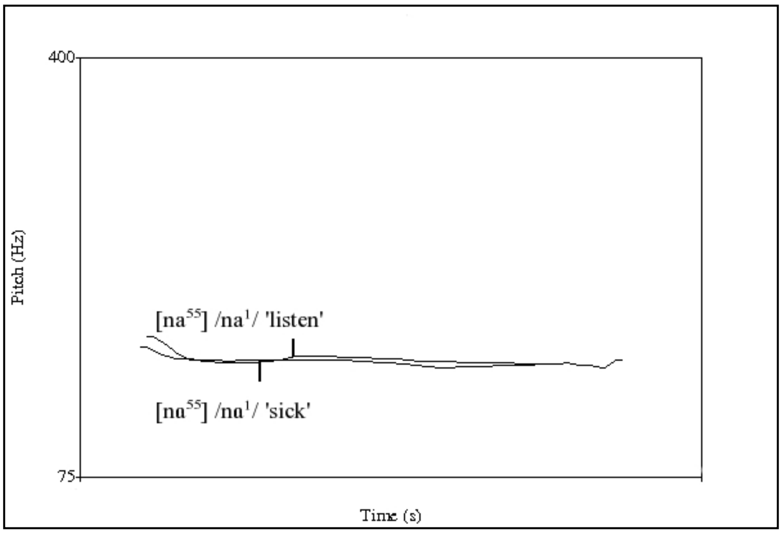
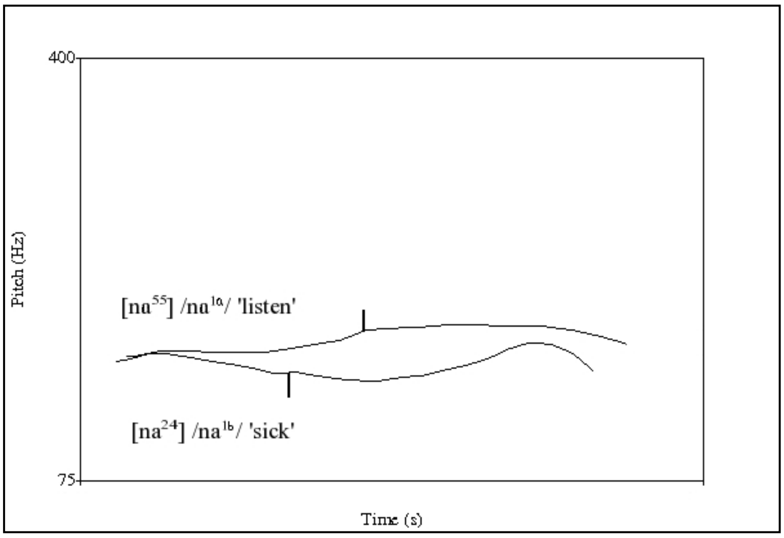


Figure 5-10: Pitch trajectories for PLa minimal pair ‘listen’ vs ‘sick’ in CE-YA.



5.3.2 Tone change in E Lalo

Table 5-12 below shows the tonal development of E Lalo varieties. In E Lalo, Tone *1 underwent a phonemic split in which syllables with *voiceless initials and *preglottalised sonorants remained high, but syllables with *voiced initials split to low-rising. E Lalo varieties also show loss of harsh phonation in *H, resulting in a merger of Tone *3 and *H to mid level [33] pitch. E-TS and E-HS have preserved harsh phonation in *L, but E-DC has lost harsh phonation in *L as well as *H, with a resulting phonetic change in *L to mid-falling [32] pitch in modal phonation.

Table 5-12: Tonal development in Eastern Lalo

Proto Lalo	E-TS	E-HS	E-DC
1: High/[+voi]_	24	24	24
*1: High/elsewhere	55	55	55
*2: Low	21	21	21
*3: Mid	33	33	33
*H: Mid, harsh			
*L: Low, harsh	21	21	31

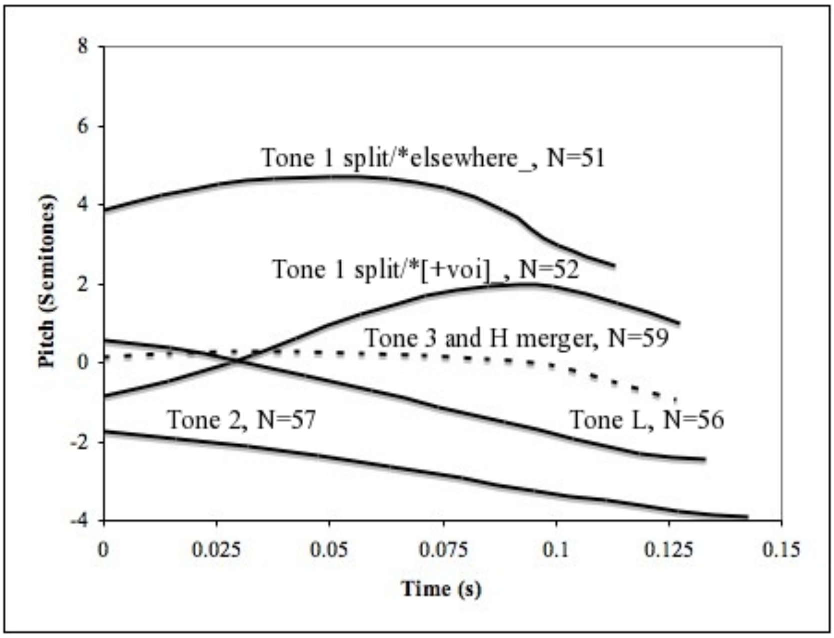
Table 5-13 gives examples of E Lalo varieties’ Tone *1 split. In E Lalo, the Tone *1 split became phonemically contrastive when *preglottalised initials merged with their plain counterparts. This parallels the development seen in CE-YA.

Table 5-13: Examples of E Lalo varieties' Tone *1 split

Gloss	PLa	E-DC	E-TS	E-HS
light (adj.)	*laŋ^{1}	la^{24}	la^{24}	la^{24}
sick	*na^{1}	nɔ^{24}	nɔ^{24}	nɔ^{24}
bamboo	*ma^{1}	mɔ^{24}	mɔ^{24}	mɔ^{24}
to winnow	*ʔva^{1}	ɔ^{55}	u^{55}	va^{55}
tongue	*ʔla^{1}	lɔ^{55}	lɔ^{55}	lɔ^{55}
listen	*ʔna^{1}	nɔ^{55}	nɔ^{55}	nɔ^{55}
person	*tsʰaŋ^{1}	tsʰa^{55}	tsʰa^{55}	tsʰa^{55}
iron	*xy^{1}	xə^{55}	xu^{55}	xɨ^{55}
star	*kɛ^{1}	kɛ^{55}	kɛ^{55}	kɛ^{55}

Figure 5-11 gives E-DC's tonal inventory. E-DC's tonal system roughly parallels that of CE-YA, with only two differences: the merger of *3 and *H, and the change of *L from low with harsh phonation to mid-falling with modal phonation. E-TS and E-HS differ from E-DC in that *L is still pronounced with harsh phonation. Much like CW-QY's *L tone, the pitch of *L in E-TS and E-HS is raised above that of *2, due to the effect of harsh phonation. The heightened pitch of *L, a subphonemic correlate of harsh phonation in E-TS and E-HS, has become contrastive in E-DC after the loss of harsh phonation. This interaction of harsh phonation and pitch, and the resultant tone change, is similar to the developments seen in W Lalo, XZ and YL varieties, described in Sections 5.3.3 and 5.3.4 below.

Figure 5-11: E-DC tonal inventory. Normalised for mean Tone 3 pitch; Tone 3 and H merger marked with dotted line. N=275.



5.3.3 Tone change in W Lalo

Table 5-14 below summarises the tonal development of W varieties. In W Lalo, a tonal chain of innovation occurred. Like E Lalo, Tone *1 underwent a split conditioned by voiced initials. W Lalo lost harsh phonation in both *L and *H, with resulting reorganisation of the tonal system. *L changed from low with harsh phonation to high with modal phonation. *H changed from mid with harsh phonation to mid-high with modal phonation, and merged with Tone *1's syllables with *preglottalised initials. Although the ordering of the tonal chain is uncertain, a likely ordering is: 1) Tone *1 split to low-rising while Tone *1's *preglottalised initials merged with *H, and then 2) *L was dragged up to the highest pitch slot in the system. Core W varieties (SLZ, SZP, and DT) all share the expansion of the low-rising pitch to syllables with voiceless initials, remaining high only in syllables with *preglottalised initials. Non-core W-YL does not participate in this later change, and is therefore excluded from Core W. However, W-YL shares the other innovations in tone and also in initials that qualify it as a W variety, as discussed in §6.6.3.

Table 5-14: Tonal development in W Lalo varieties

Proto Lalo	W-DT	W-SZP	W-SLZ	W-YL
1: High/+voi_	24	24	24	24
1: High/-voi	24	24	24	44
*1: High/*ʔ_	44	44	44	44
*H: Mid, harsh	44	44	44	44
*2: Low	21	21	21	21
*3: Mid	33	33	33	33
*L: Low, harsh	45	453	453	53

Examples of Tones *1 and *H in W Lalo varieties are given in Table 5-15 below to illustrate W's Tone *1 split and merger with *H. CW-QY is given as a reference. In W, Tone *1 with *preglottalised initials merges with *H to mid-high. Core W's low-rising tonal reflex is seen in both voiced and voiceless initials.

Table 5-15: Examples of Tones *1 and *H in C, E, and W Lalo

Gloss	PLa	CW-QY	W-YL	W-SLZ	W-DT	W-SZP
light (adj.)	*laŋ¹	lu⁴⁵	lu²⁴	lu²⁴	la²⁴	lu²⁴
sick	*na¹	na⁴⁵	nɐ²⁴	na²⁴	no²⁴	na²⁴
iron	*xy¹	ɕy⁵⁵	ɕy⁴⁴	xue²⁴	xy²⁴	xu²⁴
star	*kjɛ¹	kɨ⁵⁵	ki⁴⁴	kɛ²⁴	kɛ²⁴	kɛ²⁴
tongue	*ʔla¹	ʔla⁵⁵	lɐ⁴⁴	la⁴⁴	lo⁴⁴	la⁴⁴
listen	*ʔna¹	ʔna⁵⁵	nɐ⁴⁴	na⁴⁴	no⁵⁵	na⁴⁴
bean	*nu̠ᴴ	nə̠³³	no⁴⁴	nu⁴⁴	nu⁴⁴	nu⁴⁴
stone	*lu̠ᴴ	lə̠³³	lo⁴⁴	lu⁴⁴	lu⁴⁴	lu⁴⁴

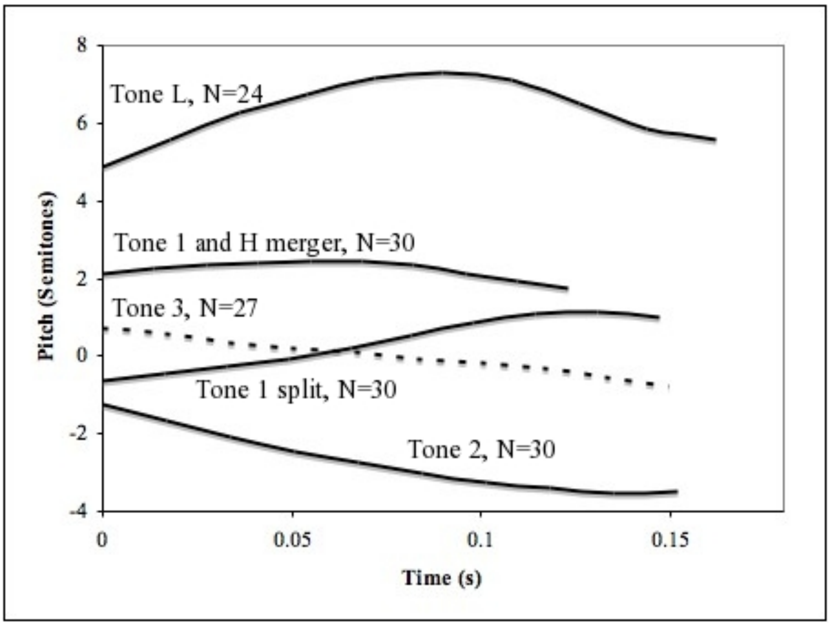
Table 5-16 gives examples of *L in CW-QY and W Lalo varieties. W Lalo varieties all show a high pitch reflex for *L, although the phonetic values for *L vary by variety: high-falling in W-YL, high-rising in W-DT, and high rising-falling in W-SLZ and W-SZP. This regional variation in the phonetic value of *L is further discussed below.

Table 5-16: Examples of *L in C and W Lalo

Gloss	PLa	CW-QY	W-YL	W-DT	W-SLZ	W-SZP
hand	*le̠^{L}	lɛ̠^{21}	lɛ^{53}	le^{45}	le^{453}	le^{453}
brains	*ʔnu̠^{L}	ʔnə̠^{21}	no^{53}	nu^{45}	nu^{453}	nu^{453}
to descend	*ze̠^{L}	zɛ̠^{21}	zɛ^{53}	ze^{45}	ze^{453}	ze^{453}
to swell	*pʰy̠^{L}	pʰy̠^{21}	pʰy^{53}	pʰy^{45}	pʰi^{453}	pʰy^{453}

Figure 5-12, Figure 5-13 and Figure 5-14 below show the tonal inventories of W varieties W-SZP, W-YL and W-DT, respectively. In W-SZP Lalo, seen in Figure 5-12, *L is now the highest pitch in the tone system, with a rise to the midpoint of the syllable followed by a fall. All *H syllables and Tone *1 syllables with *preglottalised initials have merged to a mid-high reflex, a level pitch located roughly equidistantly between the pitch onset of *L and the mid level pitch of *3. Tone *1 with initials other than *preglottalised initials are reflected by the low-rising pitch (marked Tone 1 split), beginning in the lower register and rising to above mid by the end of the syllable.

Figure 5-12: W-SZP tonal inventory. Normalised for mean Tone 3 pitch; Tone 3 marked with dotted line. N=141.



W-YL and W-DT's tonal inventories match W-SZP except for the phonetic value of *L. In W-YL (Figure 5-13), *L is reflected as a high pitch with a slight fall, and in W-DT (Figure 5-14) as a high-rising pitch. W-YL's tonal system also differs from Core W Lalo in that its Tone *1 split follows the conditioning of Eastern Lalo, with *+voi conditioning the low-rising pitch.

Figure 5-13: W-YL tonal inventory. Normalised for mean Tone 3 pitch; Tone 3 marked with dotted line. N=148.

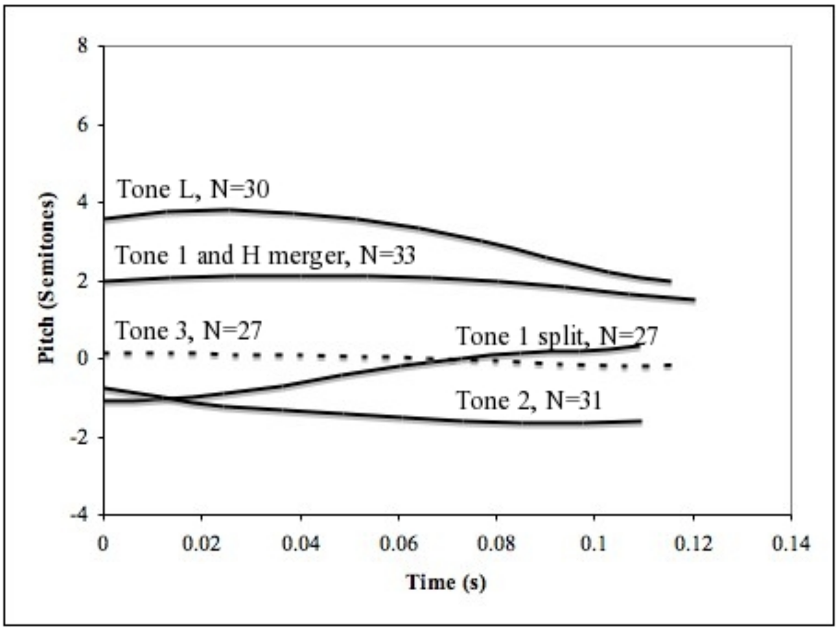
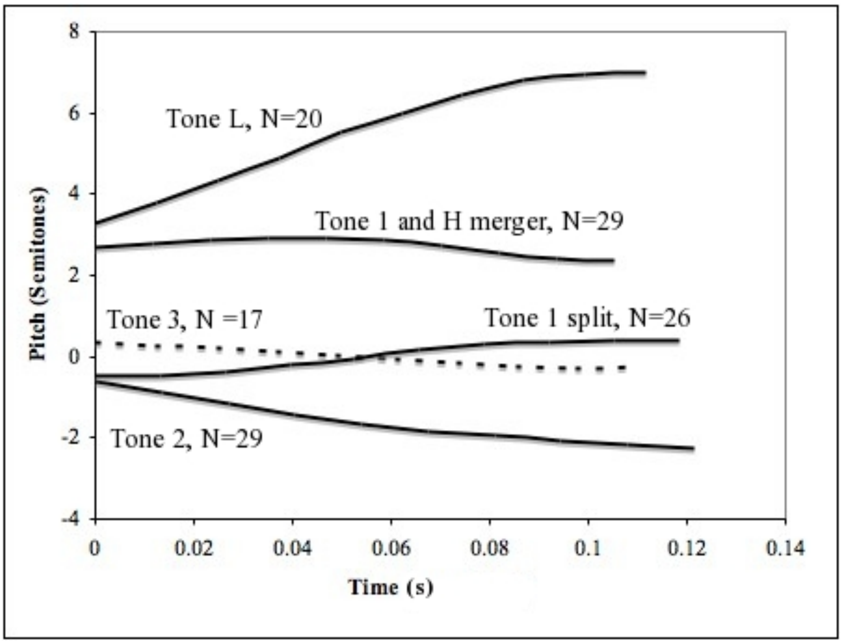


Figure 5-14: W-DT tonal inventory. Normalised for mean Tone 3 pitch; Tone 3 marked with dotted line. N=121.

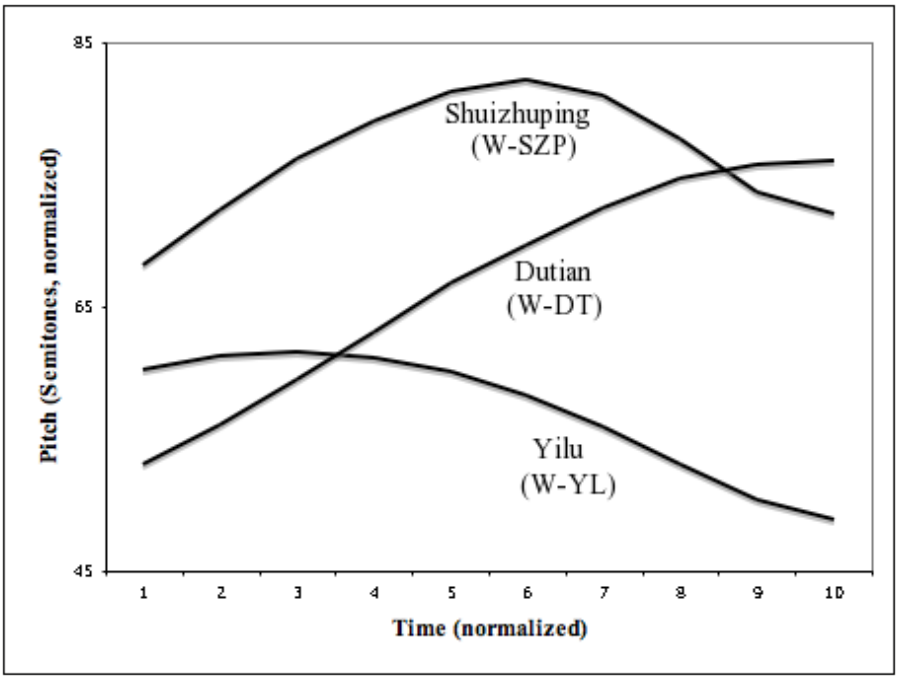


All W Lalo varieties show *L as the highest pitch in the tonal inventory, but the contour shape varies across W Lalo varieties. The development of *L is variably realised as a high falling pitch, a high rising-falling pitch, or a high rising pitch. Figure 5-15 shows the synchronic reflexes for *L in three Western Lalo varieties: W-YL, W-SZP, and W-DT. W-SLZ, a fourth W variety, shows essentially the same rising-falling contour as W-SZP and so is not included. To compare across speakers, pitch in semitones is normalised according to the maximum and minimum F0 (F0max and F0min), instead of being normalised to the Tone 3 mean, using the following formula:

F0normalised=100*(St-F0min)/(F0max-F0min), where St refers to the value of the pitch in semitones.

All W Lalo varieties are closely related, and all share the change in which *L > high. In Proto W, I therefore reconstruct *L's Tone feature as high without specifying a contour. The varying contour shapes may have arisen from the physiological factors involved in producing a high pitch target. Xu and Wang (2001) find that physiologically, rises in pitch take a longer amount of time than a fall. The time lag for rising pitch sometimes results in peak delay, in which a rising pitch's peak actually occurs on the following syllable. Building on these findings, Pittayaporn (2007b), in his tone change model, states that pitch peaks are more likely to slide to the right than to the left. A high falling tone is more likely to become a convex contour than the other way around. A convex contour could then in turn become a rising contour. Peak sliding leads to a possible phonetic explanation for the dialectal variation in *L's contour shapes. *L > high across all W Lalo varieties, and the pitch peak has remained at the pitch onset in W-YL. In W-SZP and W-SLZ, the pitch peak has slid to the middle of the tone span, resulting in a convex pitch contour. In W-DT, the peak has slid all the way to the right, resulting in a high rising pitch contour. Although the geographic variation in pitch contour does not prove peak sliding has occurred, the mechanism of peak sliding is a reasonable phonetic explanation for the variation seen in closely related varieties.

Figure 5-15: Variation in *L in W Lalo varieties. Pitch (in semitones) normalised across speakers according to maximum and minimum F0.



5.3.4 Tone change in SE Lalo

SE Lalo varieties, represented by SE-GP, show a distinct tonal innovation chain in which *2 and *L split to high based on voicing of the initial, *1 is lowered to a mid-high level pitch (possibly pushed down), and *3 and *H merge to mid level pitch. In SE Lalo, Tone *2 syllables with Proto Lalo voiceless unaspirated stops, preglottalised initials, and *ʃ- became high pitch in, and Tone *L syllables with Proto Lalo voiceless initials became high pitch. The conditioning of the *2/*L tone splits are similar to those seen in Lisu and Lolo: the Proto Ngwi *ʔ/*s- prefix, which conditioned the development of Central Ngwi languages' voiceless unaspirated stops, also conditioned a split to high in *2 and *L in Lisu and Lolo (Bradley 2004). However, SE-GP does not share other Lisu/Lolo tone changes, such as the complete (Lolo) or partial (Lisu) merger of *1 and *3 to mid level pitch. Instead, SE-GP's *3 and *H show a partial merger to mid level pitch; Tone *H syllables with PLa preglottalised sonorants merge with *1. Table 5-17 gives examples of the reflexes of Proto Lalo tone categories in CW-QY and SE Lalo varieties, in various conditioning environments.

Table 5-17: Examples of tonal reflexes in C and SE Lalo

Tone	Gloss	PLa	CW-QY	SE-GP	SE-Ziyou	SE-Runze
*1	drink	*daŋ^{1}	du^{55}	da^{44}	da^{44}	da^{44}
2/[-voi,+sg]_	comb	*pɨ^{2}	pʉ^{21}	pɨ^{55}	pɨ^{55}	pɨ^{55}
*2/*ʃ_	seed	*ʃɨ^{2}	ʂʅ^{21}	sɿ^{55}	sɿ^{55}	sɿ^{55}
*2/*ʔ_	tail	*ʔmɛ^{2}	ʔmɛ̤^{21}	mɛ^{55}	mɛ^{55}	mɛ^{55}
L/[-voi]_	to bite	*kʰo̱^{L}	kʰo̱^{21}	kʰɨ^{55}	kʰo^{55}	kʰo^{55}
*L/elsewhere	sew	*gu̱^{L}	gə̱^{21}	gɨ̱^{21}	gɨ̱^{21}	gɨ̱^{21}
*2/elsewhere	far	*vi^{2}	ji^{21}	vi^{21}	vi^{21}	vi^{21}
*3	dry	* fɛ^{3}	fɛ^{33}	fɛ^{33}	fɛ^{33}	fɛ^{33}
*H/elsewhere	sharp	*tʰe̱^{H}	tʰiɛ̱^{33}	tʰi^{33}	tʰi^{33}	tʰi^{33}
*H/*ʔ[+sonorant]_	blow	*ʔmy̱^{H}	ʔmʉ̱^{33}	mɨ^{44}	mə^{44}	mə^{44}

Figure 5-16 and Figure 5-17 show the tonal inventories for SE-GP in citation form and embedded in a carrier phrase. As with other Lalo varieties, the pitch onset for Tone *L with harsh voice begins at a higher pitch than Tone *2. The *L/*2 split to high pitch has a slightly concave shape, which may be perceptually salient to speakers, but a perception experiment is needed to confirm that hypothesis. SE-GP's *L/*2 split shares some commonality with non-Lalo Central Ngwi languages like Lisu and Lolo, which underlines the tendency for voiceless or preglottalised initials to condition a higher pitch in these languages.

Figure 5-16: SE-GP tonal inventory (speaker GP1). Citation form. Normalised for mean Tone 3/H pitch; Tone 3/H marked with dotted line. N=132.

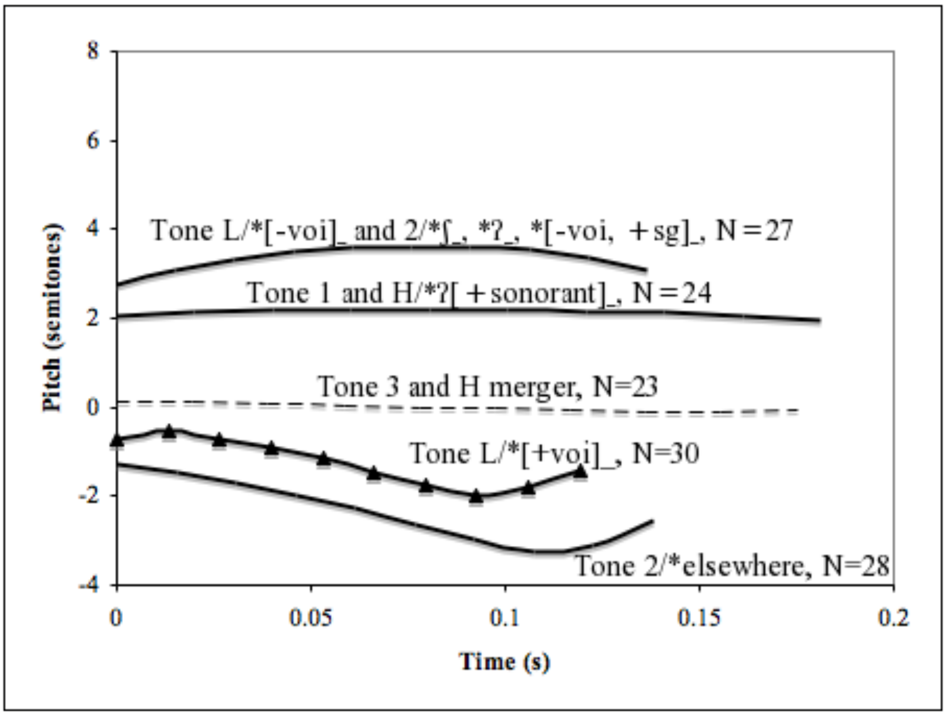
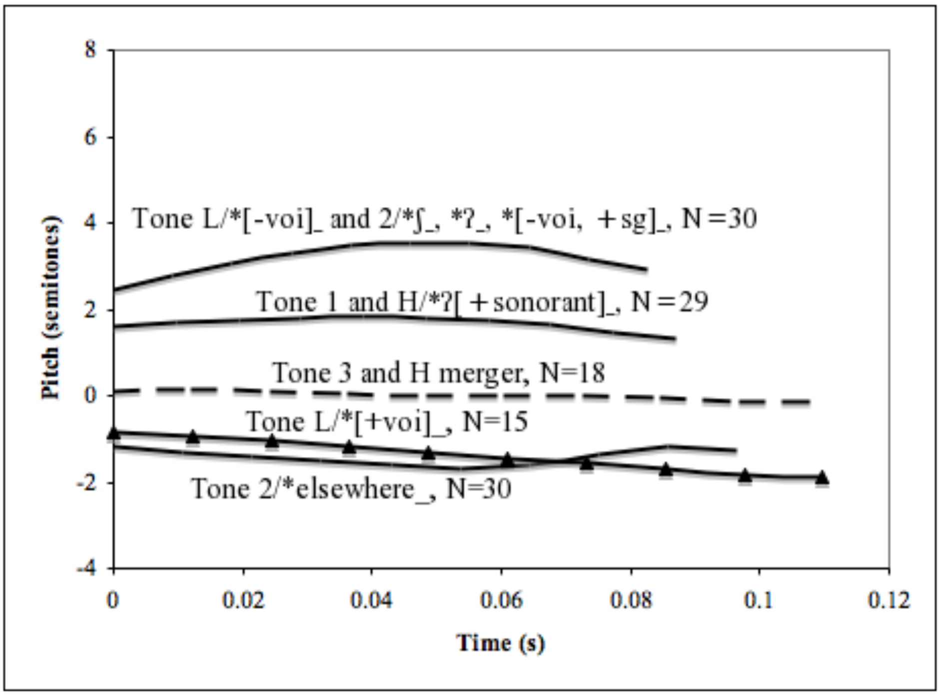


Figure 5-17: SE-GP tonal inventory (speaker GP1). Normalised for mean Tone 3/H pitch; Tone 3/H marked with dotted line. N=122.



5.3.5 Tone change in XZ, YL and Eka

The tonal developments of XZ, YL and Eka are summarised in Table 5-10 in §5.3. Each variety's distinctive developments, along with their acoustic tonal analysis, are described in this section. Table 5-18 below gives examples of Tone *1 in XZ, YL and Eka. Tone *1 development in these varieties, as in W and E Lalo, was influenced by Proto Lalo's subphonemic allotonic variation, as noted in §5.3.1. XZ shows the Eastern-type Tone *1 split, YL shows a slight variation of that split, and Eka shows the spread of the low-rising pitch through almost all environments in Tone *1.

Table 5-18: Examples of XZ, YL, and Eka's developments in Tone *1

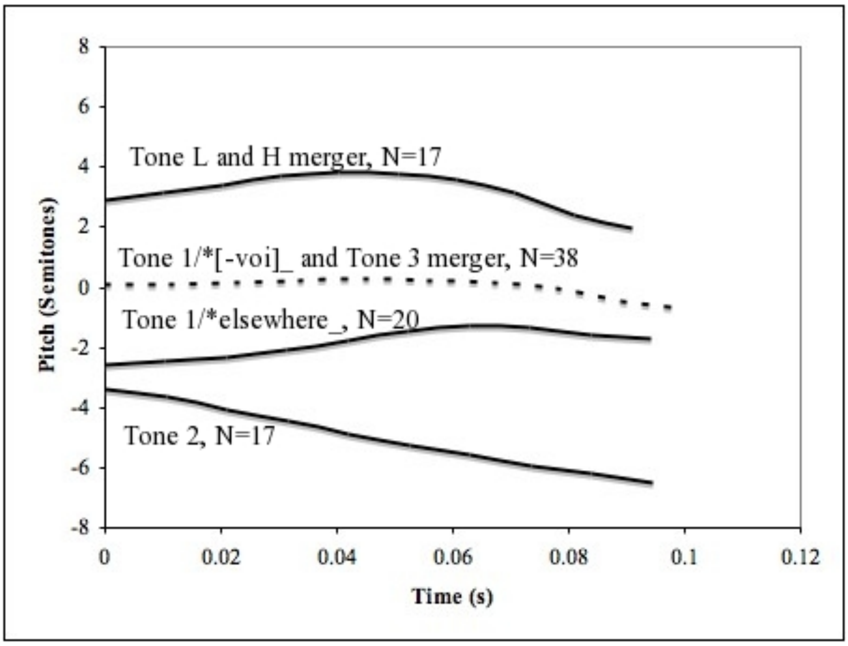
Gloss	PLa	XZ	YL-old	YL- young	Eka
light (adj.)	*laŋ^{1}	la^{24}	lu^{24}	lu^{33}	la^{24}
sick	*na^{1}	no^{24}	na^{24}	na^{33}	no^{24}
bamboo	*ma^{1}	mo^{24}	ma^{24}	ma^{33}	/
to winnow	*ʔva^{1}	o^{55}	waŋ^{24}	waŋ^{33}	o^{24}
tongue	*ʔla^{1}	lo^{55}	la^{24}	la^{33}	lo^{24}
iron	*xy^{1}	xɣ^{55}	xɯ^{33}	xɯ^{33}	xə^{24}
star	*kɛ^{1}	kɛ^{55}	kɛ^{33}	kɛ^{33}	ki^{24}

YL, a peripheral variety found in Baoshan, the far western corner of Lalo distribution, shows a variation of the Tone *1 split not seen anywhere else. The split is now only seen in older speakers. Figure 5-18 below shows the tonal inventory for YL-older. Speaker YL2 (over 50 years old) shows a Tone *1 split in which syllables with *voiceless initials merge with *3 to mid, while syllables with all other initials, including PLa *preglottalised sonorants, show low-rising pitch.

The fact that the low-rising pitch is seen in syllables with PLa *preglottalised initials suggests that this split occurred after the loss of *preglottalisation, which is why *preglottalisation had no effect on the development of the pitch. This relative ordering of changes is in contrast to all other Lalo varieties, in which *preglottalised initials must have been present at the time of the Tone *1 split to affect the development of the pitch. In YL, preglottalised initials before close vowels were often dropped, with compensatory nasalisation on the vowel, as described in §4.2.4. The YL Tone *1 split to low-rising includes the syllables with PLa preglottalised nasals before close vowels, which now have no initial in modern YL. As a result, the low-rising pitch is now seen on syllables with voiced initials and with no initial.

The low-rising tone is contrastive with all other tones, even though no syllable with a voiceless initial occurs with this tone. In syllables with voiced initials or no initial, the low-rising tone contrasts with Tone *3 reflexes, e.g., the Proto Lalo minimal pair *ma^1 'bamboo' and *ma^3 'female suffix' are reflected as [ma^{24}] /ma^{1b}/ and [ma^{33}] /ma^3/, respectively.

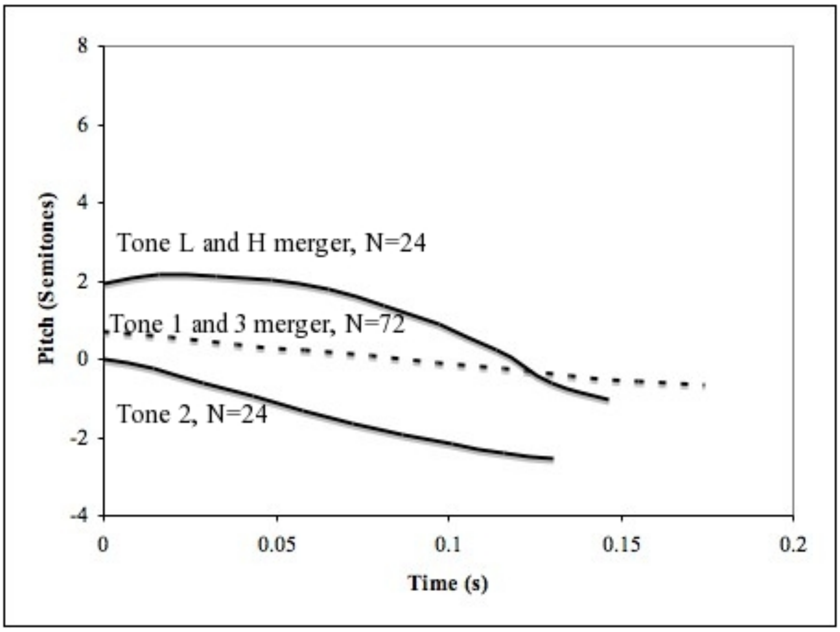
Figure 5-18: YL-older tonal inventory. Normalised for the mean Tone 1 and 3 merger pitch; Tone 1 and 3 merger marked with dotted line. N=92.



In contrast with YL-older, Speaker YL1 (18 years old) has merged tonal reflexes for voiced and voiceless initials to a mid level [33] pitch. This generational difference suggests that the YL variety of younger speakers has undergone a merger of the Tone *1 split with the already merged Tone *1/[-voi] and Tone *3 category. The tonal inventory of YL-young can be seen in Figure 5-19 below. Only citation forms are available for the Speaker YL1, but citation forms presumably do not radically alter the tonal inventory. The mergers of *1 with *3, and *H with *L, result in the fewest tonal contrasts of any Lalo variety.

Both older and younger speakers of YL share the merger of *H and *L to the highest pitch in the system, as can be seen in their respective tonal inventories. Harsh phonation's effect on pitch is seen in YL through the raising of the pitch heights of both *H and *L. YL is the only Lalo variety to raise both *H and *L to the highest tone. Harsh phonation's effect of raising the perceived pitch is a theme running through many Lalo varieties' tonal development. The theme remains constant, but variation is seen in each variety's development, with a resulting diversity of tonal systems.

Figure 5-19: YL-young tonal inventory (speaker YL1). Citation form. Normalised for mean Tone 1 and 3 merger pitch; Tone 1 and 3 merger marked with dotted line. N=120.



XZ's tonal inventory is seen in Figure 5-20 below. XZ shows the Eastern-type Tone *1 split, with *voiced initials conditioning a low-rising tone, and *voiceless and *preglottalised initials a high level tone. XZ most likely followed the same development path for the Tone *1 split as that described for CE-YA in §5.3.1, with subphonemic allotones becoming contrastive tones after the merger of *preglottalised and *plain initials. Unlike other Lalo varieties, however, XZ has undergone a three-way merger of *3, *H and *L to the mid level pitch. Bradley (1977) identifies changes of high or low pitches to mid level as a least-effort type of change. Also, harsh phonation's effect can be seen in the raising of *L to mid. The Tone *1 split and merger of *3, *H and *L leaves XZ with three equally spaced level tones and one rising tone.

Figure 5-21 below gives Eka's tonal inventory, based on the citation form. The utterance medial form shows almost complete neutralisation of the contrast between harsh and modal phonation, a contrast that is present in citation form. Eka, a peripheral group that emigrated from the Lalo homeland in Weishan/Nanjian several hundred years ago, has one of the most complex tonal systems of all Lalo varieties investigated. Besides maintaining the distinction between harsh and modal, Eka has added an additional contrastive high tone, the result of splits from *1, *2, *H and *L.

The conditioning of these splits to high is usually triggered by the *ʔ- or *s- prefix, a typical conditioning environment for Central Ngwi languages. For example, in *L tone syllables preceded by the causative *s-prefix, Eka reflexes show the split, e.g., [vi̠^{53}] 'to dress (transitive)' from Proto Ngwi *səwat^{L}. In *H and *2 in a few lexical items, the *ʔ- or *s- prefix has a similar effect, e.g., Proto Ngwi *ʔəʃik^{H} 'day after tomorrow' > [sɿ^{55}], and *ʃ-boŋ^{2} 'leg' > [bɨ^{55}]. No other Lalo varieties show these tone splits.

Almost all reflexes of Tone *1 are low-rising pitch in Eka, including most syllables with voiceless initials. Only in a few lexical items, all beginning with voiceless aspirated stops or voiceless fricatives, is the high level pitch retained, e.g. PLa *po^{1} 'rooster' > [p^{h}ɨ^{55}], *k^{h}i^{1} 'leg'> [k^{h}i^{55}] and *sa^{1}la^{2} 'cotton' > [so^{55}lo^{21}]. The subphonemic rising allotone of Proto Lalo has been generalised to include almost the entire Tone *1 category.

Figure 5-20: XZ tonal inventory (speaker XZ1). Normalised for mean Tone 3, H, and L merger pitch; Tone 3, H, L merger marked with dotted line. N=149.

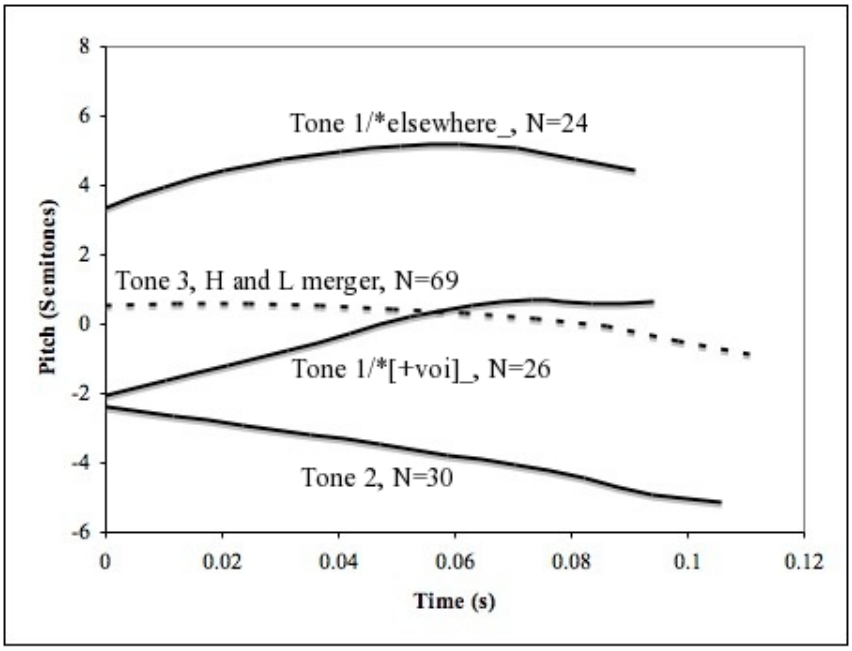
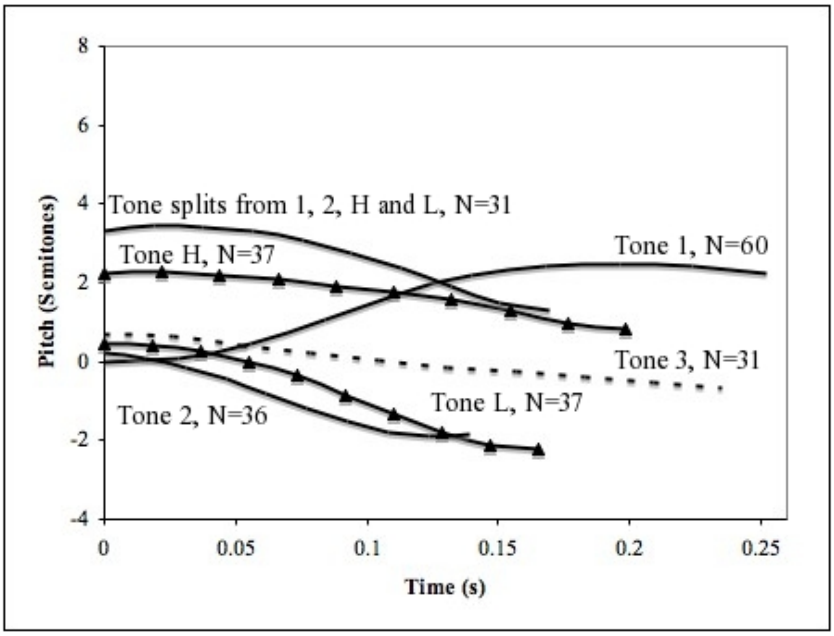


Figure 5-21: Eka tonal inventory. Citation form. Normalised for mean Tone 3 pitch; Tone 3 marked with dotted line, Tone L and H marked with triangles. N=232.



5.4 Discussion

Sections 5.4 and 5.5 conclude the chapter with a discussion and summary of the phonetic motivations of the tone changes seen in Lalo varieties, and the implications these changes have for our understanding of tone change. Special emphasis is given to the changes seen in E and W Lalo, which demonstrate slightly more complex tone changes than other Lalo varieties.

5.4.1 Tone *1 split

The various Tone *1 splits seen in many Lalo varieties are variations on the voiced-low principle so prevalent in tonogenesis. Classic models of tonogenesis (Haudricourt 1954, Matisoff 1973) predict that voiced prevocalic consonants will condition low pitch, and voiceless will condition high pitch, because the lowered larynx and relaxed cricothyroid muscles of voiced obstruents depress F0, while the engaged cricothyroid muscles of voiceless obstruents raise F0 (Löfqvist et al. 1989, Honda 2004).

Differences in pitch after voiced and voiceless obstruents are still significant after 100 milliseconds, well into the pronunciation of the vowel, though not through the whole duration of the syllable (Hombert et al. 1979). Prevocalic segments thus have a microprosodic effect on the pitch, affecting pitch at the vowel onset but not over the entire syllable. In E Lalo's tone change, prevocalic segments' microprosodic effects directly influence the development of contour tones. As seen in Eastern Lalo's Tone *1 split, voiced prevocalic consonants depressed only the pitch onset, not the pitch over the entire syllable. The result is a new rising contour tone. According to Pittayaporn's (2007) tone change model, prevocalic segments' local effects are more likely to affect only the pitch onset, not the pitch over the entire syllable. For example, in Thai, aspirated obstruents conditioned a low-rising tone; this, like the Eastern Lalo Tone *1 split, is a case where prevocalic segments only affected the tonal onset, not the entire syllable.

Insight into the probable path of tonal change may be gained by comparing CW-QY's tonal system, which is the most conservative, to the more innovative Eastern tonal system. The subphonemic variation seen in CW-QY today, as shown in Figure 5-4, was probably found in Proto Eastern Lalo. Because the original pitch target of Tone *1 was /H, h/, voiced segments' lowering of the pitch onset caused the pitch to take on a rising contour, creating a rising allotone. In E Lalo, the rising allotone became contrastive after the loss of *preglottalisation, and the difference between the new rising tone and all other tones became enhanced. The new rising tone was perceived as a contour tone, contrastive not only in pitch height, but also in pitch contour. Pittayaporn (2007b) predicts that, in order to maintain perceptual maximisation, F0 excursion (i.e., the difference between maximum and minimum F0) increases to maintain the contrast. E Lalo's tone change fits this prediction: the pitch onset has fallen from the High register to the Low register, and the F0 excursion is greater in E Lalo than in C Lalo's rising allotone.

E Lalo has shifted from the Proto Lalo system of level pitches and harsh versus non-harsh phonation to a system containing both level and contour pitches, all in modal phonation. Phonologically, the low-rising tone (/L, lh/) contrasts with Tone *2's low tone (/L, l/), and Tone *L's mid-falling /L, hl/. Although low-rising shares the lower register with the low tone and mid-falling tone, all are phonemically contrastive. Low-rising is not simply filling in the low register slot in the system. The salient cue that distinguishes the new tone is its rising contour. This is in contrast to Central Lalo, in which the tones can be phonologically represented as level tones.

In W Lalo's Tone *1 split, preglottalisation blocked the spread of low-rising; syllables with *preglottalised initials maintained the original high, level pitch, while all other syllables took a low-rising pitch. Syllables with *preglottalised initials began with glottal closure. To produce a glottal stop, vocal folds adduct through movement of the arytenoid cartilages and through increased tension in the cricothyroid muscles, the same muscles that control pitch. The increased tension in the vocal folds increases both voice onset time and pitch, thereby decreasing the likelihood of a lowered pitch onset. As discussed in 5.4.2 below, glottal constriction is also the underlying phonetic motivation for the raising of pitch seen in *L and *H tone changes.

5.4.2 Interaction between harsh phonation and pitch in *L and *H tone changes

W, YL, and XZ tone changes in *L and *H show the influence of harsh phonation on pitch. Glottal constriction in the form of harsh phonation conditioned the raising of pitch height, just as *preglottalisation blocked the spread of a low-rising tone. As seen in the tonal inventories of W varieties, *L has become the highest tone in the system, while *H has merged with *1 as mid-high. As described in §5.2, Proto Ngwi's syllable-final *stops merged to a post-vocalic glottal stop, which by the Proto Lalo stage had conditioned harsh phonation on the vowel. Harsh phonation then conditioned raising of the pitch height, resulting in *L (L, harsh) > /H, h/ and *H (H, harsh) merging with the remnants of Tone *1 to mid-high (/H, l/).

As in §5.4.1, comparison of CW-QY's acoustic tonal analysis to W Lalo varieties' tonal systems yields insight into the probable phonetic basis of the W Lalo tone changes. In the acoustic analysis of CW-QY (Figure 5-4), the pitch heights of both *L and *H are higher than their modal phonation counterparts in *2 and *3, probably a result of the increased tension in the vocal folds that occurs in the articulation of harsh phonation. I suggest that these subphonemically higher pitches existed in Proto Lalo as well. This hypothesis fits both the synchronic evidence and provides maximally simple development paths for the tone changes seen in all Lalo varieties that have lost distinctive harsh phonation. In W Lalo, as harsh phonation was lost, the subphonemic higher pitches became contrastive, resulting in *L's leap to the higher register and *H's merger with the remaining high pitch syllables of Tone *1. XZ and YL also show harsh phonation interacting with the perception of pitch, as in YL's merger of *H and *L to the highest tone in the system, and XZ's raising of *L to merge with *H and *3 to mid level.

5.5 Summary

New data from Lalo varieties show interesting interactions between laryngeal gestures and pitch, leading to several different tonal development paths and a striking diversity of tonal inventories. E Lalo's Tone *1 split, also seen in CE-YA, W-YL and XZ, shows voiced prevocalic segments' microprosodic lowering of the pitch onset resulting in the introduction of a rising contour tone into a system that previously only had level pitches. W Lalo's Tone *1 split shows *preglottalisation as a key conditioning factor in maintaining Tone *1's original high level pitch, while all other Tone *1 syllables become low-rising. YL's Tone *1 split probably occurred after the loss of *preglottalised initials, and shows the rising tone in all syllables except for those with voiceless initials.

The correlation between glottal constriction and pitch height is seen again in Lalo varieties' changes in *L and *H. Harsh phonation consistently conditions raising of the pitch. This research is one of the first to link this effect to the physiology of the production of harsh phonation, only recently understood through laryngoscopic studies (Edmondson & Esling 2006). As harsh phonation is lost, pitch height and contour may shoulder the burden of maintaining tonal contrasts, unless the contrast is simply lost, as in E Lalo's *3.*H merger. The resulting mergers or phonetic tone changes vary according to variety.

W varieties show an intriguing dialect variation in the phonetic value of *L, with some varieties showing high falling, others high rising, and still others high rising falling, as described in §5.3.3. Peak sliding (from Pittayaporn (2007b)) is offered as a phonetically based, diachronic explanation for the synchronic, dialectal variation in the realisation of *L's contour shape in W varieties.

6 *Diachronic subgrouping of Lalo varieties*

6.1 Introduction

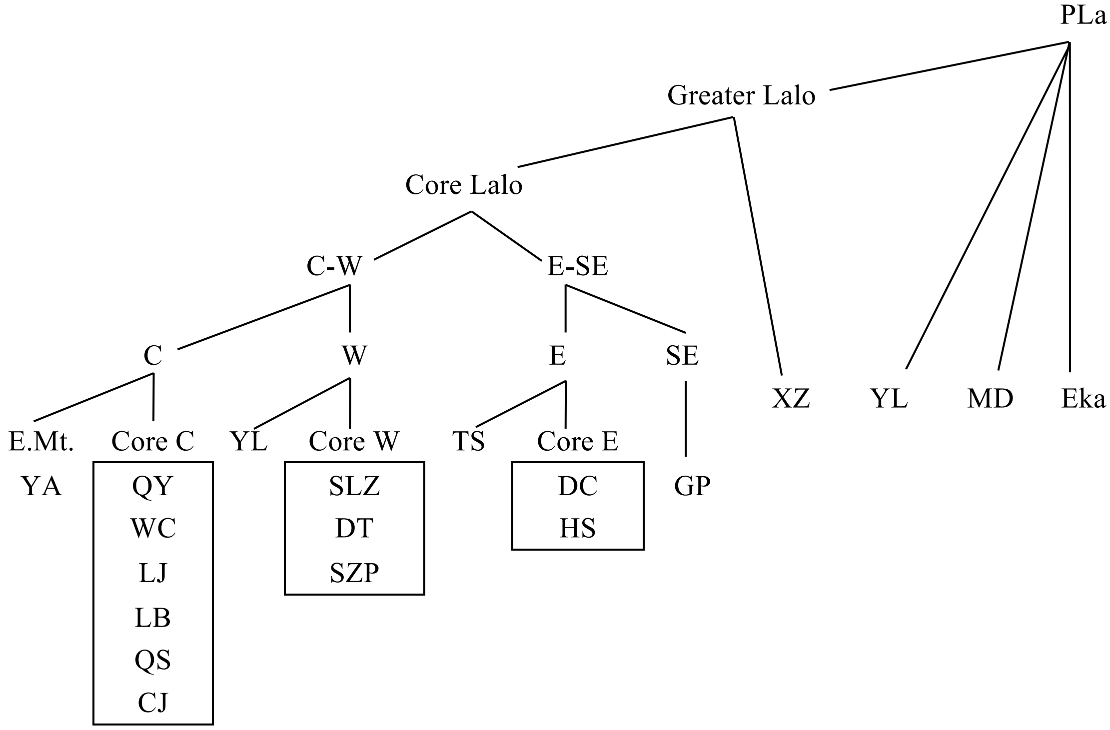
This chapter presents Lalo diachronic subgroups and the evidence in support of the proposed subgrouping. I first review previous subgrouping attempts and explain why they are inadequate. I then summarise the subgrouping criteria used and the definitive innovations used as evidence for the subgrouping. The rest of the chapter details the specific innovations that define Lalo subgroups and the contact relationships between certain Lalo varieties that have influenced their development. Parts of this chapter appear in Yang (2009b).

Previously, there have been no rigorous attempts at subgrouping Lalo dialects, as very few Lalo varieties had even been documented (see §1.2). Chen et al. (1985), based on linguistic survey data from the 1950's, describes Lalo as having two dialects, East Mountain and West Mountain, divided by the valley that divides Weishan into eastern and western halves (see Figure 1-5). Until now, this taxonomy was accepted as an adequate picture of Lalo dialect diversity as a whole. Later large scale surveys of Yi languages (Wang 2003, Zhu 2005) echo Chen et al. in applying the East-West dichotomy to Lalo as a whole. 'East Mountain' served as a category for any variety that was not West Mountain, including groups ranging from Midu in the east to as far west as Baoshan (Jin 1983).

However, the labels East and West Mountain only have relevance within Weishan County. Lalo speakers within Weishan recognise these two groups and use the labels to distinguish themselves, using terms such as 'Dongshan-pa' and 'Xishan-pa'. 'Donghan' (East Mountain) and 'Xishan' (West Mountain) are Chinese geographic terms, and -pa is the Lalo male suffix that serves as a generic person marker. Even in neighboring Dali Municipality, these labels are not recognised, for two reasons. First, the geographic motivation behind the labels has already ceased to be relevant, as the Weishan valley does not extend as far north as Dali Municipality. More significantly, Lalo speakers in Dali Municipality belong to the distinct E Lalo subgroup, and are highly aware of the differences between themselves and their Central neighbors. E-HS speakers use the loconym [ɕi^{33}mi^{33}kɛ^{33}pa̠^{21}], referring to Dali, not Weishan, and call all Lalo from Weishan 'Misha-pa,' regardless of whether they are East or West Mountain. The East Mountain label, as used by previous researchers, conflated the true East Mountain in northeast Weishan and the Eastern Lalo spoken in Dali Municipality. The incorrect perception that Lalo in that area were identical was probably due to their geographic proximity and similar ethnic costume, and the lack of linguistic and sociolinguistic data. Thus, Lalo speakers' inside perspectives on dialect differences and the academic representation of Lalo dialects have been widely disparate until now.

This chapter demonstrates that both East and West Mountain Lalo belong to the Central Lalo subgroup, which in turn is only one of several Lalo subgroups. The proposed Lalo phylogenetic tree is seen in Figure 6-1 below. As there are additional Lalo varieties that have not yet been documented, the subgrouping presented here remains open to expansion and revision. The reconstruction of Proto Lalo in Chapter 4 forms the foundation upon which the proposed subgrouping is formulated. Reconstructing Proto Lalo is a necessary step to subgrouping Lalo varieties, as only after the proto-language has been established does it become clear which shared features are the result of retention or innovation after the Proto Lalo stage.

Figure 6-1: Lalo phylogenetic tree



Eka, MD, and YL descend directly from Proto Lalo and do not share in any of the innovations that define Greater Lalo or subsequent subgroups. Ancestors of the Eka emigrated out of the Lalo homeland area in Dali around the beginning of the Qing dynasty (~1644), according to their oral history and the *Gazetteer of Shuangjiang County* (Zhao 1995). Ancestors of MD speakers took part in a later migration out of the Weishan/Nanjian area, probably around 200 years ago (GMXZ 1995). It is unknown when the ancestors of YL emigrated out of the southern Dali area. Core Lalo varieties plus XZ share an intermediate phase I refer to as Greater Lalo. Core Lalo, which excludes XZ, includes the four dialect clusters C, W, E and SE. C and W form the C-W subgroup, while E and SE form the E-SE subgroup. Within C, W, and E, there is a distinction between central (Core E, Core W, Core C) and peripheral varieties. Core Lalo varieties are all located in or originate from southern Dali Prefecture, the probable area of origin for all Lalo, an area with the earliest historical accounts of a Lalo presence, the highest concentration of Lalo population, and the greatest linguistic diversity. Within Core Lalo, Central Lalo is the most populous group and the one most closely linked historically to the Meng clan of the Nanzhao Kingdom (see §1.3.4).

Subgrouping criteria are phonological, lexical, and morphological innovations that satisfy the standards set out in §1.4.4) linguistic complexity of the innovation, 2) ecological distinctiveness of the innovation, and 3) sociohistorical plausibility (Toulmin 2009). Single sound changes are not considered strong enough evidence for subgrouping, since most types of individual sound changes can diffuse through contact. Rather, a set or cluster of innovations is required as evidence of shared history. Table 6-1 below summarises the innovations that define Lalo subgroups. Relative chronology of changes is marked with ordinal numbers.

Table 6-1: Innovations that define Lalo subgroups

Groups	Innovations
PLa	PN *2 > *L/*ʔ-+obstruent+*a_ 1) PN *o, *u > o/b_ 2) PN *o > wɨ/labial stops_
Eka	a) *1 > low-rising/elsewhere b) Splits in *1, *2, *H, *L to high level [55] under various conditions
YL	a) *1 > mid/*[-voi]_, low-rising/elsewhere b) *L, *H > high (loss of harsh phonation)
MD	a) *y̱ > ɑ̱ b) *o > ɨ/[+back]_ c) *e, *ɛ > ɛ
Greater Lalo: Core plus XZ	a) ‘crow’ (n) *a^{3}nak^{H} (‘the black one’)> *a^{1}ŋja̱^{H}bɛ̱^{H} (‘bird’+bɛ̱^{H}) b) ‘taro’ *a^{1}tʃʰo̱^{H}
XZ	*H, *L, *3 > mid (loss of harsh phonation)
Core Lalo: C-W-E-SE	*-tsa^{33} plural marker in personal pronoun paradigm
E-SE	a) *y > ɨ/[+round, -high]_ b) *o> ɨ//[-back] and [+back,+nasal]_
SE	a) *2/*ʃ, *ʔ_, *[-voi, +sg]__ > high b) *L/*[-voi]__ > high
Core E: E-HS & E-DC	*y, *o > ɨ/elsewhere
E-TS	a) *y, *o > u/[+back, -son]_
C-W	a) *g > ɣ/_*a, *aŋ, *o̱ b) ‘young’ > ‘soft years’
C	a) *e > i b) *e̱ > i̱/[+high, -back]_ c) *ɛ̱ > a̱/[+back]_ d) *a > ɛ/ *C$_{[+anterior, +strident]}$_$CV$_{[-back]}$
East Mountain (CE-YA)	a) *f, *v > [+high, +back]/_[+high,+back]
Core C	a) *ɛ̱ > a̱/elsewhere
W	a) *L > high b) *1/+ʔ_ > mid-high c) *H > mid-high
Core W (excludes W-YL)	a) *1 > low-rising/elsewhere b) metathesis of initials in ‘grasshopper’ c) shared tone sandhi patterns: high > mid-high/_high

6.2 Membership in Lalo

All Lalo varieties share certain sound changes: a conditioned split in PN Tone *2, the merger of PN *o and *u after *b to *o, and the subsequent unpacking of *o to *wɤ and then fronting to *wɨ after all labial stops. There is evidence of these changes in all Lalo varieties, but not in any other Ngwi language. Examples are given in Table 6-2. In PLa’s Tone *2 split, described in §5.2.2, preglottalised obstruents with rhyme *-a conditioned Tone *2 syllables to shift to the *L tone category. The Lalo Tone *2 split, because of its complex conditioning environment and its exclusive occurrence in Lalo varieties, provides critical evidence for membership as a Lalo language. The shared changes in *o and *u, and the shared relative chronology of those changes, are also diagnostic of Lalo membership.

By the PLa stage, PN *u had merged with *o after *b, but not after *p or *pʰ, as discussed in §4.3.2.2. The evidence for this conditioned merger is seen in two examples, '(for an animal) to crow, to call' and 'owe,' both given in Table 6-2. 'To crow' PB *mbu^{1} shows similar reflexes as 'to carry' PN *bo^{2}, making the merger unambiguous. While there is not yet a PB reconstruction of 'to owe', it is probably either *mbu^{3} or *bu^{3}, given its reflex in Lisu as [bu^{33}] and in Sonaga as [bʏ̩^{33}]; both Lisu and Sonaga show [bo] as the reflex of PN *bo. In PLa, there is no contrastive *bu, whereas PLa *pu and *po show distinct developments, as do *pʰu and *pʰo. The conditioned *u and *o merger must be ordered before the *bo > *bwɨ change also seen in PLa, as the first change feeds into the second.

After PN *u and *o partially merged, PN *o > *wɤ after all labial stops, a type of phonetic unpacking, and then *wɤ > PLa *wɨ. The features of the *o were first unpacked into two sounds, one with [+round] and the other with [-high, +back]. The second sound then moved frontward to *ɨ, where it remained in most Lalo varieties. In some varieties (C, MD, YL), the *ɨ later moved forward to [i]. *bwɨ was not contrastive with *bo, but was rather the phonetic realization of *bo at the PLa stage. In C-W, XZ and E-TS, the labiovelar glide became a labiodental fricative, e.g., *bwɨ > *bvɨ. The resulting affricates *bv, *pf, and *pʰf later became alveolar affricates in W, and either palatoalveolar affricates or labiodental fricatives in C, developments that are described in more detail in §6.6.3. MD, YL, E-DC, E-HS, and SE-GP dropped the labiovelar glide. *bwɨ remained distinct from *bɨ in all varieties except Eka, E-DC, E-HS and SE-GP, as can be seen by contrasting 'to carry' PLa *bwɨ^{2}, with 'dare,' PLa *pɨ^{2}. Table 6-2 gives examples; the development of *o in other environments is discussed in §4.3.2.4.

Table 6-2: PLa innovations

Gloss	PN/ PB	PLa	Eka	MD	YL	E-DC	E-HS	SE-GP	XZ	W-SLZ	CW QY
male suffix	ʔ-pa^{2}	pa̱^{L}	po̱^{21}	pɑ̱^{21}	pa^{53}	pu^{42}	pɔ̱^{21}	po^{55}	po^{33}	pa^{53}	pa̱^{21}
sad	ʔ-ra^{2}	ʃa̱^{L}	so̱^{21}	sɑ̱^{21}	sa^{53}	sɔ^{42}	sɔ̱^{21}	so^{55}	ʂo^{33}	ʂa^{53}	ʂa̱^{21}
crow	mbu^{1}	bwɨ^{1}	bɨ^{24}	bi^{55}	bi^{33}	bə^{24}	bɨ^{24}	bɨ^{44}	dzʅ^{24}	dzʅ^{24}	vi^{55}
owe	bu^{3}	bwɨ^{3}	bɨ^{33}	bi^{33}	bi^{33}	bə^{33}	bɨ^{33}	bɨ^{33}	dzʅ^{33}	dzʅ^{33}	vi^{33}
carry	bo^{2}	bwɨ^{2}	bɨ^{21}	bi^{21}	bi^{21}	bə^{21}	bɨ^{21}	bɨ^{21}	dzʅ^{21}	dzʅ^{21}	vi^{21}
price	po^{2}	pʰwɨ^{2}	pʰɨ^{2}	pʰi^{21}	pʰɨ^{21}	pʰə^{21}	pʰɨ^{21}	pʰɨ^{21}	tsʰʅ^{21}	tsʰʅ^{21}	fi^{21}
dare		pɨ^{2}	pɨ^{21}	pɨ^{21}	pu^{21}	pə^{21}	pɨ^{21}	pɨ^{55}	pɨ^{21}	pɨ^{21}	pɨ^{21}

Table 6-3 below shows lexico-semantic innovations for 'wife' and 'bat,' that, while not diagnostic of Lalo membership, are characteristic of Lalo varieties; that is, these innovations are found in most Lalo varieties but not in any other Ngwi language. E Lalo varieties do not show these particular innovations, but they are still grouped with Lalo because of their participation in the phonological innovations. In both cases, E Lalo varieties show forms that are very similar to those found in neighbouring languages, suggesting the possibility of contact-induced change.

'Bat,' PLa *a^{1}py^{H}, is a nominalised form of the verb 'to fly,' PLa *by^{1}. The first syllable is the nominalising prefix *a^{1}- seen in many animal names and kinship terms. In the second syllable, a nominalisation of the verb 'to fly,' the initial has become devoiced and the tone reflects PLa *H, hence *py^{H}. Both changes are probably due to the presence of the Proto Ngwi *ʔ- prefix, functioning as a nominaliser of the verb, one of the many semantic functions attributed to the PTB/PB glottal prefix (Matisoff 2003). E-DC and E-TS show an alternate form with possible reduplication of *py^{H}; this form may be due to contact, as similar forms are also seen in Zibusi, Laizisi, and Sonaga, located just north of the Lalo-speaking region (Castro et al 2010). No Lalo variety reflects the PN reconstructed form *bo^{1}, which would have yielded either [dzʅ^{24}] (W, XZ), [bə^{24}] (E, Eka), [bi^{33}/^{55}] (YL/MD) or [vi^{55}] (C).

Southeastern Ngwi languages also show a nominalised form for 'bat' derived from the verb 'to fly,' in which the compound is a reflex of 'to fly' plus the *wa nominalising suffix, with regressive tonal assimilation, e.g., Phuza [dʒɛ^{21}va^{21}] (Pelkey 2011). Although both SE Ngwi and Lalo show the replacement of 'bat' by 'flyer,' the lexicalisation strategies and resulting compounds are different and probably not genetically related. Some Central Lalo varieties have shifted 'the flyer' compound to refer to 'swallow (n)' instead of 'bat'.

The lexical compound for 'wife' found exclusively in most Lalo varieties reflects PLa *mɛ^{2} ʔny^{1} and represents a semantic shift of 'daughter-in-law/younger sister' > 'wife'. Proto Ngwi *mi^{2} 'female' is retained in the first syllable, but the second syllable descends from PTB *s-nam 'daughter-in-law,' instead of PN *ya. Matisoff (2003: 251) finds *s-nam occurring in Lahu no^{21} 'term of endearment usable to persons of either sex'. PN *ʔəs-nam^{1} 'younger sister of a male' (cf. Burmese hnama) may also descend from PTB *s-nam and is reflected in PLa as *ʔny^{2}ma^{3}. The tone change from Tone *1 to Tone *2 in PN *ʔəs-nam^{1} > PLa *ʔny^{2} is unexpected, but the initial and rhyme are regular. In all Lalo varieties, 'daughter-in-law' PLa *k^{h}ɨ^{2}ma^{3} reflects PN *krwe^{2}, descending from PTB root *krwəj, an alternate form for 'daughter-in-law'.

Eka has lost PLa *mɛ^{2} and reflects only the second syllable *ʔny^{1}. The form at the PLa stage was most likely *mɛ^{2} ʔny^{1}, rather than just *ʔny^{1}. PLa *mɛ^{2} is a retention from PN *mi^{2}, so reconstructing PLa *mɛ^{2} ʔny^{1} avoids the awkwardness of first losing *mɛ^{2} and then regaining it in most other Lalo varieties. In E Lalo, 'wife' reflects *k^{h}ɨ^{2}ma^{3}, a descendant from the PTB alternate form for 'daughter-in-law,' instead of PLa *mɛ^{2} ʔny^{1}; the lexical shift of 'daughter-in-law' > 'wife' is still apparent, but has involved a competing form. E varieties' modern form for 'daughter-in-law' is a compound of 'son' plus 'wife,' e.g., E-HS [zɔ^{21}k^{h}ɨ^{21}mɔ^{33}], [zɔ^{21}] meaning 'son'. This same pattern is seen in Eastern Lipo, Laizisi and Sonaga, and contact with these or related languages may have influenced E varieties.

Table 6-3: 'bat' and 'wife'

Gloss	PN	PLa	Eka	MD	C-CJ	SE-GP	E-DC
bat	*bo^{1} no/na^{3}/^{2}	a^{1}py^{H}	a^{33}pɨ^{55}jo^{31}	a^{55}pɑ̠^{33}	a^{55}py^{33}	ha^{33}pu^{44}	pə^{55}pə^{33}
wife	*mi^{2} ya^{2}	mɛ^{2} ʔny^{1}	ni^{24}	n̩^{21}nə^{55}	ma^{21}ny^{55}	mɛ^{21}ny^{44}	tɕ^{h}i^{21}mɔ^{33}

6.3 Peripheral varieties Eka, YL and MD

Eka, YL and MD directly descend from Proto Lalo and do not share in any Greater Lalo innovations. Instead, they show divergent developments that make them decidedly different from any other Lalo variety. As discussed in §5.3.4, YL shows a merger of *1 and *3 to mid and *L and *H to high. While MD does not show distinctive tonal innovations, it shows a number of phonological innovations that distinguish it from other Lalo varieties, such as PLa *e merging with *ɛ to [ɛ] and harsh *y̠ becoming [ɑ̠], and *o merging with *i to [ɨ] after velar initials.

MD's autonym /lo^{21}lo̠^{33}pɑ̠^{21}/ is confusingly similar to the Lolo autonym (/lo̠^{21}lo^{33}/); however, /lo^{21}lo̠^{33}pɑ̠^{21}/ could not have descended from the Proto Lolo autonym *lok^{L}lo^{3} (Bradley 2004), as evidenced by the phonation differences between Lolo and MD. In MD, the first syllable is modal and the second is harsh, the opposite of the expected reflex from Proto Lolo. MD's autonym can be systematically derived from PLa *la^{2}lo̠^{H}pa̠^{L}, given the MD vowel change *a > o. Also, MD shares in all distinctive PLa innovations, so there is little question of MD's membership as a Lalo language.

Eka is located in Shuangjiang County, southern Lincang Prefecture at the far edges of Lalo geographic distribution. Not only does Eka fail to share in any of the innovations that define Greater Lalo, but it also shows divergent developments that no other Lalo varieties show. As described in §5.3.4, Eka's distinctive tonal innovations distinguish it from any other Lalo variety: Eka shows several initial conditioned micro-splits in *1, *2, *H, and *L that result in the creation of an additional high level [55] tonal category. The result is a new [55] tone added on top of the existing tonal system, similar to the diachronic development of Nisu's [55] tone.

At first glance, Eka diverges from all other Lalo varieties to the extent that its status as a member of the Lalo language group is in question. The Eka autonym (/o^{21}k^{h}a^{24}/) cannot be traced back to PLa *la^{2}lo̠^{H}pa̠^{L}, but other sociohistorical and linguistic evidence identify Eka as a descendant of Proto Lalo. Elders in the Eka community claim that the group did call itself /la^{21}lṳ^{33}po̱^{21}/ at one time in the past, though younger speakers do not recognise the term now. Exonyms given to the Eka by neighboring groups all link the Eka to Menghua or Mengshe, the old name for the Weishan/Nanjian area: the Han Chinese call them 'Menghua people,' the Black Lahu call them Mika, and the Dai call them Mangmao. In addition, the oral history of Eka speakers links them to migration from the Dali area several hundred years ago. Eka speakers claim to have emigrated from the Weishan area approximately 300 years ago, around the beginning of the Qing dynasty, a date which is also reported in the *Gazetteer of Shuangjiang County* (Zhao 1995). Because of Eka's participation in the PLa phonological innovations, its classification as a Lalo variety is reasonable.

6.4 Greater Lalo

Greater Lalo groups XZ with the Core Lalo group based on two lexico-semantic innovations. XZ alone shares these innovations with other Core Lalo varieties, suggesting a closer relationship to Core Lalo than others show. XZ and W-SLZ varieties are both spoken in Wafang District in Baoshan, so there is a question of whether these lexico-semantic innovations are in fact loan words from W-SLZ to XZ. However, XZ reflexes reflect regular diachronic development from Proto Greater Lalo and differ from W-SLZ's reflexes, so the possibility of loans from W-SLZ is discounted.

Table 6-4 below shows the two Greater Lalo lexical innovations, in 'crow (n)' and 'taro'. 'Crow (n)' in peripheral Lalo varieties reflects PN *a^{3} nak^{H}, e.g., YL [a^{55}ni^{53}], probably related to 'black,' PN *nak^{H}, as crows are black in color. In Core Lalo and XZ, 'crow' instead reflects a compound of 'bird,' PLa *a^{1}ŋja̱^{H}, plus a following syllable of unknown meaning, *bɛ̱^{H} ('speak' is a possible meaning, although 'speak' in PLa is *be̱^{H}, not *bɛ̱^{H}). Reflexes of 'bird' and 'black' are included in the table for comparison. SE-GP is unusual in combining the reflex of 'black' *a^{3} nak^{H} with *bɛ̱^{H}. 'Taro' is a Greater Lalo innovative compound *a^{1}tʃʰo̱^{H}, not seen elsewhere in Lalo or other Ngwi languages. XZ's reflex of 'taro' shows the second syllable's vowel assimilating to the frontness of the first syllable's vowel, something that does not occur in W-SLZ.

Table 6-4: Greater Lalo lexical innovations for 'crow (n)' and 'taro'

Gloss	PN	PGLa	XZ	W-SLZ	SE-GP	E-TS	C-QS
crow	a^{3} nak^{H}	a^{1}ŋja̱^{H} bɛ̱^{H}	a^{55}ɲa^{33} bɛ^{33}	a^{44}ɲa^{44} bɛ˞^{55}	a^{44}ni^{44} bɛ^{33}	a^{55}ŋɛ^{33} bɛ^{33}	ɑ^{55}ŋa̱^{33} ba̱^{33}
bird	s-ŋjak^{H}	a^{1}ŋja̱^{H}	a^{55}ɲa^{33}	a^{44}ɲa^{44}	a^{44}ŋa^{33}	a^{55}ŋɛ^{33}	ɑ^{55}ŋa̱^{33}
black	nak^{H}	nak^{H}	ne^{33}	ne^{44}	ni^{44}	ni^{33}	niɛ̱^{33}
taro	blum^{2}	a^{1}tʃʰo̱^{H}	sɿ^{33}tɕʰi^{33}	a^{44}tsʰu^{44}	tsʰo^{33}ʂʅ^{21}	a^{55}tsʰu^{33}	ɣɨ^{55}tsʰo̱^{33}

6.5 Core Lalo: C-W-E-SE

Core Lalo, one node below Greater Lalo, excludes XZ and consists of the four major Lalo dialect clusters, C, W, E, and SE. Core Lalo varieties are all located in or originated from the traditional Lalo homeland in southern Dali Prefecture, encompassing Weishan, Nanjian, Yongping, Midu, and Yangbi counties, along with Dali Municipality; these are the six counties/municipalities that show the most concentrated Lalo population and the longest historical presence, possibly dating back to the Wu Man of the Nanzhao era (8th and 9th centuries A.D., see §1.2.4). The key morphological innovation that defines this subgroup is an innovative *-tsa^{33} plural marker in the personal pronoun paradigm with concurrent tonal assimilation, as shown in Table 6-5 below.

Table 6-5: Core Lalo innovative -tsa^{33} plural marker in pronoun paradigm

Gloss	PN	PCoreLa	YL	W-SLZ	E-DC	SE-GP	CW-QY
1SG	*C-ŋa^{1}	ŋa^{1}	ŋa^{33}	ŋa^{24}	ŋɔ^{55}	ŋa^{44}	ŋa^{45}
1PL EXCL	*C-ŋa^{1} ʔ-way^{2}/^{3}	ŋa^{3} tsa^{3}	/	/	ŋɔ^{33}tsɔ^{33}	ŋa^{33}tso^{33}	ŋa^{33}tsa^{33}
1PL INCL		ʔŋa^{2}	ŋa^{53}	õ^{21}	/	na^{55}	a^{2}va^{2}
2SG	*naŋ^{1}	(ʔ)ni^{1}	ni^{33}	ni^{24}	ni^{55}	ni^{44}	ŋ^{55}
2PL	*naŋ^{1} ʔ-way^{2}/^{3}	(ʔ)ni^{3} tsa^{3}	/	n̩^{33}tsa^{33}	ni^{33}tsɔ^{33}	ni^{33}tso^{33}	n̩^{33}tsa^{33}
2PL	non-Core:	ɲa^{2}	ɲa^{21}	/	/	/	/
3SG	*ʒaŋ^{2}	ʒaŋ^{3}	ja^{33}	ja^{33}	ja^{33}	ʑi^{21}	wu^{33}
3PL	*ʒaŋ^{2} ʔ-way^{2}/^{3}	ʒaŋ^{3} tsa^{3}	/	i^{33}tsa^{33}	ja^{33}tsɔ^{33}	ʑi^{33}tso^{33}	wu^{33}tsa^{33}
3PL	non-Core	ʒaŋ^{2}	ja^{21}	/	/	/	/

The Core Lalo personal pronoun paradigm has singular forms *ŋa^{1} '1SG', *(ʔ)ni^{1} '2SG' and *(ʒ)aŋ^{3} '3SG'. The suffix *-tsa^{33} is attached to the singular form to mark plural. *(ʔ)ni^{1} '2SG' reflects contact with Mandarin ([ni^{35}] '2SG'), instead of the expected reflex *naŋ^{1} from PN *naŋ^{1}. Some Core Lalo varieties distinguish exclusive and inclusive first person plural forms; 1PL exclusive reflects PLa *ŋa^{3}tsa^{3}, e.g., C-LB's 1PL EXCL is [ŋa^{33}tsa^{33}]. 1PL inclusive is tentatively reconstructed as *ʔŋa^{2}, e.g., C-LB's 1PL INCL is [u^{21}] (metathesis of initial leads to *ʔŋa^{2} > aŋ^{2} > u^{2} in this variety).

In 1PL EXCL and 2PL, Tone *1 of the first syllable is assimilated to Tone *3 of the *-tsa^{33} plural marker. Thus CW-QY's '1SG' is [ŋa^{55}], but 1PL EXCL is [ŋa^{33}tsa^{33}], with both syllables having mid pitch, rather than the expected [ŋa^{55}tsa^{33}]. In some Core Lalo varieties (i.e., W-SZP, W-SLZ, W-DT, C-WC, C-QS, C-LJ, C-CJ), the distinction between exclusive and inclusive for 1PL is lost, with the 1PL INCL form *ʔŋa^{2} retained as the sole form. These varieties still show the innovative *-tsa^{33} plural marker for 2PL and 3PL. The combination of the *-tsa^{33} plural marker *and* tonal assimilation makes this a valuable innovation set for subgrouping. The likelihood that these shared forms came about through borrowing or independent development is small.

YL, seen in the table above, and XZ show a different paradigm: 1PL INCL is generalised (as in other varieties, described above) and 2PL and 3PL reflect *ɲa^{2} and *ʒaŋ^{2}, respectively. These monomorphemic plural pronouns are an inheritance from a stage earlier than PLa, as cognates can be found in the non-Lalo Central Ngwi languages Nanhua Lolo (Sun 1991) and Kuansi (Castro et al. 2010). They may be an innovation within a subgroup of Central Ngwi. Eka and MD show plural markers that probably reflect the PN plural marker, e.g., in MD, 1PL EXCL is [ə^{55}xɨ^{33}], and in Eka, [ŋo^{55}so^{33}]. Additionally, neither Eka nor MD shows the tonal assimilation that most Core Lalo varieties show.

The innovative plural marker *-tsa^{33}, seen in all Core Lalo varieties, is diagnostic of Core Lalo membership. There are other innovations that are seen in most Core Lalo varieties, but not in all. The distribution of these innovations, seen in Table 6-8, may be best explained in terms of the variable spread of the innovations across lects in the Core Lalo area. These innovations are not diagnostic of Core Lalo membership; rather, they reflect changes that have diffused across the Core Lalo region through contact. As all Core Lalo varieties are located in or around Southern Dali Prefecture, it is not surprising that some changes have diffused across the region. The innovations are 1) *p > k and *p^{h} > f before *u and 2) an additional form for 'white' (PLa *ʔvḛ^{H}) besides inherited PN *plu^{1}, possibly a conversion from the verb 'to bloom/blossom'. No non-Core varieties take part in this set of changes, suggesting that these innovations spread after non-Core groups left the Lalo homeland area.

Unaspirated *pu becomes /kv̩/ in all Core Lalo varieties except C-WC and CW-QY, which instead retain /p/. Aspirated *p^{h}u becomes /fv̩/ in all Core Lalo except W-DT, where it remains /p^{h}/, and C-LB and W-YL, where it becomes /k^{h}/. Examples of *p > k and 2) *p^{h} > f before PLa *u are given in Table 6-6 below. It is unusual that unaspirated and aspirated stops should develop into such different segments in the same environment. C-LB and W-YL's parallel development of both *p and *pʰ to velar stops is a less unexpected change. However, there was no shared intermediate stage in which *pʰu > *kʰu and then became /fv̩/ in other Core Lalo varieties. That would entail a merger of *pʰu and *kʰu, but no such merger occurred. In Core Lalo, *kʰu becomes /kʰv̩/, e.g., PLa *kʰu^{1} 'to burn' > C-WC's /kʰv̩^{55}/, and only *pʰu becomes /fv̩/, e.g., PLa *pʰu^{1} 'silver' > C-WC's /fv̩^{55}/. C-LB and W-YL, two neighboring varieties in Yongping County, innovated the *pʰu > *kʰu merger separately from the rest of Core Lalo. CE-YA probably had /f/ for *pʰ at an earlier stage, but the *f has now weakened to /x/. The spread of this innovation in SE-GP is incomplete, perhaps reflecting its geographic marginality on the eastern boundary of the Core Lalo area: /p/ and /pʰ/ are reflected before *u in some syllables (e.g., *pu^{1} 'porcupine' and *pʰu^{1} 'silver'), but in others (e.g., *pu^{1} 'grasshopper' and *pʰu^{3} 'open'), the expected Core Lalo innovative reflex is found. Non-Core varieties retain the PLa labial stops before *u in all environments.

A phonetic motivation for the different developments of unaspirated and aspirated labial stops may be the different levels of intensity of the coarticulated [^{f}] in the transition between the stop and the rhyme. PLa *u was most likely pronounced with lip compression, a manner of articulation in which the lower lip pushes upwards to the upper lip. Lip compression is seen in many Ngwi languages, usually transcribed as the syllabic fricative [v̩]. Lip compression of the vowel probably spread to the labial initial, resulting in the insertion a labiodental fricative in the transition from initial stop to vowel, i.e., [p^{hf}v̩]. The labiodental affricate *[p^{hf}] then simplified to /f/ before /v̩/. *p probably also had a labiodental fricative in the vowel-rhyme transition, but with less noise than the aspirated stop, making [p^{f}] the less likely candidate for merger with *f. Instead of simplifying to *f, *p became unaspirated stop /k/ and thus avoided a merger with *pʰ.

Table 6-6: Phonological innovations in *pu and *pʰu

Gloss	PLa	C- LB	W-YL	W-SZP	E-DC	SE-GP	CE-YA	C-LJ	C-CJ	CW QY
porcu-pine	*pu^{1}	kv̩^{55}	kv̩^{55}	/	kɣ̻^{55}	pɨ^{44}	kə^{55}	kv̩^{55}	kv̩^{55}	/
steam	*pu^{2}	kv̩^{21}	kv̩^{21}	kv̩^{21}	kɣ̻^{42}	ku^{55}	kə^{21}	kv̩^{21}	kv̩^{21}	pɨ^{21}
open	*pʰu^{3}	k^{hf}v̩^{33}	k^{hf}v̩^{33}	fv̩^{33}	/	fu^{33}	xə^{33}	fv̩^{33}	fv̩^{33}	fv̩^{33}
silver	*pʰu^{1}	k^{hf}v̩^{55}	k^{hf}v̩^{55}	fv̩^{24}	fɣ̻^{55}	pʰɨ^{44}	xə^{55}	fv̩^{55}	fv̩^{55}	fv̩^{55}

One lexical innovation that was adopted by most Core Lalo varieties is the addition of a synonym for 'white,' seen in Table 6-7 below. Most Core Lalo varieties have two words for white, one reflecting PN *plu^{1} and one reflecting Proto Core Lalo *ʔve̠^{H}. *ʔve̠^{H} possibly reflects PB/PN *s-wat^{H} 'flower/blossom (v)'. For PLa 'flower,' the innovative form *ga^{1}lu^{3} has replaced PB/PN *s-wat^{H}, although CW-QY has combined both forms, i.e., [ɣa^{55}lə^{33}ʔvɛ̠^{33}]. The innovative 'white' may be a lexical change in which 'flower/blossom (v)' is converted to an adjective to convey the colour 'white,' a common colour of flowers.

Table 6-7: Lexical innovation for 'white'

Gloss	P-Core Lalo	E- HS	W-SZP	W-YL	C- LB	C-WC	C- LJ	C-CJ	CW QY
bloom	ʔve̠^{H}	vi^{33}	ve^{44}	vɛ^{44}	vi̠ɛ^{33}	vi̠ɛ^{33}	væ̠^{33}	vi̠ɛ^{33}	ʔvɛ̠^{33}
white	ʔve̠^{H}	vi^{33}	ve^{44}	vɛ^{44}	vi̠ɛ^{33}	vi̠ɛ^{33}	væ̠^{33}	vi̠ɛ^{33}	ʔvɛ̠^{33}
white	pʰu^{1}	fɣ̻^{55}	fv̩^{24}	k^{hf}v̩^{55}	k^{hf}v̩^{55}	hə^{55}	fv̩^{55}	fv̩^{55}	fv̩^{55}

Table 6-8 presents the distribution of the lexical and phonological innovations discussed above; a check (✓) denotes the locations that show a particular innovation. Almost all Core Lalo varieties share in most or all innovations described in this section. The lexical innovation 'blossom' > 'white' is seen in the fewest varieties, and only one E Lalo variety shows this innovation. As for the phonological changes, only a few varieties either retain the PLa initial or show a different innovation, as shown in the bottom three rows of Table 6-8. W-YL and C-LB, neighboring varieties, merge *p^h and *k^h before *u instead of taking part in the *p^{h}u > fu change, while W-DT retains PLa *p^{h}u without change. CW-QY and C-WC, also neighboring varieties, retain PLa *pu without change. W-DT and E-TS do not reflect any *pu cognates, so it is impossible to confirm whether they share the *pu > /ku/ innovation or not. Since E-TS shares the change *p^{h}u > /fu/, I assume that E-TS's unaspirated *p developed similarly to other E varieties.

Table 6-8: Distribution of innovations in *pu, *p^{h}u, and 'white'

	SE	W				C							E		
	GP	DT	SLZ	SZP	YL	LB	QY	WC	QS	LJ	YA	CJ	DC	HS	TS
white		✓	✓	✓	✓	✓	✓	✓		✓		✓		✓	
p>k	✓	nd	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	nd
p^h>f	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
p^h>k^h					✓	✓									
p^h ~ p^h	✓	✓													
p ~ p	✓						✓	✓							

6.6 E-SE

All E-SE varieties share a chain of rhyme innovations: *o and *y partially merge to /ɨ/, followed by *a > /o/_# and *aŋ > /a/. The conditioned merger of *o, *y and *ɨ to /ɨ/ is an innovation unique to this cluster. The specific conditionings of the merger are 1) *y > [ɨ] after unpalatalised labials ([+round, -high]), and 2) *o > [ɨ] after all labials and the velar nasal. The *o > [ɨ] conditioning can be described as following [-back] and [+back,+nasal] initials; in PLa, *o does not occur after any alveolar initial or velar fricative. E-DC and E-HS then share a later expansion of *o and *y > [ɨ] to all environments, resulting in a complete merger of *o, *y, and *ɨ.

Table 6-9: *a, *aŋ, *o, *y, and *ɨ in E-SE

Gloss	Proto Lalo	E-HS	E-DC	E-TS	SE-GP
carry	*bwɨ^{2}	bɨ^{21}	bə^{21}	dzɿ^{21}	bɨ^{21}
rooster	*p^{h}wɨ^{1}	p^{h}ɨ^{55}	p^{h}ə^{55}	ts^{h}ɿ^{55}	p^{h}ɨ^{44}
mushroom	*mo^{1}	mɨ^{24}	mə^{24}	mɨ^{24}	mɨ^{44}
to cry	*ŋo^{1}	ŋɨ^{24}	ŋə^{24}	ŋɨ^{24}	ŋɨ^{44}
to steal	*k^{h}o^{2}	k^{h}ɨ^{21}	k^{h}ə^{21}	k^{h}u^{21}	k^{h}ɨ^{21}
eggshell	*kjo^{2}	kɨ^{21}	kə^{21}	ku^{21}	ku^{55}
melon	*p^{h}y^{2}	p^{h}ɨ^{21}	p^{h}ə^{21}	p^{h}ɨ^{21}	p^{h}ɨ^{21}
flour	*my^{3}	mɨ^{33}	mə^{33}	mɨ^{33}	mɨ^{33}
iron	*xy^{1}	xɨ^{55}	xə^{55}	xu^{55}	xu^{44}
dew	*kjy^{2}	tʃɨ^{21}	tsə^{21}	tɕu^{21}	tɕy^{55}
release	*p^{h}jy^{2}	p^{h}ɨ^{21}	p^{h}ei^{21}	p^{h}y^{21}	p^{h}u^{21}
to untie	*p^{h}ɨ^{1}	p^{h}ɨ^{55}	p^{h}ə^{55}	p^{h}ɨ^{55}	p^{h}ɨ^{55}
water	*ɣɨ^{1}	ɣɨ^{24}	ɣə^{24}	ɣɨ^{24}	ɣɨ^{24}
exchange	*pa^{1}	pɔ^{55}	pɔ^{55}	pu^{55}	po^{44}
meat	*xa^{2}	xɔ^{21}	xɔ^{21}	xɔ^{21}	xo^{21}
ear	*paŋ^{1}	pa^{55}	pa^{55}	pa^{55}	pa^{44}
clean	*xaŋ^{1}	xa^{55}	/	ha^{55}	xa^{44}

The later merger of *o, *y, and *ɨ serves to group E-HS and E-DC as Core E, to the exclusion of E-TS, which fails to share this later change. In E-TS, *y and *o merge to [u] after velar obstruents; *y remains [y] elsewhere, while *o > [ɨ] elsewhere. In SE-GP, the conditioned splits are even more complex: *o > [ɨ] elsewhere except after *kj, where *o > [u], and *y > [u] after palatalised labials and unpalatalised velars, remaining [y] elsewhere. Table 6-9 below gives examples of the different developments of *a, *aŋ, *o, *y, and *ɨ in E-SE Lalo. In E-DC, [ə] appears instead of [ɨ], a later lowering of the vowel.

E-SE rhyme innovations are summarised in Table 6-10 below. The chain shift of *a > [o]_#, *aŋ > [a] also occurs in W-DT, XZ, MD, Eka, and in other Ngwi languages, including Nanhua Lolo (Sun 1991). Bradley (1979) finds this isogloss insufficient for Ngwi subgrouping due to its dispersed geographical distribution: *a > [o]_# happened independently in different languages belonging to each of the Ngwi sub-branches (Central, Southern, and Northern). Therefore, it is dubious to group together all varieties that show *a > [o]_#, *aŋ > [a]. In E-SE, *a > [o]_# must have happened after *o > [ɨ]/labials_, because PLa *a rhymes do not participate in the *o > [ɨ] change; that is, *a > [o]_# must be placed in counter-feeding order with *o > [ɨ]. So, *a > [o]_# happened after E-SE Lalo varieties broke off from Core Lalo. The E-SE cluster does not participate in any of the C-W distinctive innovations described in §6.7 below.

Table 6-10: Summary of E-SE rhyme innovations

	E-DC	E-HS	E-TS	SE-GP	XZ	MD	Eka	W-DT
1) *o > ɨ/[-back]_; [+back,+nasal]_	✓	✓	✓	✓				
*y > ɨ/[+round, -high]_	✓	✓	✓	✓				
*y, *o > ɨ/elsewhere	✓	✓						
*y, *o > u/[+back,-son]_			✓					
2) *a > o_#	✓	✓	✓	✓	✓	✓	✓	✓
*aŋ > a	✓	✓	✓	✓	✓	✓	✓	✓

6.7 C-W

Within Core Lalo, the C and W clusters group together to the exclusion of the E and SE clusters. The main phonological innovation that C and W clusters share is the lenition of PLa *g to Proto C-W *ɣ before rhymes with open back vowel *a (i.e., *a and *aŋ) and harsh *o̱. Examples are given in Table 6-11 below. Before close vowels *i, *e, *y, *ɨ, and *u, C-W varieties retain *g, merging with PLa consonant cluster *gj. All other Lalo varieties, including E Lalo, retain PLa *g in all environments and do not show this lenition. Most C-W varieties show a further expansion of the lenition to include modal *o and *ɛ as conditioning environments. W-DT alone retains the original conditioning for the lenition, as seen in its reflexes of [g] for 'wound' PC-W *gɛ^2 and 'thunder' PC-W *go^2. Subsequent change of Proto C-W's *ɣ to [w] or [ɣ^w] before modal or harsh [o] is seen in most C-W varieties except W-YL and C-CJ, which instead show a change to [j] before *ɛ.

Table 6-11: C-W phonological innovation of *g > *ɣ/_*a, *aŋ, *o̠

Gloss	PLa	P-C-W	W-SZP	W- DT	W- YL	CW-QY	C- LB	C- CJ
bend	go̠^{L}	ɣo̠^{L}	wo^{53}	vv̩^{45}	ɣo^{453}	wo̠^{21}	ɣ^{w}o̠^{21}	ɣ^{w}o̠^{21}
buckwheat	ga^{2}	ɣa^{2}	ɣa^{21}	ɣo^{21}	ɣa^{21}	ɣa̤^{21}	ɣɑ^{21}	ɣɑ^{21}
drive cattle	ga̠^{L}	ɣa̠^{L}	ɣɛ^{53}	ɣa^{45}	ɣa^{453}	ɣa̠^{21}	ɣa̠^{21}	ɣa̠^{21}
pull	gaŋ^{1}	ɣaŋ^{1}	wo^{24}	/	ɣo^{24}	wo^{55}	/	ɣ^{w}u^{55}
wound (n.)	gɛ^{2}	gɛ^{2}	ɣɛ^{21}	gɛ˞^{21}	jɛ^{21}	ɣɛ̤^{21}	ɣɛ^{21}	ji^{21}
thunder	go^{2}	go^{2}	ɣo^{21}	gv̩^{21}	/	ɣə^{21}	/	/
bracelet	goŋ^{1}	go^{1}	wo^{33}	gv̩^{33}	ɣo^{33}	wo^{55}	wu^{55}	wo^{55}

A distinctive C-W lexico-semantic innovation is the reinterpretation of lexical compounds 'young' to 'soft timespan/years'. In PLa, 'young' is a compound of modified noun + modifier: *tʰy^{2} nu^{1}, *tʰy^{2} meaning 'years/timespan' and *nu^{1} meaning 'young'. PLa *nu^{1} in 'young' may be a reflex of PN *nay^{1} 'young,' as the PLa initial and tone match the expected development, even though the rhyme shows an unexpected development to PLa *u. In contrast, 'young' in P-C-W is *tʰy^{2} nu^{2}, literally 'years/timespan+soft;' this glossing of the compound was given to me by one Core Lalo language speaker during the elicitation process. The phonetic similarity between *nu^{1} 'young' and *nu^{2} 'soft' may have facilitated the reinterpretation of the compound. XZ, YL, MD, Eka, and E varieties retain the PLa compounds, but all C-W varieties reanalyse the compound as 'years + soft'. Reflexes from C-W varieties, as well as the non-C-W variety YL, are shown in Table 6-12 below.

In a later development, all C-W varieties except W-DT show the same type of reanalysis for 'glutinous rice'. This change may have spread through the C-W area after W-DT broke off from W Lalo. In PLa, 'glutinous rice' is a compound *tʃʰe^{1}ɲa^{2}, literally 'rice+glutinous'. PLa *ɲa^{2} 'glutinous rice' may be an early loan from Chinese, possibly from Middle Chinese 'glutinous rice' *nwaH (H represents the Departing Tone, a falling pitch) (Baxter 1992, Baxter & Sagart 2008). Across the C-W area, however, 'glutinous rice' reflects *tʃʰe^{1}nu^{2}, literally 'rice+soft,' shown in Table 6-12 below.

Table 6-12: C-W lexico-semantic innovations involving 'soft'

Gloss	PLa	P-CW	YL	W-DT	W-YL	C-LJ	C-CJ
soft	nu^{2}	nu^{2}	nɣ̠^{21}	nv̩^{21}	nv̩^{21}	nv̩^{21}	nv̩^{21}
young	tʰy^{2} nu^{1}	tʰy^{2} nu^{2}	tʰə^{21}ɲo^{33}	tʰy^{21}nv̩^{21}	tʰy^{21}nv̩^{21}	tʰy^{21}nv̩^{21}	tʰy^{21} nv̩^{21}
glutinous rice	tʃʰe^{1}ɲa^{2}	tʃʰe^{1}nu^{2}	tɕʰi^{55}ɲa^{21}	tɕʰi^{44}ɲa^{21}	tɕʰi^{44}nv̩^{21}	tɕʰi^{55}nv̩^{21}	tɕʰi^{55} nv̩^{21}

6.8 Lower-level clusters: E, W, C and SE

6.8.1 Tonal innovations that distinguish W, E, and SE

In this section, I discuss the divergent developments of tones that provide evidence for distinct W and SE clusters. Detailed description and phonetic motivations for these tonal innovations are given in Chapter 5 and Yang (2010). Table 6-13 below presents all innovations in tone shown by various Lalo varieties, but only the innovations enclosed with a line are considered diagnostic of phylogenetic grouping. Most Lalo varieties, excluding MD and C, show a split in Tone *1 to low-rising in syllables with voiced initials and remaining high elsewhere. I refer to the original conditioning of the Tone *1 split as the Eastern-type split, as Eastern varieties, along with W-YL and XZ, retain the original conditioning of the Tone *1 split without further innovation.

Core W, however, show an expansion of the low-rising tone to syllables with voiceless, non-preglottalised consonants, resulting in the conditioning now seen (*1 > mid-high/preglottalised_, low-rising/elsewhere). The W expansion of the Tone *1 split must have happened before the loss of preglottalised initials, as preglottalisation blocked the low-rising tone from developing. In YL, however, the loss of preglottalised initials must have happened before the split, since the split to low-rising is seen in syllables with PLa *preglottalised initials (which became voiced sonorants and fricatives in YL).

I choose not to posit a phylogenetic link between all varieties that show some type of Tone *1 split to low-rising. I instead suggest that the various Tone *1 splits are independent developments based on the allotonic variation that was found in Proto Lalo. As I discuss in §5.3.1, the rising and level allotones of Tone *1 seen in CW-QY were most likely also present in Proto Lalo and transmitted to the ancestors of W, E, and other Lalo varieties. With the merger of *preglottalised and plain initials, which may have taken place at different times in the different clusters, the low-rising pitch became contrastive in W, E, and XZ. In YL, the merger of *preglottalised and *plain initials occurred before the split, and the low-rising pitch became contrastive only after Tone *1 conditionally merged with Tone *3 in syllables with voiceless initials.

The distribution of the Eastern-type split is geographically non-contiguous, found in E Lalo, non-core XZ, one W variety (W-YL), and one Central variety (CE-YA). The same exact conditioning also results in the same split in Tone *1 in non-Lalo languages in the Central Ngwi branch: Limi, spoken in Lincang Prefecture, and Gomotage, spoken in Eryuan County in Dali Prefecture, based on preliminary analysis of wordlists gathered there during my fieldwork in 2008. The non-contiguous distribution of the split within Lalo, occurring in each of the Core Lalo clusters and in non-core Lalo varieties, and even occurring in languages that are clearly not Lalo, suggests that this split is not a very useful subgrouping criterion for linking dialect clusters.

Secondly, the phonetic naturalness of this change also lessens its value for subgrouping. Voiced initials conditioning a low pitch follows the voiced-low principle found in many other tonal languages, such as Lahu (Bradley 1977) and Tai languages (Li 1977). Eastern Lalo's Tone *1 split presents a slight variation on the voiced-low principle: only the tonal onset is lowered, not the pitch of the entire syllable. Since the original pitch target of Tone *1 was probably high, depressing the onset results in a rising contour. Plus, the allotonic variation seen in Central Lalo (high with voiceless and preglottalised initials, rising with voiced initials) suggests that the contrastive low-rising tone follows naturally after the merger of preglottalised and plain sonorants.

Thirdly, the split appears to have occurred in CE-YA as a result of contact with Eastern varieties, as discussed in §5.3.1. The split has happened in the past 200 years in East Mountain varieties such as CE-YA that are located closest to Eastern Lalo. A tone split is an unusual result of diffusion (Labov 2007), but both linguistic and sociolinguistic circumstances were favorable to the diffusion of the split: 1) linguistically, the phonologisation of Tone *1's low-rising allotone arises from the merger of *preglottalised and *plain initials, as described in §5.3.1, and 2) sociolinguistically, CE-YA and E speakers are in close contact through the practice of bride exchange between villages, in particular between CE-YA and E-DC. Children are therefore exposed from birth to both varieties and may have acquired the split during the learning process.

Finally, phonological and lexico-semantic innovations, as described in §6.6 above, suggest a C-W subgroup, to the exclusion of the E-SE cluster. When weighed against a series of innovations, the Tone *1 split seems paltry evidence for a higher-level subgrouping of E and W clusters. The non-contiguous distribution of the Eastern-type split, including languages that are clearly not Lalo, the phonetic naturalness of the conditioning of that split, and the apparent ease of its spread to neighboring varieties all weaken the Eastern-type Tone *1 split's value as a unique, subgroup-identifying criterion.

There are other tonal innovations that distinguish lower-level clusters of W and SE. All W varieties share a tonal innovation chain: Tone *1 becomes low-rising in syllables with *voiced initials, *L becomes high, and *1 in *preglottalised syllables merges with *H to mid-high. Harsh phonation is completely lost in W, enabling the merger of *1 and *H. Core W varieties (SLZ, SZP, and DT) all share the expansion of the low-rising pitch to syllables with voiceless initials, remaining high only in syllables with *preglottalised initials. Non-core W-YL does not participate in this later change, and is therefore excluded from Core W.

SE shows the partial merger of *L and *2 to high, described in §5.3.4, and also merges *3 and *H to mid. Eastern varieties also merge *3 and *H to mid. E-HS and E-TS lose harsh phonation in *H, but not in *L, while E-DC loses harsh phonation completely. Since the partial or complete loss of harsh phonation is an ecologically non-distinctive change (see §6.8), this merger is not considered a diagnostic criterion; justification for the E-SE cluster is primarily based on shared rhyme innovations, described in §6.6 above. Peripheral varieties YL and XZ show divergent tonal innovations that do not qualify them for membership in any of the lower-level clusters. XZ shows the Eastern-type Tone *1 split and a three-way merger of *L, *H and *3 to mid, along with loss of harsh phonation. YL older speakers show an unusual split in Tone *1, becoming mid after voiceless initials and low-rising elsewhere, a split that must have occurred after the loss of preglottalisation, as discussed above and in §5.3.4. YL also shows a merger of *L and *H to high and loss of harsh phonation.

Table 6-13: Innovations in tone from Proto Lalo

Location / Innovation	YL	XZ	E-DC	E-HS	E TS	W-DT	W-S LZ	W-S ZP	W-YL	SE GP	CE YA
*1 > low-rising /[+voi]_	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Loss of harsh phonation	✓	✓	✓	(p)	(p)	✓	✓	✓	✓	(p)	
*L > high						✓	✓	✓	✓		
*1> mid-high/*ʔ-_						✓	✓	✓	✓		
*H > mid-high						✓	✓	✓	✓		
*1 > low- rising /non-ʔ-_						✓	✓	✓			
*H, *3 > mid			✓	✓	✓					✓	
*1 > mid/[-voi]_	✓										
*L, *H> high	✓										
*L, *H, *3 > mid		✓									
*2/*ʃ, *ʔ_, *[-voi, +sg]__ > high										✓	
L/[-voi]__ > high										✓	

6.8.2 C and W innovations in initials

Distinct developments of PLa *bwɨ provide evidence for lower level divisions between C and W. Table 6-14 below summarises the innovations. In both the table and the following discussion, *b is used as a cover symbol for PLa bilabial stops *pʰ and *b, since the set develops in parallel. Unfortunately, there are no examples of PLa unaspirated *po in the wordlist. Given the *bwɨ/*bi merger in Core W, *po is predicted to be [tsɿ] in W varieties, as *pi > [tsɿ], but the development of *po is still unclear for C varieties. The first column in Table 6-14 shows the relative ordering of changes in both C and W (unmarked) and the separate innovations that occurred in C (marked C) and W (marked W, but includes XZ and E-TS).

Table 6-14: Innovations involving *bwɨ and *bi

				W				C					
#		XZ	E-TS	DT	SLZ	SZP	YL	YA	QY	WC	QS	LB	LJ
1.	*bwɨ >*b^{v}ɨ	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2.	*b^{v}ɨ > *b^{v}i	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2.W	*b^{v}> dz	✓	✓	✓	✓	✓	✓						
3.W	*bi > *b^{v}i	✓	✓	✓	✓	✓							
4.W	*b^{v} > dz	✓	✓	✓	✓	✓							
3.C	*b^{v} > v							✓	✓	✓	✓		
3.C	*b^{v} > dʑ											✓	✓

All C-W varieties (plus XZ and E-TS) went through an intermediate stage in which the labiovelar glide became a labiodental fricative, i.e., *bwɨ >*b^{v}ɨ, and the vowel moved forward to /i/. Most other Lalo varieties do not share the (af)frication innovation; instead, the labiovelar glide is dropped. Some Lalo varieties still show remnants of this labiodental affricate, as in [pf^{h}i^{55}] 'rooster' (< *p^{h}o^{1}) in C-QS. Although the exact phonetic quality of the Proto Lalo vowel is uncertain, the vowel may have been pronounced with lip compression, resulting in the insertion a labiodental fricative in the transition from initial stop to vowel, much the same as *p^{h}u, discussed in §6.5. Lahu also has labiodental affricates as reflexes of *bo (>/pu/ [pfɯ]) and *po (> /p^{h}u/ [pf^{h}ɯ]) as a result of synchronic processes; in Lahu, labiodental affricates are allophones of bilabial stops before /u/, which in turn is always found with lip compression in this environment (Bradley 1979a). A similar phenomenon occurs in Lisu (David Bradley, personal communication, February 20, 2009). The intermediate phase of *labiodental affricates, still seen in C-QS (e.g., [pf^{h}i^{55}] 'rooster'), makes sense given their development into alveolar affricates in W varieties and into palatoalveolar affricates in C-LB and C-LJ.

The *labiodental affricates contrasted with plain labials when *wɨ became [i], so that there was a contrast between *b^{v}i and *bi. The feature that kept the contrast between these two correspondence sets was the manner of the initial (*bv versus *b), which prevented their merger. This can be seen by the separate correspondence sets of *b^{v}i and *bi: *b^{v}i became [dzɿ] in W, and [vi] or [dʑi] in C, whereas bi remained [bi] in W-YL and most C varieties. See Table 6-15 and Table 6-16 below for examples of the separate developments of *bwɨ and *bi.

In Core W (plus XZ and E-TS, both in contact with Core W varieties), there was an additional, later development of *bi > *b^{v}i > /dzi/ [dzɿ]. Apical vowel [ɿ] was at that stage an allophone of /i/ after alveolar affricates or fricatives, though subsequent changes transferred this vowel to be an allophone of close central vowel /ɨ/ in several varieties. Core W *bi > *b^{v}i is placed in counter-feeding order with P-C-W *b^{v}i > /dzi/ [dzɿ]. *bi > *b^{v}i must have happened after W-YL broke off from Core W, because W-YL does not merge *bi and *b^{v}i, but rather retains *bi as /bi/.

The evidence does not suggest a C-W shared intermediate stage of *alveolar affricates *ts^{h} and *dz, which then simplify to [f] and [v] in Central Lalo. Proto Lalo already had *alveolar affricates, and if Central Lalo had merged the *labiodental affricates with the *alveolar affricates, the series could not then un-merge to today's distinct labiodental fricatives and alveolar affricates.

Table 6-15 below gives examples of the developments in *bwɨ, while Table 6-16 shows *bi. CE-YA shows variation in its reflexes of *bwɨ, in keeping with its transitional nature and contact effects. While CE-YA's reflexes of *p^{h}wɨ^{2}, *bwɨ^{1} and *bwɨ^{2} match the usual Central Lalo reflexes, *p^{h}wɨ^{1} 'rooster' and *bwɨ^{3} 'owe (v.)' show the alveolar affricate. The majority of Central Lalo varieties (CW-QY, C-CJ, C-WC, C-QS) show a consistent labiodental fricative. C varieties C-LJ and C-LB show alveopalatal [tɕ^{h}] and [dʑ] in this environment. This is not a shared innovation with W Lalo, since C-LJ/C-LB show alveopalatal affricates rather than alveolar.

Table 6-15: *bwɨ

Gloss	PLa	W- DT	W- YL	CE-YA	C- CJ	CW-QY	C- LJ
crow (v.)	*bwɨ^{1}	dzɿ^{24}	dzɿ^{24}	vi^{24}	vi^{55}	vi^{55}	dʑi^{55}
carry (v.)	*bwɨ^{2}	dzɿ^{21}	dzɿ^{21}	vi^{21}	vi̤^{21}	vi^{21}	dʑi^{21}
owe	*bwɨ^{3}	dzɿ^{33}	dzɿ^{33}	dzɿ^{33}	vi^{33}	vi^{33}	dʑi^{33}
butterfly	*bwɨ^{2} lu^{3}	dzɿ^{21}	dzɿ^{21}	/	vi^{21}	vi̤^{21}	dʑi^{21}
price	*pʰwɨ^{2}	tsʰɿ^{21}	tɕʰi^{21}	fi^{21}	fi^{21}	fi^{21}	tɕʰi^{21}
rooster	*pʰwɨ^{1}	tsʰɿ^{24}	tsʰɿ^{44}	tsʰə^{55}	fi^{55}	fi^{55}	tɕʰi^{55}

Table 6-16: *bi

Gloss	PLa	W- DT	W- YL	CE-YA	C- CJ	CW-QY	C- LJ
pus	*bi^{1}	dzɿ^{24}	bi^{24}	bi^{24}	dzɿ^{24}	vi^{55}	dʑi^{55}
full	*bi^{3}	dzɿ^{33}	bi^{33}	bi^{33}	dzɿ^{33}	vi^{33}	bi^{33}
spit	*pʰi̲^{L}	tsʰɿ^{45}	/	pʰi̲^{21}	tsʰɿ̲^{21}	fi̲^{21}	fɛ̲^{21}
older woman	*pʰi^{2}	tsʰɿ^{21}	pʰi^{21}	pʰi^{21}	tsʰɿ^{21}	fi^{21}	pʰi^{21}
grandparent+ grandchildren	*pi^{2} la^{2}	tsɿ^{21}	pi^{21}	pia^{21}	tsɿ^{21}	pi^{21}	pi^{21}

Comparing the two tables reveals that W-DT, representative of Core W, now has /dzi/ [dzɿ]) as a reflex of both *bi and *bwɨ. I argue above that this apparent merger of *bi and *bwɨ in Core W actually took place in two intermediate stages, with *bi > dzɿ occurring after W-YL broke off from Core W varieties. CE-YA, while a bit erratic in its reflex of /vi/ for *bwɨ, nonetheless consistently shows /bi/ for *bi. C-CJ shows *bᵛi > vi, but *bi > dzɿ, a distinct correspondence set from other C varieties. CW-QY shows an almost complete merger of *bwɨ and *bi to /vi/, except that *pi is retained as [pi], e.g., in 'grandparent + grandchild (family group classifier)'. C-LJ consistently shows [dʑi] for *bwɨ, but irregularly shows both [dʑi] and [bi] for *bi. C-LJ's reflex of /fɛ̲^{21}/ for pʰi̲^{L} is unexpected (the expected reflex is tɕʰi̲^{21}) and may have diffused from surrounding C varieties.

These innovations in the bilabial stops provide supporting evidence for distinguishing C and W clusters. No C variety shows *bwɨ > *bᵛi > /dzi/, but all W varieties do. Complicating this neat subgrouping is the fact that XZ and E-TS take part in all Core W innovations of *bwɨ and *bi. Therefore, for subgrouping W, these changes provide less clear evidence than the tonal innovation chain described in §6.7.1.

6.8.3 C rhyme innovations

The C Lalo cluster is also distinguished by innovations in rhymes: a conditioned merger of harsh *e̲ and *i̲ to /i̲/ after [+high, -back] initials, an unconditioned merger of *e and *i to /i/ in modal phonation, a merger of *ɛ̲ and *a̲ to /a̲/ after [+back] initials, and a complex vowel assimilation process affecting the *-a rhyme.

Examples of the vowel mergers of are given in Table 6-17 below. Harsh i̲ is realised as diphthong [iɛ̲] in several C varieties, which is also the case in some Nisu varieties. C-LJ shows the original conditioning of Proto C's *e̲ > i̲/[+high, -back]_, i.e., after palatal *ɲ, palatoalveolar initials *tʃ, *dʒ, *ʃ, *ʒ, and palatalised velar consonants *kj and *gj. Elsewhere, C-LJ reflects *e̲ as harsh /ɛ̲/, realised as [æ], which is contrastive with /i̲/ [iɛ̲] except after the initials that triggered the partial merger of *e̲ and *i̲. Proto C's *e̲ > i̲/[+high, -back]_ took place after Proto C's *ɣ > j/_e̲, since 'chicken' PLa *ɣe̲^{H} participates in the change: *ɣe̲^{H} > C-LJ [jɛ̲^{33}].

CE-YA shows the original conditioning of Proto C's partial merger of *ɛ̱ and *a̱ to a̱ after [+back] initials, that is, after velars and *h. As shown in the table below, after velars or /h/, CE-YA shows /a/̱, but elsewhere shows /ɛ/̱. In Core C, which excludes CE-YA, the conditioning of *ɛ̱ > /a/̱ later spread to all initials. CE-YA is additionally distinct from Core C by its innovation of labiodental fricatives becoming velar before *u, i.e., *f, *v > [+high, +back] /_[+high,+back]. This innovation comes after *pʰ > [f]/_/u/, as CE-YA's reflex of *pʰu is [xə] (*u > ə in CE-YA). While most Central varieties have /i̱/ but no /e̱/ or /ɛ̱/ due to the complete merger of *e̱ with *i̱ and *ɛ̱ with *a̱, CE-YA and C-LJ have contrastive /i̱/ and /ɛ̱/.

Table 6-17: Vowel changes in Central Lalo

Gloss	PLa	C-WC	CW-QY	C-CJ	CE-YA	C-LJ	C-LB	W-YL
cat	ni^{1}	ni^{55}	ni^{55}	ni^{55}	ni^{55}	ni^{55}	ni^{55}	ni^{24}
heart	ʔni̱^{H}	niɛ̱^{33}	ʔni̱^{33}	/	/	ĩ̱^{33}	iɛ̱̃^{33}	ni^{44}
pound(v.)	te^{2}	tɛ^{21}	ti^{21}	ti^{21}	ti^{21}	ti^{21}	ti^{21}	tɛ^{21}
carry	te̱^{H}	tiɛ̱^{33}	ti̱^{33}	ti̱^{33}	tiɛ̱^{33}	tæ̱^{33}	tiɛ̱^{33}	tɛ^{44}
ashamed-1	ʃe̱^{L}	ɕiɛ̱^{21}	ɕɛ̱^{21}	ci̱^{21}	ɕiɛ̱^{21}	ɕɛ̱^{21}	ɕiɛ̱^{21}	ɕɛ^{55}
chicken-2	ɣe̱^{H}	jiɛ̱^{33}	jɛ̱^{33}	ji̱^{33}	jɛ̱^{33}	jɛ̱^{33}	jiɛ̱^{33}	ʝɛ^{44}
lack	kʰɛ̱^{L}	kʰa̱^{21}	kʰa̱^{21}	kʰa̱^{21}	kʰa̱^{21}	kʰa̱^{21}	kʰa̱^{21}	/
rat	hɛ̱^{H}	ha̱^{33}	ha̱^{33}	ha̱^{33}	ha̱^{33}	ha̱^{33}	ha̱^{33}	ha^{44}
mend	ʔnɛ̱^{L}	na̱^{21}	ʔna̱^{21}	na̱^{21}	nɛ̱^{21}	na̱^{21}	na̱^{21}	na^{53}

Also, all Central varieties show complex conditioning for a regressive vowel assimilation process affecting the *-a rhyme: *a > /ɛ/ in a syllable beginning with an alveolar obstruent if the following syllable has a front vowel, i.e., *i, *y, *e, or *ɛ, i.e., *a > /ɛ/ /*C[+anterior,+strident]_$CV[+front]. Examples are given in Table 6-18. PLa palatoalveolar obstruents, as seen in *ʃa^{1}xe^{1} 'centipede,' have become retroflex in C Lalo and block the assimilation from taking place. Syllables with alveolar sonorants, as seen in *la^{1}ʃɛ^{1} 'snake,' are not affected by the assimilation process either.

Table 6-18: Vowel assimilation in Central Lalo

Gloss	PLa	CE-YA	CW-QY	C-LJ	C-LB
daughter	za^{2}mɛ^{2}	zɛ^{21}mɛ^{21}	zɛ̤^{21}mɛ̤^{21}	zɛ^{21}mɛ^{21}	zɛ̤^{21}mɛ̤^{21}
walnut	sa^{2}me^{1}	sɛŋ^{353}	sɛ̤^{21}mi^{55}	sɛ^{21}mi^{55}	sɛ̤^{21}mi^{55}
cucumber	sa^{2}kjɛ^{2}	sɛ^{21}kɛi^{21}	sɛ̤^{21}kɛ̤^{21}	sɛ^{21}kɛ^{21}	sɛ^{21}kɛ^{21}
peach	sa^{2}ʔly^{2}	sɛ^{21}wu^{21}	sø̤^{21}ʔø̤^{21}	sɛ^{21}ʔly^{21}	sɛ^{21}ly^{21}
centipede	ʃa^{1}xe^{1}	/	ʂa^{55}ɕi^{55}	ʂa^{55}ɕi^{55}	/
snake	la^{1}ʃɛ^{1}	la^{33}sɛ^{55}	la^{55}ɕɛ^{55}	la^{55}ʂa^{55}	la^{55}ʂɛ^{55}

Table 6-19 summarises the distribution of the C Lalo rhyme innovations described above. No variety outside of the C cluster shows all of the innovations, although a few participate in one or two of the changes. E-TS and E-HS both show the merger of harsh and modal *e, *e̱ with *i, *i̱. W-YL, Eka, and MD show the merger of *ɛ̱ and *a̱ to /a/̱. W-YL and E-HS, both of which have C Lalo neighbors, irregularly show the *a > /ɛ/ change in the same environment as C Lalo varieties. The irregularity of their reflexes, however, suggests contact rather than a transmitted innovation.

Table 6-19: Summary of C Lalo rhyme innovations

	E-HS	E-TS	W-YL	CE YA	CW QY	C-WC	C-CJ	C-QS	C-LB	C-LJ
*e > i	✓	✓		✓	✓	✓	✓	✓	✓	✓
*ɛ̱ > a̱/ [+back]_			✓	✓	✓	✓	✓	✓	✓	✓
*e̱ > i̱/ [+high, -back]_	✓	✓		✓	✓	✓	✓	✓	✓	✓
*a > ɛ /*C[+ant,+stri] _$CV[+front]	irr.		irr.	✓	✓	✓	✓	✓	✓	✓
*ɛ̱ > a̱/ elsewhere			✓		✓	✓	✓	✓	✓	✓
*e̱ > i̱/ elsewhere	✓	✓		✓	✓	✓	✓	✓	✓	

6.8.4 Core W innovations

Besides the tonal chain of innovations described in §6.7.1, Core W varieties also show metathesis of initial consonants in 'grasshopper,' and shared tone sandhi patterns in which high > mid-high/_high. W-DT, W-SZP, and W-SLZ take part in both innovations, and thus are considered Core W members. W-YL takes part in neither innovation, and is therefore excluded from the Core W cluster.

Table 6-20 shows the reflexes of the two Core W Lalo innovations. In the compound word 'grasshopper' PLa *tʃɛ^{1}pu^{1}, the initial consonants of each syllable metathesise so that PLa *tʃɛ^{1}pu^{1} > P-Core W *pɛ^{1}tʃu^{1}. W-YL, in contrast, retains the PLa compound with subsequent developments of *pu > /ku/, described in §6.5, and an unexpected development in the rhyme of the first syllable, which is possibly assimilation to the second syllable's rhyme. Interestingly, a form reflecting *pɛ^{1}tʃu^{1} is also seen in C-WC's /pɛ^{55}tʂu^{55}/, possibly a result of diffusion from C-WC's Core W neighbor, W-SZP.

Core W varieties (W-DT, W-SZP, and W-SLZ) show a tone sandhi pattern in which the high tone, the reflex of *L, merges with mid-high when the following syllable's tone is high: high > mid-high/_high. This can be seen by comparing the different forms for 'goat' and 'ram' in Table 6-20 below. In 'goat' PLa *a^{1}tʃʰi̱^{L}, the reflex for *tʃʰi̱^{L} is the expected high tone (realised as rising-falling in W-SLZ and W-SZP, as high rising in W-DT, and high falling in W-YL). However, in 'ram,' PLa *a^{1}tʃʰi̱^{L}pa̱^{L}, 'goat' is modified by the male suffix *pa̱^{L}, so the compound has consecutive syllables with the high tone (reflexes of *L). In 'ram,' the reflex for *tʃʰi̱^{L} has the mid-high tone instead of the expected high tone. The result is a neutralisation of contrast between high and mid-high before a high tone syllable. Other examples of this phenomenon are seen in 'tree branch' *si̱^{H}ka̱^{L}le̱^{L}: W-SLZ has a mid-high tone on [ka^{44}] in the compound [sɿ^{44}ka^{44}le^{453}] instead of the expected reflex of *L, [ka^{453}]. Also, in 'wrist' PLa *le̱^{L}tsi̱^{L}, W-DT has mid-high [le^{44}] instead of high-rising [le^{45}].

W-YL, on the other hand, does not show the same tone sandhi pattern. Instead of merging with mid-high, W-YL's reflexes of *L in this environment remain high. W-YL's high tone is realised as high level, an allophone of the high tone when occurring before another high tone. Although in both Core W and W-YL, the contour has been leveled, only in Core W Lalo varieties is the result a neutralisation of contrast between the reflexes of *L and the *1/*H merger.

Table 6-20: Other W Lalo innovations

Gloss	PLa	W-SZP	W-SLZ	W-DT	W-YL
grass-hopper	tʃɛ^{1}pu^{1}	pɛ˞^{44}tʂu^{44}	pa^{44}tʂu^{44}	pɛ˞^{44}tʂu^{44}	tʃo^{44}ku^{53}
goat	a^{1}tʃʰi̱^{L}	a^{33}tʂʰʅ^{453}	a^{33}tʂʰʅ^{453}	a^{21}tʂʰʅ^{45}	a^{44}tʂʰʅ^{53}
ram	a^{1}tʃʰi̱^{L}pa̱^{L}	a^{33}tʂʰʅ^{44}pa^{53}	a^{33}tʂʰʅ^{44}pa^{53}	a^{21}tʂʰʅ^{44}po^{53}	a^{21}tʂʰʅ^{44}po^{53}
tree branch	si̱^{H}ka̱^{L}le̱^{L}	/	sɿ^{44}ka^{44}le^{453}	/	sɿ^{44}ka^{55}lɛ^{53}
wrist	le̱^{L}tsi̱^{L}	/	/	le^{44}tsɿ^{53}	lɛ^{55}tsɿ^{53}

6.9 Contact relationships

Contact, both between Lalo varieties and with non-Lalo languages such as Southwest (SW) Mandarin, has had a considerable impact on Lalo varieties' development. The superstratal pressure of SW Mandarin remains the most powerful influence on Lalo varieties as a whole. Mandarin's presence in Lalo territory has been expanding ever since Yunnan's full incorporation into the Chinese political system during the Yuan dynasty, particularly after the intense migration of Han Chinese to Yunnan during the Qing dynasty (Giersch 2006).

Bilingualism in SW Mandarin is a widespread attribute of the Lalo speech community as a whole, as discussed in §1.3.5. In some areas, Lalo communities have already shifted to SW Mandarin, or are shifting at a rapid rate, as shown in §8.2. Contact-induced change as a result of the influence of SW Mandarin is a natural consequence of the linguistic ecology in western Yunnan. Such contact-induced change can be seen through the following widespread changes seen in all Lalo subgroups: the loss of *harsh phonation, *preglottalised initials, *retroflex fricatives and affricates, and nasal glottal fricative *h̃. Table 6-21 below shows the distribution of these changes among Lalo varieties.

The four features mentioned above (*harsh phonation, *preglottalised initials, etc.) existed in Proto Lalo, but do not exist in SW Mandarin. As bilingual Mandarin-Lalo speakers function in a Mandarin dominated world, they assimilate SW Mandarin features into Lalo. These changes are ecologically non-distinctive and are likely the result of contact-induced change; therefore, they have not been used in subgrouping Lalo varieties.

The distribution seen in Table 6-21 also presents an interesting implicational hierarchy. Those varieties with more exposure to Mandarin are the ones who show loss of three or more of the PLa features that Mandarin does not have. Non-Core Lalo varieties such as Eka, MD, XZ, and YL emigrated out of the Lalo homeland and are now found mostly in pockets with small populations and sometimes completely out of contact with other Lalo varieties. As such, these groups have a more intense contact relationship with SW Mandarin and other languages, and therefore are more likely to show contact-induced changes.

Likewise, E Lalo speakers are all located within half an hour's bus ride to Xiaguan, Dali's prefectural capital and the main urban center of Dali. Many E Lalo speakers live and work in Xiaguan, returning home only for special occasions and when crops need intense attention, such as harvest time. Thus, E Lalo speakers are also more likely to have undergone the changes in Table 6-21 than, for example, Central Lalo speakers who live in areas with a more concentrated Lalo population. Just as non-Core varieties, E speakers show a greater tendency to lose PLa features that differ from Mandarin than C-W varieties. C-W varieties show a loss of two or less, and this may be due to the fact that their social networks are more Lalo-centered, with a less intense contact relationship with Mandarin. C-W varieties are also more likely to have higher ethnolinguistic vitality than peripheral varieties.

Table 6-21: Summary of ecologically non-distinctive changes in Lalo

Partial or complete loss of:		*preglottalised initials	*retroflex fricatives and affricates	*harsh phonation	*h̃
	Eka	✓	✓	✓	✓
	MD	✓		✓	✓
	YL	✓	✓	✓	✓
	XZ	✓		✓	✓
SE	GP	✓		✓	
E	DC	✓	✓	✓	✓
	HS	✓	✓	✓	
	TS	✓	✓	✓	
W	YL	✓		✓	
	DT	✓		✓	
	SZP	✓		✓	
	SLZ	✓		✓	
C	YA	✓	✓		
	QS	✓	✓		
	CJ	✓	✓		
	WC	✓			
	LB	✓			
	LJ				
	QY				

While SW Mandarin is the dominant language in all Lalo-speaking areas, Lalo speakers are often in contact with other indigenous minority groups such as Bai, Wotizo, Dai and Lahu. Table 6-22 below shows which Lalo varieties are in contact with these other languages. MD speakers in southern Lincang have adopted the Dai Buddhist religion, and Eka speakers have become Christians through the influence of their Lahu neighbors. XZ, YL and W-SLZ are all located in townships where Lalo and Bai villages are interspersed. E-HS and E-DC speakers, when using Mandarin to explain the difference between their speech and that of CE-YA, referred to themselves as 'Bai Yi' and to CE-YA as 'Han Yi,' and further explained that the difference between themselves and CE-YA was that they have a stronger contact relationship with Bai than CE-YA has.

Table 6-22: Other languages in contact with Lalo

	Dai (Lincang)	Lahu (Lincang)	Bai
MD	✓		
Eka	✓	✓	
XZ, YL, W-SLZ			✓
E-HS, E-DC			✓

Contact relationships also exist between Lalo varieties, relationships that cut across Core Lalo cluster boundaries, as well as between W-SLZ and XZ. One example of contact-induced change is CE-YA's Tone *1 split, discussed in §5.3.1, which could be the result of contact with E-DC and E-HS speakers. Other East Mountain varieties to the south of CE-YA, which do not have close contact with E Lalo, do not show the split. E-TS and XZ's affrication of labial stops, discussed in §6.7.3, may be a result of contact with W varieties. C-LB and W-YL's parallel development of PLa labial stops before *u, discussed in §6.5, is another example of the diffusion of change across dialect clusters. While the comparative method is largely able to identify and disregard changes resulting from diffusion, the impact these contact relationships have on the synchronic classification of Lalo varieties is still important to consider in terms of language planning, as is discussed further in §7.2.

6.10 Summary

This chapter provides evidence supporting the Lalo phylogenetic tree presented in Figure 6-1. Eka, MD and YL descend directly from Proto Lalo; the early migrations of these groups' ancestors out of the Lalo homeland result in their failure to share in any subsequent innovations that define Lalo subgroups. The ancestors of Eka speakers left the Lalo homeland area over 300 years ago. Ancestors of MD emigrated out of southern Dali at a later time than Eka, probably less than 200 years ago. The migration history of YL, located in the far western periphery of Lalo distribution, is as yet unknown. All other Lalo varieties are grouped within Greater Lalo, which includes XZ and Core Lalo varieties.

In contrast with peripheral groups and XZ, Core Lalo varieties are all found in and around the traditional Lalo homeland of southern Dali Prefecture. Core Lalo contains the four major dialect clusters of Lalo: C, W, E and SE. Within Core Lalo, C-W and E-SE form distinct clusters. Each lower-level cluster shows distinct sets of innovations that serve to define them as a cluster. W Lalo varieties share a chain of tonal innovations, C Lalo varieties share changes in initials and rhymes, SE varieties share a conditioned tone split, and E Lalo varieties share innovations in rhymes. Later changes divide divergent varieties from the inner core within W, C, and E clusters. The patterns of change described in this chapter create complex synchronic correspondence sets that negatively impact cross-dialectal comprehension, to the extent that intelligibility between the three groups is negligible, as shown in §7.3.

The shared innovations described in the above sections are summarised in Table 6-23 below. This list of innovations is by no means exhaustive, but adequately demonstrates the distinctive innovations sets that define Lalo subgroups after the PLa stage. As peripheral varieties Eka, MD, and YL do not share any innovations after the PLa stage, they are not included. Innovations that distinguish the groups are enclosed with lines, and labels are given above the respective subgroups. The key to the innovation numbers is given below Table 6-23.

Table 6-23: Summary of distinctive Lalo subgroup innovations

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
		Greater Lalo																			
	XZ	✓	✓	Core Lalo														E-SE			SE
SE	GP	✓	✓	✓														✓	✓		✓
E	TS	✓	✓	✓									✓					✓	✓		
	DC	✓	✓	✓											Core E			✓	✓	✓	
	HS	✓	✓	✓	C-W		W						✓					✓	✓	✓	
W	YL	✓	✓	✓	✓	✓	✓	✓	✓	Core W							✓				
	DT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓									
	SZP	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓									
	SLZ	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	C								
C	YA	✓	✓	✓	✓	✓							✓	✓	✓	✓	Core C				
	WC	✓	✓	✓	✓	✓					✓		✓	✓	✓	✓	✓				
	QY	✓	✓	✓	✓	✓							✓	✓	✓	✓	✓				
	LB	✓	✓	✓	✓	✓							✓	✓	✓	✓	✓				
	QS	✓	✓	✓	✓	✓							✓	✓	✓	✓	✓				
	CJ	✓	✓	✓	✓	✓							✓	✓	✓	✓	✓				
	LJ	✓	✓	✓	✓	✓							✓	✓	✓	✓	✓				

Key to Table 6-23 innovation numbers:

1) 'crow' (n) *a³nak^H ('the black one')> *a¹ŋja̠^Hbɛ̠^H ('bird'+bɛ̠^H)
2) 'taro' *a¹tʃʰo̠^H
3) *-tsa³³ plural marker in personal pronoun paradigm
4) *g > ɣ/_*a, *aŋ, *o̠
5) reinterpretation of 'young' as 'soft years'
6) *L > high
7) *1/+ʔ_ > mid-high
8) *H > mid-high
9) *1 > low-rising/elsewhere
10) metathesis of initials in 'grasshopper'
11) shared tone sandhi patterns: high > mid-high/_high
12) *e > i
13) *e̠ > i̠/[+high, -back]_
14) *ɛ̠ > a̠/[+back]_
15) *a > ɛ/ *C[+ant, -stri]_$CV[+front]
16) *ɛ̠ > a̠/elsewhere
17) *y > ɨ/[+round, -high]_
18) *o> ɨ//[-back] and [+back,+nasal]_
19) *y, *ɨ > ɨ/elsewhere
20) *2/*ʃ, *ʔ_, *[-voi, +sg]__ > high; *L/*[-voi]__ > high

7 Synchronic subgrouping of Lalo varieties

7.1 Introduction

While Chapter 6 provides evidence for subgrouping Lalo varieties from a diachronic, phylogenetic perspective, this chapter uses phonetic distance, intelligibility, and perception to classify Lalo varieties from a synchronic perspective. NeighborNet and multidimensional scaling diagrams based on phonetic distance identify lower-level clusters of E, SE, W, and C Lalo, and individual non-Core varieties Eka, MD, YL and XZ (§7.2). Intelligibility test results indicate that cross-cluster intelligibility is usually low, unless a variety has significant cross-cluster contact (§7.3). In §7.4, intelligibility test results show a strong, significant correlation with phonetic distance, thus providing an external validation of the phonetic distance results. Finally, speaker perceptions and interactions show native speaker awareness of dialect similarity and difference, enriching the overall picture of Lalo dialect relationships (§7.5).

7.2 Phonetic distance results

Phonetic distance as measured by the Levenshtein distance (LD) algorithm, unlike the comparative method, does not differentiate between retention and innovation, nor does it distinguish contact-induced change from genetically shared change. Therefore, results based on phonetic distance should not be equated with a phylogenetic tree based on shared innovations, though there are often similarities. Similarities between diachronic trees and synchronic networks are due to inherent aspects of dialect diversification, namely, that historical innovations cause phonological divergence between different dialect clusters. Yet contact, retention, and drift are also inherent characteristics of the progression of language through time. The comparative method attempts to sift out contact, retention, and drift and identify innovations that are useful for subgrouping. However, a more complete picture of Lalo linguistic ecology should incorporate both divergent and convergent evolutionary effects.

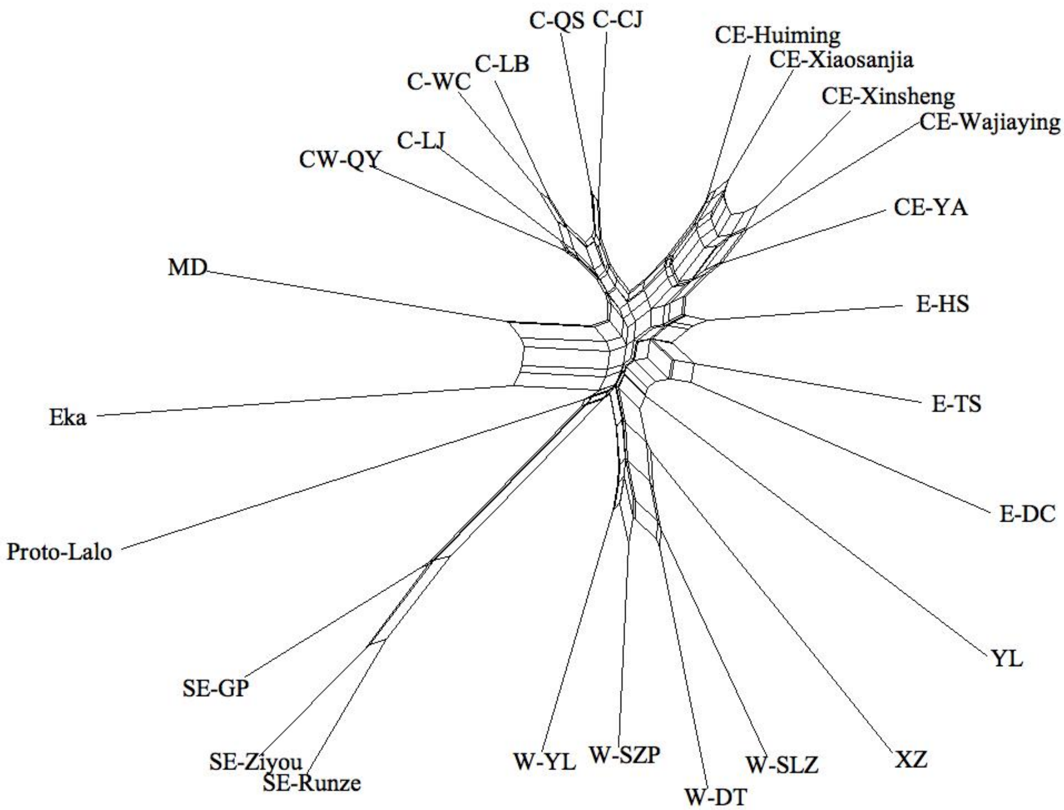
The usefulness of phonetic distance is to be found in its strong correlation to speaker perception and intelligibility (Gooskens & Heeringa 2004, Gooskens 2006), as discussed in §1.4.3. For the purposes of language planning, factors such as overall phonetic similarity (whatever the cause), speaker's perceptions of difference, and intelligibility are often more important than shared innovations. Critically for endangered languages, historical linguistics and language development efforts must be considered in tandem. As shown in §7.2.1 and 7.2.2 below, phonetic distance results usually match the subgroups of Chapter 6, especially in the identification of distinct E, SE, C, and W clusters. Yet the discrepancies between the diachronic and synchronic classifications have fruitful implications for language planning.

For example, Central East Mountain (CE) speakers in northeastern Weishan County are in close contact with E Lalo varieties E-DC and E-HS, located in eastern Dali Municipality. This contact is probably responsible for the development of the contrastive low-rising tone in CE-YA, as discussed in §5.3.1. However, shared innovations identify CE-YA as a C Lalo variety, as shown in Chapter 6. The NeighborNet phenogram in Figure 7-1 portrays CE varieties as a distinct branch halfway in between the C and E clusters. This reflects the hybrid nature of CE varieties, located as they are in an area of convergence of the C and E clusters. This finding has implications for language planning efforts in this area. Language planners should consider including CE-YA and E Lalo speakers in the same community-based language planning efforts. For CE-YA speakers, non-print media in Lalo, such as a video on AIDS prevention, may be more effective in an E Lalo variety than, for example, in a West Mountain C Lalo variety such as CW-QY.

7.2.1 NeighborNet network analysis

Figure 7-1 below shows the NeighborNet phenogram using the equal angle method on the phonetic distance matrix for 24 Lalo varieties, plus Proto Lalo. Data from six CE and SE varieties come from Lam and Chan (2009): CE-Huiming, CE-Xiaosanjia, CE-Xinsheng, CE-Wajiaying, SE-Runze, and SE-Ziyou. Figure 7-1 is not a historical tree, in that it does not illustrate genetic relatedness. This phenogram shows Lalo varieties' relative distance from each other in terms of the differences in their pronunciation of the 175 cognates contained in the Swadesh 200 subset of the 1,001.item word list (see §2.4.1). The reticulated or net-like lines show ambiguity or mixed signals in the data: while some pronunciations are shared, others are different. Reticulation in a linguistic phenogram is a result of either independent shared developments or borrowing through contact (McMahon et al. 2007). Fewer reticulated lines mean a clearer signal and thus a more clearly defined cluster. The relative length of the lines depicts relative difference: the longer the branch, the more different the variety is.

Figure 7-1: NeighborNet phenogram based on LD, 24 varieties



In Figure 7-1, all C varieties branch off together and then quickly bifurcate into two sub-branches in the upper half of the phenogram. Core C varieties form a tight cluster with fewer reticulations and shorter lines connecting them, while CE varieties forming a slightly looser cluster. All E Lalo varieties are found in one area of the phenogram, though not as a tightly bundled cluster. This result is consistent with the phonological differences found among E Lalo varieties, as described in §3.6. For example, while E-DC has lost harsh phonation in both *L and *H tone categories, E-HS and E-TS have preserved harsh in *L but not in *H. YL, a non-Core, peripheral Lalo variety, does not cluster with any Core or non-Core Lalo varieties. Instead, it branches off from the root of the W cluster and diverges away from all other varieties with a long single line. The YL node leans in the direction of W varieties, probably because of YL's tonal changes, described in §5.3.4. YL shows the *L > high change as W varieties do, although in YL both *H and *L merge to high.

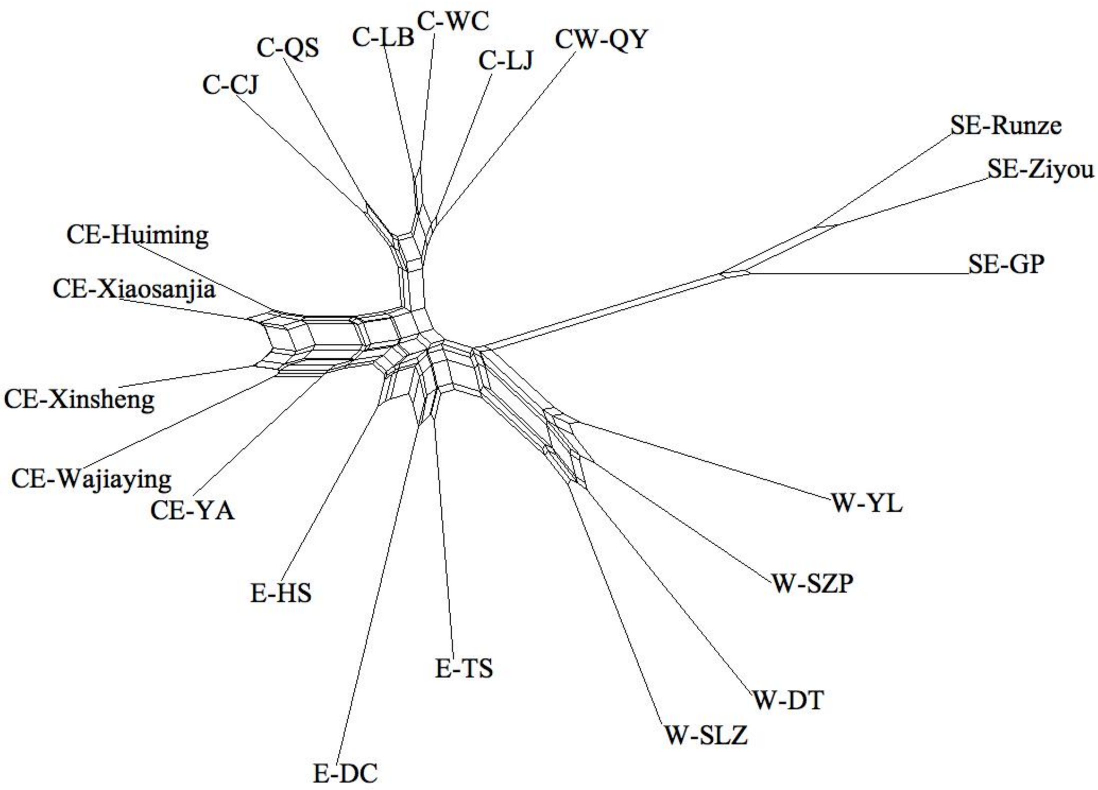
W varieties form a rather long reticulated branch in the bottom half of the phenogram. Although W forms a more clearly defined cluster than E Lalo varieties, it is still not as tightly bundled as C Lalo varieties. This is consistent with the differences among W varieties' phonological inventories as described in §3.5. For example, W-DT shows the *a > o, *aŋ > a set of changes, while other W varieties do not. XZ is seen as linked to W varieties; this perhaps may reflect XZ's participation in Greater Lalo innovations. SE varieties are separated from other Lalo varieties by even longer lines than the W branch, reflecting the substantial phonetic differences between SE varieties and the other Core Lalo clusters.

MD and Eka appear to form a cluster through a long, reticulated branch, but are then separated from each other by long individual lines. The long lines separating MD and Eka from other varieties reflects their early migration out of the Lalo area, which occurred before the Core Lalo innovations did. The apparent MD and Eka cluster is a result of shared retentions and areal influence, not innovations, and they are not grouped together on historical grounds. Synchronically, though, both Eka and MD are located in the same area of southern Lincang Prefecture, and are thus part of the same linguistic ecological region. Both Eka and MD are in contact with the languages of this region, such as Dai and Black Lahu. From a language planning perspective, their geographical proximity and shared areal influence make them ideal candidates for partnership in community-based language planning efforts.

Figure 7-2 below gives the NeighborNet phenogram for Core Lalo varieties only, providing a closer look at NeighborNet's identification of the four Core Lalo clusters. As in Figure 7-1, Core C Lalo varieties form the tightest cluster, W and SE clusters form long, reticulated branches, and E varieties cluster loosely, with CE varieties between Core C and E. NeighborNet does not represent the historical link between E and SE or between C and W, as described in §6.6 and 6.7. This is probably due to W and SE varieties' multiple tone splits and mergers, as described in §5.3, which increases the distance between W and C varieties, and between E and SE varieties.

Within the C Lalo cluster, C-CJ and C-QS branch off together, which matches their geographical proximity and some shared developments. C-CJ and C-QS are both located in the southern area of C Lalo distribution, with C-CJ in southern Nanjian County and C-QS in northern Jingdong County. Also, both C-CJ and C-QS show the merger of retroflex fricatives with alveolar fricatives. C-LB and C-WC are loosely paired. Like CJ and QS, LB and WC have lost preglottalised initials and gained a contrast between /a/ and /ɑ/, but unlike CJ-QS, LB and WC have retained retroflex fricatives, as LJ and QY do. These developments and retentions, some shared with the CJ-QS pair and some with the LJ-QY pair, help explain LB-WC's position in between the CJ-QS and LJ-QY pairs, though a bit closer to LJ-QY. LJ-QY pair off together as the only two Lalo varieties in this research that have retained the Proto Lalo preglottalised initials. They are also geographically contiguous to one another.

Figure 7-2: NeighborNet phenogram based on LD, Core Lalo only



7.2.2 Multidimensional scaling (MDS)

Figure 7-3 and Figure 7-4 show the results of using Kruskal's (1964) method of MDS on the phonetic distance matrix. Figure 7-3 shows all Lalo varieties, while Figure 7-4 shows only Greater Lalo (Core Lalo plus XZ). In general, these results are consistent with NeighborNet's network diagrams given in §7.2.1.

Figure 7-3: Multidimensional scaling (Kruskal's method) of all Lalo varieties

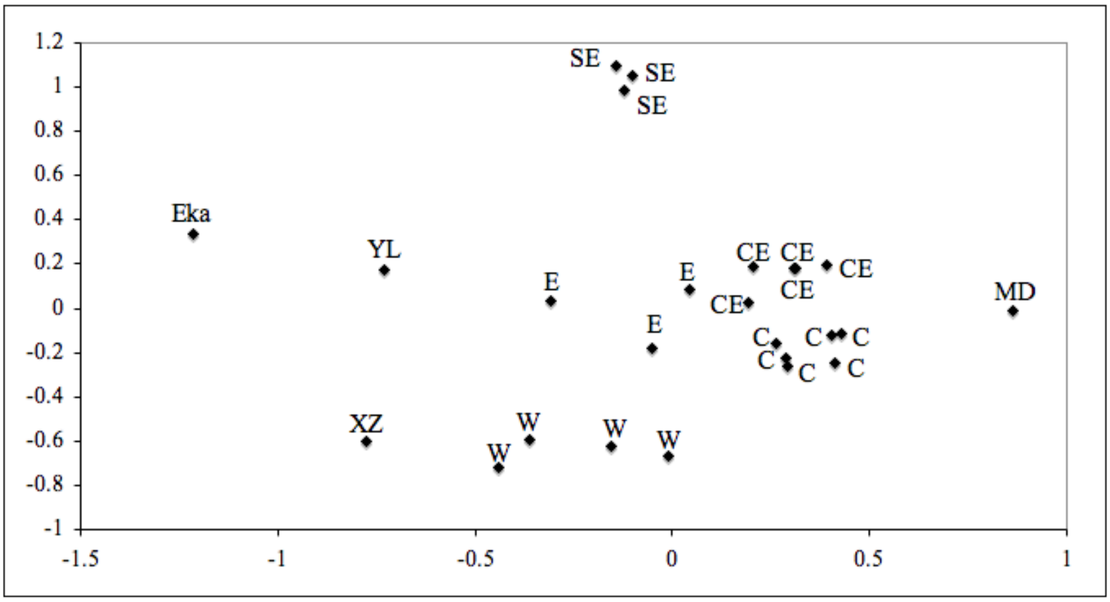


Figure 7-3 shows all C and CE varieties clustering together, with E varieties close by. Peripheral varieties YL, Eka and MD are far apart from each other and from everyone else, and do not form a cluster with anyone. Historically, these varieties do not take part in any Greater Lalo innovations. The MDS distance also matches the geographic distance these Lalo varieties have with Core Lalo, with Eka and MD to the far south and YL to the far west of Core Lalo distribution. XZ belongs to Greater Lalo but is not part of Core Lalo, which is reflected by its proximity to the W cluster. C, CE and SE clusters are clearly defined, while the W and E cluster is less clearly defined, similar to the results given in §7.2.1.

Figure 7-4: Multidimensional scaling (Kruskal's method) of Lalo varieties, Core Lalo only

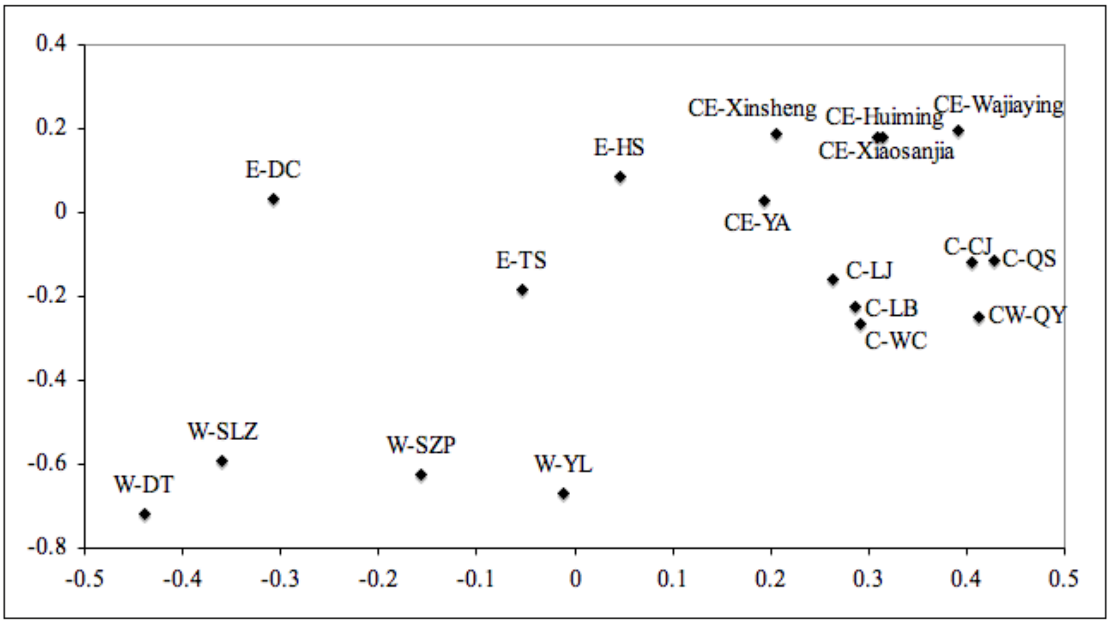


Figure 7-4 above shows MDS based solely on Core Lalo without the SE cluster. Within the C cluster, as in NeighborNet's Figure 7-2, C-CJ and C-QS cluster together. However, C varieties do not pair off completely; instead, a triplet grouping of C-LJ, C-WC and C-LB is seen, with CW-QY slightly off to the right. This may be due to some of the distinctive developments of CW-QY, such as the change of Proto C Lalo's *ɣ̩ to /ə/. The fuzzy border between CE and E clusters is consistent with the dialect convergence zone seen in northeast Weishan and eastern Dali Municipality. W varieties show pairs of W-DT and W-SLZ versus W-SZP and W-YL. While E-TS and E-HS are relatively closer to each other, E-DC is more distant. E-DC's distance from other E Lalo varieties is hinted at in its relatively longer line seen in Figure 7-2, but becomes more visually apparent in Figure 7-4. This finding is consistent with the divergent nature of E-DC's tonal developments, as noted in §7.2.1.

7.3 Intelligibility test results

Intelligibility tests, based on Recorded Text Testing (RTT) methodology described in §2.5, measure levels of comprehension when a listener from variety A listens to a short narrative from variety B. Intelligibility test results gauge the impact on comprehension of cross-varietal differences in the phonetics, phonology, lexicon, and syntax of the two tested varieties. From a language planning perspective, cross-varietal intelligibility is a crucial factor in the planning and dissemination of language materials, both print and non-print. Intelligibility test results also provide external validation for the phonetic distance results through the strong, significant correlation found between them, presented in §7.4 below.

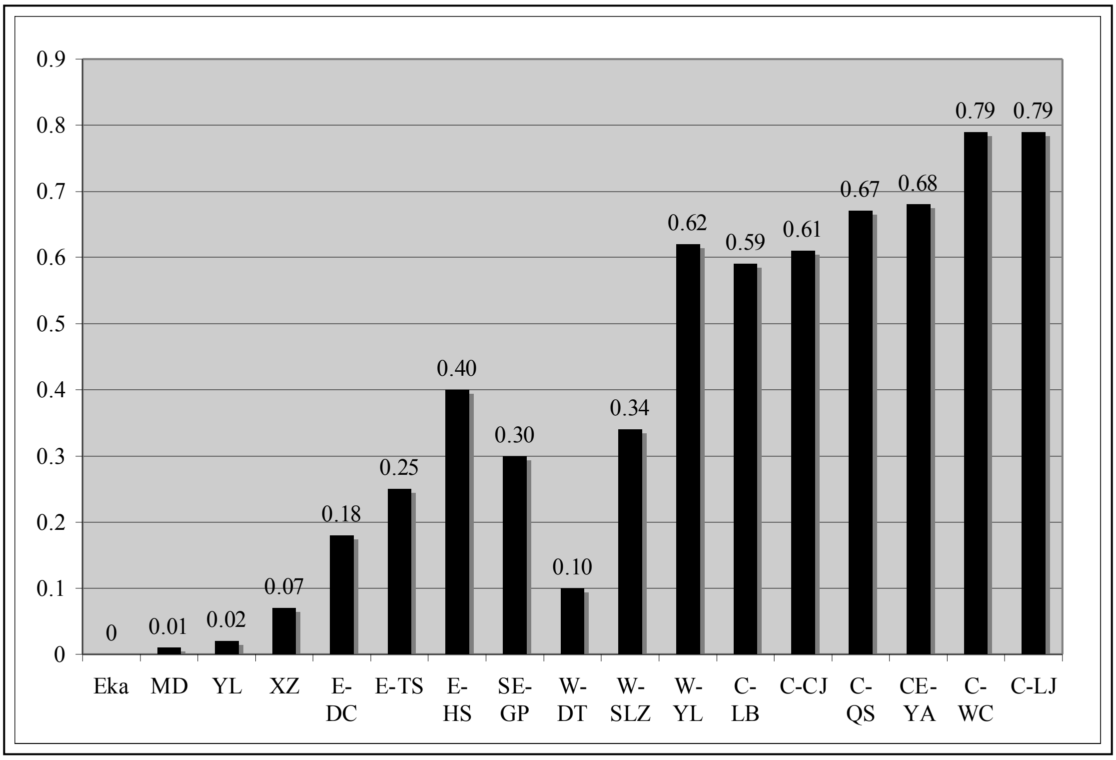
Table 7-1 presents the RTT intelligibility test results for all varieties that were tested during fieldwork. The limitations of listeners' patience and travel time, as discussed in §2.5, made testing all RTTs at every datapoint not feasible. RTT results of E varieties listening to CW-QY are marked with an asterisk to denote that E speakers listened to a different CW-QY text than other varieties, and were tested with the traditional RTT question and answer format, as opposed to the RTT retelling format used in all other locations. Reasons for this discrepancy are given in §2.5.

Table 7-1: RTT intelligibility test results

Text: / Listener:	CW-QY	C-LJ	CE-YA	E-HS	E-DC	C-CJ	C-WC	W-DT	W-YL
MD	0.01	0	0		0				
Eka	0								
YL	0.02								
W-DT	0.10	0.35			0.04		0.66		
W-YL	0.62	0.86						0.62	
W-SLZ	0.34			0.14					0.24
XZ	0.07			0.05				0.60	0.11
E-TS	0.25*								
E-DC	0.18*			0.88					
E-HS	0.40*								
SE-GP	0.30		0.24	0.65					
CE-YA	0.68				0.70				
CW-QY				0.58					
C-WC	0.79	0.93			0				
C-QS	0.67	0.64				0.32			
C-LJ	0.79		0.53		0.06				
C-LB	0.59	0.70		0.17				0.24	
C-CJ	0.61	0.75							

Figure 7-5 shows the RTT results for listeners when responding to the CW-QY text. As explained in §2.5, CW-QY was tested in the most places because of its candidacy as a reference dialect for C Lalo language planning.

Figure 7-5: RTT results for CW-QY text



In general, RTT results match expectations based on the historical divergence and synchronic dissimilarity explored in Chapter 6 and in §7.2 above. Peripheral Lalo varieties Eka, MD, YL, and XZ listeners all showed very low comprehension of the CW-QY text. E Lalo listeners showed slightly higher comprehension than peripheral varieties, but still quite low (all below 40%). W varieties range widely on their comprehension, from 10% in W-DT to 62% in W-YL. W-YL is on the border between C and W varieties and is in contact with C varieties such as C-LB. The unexpectedly high score for W-YL may reflect acquired rather than inherent intelligibility, i.e., may be due to contact rather than structural similarity. Within the C cluster, C-WC and C-LJ score the highest, which reflects their geographic and historical proximity to CW-QY. Other C Lalo varieties also score relatively high (above 60%), especially when compared with listeners from the E and W clusters.

Figure 7-6 shows the RTT results for listeners when responding to the C-LJ text, another C Lalo variety. The trend matches that of Figure 7-5: non-C listeners show low comprehension of C Lalo, while other C varieties show high comprehension. Again, W-YL's high score is anomalous, suggesting the effect of contact.

In general, non-E varieties show low comprehension, as seen in results for MD, XZ, W varieties, and most C varieties. The intra-cluster score of E-DC listening to E-HS is much higher at 88%. CE-YA's intermediate score of 70% when listening to E-DC is probably due to contact, as the two varieties are geographically contiguous and share many social ties through intermarriage and other social exchanges. Because of the close contact between these two communities, it was impossible to screen out CE-YA participants who had already been exposed to E-DC, as all adults in the community had already experienced contact with E-DC. SE-GP's intermediate score of 65% when listening to E-HS arises from a similar language contact situation.

Figure 7-6: RTT results for C-LJ text

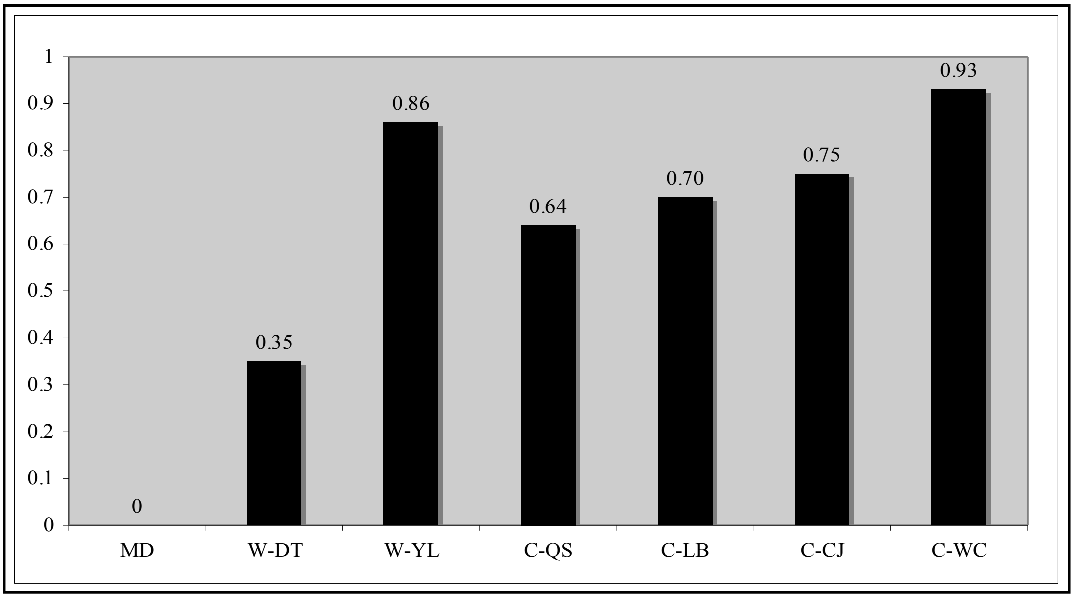
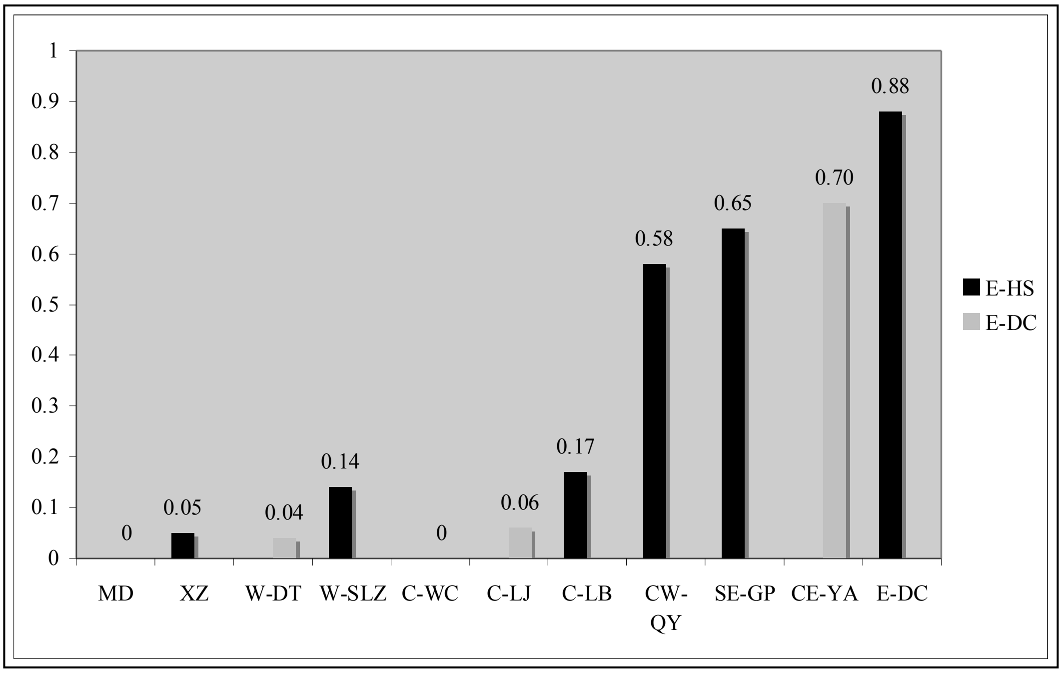


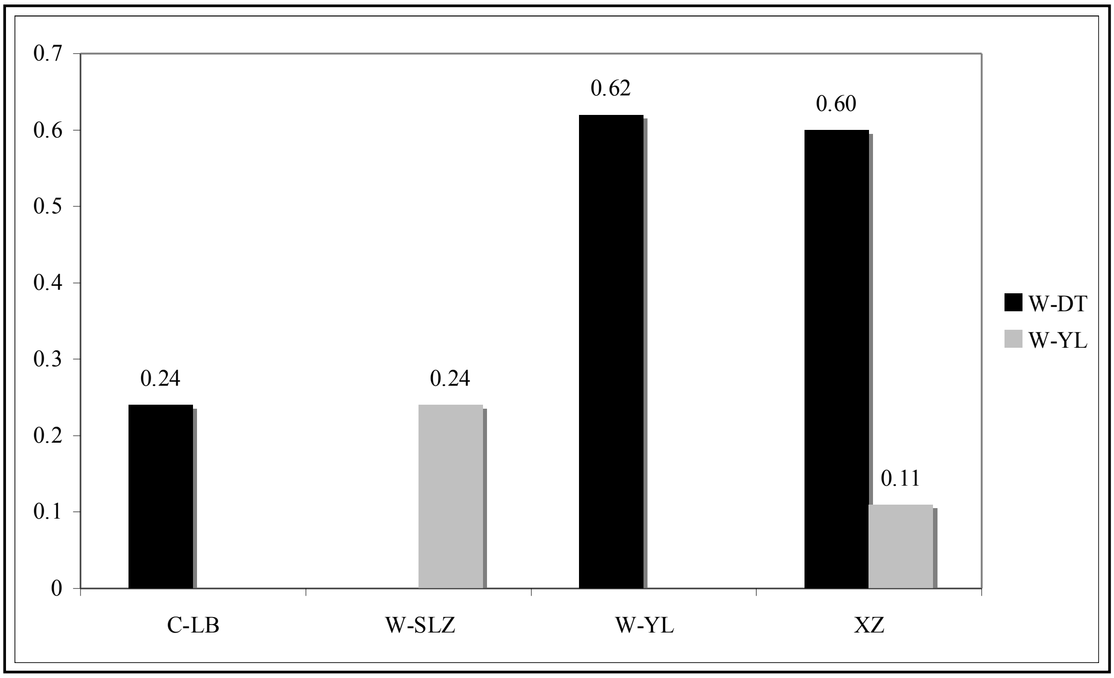
Figure 7-7 shows the RTT results for listeners when responding to E-HS (marked in black) and E-DC (marked in gray) texts.

Figure 7-7: RTT results for E-HS and E-DC texts



Finally, Figure 7-8 shows the RTT results for listeners when responding to the W-DT (marked in black) and W-YL (gray) texts. These texts were collected towards the end of fieldwork, and so were tested in the least number of locations. Still, a few observations can be made. Not surprisingly, C-LB shows low comprehension of W-DT, while W-YL shows high comprehension. Unexpectedly, W-SLZ shows low comprehension when listening to the W-YL text, but this may reflect the peripheral nature of W-YL's membership in the W cluster. XZ's scores are low for the W-YL text, but rather high for W-DT. Both XZ and W-DT share the *a > o, *aŋ > a chain, so this may have aided XZ's comprehension.

Figure 7-8: RTT results for W-DT and W-YL texts



In summary, intelligibility test results agree with the classification of Lalo varieties presented in Chapter 6 and in §7.2 above. Intra-cluster intelligibility tends to be high, as seen in C Lalo varieties' scores when listening to CW-QY and C-LJ texts, and in E-DC's high score on the E-HS text. Cross-cluster intelligibility tends to be low, unless there is significant contact. This is seen, for example, in the low scores of all non-C speakers when listening to C texts, and of non-E speakers listening to E texts. Contact is usually a factor in unexpectedly high scores of cross-cluster listeners, as in the case of CE-YA listening to E-DC, and of W-YL listening to CW-QY and C-LJ texts.

7.4 Correlation between phonetic distance and intelligibility

Besides revealing the tendency for low cross-cluster intelligibility, RTT results are also used to provide external validation for the phonetic distance results given in §7.2 above. The strong, significant correlation between intelligibility and LD has already been noted for Scandinavian languages (Gooskens 2006) and Sinospheric, tonal languages such as Nisu (Yang 2009a), Bai and HSH Zhuang (Yang & Castro 2008). These correlations suggest that LD is a good approximation of intelligibility for both Indo-European and East Asian tone languages.

Table 7-2 shows the correlations between LD and intelligibility for all RTT results, and for the CW-QY text only. 'All RTT results' include all RTT scores given in Table 7-1, which includes listeners' responses to different texts. 'CW-QY text only' includes listeners' scores only when listening to a CW-QY narrative. In the column headings, N is the number of observations, R is Pearson's correlation coefficient, R squared is the proportion of variance explained by the model, and P is the level of significance. The closer R is to 1 or -1, the stronger the correlation between the two variables. The negative R values in Table 7-2 indicate a negative relationship between LD and intelligibility, i.e., the greater the phonetic distance, the lower the intelligibility score. R squared, calculated simply by squaring the value of R, indicates how well a regression line approximates real data points, i.e., how much variance in intelligibility can be explained by LD. The closer to 1 R squared is, the better LD is at predicting intelligibility. The P value is the probability of finding the current R if the real R were in fact zero. P values of less than .05 are usually accepted as statistically significant. Very low P values, as seen in Table 7-2, indicate a low probability of accepting that there is a relationship between LD and intelligibility when there really is not.

Both correlations given in Table 7-2 are high and statistically significant, with R = -0.71, P = 0.000000 for all RTT results, and R = -0.85, P = 0.000001 for the CW-QY text only. The difference between the R values of all RTT results versus CW-QY text only is probably due to the lack of comparability between different RTT texts. Not all RTT texts are equal in terms of ease of understanding, as some may have more predictable plots or Chinese loanwords that enable guessing. Therefore, a better way of external validation is to include only the RTT scores of the CW-QY text; in this way, all listeners are responding to the same or similar stimuli. E Lalo speakers, however, listened to a different CW-QY story and used a slightly different format than other listeners, so the stimulus is not exactly the same for all listeners. Yet the stimuli are similar in the sense that all listeners are responding to the same variety. If the RTT results from E listeners are taken out, the correlation increases slightly to -0.86, with a slightly higher p value (0.00009) that is still strongly significant.

With CW-QY results only, the R squared is very high at 0.72. This means that LD alone is able to explain 72% of the variance in intelligibility scores. The remaining 27% of the variance is probably due to cross-varietal differences in lexicon and syntax, as well as other factors such as attitude and previous exposure to CW-QY. If the cross-varietal differences were included in a multiple regression model, we would be able to see which level (phonetic, lexical or syntactic) contributes the most to difficulties in comprehension. That, however, is beyond the scope of this book.

Table 7-2: Correlations between LD and Intelligibility

	N	R	R squared	P
All RTT results	44	-0.71	0.50	0.000000
CW-QY text only	17	-0.85	0.72	0.000001

Figure 7-9 shows the scatter plot of intelligibility versus LD for all RTT results, with intelligibility as the Y variable and LD as the X variable. Outliers are labeled, with the listener variety listed first, followed by the text. Most outliers appear above the regression line, indicating unexpectedly high RTT scores. W-YL's unexpectedly high scores when listening to C varieties, and CE-YA's high score when listening to E-DC, are due to acquired intelligibility through contact, as noted already in §7.3. E-DC's high score when listening to E-HS also appears above the regression line, even though both are E varieties. In this case, perhaps LD's sensitivity to small phonetic differences has negatively impacted its approximation of intelligibility. The only outlier below the line is C-QS listening to C-CJ. Even though these two varieties cluster closely together from both diachronic and synchronic perspectives, QS listeners score poorly when listening to the C-CJ text. This may be due to the difficulty of the C-CJ text or to some other external variable, a question for future investigation. In general, however, intelligibility scores decrease as LD increases.

Figure 7-10 shows the scatter plot of intelligibility versus LD for CW-QY RTT results only. The regression line fits well, with only W-YL appearing as an outlier, due to contact with C varieties. C Lalo varieties cluster in the top left with high comprehension and low LD, E and W show lower comprehension and higher LD, and peripheral varieties show almost no comprehension and high LD.

Figure 7-9: Scatter plot of intelligibility versus LD, all RTT results

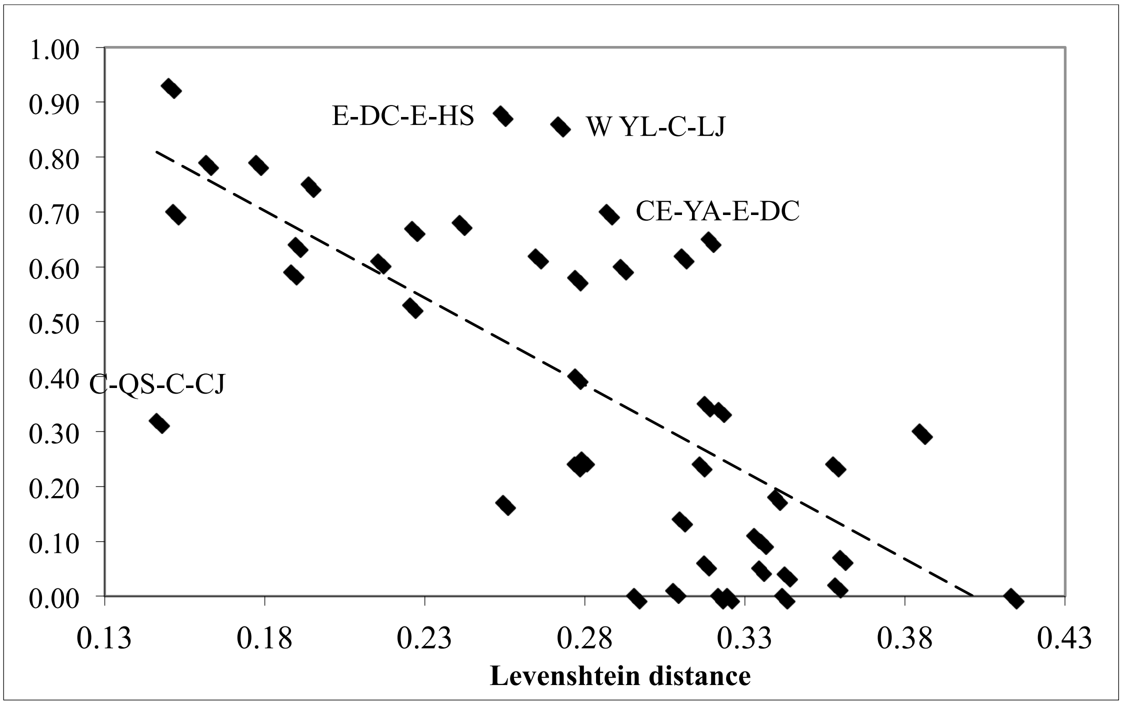
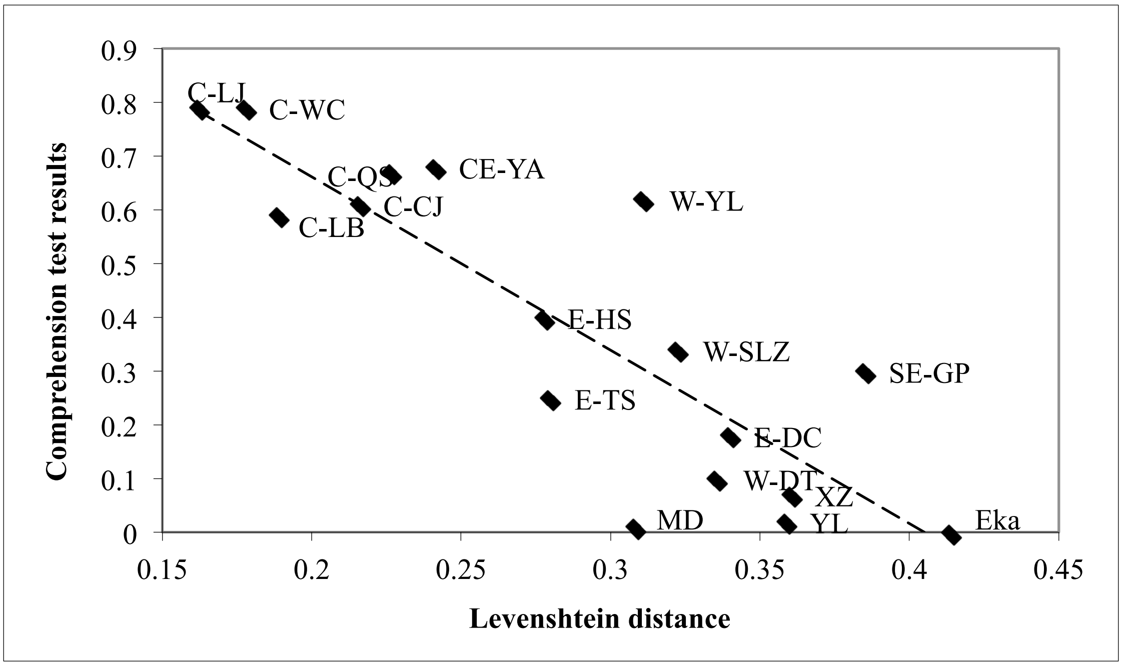


Figure 7-10: Scatter plot of intelligibility versus LD, CW-QY RTT results only



7.5 Speaker perception and interactions

As discussed in §2.6, subjective measures of difference such as the perception of sameness or difference can reveal yet another aspect of the synchronic relationships between Lalo varieties. Lalo speakers' perceptions of other varieties were explored through the indicators of prestige and perceived sameness or difference. Prestige was probed through asking which village spoke the best Lalo and which village was the most important. In almost all cases, participants preferred their own variety to others. Only one location, C-LJ, responded that CW-QY sounded better because CW-QY speech contained fewer Chinese loanwords. The general egalitarian structure among Lalo varieties is similar to the sociolinguistic situation of the Sui, an indigenous minority language spoken in Guizhou (Stanford 2007, Stanford & Preston 2009). Stanford (2007) identifies the lack of a standardised form of the indigenous language and the prestige attached to Chinese as factors in explaining why varieties of Sui do not differ in prestige. The same factors are also seen in the Lalo sociolinguistic context. However, the perception of Weishan as the traditional homeland of the Lalo gives this area a subtle prestige, especially the western Weishan area where CW-QY is located. While direct probes of prestige (i.e., which village spoke the best Lalo) did not reveal Weishan's slightly raised status, asymmetrical patterns in perceived sameness or difference did, as discussed below.

To evaluate perceived sameness or difference, respondents labelled the speech of Lalo villages in their area as 'the same,' 'a little different' and 'very different' from their own speech. Participants were also asked to give a subjective evaluation of their comprehension of that variety. The same perceptual questions were asked about the speech of brides who married into the respondents' village from that particular variety.

Results from the different probes were combined to classify the named villages into the three categories of 'same,' 'a little different,' and 'very different'. Following the tradition of perceptual dialectology (Preston 1999, Long & Preston 2002), these categorisations are represented in the form of maps in Figure 7-11 and Figure 7-12. The villages or townships named in the interviews are given in Table 7-3. A thick, dark line links the datapoints to villages named as 'same,' a lighter line marks villages named as 'a little different,' while a dashed line marks 'very different'. Arrows marking directionality of perception are given when respondents named another datapoint included in the research, to clarify ambiguity. Named townships are labeled on the map, but not individual villages; both townships and villages are all listed in Table 7-3.

Figure 7-11 shows the responses of the majority of datapoints, excluding those in Baoshan, which are given in Figure 7-12, and those in Lincang (Eka and MD), which only named one other village. As expected, respondents show a tendency to identify Lalo villages located nearby as 'same' or 'a little different,' whereas villages located more distantly are more likely to be labeled 'very different'. A more interesting trend is the asymmetrical nature of datapoints' perceptions towards each other. This asymmetry is especially striking in how datapoints outside of Weishan view those inside Weishan, and how CE-YA (E Mt.) views C Lalo varieties in western Weishan. Datapoints located outside of Weishan tend to label Weishan datapoints as more similar than Weishan datapoints label them. For example, C-WC, located in Yangbi County, named CW-QY in Weishan as 'the same,' but CW-QY labeled C-WC as 'a little different'. E-DC, located in Dali Municipality, named CE-YA as 'a little different,' whereas CE-YA labeled E-DC as 'very different'. Similarly, CE-YA tends to claim more similarity with varieties in western Weishan than those same varieties extend to CE-YA. While CE-YA labeled CW-QY, C-LJ, and Qinghua Township as slightly different, both CW-QY and C-LJ label CE-YA as 'very different'.

This asymmetry is probably related to a combination of prestige and population concentration factors. These two factors overlap, as the areas of highest population concentration are also found in western Weishan, part of the traditional homeland of the Lalo. For example, CW-QY, with a high concentration of Lalo population, is more likely to think of other datapoints as slightly or very different, whereas areas with lower Lalo population concentration, such as CE-YA or C-WC, are more eager to claim affinity with a high concentration area. Prestige is also attached to the whole of Weishan County as well, as seen in the differing names used in reference to E-DC and CE-YA. While E-DC speakers refer to CE-YA speakers as [mi^{55}ʃa̱^{21}pa̱^{21}], meaning 'person from Misha (Weishan),' CE-YA speakers refer to E-DC speakers as [a^{21}wɛ^{33}pa̱^{21}], meaning 'person who speaks awkwardly'. The difference in linguistic prestige revealed in the names is paralleled by the asymmetry of perception seen between E-DC and CE-YA.

Social contact is also an important factor influencing speakers' perceptions of sameness or difference. Contact was assessed through bride exchange, participation in periodic markets, shared cultural festivals, and travel between Lalo villages. In general, more frequent contact exists between datapoints and varieties located nearby, which usually are the same varieties identified as 'the same' or 'a little different'. One puzzle of Figure 7-11 is that E-DC ranks CE-YA as 'a little different' while they rank E-HS as 'very different,' even though CE-YA is a C Lalo variety and E-HS belongs with E-DC to the E Lalo cluster. Patterns of contact help explain this puzzle. In terms of bride exchange, E-DC identified CE-YA and the surrounding E Mountain villages as frequent givers and receivers of brides, whereas E-HS was not identified as a destination or sender of brides at all. The high level of contact between E-DC and CE-YA has most likely influenced E-DC speakers to classify CE-YA as more similar to them than they perceive E-HS to be, even though E-HS is phylogenetically closer to E-DC than CE-YA is.

Figure 7-11: Lalo dialect perceptions, excluding Baoshan and Lincang. Arrows indicate directionality of perception.

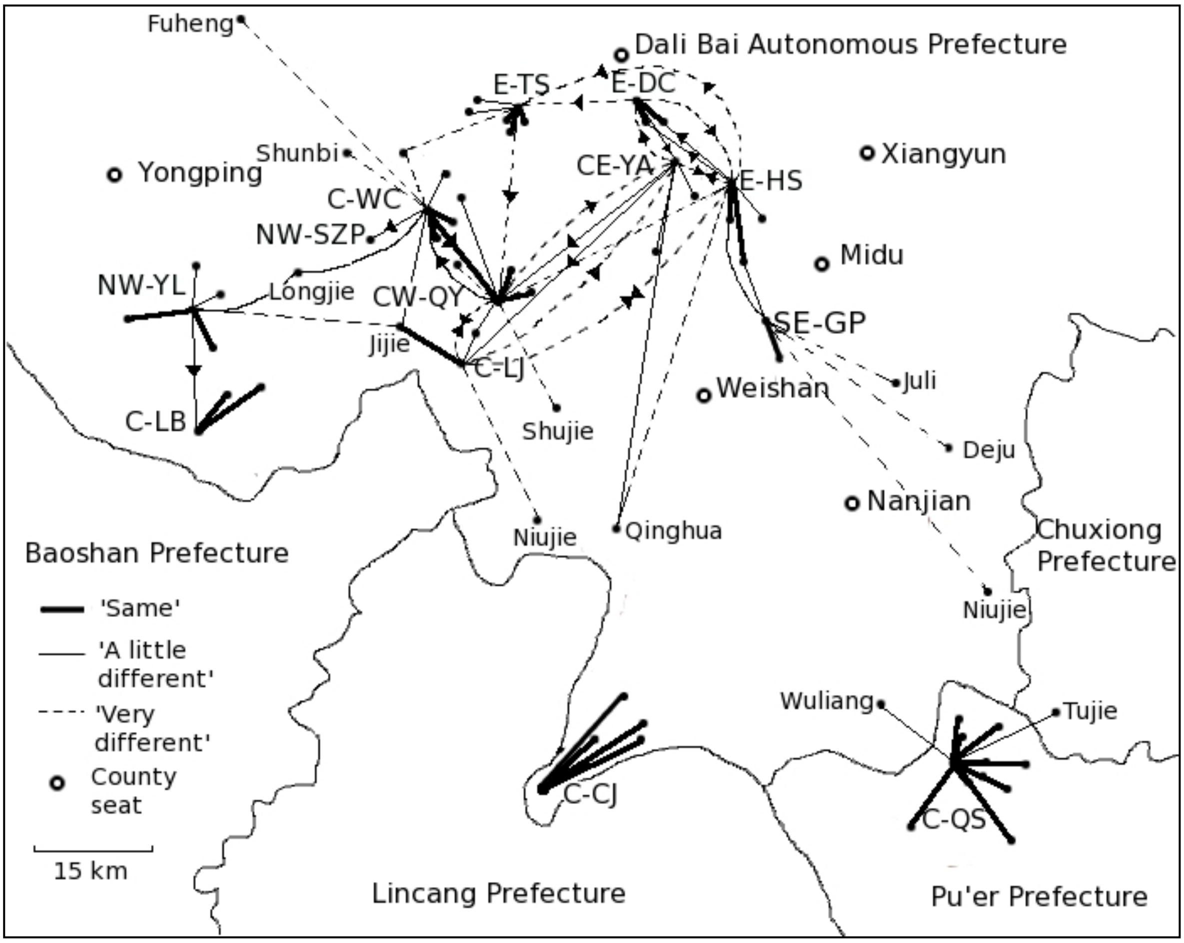


Figure 7-12 is a Lalo dialect perception map of the datapoints located in Baoshan, i.e., W-SLZ, XZ, and YL. Because of these datapoints' increased distance from other Core Lalo varieties and from Weishan, the asymmetrical pattern associated with Weishan's prestige is not seen among these varieties. Ability to evaluate perceived sameness is dependent on some level of contact with the variety in question. Baoshan varieties, located in the far west of Lalo distribution, are not physically close enough to have contact with Weishan varieties. The closest a Baoshan datapoint gets to evaluating Weishan is W-SLZ's identification of Changning, a county within Baoshan Prefecture that borders Weishan, as 'very different'. Baoshan datapoints, on the other hand, identify and comment on other Lalo varieties located within Baoshan Prefecture. The pattern emerges of an area of relative homogeneity in Wama Township, where W-SLZ is located. W-SLZ identifies several villages in Wama Township as 'same,' including one village (Meilanshan) in Wafang Township directly to the south of Wama. Datapoint respondents reciprocally view each other as 'very different'. Both XZ and W-SLZ view the other as 'very different;' XZ also identifies YL as 'very different,' while YL respondents do not label XZ at all.

Figure 7-12: Lalo dialect perceptions, Baoshan (W-SLZ, XZ, and YL). Legend same as Figure 7-11.

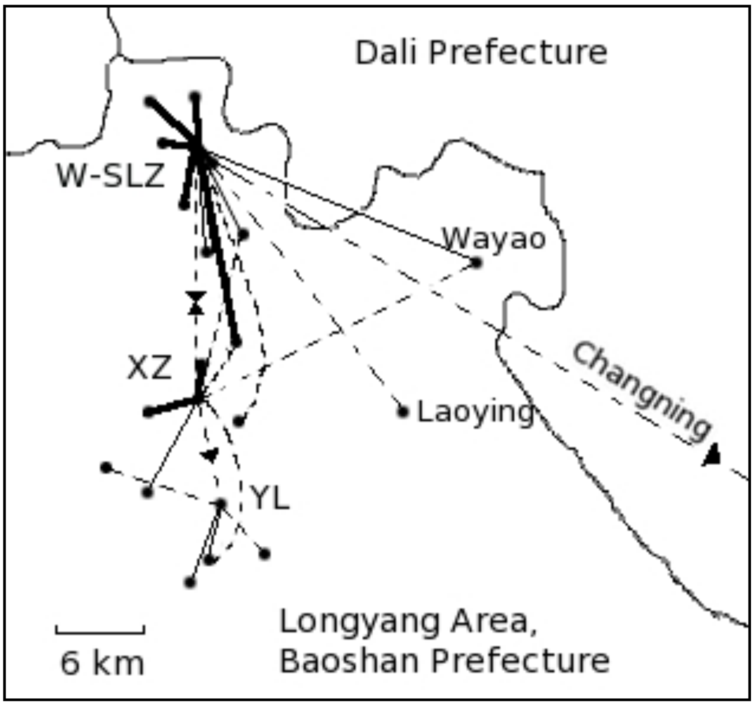


Table 7-3 lists all the village clusters and townships named by respondents during the group interview. Individual villages belonging to a village cluster with a different name are given with the village cluster name in parentheses. Counties are given in parentheses only when the village is located in a county different to the datapoint's, or when the village name is the same as another datapoint's name.

7.6 Summary

This chapter uses three different methodologies to explore the synchronic relationships between Lalo varieties, a perspective that enriches the overall picture of Lalo linguistic ecology. NeighborNet phenograms and multidimensional scaling diagrams based on phonetic distance identify distinct separations between the three non-Greater Lalo varieties (Eka, MD, and YL) and Greater Lalo (Core plus XZ). The four lower-level clusters of SE, E, W, and C Lalo are clearly defined. This analysis more or less agrees with the subgrouping given in §6.1, but lacks many characteristics of the phylogenetic tree. Greater Lalo is the only higher-level grouping uncovered by MDS (see Figure 7-3); other higher-level groupings of Core Lalo, C-W, and E-SE are not evident.

Intelligibility test results indicate that cross-cluster intelligibility is usually low, unless a variety has significant cross-cluster contact. C Lalo varieties show a relatively high degree of intelligibility within their cluster, and E-DC shows high comprehension of fellow E Lalo variety E-HS. Intelligibility between W varieties, however, is more varied, with W-SLZ showing very low comprehension of W-YL, but W-YL showing relatively high comprehension of W-DT. The correlation between intelligibility test and phonetic distance is very strong and significant, especially when only considering responses to the CW-QY text ($R=-0.855$, $P=0.000001$), thus providing an external validation of the phonetic distance results.

Finally, speaker perceptions and interactions provide a glimpse into how Lalo speakers categorise the varieties they are in contact with. While perceptions of difference usually parallel geographic and phylogenetic distance, in some cases prestige and contact influence speakers' perception, leading to interesting asymmetrical patterns of perceived sameness. These patterns highlight the prestige attached to the Weishan area, especially the areas of concentrated Lalo population in western Weishan.

Table 7-3: Villages named as 'same,' 'a little different' and 'very different'

	'Same'	'A Little Different'	'Very Different'
MD		Mengguo (Cangyuan)	
Eka		Yinchanghe	
YL		Ping'an (in Chashan village cluster), Yuzhu	Lianhe, Xiaohe (in Pingzhang village cluster)
XZ	Sikeshu, Dalang	Hewan	YL, SLZ, Meilanshan, Anbang, Chashan,Wayao
W-S LZ	Meilanshan, Shanglabao, Gumi, Shanxin, Niuwanzhou (in Wama village cluster), Zhazishu (in Wama), Xinzhai (in Mianga)	Anbang, Yangcao, Wayao	Sikeshu, Chahua, Bailongjing, Laoying, Changning
W-Y L	Wapang, Lutang	Longjie (Yongping), Qichang, Yanbei, Shuixie	Jijie (Yangbi)
E-TS	Jizao, Wuxi, Luowu, Zijin (Weishan)	Shiping, Gaofa, Diantou (Yangbi)	CW-QY, Shunbi (Yangbi)
E-DC	Baita, Damaidi	CE-YA	E-TS, E-HS
E-HS	Qingshuigou, Jingang	E-DC, Damaidi, Liwei	E-TS, CE-YA, CW-QY, C-LJ, Qinghua
SE-G P	Duohu	Qingshuigou, Jingang	Deju, Juli, Niujie (Midu)
CE-Y A		Xinsheng, Tuanjie, Qinghua, CW-QY, C-LJ	E-DC, E-HS
CW-QY	Hongqi, Huoshancun	C-WC, Henan, Zijin, Tiankoucun, Xingfu	E-DC, CE-YA, C-LJ, Sansheng, Sanhe, Shujie, Waniwu (Yangbi)
C-LJ	Jijie (Yangbi)	Henan	E-HS, CE-YA, Niujie, CW-QY
C-W C	Ruhe, Shema, CW-QY	W-SZP, CE-YA, Heima, Dacun, Jijie (Yangbi), Longjie (Yongping)	Shunbi, Fuheng, Luoshideng
C-QS	Jiucun, Qinhe, Qingyun (Jingdong), Qinglian, Wangfu, Boluolin, Xingwang, Shala, Hedi, Wenlong	Dajie, Wuliang (Nanjian), Tujie (Nanhua)	
C-CJ	Longjie (Nanjian), Longmen, Yingpan, Shenzhou		
C-LB	Abo, Wenku		

8 Conclusion

8.1 Introduction

The goal of this book has been to classify Lalo regional varieties in relation to each other from several different perspectives: diachronic and synchronic, linguistic and sociolinguistic. In pursuit of this goal, I first analysed the phonologies of sixteen Lalo varieties (Chapter 3), reconstructed Proto Lalo phonology (Chapters 4 and 5), and then classified varieties according to their shared innovations, phonetic and perceptual distance, and cross-dialectal intelligibility (Chapters 6 and 7). The various perspectives inform each other and enable a rich understanding of the ecology of Lalo varieties, synthesising evidence from the fields of historical linguistics, dialectometry, and sociolinguistics. In the remaining sections of this chapter, I first assess Lalo varieties' ethnolinguistic vitality, an important aspect of Lalo's linguistic ecology. I then summarise the major findings, identify the contributions of the book and suggest directions for future research.

8.2 Degree of endangerment of Lalo regional varieties

Assessing the degree of endangerment of Lalo varieties reveals the fragility of Lalo's ethnolinguistic sustainability. Lalo is an eroding language, with many villages, such as YL, C-LB, and W-SZP, already irrevocably on the path to extinction. Lalo endangerment is occurring in the context of what most linguists agree is a global crisis, the loss of most of the world's linguistic diversity during this century. The alarming state of Lalo vitality highlights the urgency for further research on Lalo varieties. Table 8-1 summarises the degree of endangerment of Lalo regional varieties. Results are based on sociolinguistic interviews with village leaders and groups of Lalo speakers (see Appendix C for interview schedules). Methodology for analysing the interview responses is described in §2.7. Table 8-1 uses Krauss's (2007) terminology, with categories 'stable' through 'definitively endangered' and abbreviations from the American grading system, 'a' through 'e'. The numbered columns represent the nine factors that UNESCO (2003, 2009) has identified as key in language maintenance. Each factor is evaluated on a scale of 0-5, given in Table 8-1, with further explanation in Table 8-2. The nine factors are the following: 1) Intergenerational Language Transmission, 2) Absolute Number of Speakers, 3) Proportion of Speakers within the Total Population, 4) Trends in Existing Language Domains, 5) Response to New Domains and Media, 6) Materials for Language Education and Literacy, 7) Governmental and Institutional Language Attitudes And Policies, 8) Community Members' Attitudes toward their Own Language, and 9) Amount and Quality of Documentation.

Factor 2 (total population), though relevant to Lalo as a whole, is not included in Table 8-1, as each datapoint represents only one village. There are now approximately 300,000 Lalo speakers, a comparatively large number for a minority language, but this number represents only 60% of the Lalo population (Factor 3). As I explain below, this number will probably decrease by one third in the next fifty years. Even in areas of highest Lalo concentration, i.e., Weishan, Nanjian and Yangbi counties, Lalo are still in the minority at the county level; for example, in Nanjian County, Lalo only accounted for 46% of the total population in 2004 (YNSY 2004). Throughout all Lalo speaking areas, Factors 3, 5, 6, 7 and 9 are all at Level 3 or below (on a scale of 0-5). Even in stable datapoints, Factor 5 (new media) is minimal, but with some hopeful developments seen in the recording and dissemination of home videos of Lalo traditional song and dance performed during cultural celebrations. In some villages, growing access to video cameras and editing technology have facilitated the increasing popularity of these videos in the last five years. There are no educational materials in Lalo; there is not even a Lalo orthography, which prevents the use of Lalo in any new print domains such as the Internet. There is no governmental or institutional support for Lalo; though the Chinese constitution gives minorities the right to develop their language, there is no monetary or administrative support for the Lalo to do so. Besides Björverud's (1998) grammar of Longjie Lalo and a handful of phonological sketches and wordlists from the Longjie area, documentation of Lalo varieties is lacking. Most Lalo varieties are documented in this book for the first time, but the documentation only includes the phonological sketches presented in Chapter 3 and the wordlist in Appendix E.

Table 8-1: Degrees of endangerment of Lalo varieties (1)

Variety	Location	Category/Grade		1	3	4	5	6	7	8	9
CW-QY	Weishan	stable	a	5.	3	4	1	0	3	4	3
C-LJ	Weishan	stable	a	5.	3	4	1	0	3	4	3
CE-YA	Weishan	stable	a	5.	3	4	1	0	3	4	2
C-WC	Yangbi	stable	a	5.	3	4	1	0	3	4	2
E-DC	Dali Municip.	stable	a	5.	3	4	1	0	3	4	2
E-HS	Dali Municip.	stable	a	5.	3	4	1	0	3	4	2
E-TS	Dali Municip.	stable	a	5.	3	4	1	0	3	4	2
SE-GP	Midu	stable	a	5.	3	4	1	0	3	4	2
MD	Gengma	stable	a	5.	3	4	1	0	3	4	2
C-CJ	Nanjian	partly stable	a-	5.	3	4	0	0	3	4	2
XZ	Longyang	partly stable	a-	5.	3	4	0	0	3	4	2
W-YL	Yongping	eroding	a--	4	3	3	0	0	3	4	2
Eka	Shuangjiang	eroding	a--	4	3	3	0	0	3	3	2
W-DT	Yangbi	eroding	a--	4	3	3	0	0	3	3	2
C-LB	Yongping	definitively	b	3	3	2	0	0	3	3	2
C-QS	Jingdong	definitively	b	3	3	2	0	0	3	3	2
W-SZP	Yangbi	definitively	b	3	3	2	0	0	3	3	2
W-SLZ	Longyang	definitively	b	3	3	2	0	0	3	3	2
YL	Longyang	definitively	b	3	3	2	0	0	3	3	2

In all stable datapoints, Factors 1, 4, and 8 are at Level 4 or above. Factor 1 (intergenerational transmission) is at Level 5., indicated by all children in the village learning to speak Lalo as their first language and using Lalo when playing with their Lalo peers. However, Chinese is encroaching on the home domain with the introduction of new media domains such as TV. Factor 4 (domains) and Factor 8 (attitudes) are at Level 4, indicated by the use of Lalo not only in the home, but also in public domains such as village meetings and in the classroom; also, participants' identified the Lalo language as an important aspect of their cultural identity that they wish to pass on to their children. One level below 'stable' are the two 'partly stable' varieties of C-CJ and XZ, which have not made use of the recently available videography technology to record Lalo media products.

In the remaining Lalo datapoints, however, Factors 1, 4, and 8 are at Level 4 or below. In the three 'eroding' varieties, Factors 8 (attitude) and 4 (domains) are crucially lower, usually 3 or below. Speakers of these varieties are characterised by a more laissez-faire attitude toward the transmission of Lalo; they do not mind if their children do not learn to speak Lalo. Also, Chinese is used in all public domains, including village meetings, and parents have begun speaking Chinese to their children in the hopes of giving them an advantage in school. Eroding varieties will probably shift to definitively endangered within the next twenty years, as children today will probably not teach their children Lalo. Five Lalo varieties have already entered the definitively endangered category and speakers have ceased to transmit Lalo to their children. These varieties will probably become severely endangered or extinct in the next fifty years.

Table 8-2: UNESCO (2009) endangerment scales in the Lalo context

Factor	Level	Description
1	5	Safe but threatened: unbroken intergenerational transmission, but Chinese is encroaching on some domains
	4	Unsafe: all children in limited domains
	3	Definitely endangered: no longer learned as mother tongue
3	3	Definitely endangered: only 60% of the Lalo still speak Lalo
4	4	Multilingual parity: Lalo used in most domains, even in village meetings, but not in school after third grade
	3	Dwindling domains: Lalo used in most domains, but Chinese begins to penetrate home domains
	2	Limited domains: Lalo only spoken in home; parents first teach Chinese to children
5	1	Minimal: Lalo is used in only a few new domains, i.e., videos of Lalo cultural celebrations.
	0	Inactive: Lalo is not used in any new domains.
6	0	No orthography is available to the community.
7	3	Passive assimilation: although minorities have a constitutional right to develop their language, there is no government support for Lalo language development, and Chinese prevails in the public domain.
8	4	Most members support language maintenance.
	3	Many members support language maintenance; many others are indifferent or may even support language shift.
9	3	Fair: C-LJ has one good grammar (Björverud 1998) and several published wordlists; CW-QY has several unpublished texts and wordlists (Blackburn, unpublished), both have audio and video recordings, but no dictionary and no everyday media
	2	Fragmentary: Other Lalo varieties have only short phonological sketches, wordlists, and audio and video recordings, most of which were collected as part of this book.

In Table 8-3 below, the scales are simplified so that a plus '+' designates Level 4 and above, while a minus '-' indicates Level 3 and below. Varieties in which Factor 5 (new media) is at least 1 are marked with a plus as well. Together, Factors 5, 8, 4 and 1 form an implicational hierarchy. A positive for Factor 5 (new media) implies a positive for 8, 4, and 1; 8 (attitudes) usually implies 4 and 1, and 4 (domains) implies 1 (transmission). The enthusiastic recording and watching of Lalo videos (Factor 5) is a positive sign of ethnolinguistc vitality; wherever this phenomenon is seen, Lalo vitality is stable. Positive attitudes towards Lalo (Factor 8) usually co-occur with the use of Lalo in public domains such as village meetings or in the classroom (Factor 4), except in the case of W-DT, where attitudes are positive but Lalo's domain is limited to the home. If Factor 8 or 4 is a minus, vitality is weaker and intergenerational transmission may become threatened.

Table 8-3: Degrees of endangerment of Lalo varieties (2)

Variety	Location	Category/Grade		1	4	8	5	3	6	7	9
C-LJ	Weishan	stable	a	+	+	+	+	-	-	-	-
CW-QY	Weishan	stable	a	+	+	+	+	-	-	-	-
MD	Gengma	stable	a	+	+	+	+	-	-	-	-
C-CJ	Nanjian	partly stable	a-	+	+	+	-	-	-	-	-
XZ	Longyang	partly stable	a-	+	+	+	-	-	-	-	-
W-YL	Yongping	eroding	a--	+	+	-	-	-	-	-	-
Eka	Shuangjiang	eroding	a--	+	-	-	-	-	-	-	-
W-DT	Yangbi	eroding	a--	+	-	+	-	-	-	-	-
C-LB	Yongping	definitively	b	-	-	-	-	-	-	-	-
YL	Longyang	definitively	b	-	-	-	-	-	-	-	-

Of the nineteen varieties studied, fourteen are still being transmitted to children and five are definitively endangered. The majority of the selected Lalo datapoints are stable or partly stable, but this does not mean that the vitality of Lalo as a whole is robust. As described in §2.2.1.1, I selected villages that were reported to be the most vital in a particular area. Government workers in the township-level Ethnic Minority and Religious Affairs Bureaus were asked to identify highly vital villages. The selection of datapoints that are eroding or definitively endangered therefore implies that other Lalo villages in the area are either at the same degree of endangerment or worse. Counties such as Jingdong and Yongping are thus areas where ethnolinguistic vitality is rapidly decreasing. In Yangbi and Longyang, most areas are eroding or worse, with a few pockets of stable or partly stable areas. The only counties where Lalo is consistently vital are Weishan and Dali Municipality, only two counties out of the nine visited. The selected datapoints do not include counties such as Fengqing and Yun where Lalo was already critically endangered at the time of the study.

Ethnic Lalo population is around 500,000, but less than 300,000 are speakers. In the next fifty years, the speaker population will likely decrease by over 100,000 as Lalo speakers die off in eroding or definitively endangered areas without teaching their children the language. The overall picture for Lalo vitality is therefore characterised as eroding (a--). Speakers in core Lalo areas in Weishan and Dali Municipality may be able to maintain Lalo vitality if steps towards the improvement of Factors 5 (new media), 6 (educational materials), 7 (institutional support) and 9 (documentation) are taken.

8.3 Summary of findings

The key question of this work is the phylogenetic relationships between Lalo varieties. To identify shared innovations, a reconstruction of Proto Lalo is required. In order to reconstruct Proto Lalo, it is first necessary to collect lexical data from many varieties, analyse their phonologies, and discover the systematic correspondences between the varieties. This reconstruction process constitutes Chapters 3 through 5, the first half of the analysis section. The final half of the analysis section presents the diachronic and synchronic classification of Lalo varieties. Chapter 6, the diachronic subgrouping of Lalo varieties, is the payoff of the reconstruction process; shared innovations that occurred after the Proto Lalo stage are used to group Lalo varieties phylogenetically. Chapter 7, the synchronic classification of Lalo varieties, presents a complementary perspective on the current relationships between Lalo varieties in terms of phonetic distance, intelligibility, and perceptions of difference. The following subsections summarise the results of the two halves of this book, the reconstruction of Proto Lalo and the classification of Lalo varieties.

8.3.1 Reconstruction of Proto Lalo

Chapter 3 presents phonological sketches of sixteen Lalo varieties, most of them documented for the first time in this book. The synchronic analysis of Lalo phonologies provides the basis for the reconstruction of Proto Lalo. This analysis also reveals a striking diversity of phonological systems found among the varieties that affiliate under the Lalo autonym. Tonal inventories range from three (YL) to six tones (CE-YA, Eka). MD and Central Lalo varieties have phonation contrasts and level pitches; E-DC, XZ, YL and W varieties have no phonation contrasts, but have contour tones, while CE-YA, Eka, E-TS and E-HS have both phonation contrasts and contour tones. Initial consonant inventory size ranges from the maximum of 33 (CW-QY and C-LJ) to a minimum of 22 (Eka and C-CJ). There are also certain characteristics shared by most Lalo varieties, some of which are areal features, e.g., monosyllabicity. The syllable template is typically (C)VTP, but a few varieties have syllable-final nasal -ŋ (i.e., Eka, YL, XZ). All Lalo varieties have a syllabic nasal that assimilates to the place of articulation of the following initial, but the conditioning of the syllabic nasal's diachronic development varies across dialects (see §3.2 for an example of this variation). Most varieties have a front rounded vowel [y], at least one nasalised vowel, usually [ĩ], and a vowel pronounced with friction and lip compression, usually [v].

Proto Lalo (PLa) segmental phonology is reconstructed in Chapter 4 by tracing PLa's descent from Proto Ngwi and Proto Burmic through comparison of the nineteen Lalo varieties' systematic correspondences. Proto Lalo is a monosyllabic language with syllable template (C)V(-ŋ)TP, with an optional initial, obligatory vowel, optional nasal final -ŋ (which can only follow -a), and tone and phonation contrasts. PLa has 48 initial consonants, including palatalised labial and velar consonants (i.e., *pj, *pʰj, *bj, *mj, *ʔmj, *kj, *kʰj, *gj, *ŋj, *ʔŋj) and preglottalised initials (i.e., *ʔm, *ʔmj, *ʔn, *ʔɲ, *ʔŋ, *ʔŋj, *ʔl, *ʔv and *ʔx). The palatalised initial series developed from Proto Ngwi's consonant clusters of stop plus medial, and preglottalised initials developed from the coalescence of Proto Ngwi's *ʔ- or *s- prefix with initial sonorants. Proto Lalo's eight vowel system distinguishes three levels of height and three degrees of backness, with one front rounded vowel /y/. There is also one nasal final rhyme *-aŋ, which is a retention from Proto Ngwi and is still retained in some varieties.

Chapter 5 provides evidence for the phonetic values of Proto Lalo tones and traces the subsequent tone changes in Lalo varieties. As in Proto Ngwi's hypothetical tonal system, PLa appears to have distinguished high, mid, and low level pitches in syllables with non-harsh phonation (Tones *1, *2, and *3), and mid and low level pitches in syllables with harsh phonation (Tones *H and *L). Central Lalo retains PLa's tonal system intact. Acoustic analysis of CW-QY's tonal inventory reveals two allotones of Tone *1, the high level tone; voiced prevocalic segments lower the pitch onset, conditioning a high rising pitch, while elsewhere Tone *1 remains high level. The diachronic conditioning of the Tone *1 split seen in many varieties such as E Lalo falls along the exact same lines as C Lalo's synchronic conditioning of Tone *1 allotones. E Lalo's Tone *1 split, seen with the same conditioning in CE-YA, W-YL and XZ, results in the development of a contrastive low-rising contour tone. This development leads to the hypothesis that PLa's Tone *1 also had two allotones, the diachronic seeds of the Tone *1 split, which later became contrastive in E Lalo after the loss of preglottalised initials. In all non-Central Lalo varieties, harsh phonation consistently conditions raising of the pitch in *L and often in *H as well. This work links this effect to the increased tension in the vocal folds that accompanies the production of harsh phonation, only recently understood through laryngoscopic studies (Edmondson & Esling 2006). In most non-Central varieties, harsh phonation is lost, leaving a system of contrastive pitch height and contour. The resulting mergers or phonetic tone changes vary according to variety.

8.3.2 Classification of Lalo varieties

Chapter 6 is the focal point of this book, the phylogenetic subgrouping of Lalo varieties. The reconstruction of Proto Lalo helps clarify which features in modern day varieties are retentions and which are innovations that occurred after the Proto Lalo phase. Shared innovations that meet the criteria for subgrouping, as described in Chapter 1, are used to subgroup Lalo varieties. Working from the bottom up, Lalo can be grouped into the Eastern, Southeastern, Western, and Central dialect clusters, with peripheral varieties XZ, YL, MD, and Eka. Peripheral varieties represent emigrations out of the Lalo homeland area of southern Dali Prefecture at different stages of history: the pre-Eka left approximately 300 years ago, the pre-MD approximately 100-200 years ago, and YL at an unknown time. The E, SE, W, and C clusters, whose ancestors remained in the Lalo homeland, form the Core Lalo group. Core Lalo and XZ together form Greater Lalo, so XZ's ancestors must have migrated out of the Lalo homeland after YL, MD and Eka did. All Lalo varieties can be traced back to Proto Lalo through the distinctive Tone *2 split, described in Chapter 5.

Central Lalo is the heart of the Lalo language, its historical, demographic, and social core. Linguistically, Central Lalo is the most conservative dialect cluster, retaining PLa's tonal system and preglottalised initials. Historically, Central Lalo speakers can be reasonably linked to the ancient Meng clan who became the leaders of the Nanzhao Kingdom (7^{th}-9^{th} centuries A.D.). In terms of demographics, Central Lalo has by far the largest population of all the groups; more than 70% of Lalo speakers speak a variety of Central Lalo. Finally, Central Lalo in Weishan is the most ethnolinguistically vital and is the most hopeful in terms of language maintenance. This is not to say that other varieties are less valuable or less important. E Lalo is also a highly vital area and is the only cluster to preserve PLa's palatalised labials. Each Lalo variety, no matter how small the population of speakers, adds to the understanding of Lalo as a whole.

As a complement to Chapter 6's diachronic subgrouping, Chapter 7 uses phonetic distance, intelligibility and perception to give a synchronic perspective on the relationships between varieties. The Levenshtein distance algorithm is used to measure phonetic distance between varieties, which is then used as input for NeighborNet network analysis and multidimensional scaling. NeighborNet and multidimensional scaling clearly identify the lower-level clusters of E, SE, W, and C Lalo. C Lalo is shown to be a relatively more homogeneous cluster when compared to E and W Lalo clusters. Peripheral varieties YL and XZ do not clearly affiliate with any other varieties. These findings are in keeping with the subgrouping in Chapter 6.

However, there are some discrepancies between the diachronic and synchronic analysis. Contact influences varieties that are not genetically related to become more phonetically similar, as in the case of CE-YA, a C Lalo variety that shows the E Lalo Tone *1 split; in the NeighborNet network, CE-YA appears in between the C and E clusters. Also, MD and Eka group together loosely in the NeighborNet diagram, but this grouping is not supported by the diachronic analysis. The synchronic pairing of MD and Eka is probably due to shared retentions and to a shared linguistic environment in southern Lincang Prefecture, where they are both in contact with languages such as Lahu and Dai. While synchronic analysis reveals the lower-level clusters, it is unsuccessful at uncovering the upper-level subgroups of C-W, E-SE, or Core Lalo. There are two reasons for this discrepancy. First, the shared innovations that characterise the upper-level subgroups do not have a large effect on the lexicon, in contrast with the later changes in the tonal systems that characterise the lower-level clusters. Second, subsequent changes after the upper-level shared innovations have lessened the subgroups' phonetic similarity, e.g., after C-W's *g > ɣ lenition, in certain varieties the ɣ changes to [w] or [v].

Phonetic distance and intelligibility test results are strongly, significantly correlated, a result consistent with previous findings (Gooskens 2006, Yang & Castro 2008). Intelligibility within the C Lalo cluster is high, but intelligibility across clusters is usually low unless there is significant contact. These intelligibility results suggest that language development materials based solely on Central Lalo will be of limited benefit to non-Central Lalo speakers. Test results also show that non-print media in the CW-QY or C-LJ varieties should be comprehensible in most C Lalo areas. Speaker perceptions of difference usually correspond to geographic and phylogenetic distance, but asymmetrical patterns of perceived sameness suggest that speakers outside of western Weishan perceive the Central Lalo spoken there as more prestigious. A synthesis of vitality, intelligibility and perception results indicates that western Weishan is an optimal location for beginning any language maintenance efforts.

8.4 Contributions of this book

The key empirical contribution of this work is the documentation of the previously unrecorded Lalo varieties MD, Eka, XZ, YL, and W, SE, and E clusters. All of these varieties, excluding MD, SE and E Lalo, will probably become extinct in the next fifty years. Without this initial documentation, these varieties may have become extinct before the linguistic community even knew of their existence, and the myth of Lalo only having two minor dialects would have been perpetuated. As each new variety is documented, possibilities for both typological and historical understanding expand. For example, the collection of these varieties' lexicons makes possible a more accurate reconstruction of Proto Lalo. Another empirical contribution is the recording of seven Central Lalo varieties, expanding on the previous C Lalo documentation of Björverud (1998), Huang and Dai (1992), Hu and Duan (2000), and Sun (1991).

This work is also useful for language planning and maintenance efforts. Orthography design for Central Lalo can now be informed by the phonological analyses of several C varieties. Correspondences between different varieties' phonemes can be worked out systematically through the phonemes' development from PLa, which can help planners design a writing system that will be easier for speakers from all C varieties to learn. Intelligibility test results, which indicate that non-Central listeners do not understand C Lalo, can guide the dissemination of print and non-print media products, avoiding costly efforts in areas that would not benefit. Conversely, evidence from this work shows that CW-QY or C-LJ varieties would be a good starting place for language corpus and status planning. Through this research, speakers of peripheral varieties Eka and MD were connected with other Lalo speakers, a connection that opens up possibilities for co-operation and partnership between Lalo groups, a crucial step towards preservation.

Besides empirical and practical contributions, this work makes several theoretical and methodological contributions as well. Reconstruction of a complex language phylum such as Tibeto-Burman, and even the Burmic branch, is built upon and clarified by the careful, detailed micro-comparison involved in the reconstruction of individual languages such as Lalo. For example, the development of Proto Lalo clarifies the need for a distinction at the Proto Burmic level between *ey and *i and between *ow and *u, as shown in §4.2. Matisoff (2003) tentatively hypothesised an *ow/*u contrast, but the distinction was unattested until the evidence from Lalo varieties showed it to be necessary. Besides Bradley's (1979a) Common Lahu, Proto Lalo is the only other reconstruction of a Ngwi language cluster. As such, Proto Lalo reconstruction is an important step toward filling in the gaps in the linguistic history of Ngwi languages. As I discuss in §8.5 below, Proto Lalo opens up new questions and hypotheses about key innovations that characterise Central Ngwi languages.

Tracing Lalo varieties' tone changes since Proto Lalo provides a valuable case study of secondary tone change, especially the development of contour tones and the effect of harsh phonation on pitch. Two of Pittyaporn's (2007) proposed mechanisms of secondary tone change are attested in Lalo varieties' development of contour tone: segment-tone interaction and peak sliding. In E Lalo's Tone *1 split, segment-tone interaction is seen in voiced initials' depression of Tone *1's initial pitch resulting in a low-rising tone. Different stages of peak sliding, in which the tone's peak slides rightward, provide a phonetically-based explanation of W varieties' different outcomes of tone change in *L: falling, rising-falling, and rising contours. Harsh phonation has been recently distinguished from creaky phonation by the incursion of the ventricular folds over the vocal folds, resulting in increased vocal fold tension (Edmondson & Esling 2006). This book links that increased tension to the raising of pitch in *L and *H in non-Central Lalo varieties. This effect may also be the conditioning factor in the raising of *L seen in several Northern Ngwi languages, as documented in Bradley (1979b).

Levenshtein distance as a measure of phonetic distance on East Asian tone languages has only been previously used on Chinese (Tang 2009), HSH Zhuang and Bai (Yang and Castro 2008), and Nisu (Yang 2009a). The strong, significant correlation between Levenshtein distance and intelligibility test results helps validate this method as a useful tool for the synchronic grouping of dialects of Ngwi languages. The comparison of dialectometric results with diachronic subgrouping confirms the method's ability to identify dialect clusters at a relatively shallow time depth. NeighborNet's failure to uncover the higher-level subgroups of Core Lalo or C-W implies that while these dialectometric tools are useful for synchronic analysis, they cannot replace the comparative method. However, phonetic similarity is at least as important to good language planning as identifying shared innovations, whether the phonetic similarity is a result of shared innovations, retentions, drift, or contact. With this caveat in mind, the dialectometric methods used in this work may enable Ngwi dialectologists to quickly analyse and visualise the synchronic relationships between a language's varieties, which is useful for both language planning and as a starting place for hypotheses about diachronic relationships.

8.5 Directions for future research

As this work is the initial study of Lalo dialects, there are many additional research questions that may be pursued in this area. First, I am aware of at least two more Lalo varieties that I was not able to document due to time constraints, located in Mengguo Village in Cangyuan County and Fuheng Township in Yangbi County. These varieties urgently need to be documented before they become moribund. Also, as this work has focused primarily on phonology, it would be valuable to reconstruct Proto Lalo syntax and see if the pattern of shared syntactic innovations agrees with the grouping presented here. Needless to say, each Lalo variety identified in this book is an ideal candidate for more description and documentation, in the form of texts with interlinear glossing, dictionaries, and grammars. The contact zone between E and C Lalo in eastern Dali Municipality and northeast Weishan County would be a fruitful site for a more in-depth study of how inter-dialectal contact influences tone change, as was seen in CE-YA's development of the E Lalo Tone *1 split (Chapter 5). A tone split is an unexpected contact-induced change, because adults, who are usually the speakers with external contact, rarely add phonemic categories (Labov 2007). However, intermarriage between E and C Lalo speakers in this area means that young children are exposed to both varieties from a young age. This type of sociolinguistic situation provides a complex, fascinating case study that blurs the line in Labov's transmission-diffusion dichotomy.

Finally, this book lays the foundation for assessing Lalo's relationship to other Central Ngwi languages. Proto Lalo fails to meet several criteria for Central Ngwi membership, such as a tone split in *L. Also, the Proto Lalo Tone *2 split shows a different result and a much narrower conditioning environment than the Tone *2 split seen in any other Central Ngwi languages. One hypothesis that needs further investigation is that Proto Lalo's Tone *2 split preserves the original conditioning for the initial Central Ngwi Tone *2 split, with other Central Ngwi languages later expanding the conditioning. Another tantalising question is Lalo's relationship to the Ngwi languages of northern Dali Prefecture and Yongsheng County in Lijiang, e.g., Talu (Zhou 2004) and Kua-nsi (Castro et al. 2010). Zhou (2004) suggests that Lalo and Talu share a close genetic relationship, but the shared feature he cites (preglottalised initials) could be interpreted as a shared retention from Proto Ngwi. Further documentation of Talu related languages and further comparative work is needed to establish definitively whether Lalo and Talu form a subgroup.

8.6 Conclusion

The purpose of this book is to clarify the relationships that exist between Lalo regional varieties from multiple perspectives. The linguistic and sociolinguistic data gathered in nineteen Lalo villages reveal a much more complex picture of Lalo regional varieties than was previously known. The documentation of several previously undescribed varieties and the reconstruction of Proto Lalo enable the diachronic and synchronic classification of Lalo varieties. Results from the comparative method, phonetic distance, and intelligibility tests, as well as sociolinguistic studies of dialect perception, contact and ethnolinguistic vitality are integrated in this rich depiction of Lalo dialect diversity and inter-dialectal relationships. Lalo, previously characterised as only having two varieties with minor differences, instead comprises the four Core Lalo dialect clusters of E, SE, W, and C Lalo, and at least four peripheral varieties, MD, Eka, XZ and YL. Core Lalo varieties cluster around the traditional Lalo homeland of southern Dali Prefecture, with the Central Lalo group as the historical, demographic and sociolinguistic heart of the Lalo language. As Lalo is an eroding language, language maintenance efforts and further documentation of Lalo dialects are urgently called for, before the disappearance of these under-researched tongues.

Appendix A: Sources of Lalo population statistics by county

In alphabetical order:

Cangyuan Wa Autonomous County:
Li Mingfu & Xiao Guoguang. 1998. *Cangyuan Wazu zizhixian zhi [Gazetteer of Cangyuan Wa autonomous county]*. Kunming: Yunnan Minzu Chubanshe.

Changning County:
Zhang Jinhui & Pu Jiaxing. 1990. *Changning xian zhi [Gazetteer of Changning county]*. Dehong: Dehong Minzu Chubanshe.
CNXQ. 2003. *Changning xianqing, 1991.1995年 [Yearbook of Changning county, 1991.1995]*. Kunming: Renmin Zhengfu.

Dali Municipality:
DLSZ. 1998. *Dali shi zhi [Gazetteer of Dali municipality]*. Beijing: Zhonghua Shuju.
DLSMZZ. 1997. *Dali shi minzu zhi [Ethnic nationality gazetteer of Dali municipality]*. Kunming: Yunnan Minzu Chubanshe.

Fengqing County:
FQXZ. 1993. *Fengqing xian zhi [Gazetteer of Fengqing county]*. Kunming: Yunnan Renmin Chubanshe.
GDZ. 2004. Guodazhai xiang jianjie [Introduction to Guodazhai township]. http://www.ynfq.gov.cn/fqxrmzfmh/5410515300867112960/20061117/85351.html. (accessed 13 Apr, 2009).

Gengma Dai Wa Autonomous County:
GMXZ. 1995. *Gengma Dai zu Wa zu zizhixian zhi [Gazetteer of Gengma Dai Wa autonomous county]*. Kunming: Yunnan Minzu Chubanshe.
GMDMZ. 1985. *Gengma Dai zu Wa zu zizhixian dimingzhi [Geographic place name gazetteer of Gengma Dai Wa autonomous county]*. Gengma: Renmin Zhengfu.

Jingdong Yi Autonomous County:
JDXZ. 1994. *Jingdong Yizu Zizhixian zhi [Gazetteer of Jingdong Yi autonomous county]*. Chengdu: Sichuan Cishu Chubanshe.
JDDMZ. 1985. *Jingdong Yizu zizhixian diming zhi [Geographic place name gazetteer of Jingdong county]*. Jingdong: Renmin Zhengfu.

Jinggu Dai Yi Autonomous County:
JGXZ. 1993. *Jinggu Daizu Yizu Zizhixian zhi [Gazetteer of Jinggu Dai Yi autonomous county]*. 1st edn. Chengdu: Sichuan Cishu Chubanshe.
JGDMZ. 1986. *Jinggu Daizu Yizu zizhixian dimingzhi [Geographic place name gazetteer of Jinggu county]*. Kunming: Jinggu Daizu Yizu Zizhixian Renmin Zhengfu.

Longyang Area, Baoshan Prefecture:
Fang Guoyu. 2003. *Baoshan xian zhi gao [Annals of Baoshan county]*. Kunming: Yunnan Minzu Chubanshe.
BSSZ. 1993. *Baoshan shi zhi [Gazetteer of Baoshan Municipality]*. Kunming: Yunnan Minzu Chubanshe.
BSDMZ. 1984. *Baoshan shi diming zhi [Geographic place name gazetteer of Baoshan municipality]*. Baoshan: Baoshan Renmin Zhengfu.
BSDQZ. 1998. *Baoshan diqu zhi [Gazetteer of Baoshan Prefecture]*. Beijing: Zhonghua Shuju.
He Jinxing. 2004. *Baoshan nianjian [Baoshan Yearbook]*. Baoshan: Yunnan Meishu Chubanshe.

Midu County:
MDXZ. 1993. *Midu xian zhi [Gazetteer of Midu county]*. Chengdu: Sichuan Cishu Chubanshe.
MDDMZ. 1984. *Midu xian dimingzhi [Geographic place name gazetteer of Midu county]*. Midu: Renmin Zhengfu.

Nanjian Yi Autonomous County:
NJXZ. 1993. *Nanjian Yizu Zizhixian zhi [Gazetteer of Nanjian Yi autonomous county]*. Chengdu: Sichuan Cishu Chubanshe.
NJMZZ. 1995. *Nanjian Yizu zizhixian minzu zhi [Ethnic nationality gazetteer of Nanjian Yi autonomous county]*. Kunming: Yunnan Minzu Chubanshe.
NJDMZ. 1983. *Nanjian Yizu zizhixian dimingzhi [Geographic place name gazetteer of Nanjian county]*. Nanjian: Renmin Zhengfu.

Shuangjiang Lahu Wa Bulang Dai Autonomous County:
Zhao Chenglong. 1995. *Shuangjiang Lahu zu Wa zu Bulang zu Dai zu zizhixian zhi [Gazetteer of Shuangjiang Lahu Wa Bulang Dai Autonomous County]*. Kunming: Yunnan Minzu Chubanshe.

Weishan Yi Hui Autonomous County:
WSXZ. 1993. *Weishan Yizu Huizu Zizhixian zhi [Gazetteer of Weishan Yi and Hui autonomous county]*. Kunming: Yunnan Renmin Chubanshe.
WSDMZ. 1987. *Weishan Yizu Huizu zizhixian diming zhi [Geographic place name gazetteer of Weishan county]*. Weishan: Renmin Zhengfu.
Cha Chongliang. 2005. *Weishan Nianjian [Weishan Yearbook]*. Dehong: Dehong Minzu Chubanshe.
Cha Chongliang. 2002. *Weishan Nianjian [Weishan Yearbook]*. Dehong: Dehong MinzuChubanshe.
Cha Chongliang. 2003. *Weishan Nianjian [Weishan Yearbook]*. Dehong: Dehong Minzu Chubanshe.
Zhang Qinghua. 1996. *Weishan Nianjian [Weishan Yearbook, 1991.1994]*. Yunnan: Yunnan Nianjian Zazhishe.

Yangbi Yi Autonomous County:
YBXZ. 2000. *Yangbi Yizu zizhixian zhi [Gazetteer of Yangbi Yi autonomous county]*. Kunming: Yunnan Renmin Chubanshe.
Cui Shaoquan & Zuo Yanjun. 1991. *Yangbi Yizu zizhixian dimingzhi [Geographic place name gazetteer of Yangbi Yi autonomous county]*. Yangbi: Renmin Zhengfu.

Yongping County:
YPXZ. 1994. *Yongping xian zhi [Gazetteer of Yongping county]*. Kunming: Yunnan Renmin Chubanshe.
YPDMZ. 1986. *Yongping xian dimingzhi [Geographic place name gazetteer of Yongping county]*. Yongping: Renmin Zhengfu.

Yun County:
YXZ. 1994. *Yun xian zhi [Gazetteer of Yun county]*. Kunming: Yunnan Renmin Chubanshe.
YXXXW. 2005. Yun xian renmin zhengfu gongzhong xinxi wang [Yun county government information website]. http://www.ynyx.gov.cn/list.aspx?cid=8. (accessed June 20, 2007).

Appendix B: Elicitation frames from Pelkey (2008)

Translated overview of elicitation frames used in lexical data collection (reproduced with permission).

Class		Primary Frame	Alternate Frame
Count Nouns		3S (FAMILY) ____ three CLF have	3S (POSS)____ good INTF
	e.g.,	*His family has three dogs.*	*His brain is very good.*
Mass Nouns		3S (FAMILY) ____ three CLF_M have	3S (POSS) ____ (NEG) good INTF
	e.g.,	*His family has three piles of manure.*	*His bile is no good.*
Meteorological Nouns		(Today) ____ (NEG) good INTF	(Today) ____ bright/big INTF
	e.g.,	*Frost is no good.*	*The sun is very bright today.*
Activity Predicates[1]		3S ____ PFV	(. . .) ____ CPV
	e.g.,	*He has ridden (before).*	*The wood burned up; His father died.*
Statives		3S ____ SPV.INTF	DEM LOC ____ INTF
	e.g.,	*He is extremely thin.*	*That place is very far (from here).*
Interrogatives and General Adverbials *e.g.,*		[each unique] *Who hit me? Why didn't he come?*	[each unique] *Come again tomorrow.*
Time Adverbials		3S ____ hither come	NA
	e.g.,	*He came the day before yesterday.*	
Numerals		____CLF good INTF	NA
	e.g.,	*'nine of them (are/would be) very good'*	
Locatives and Demonstratives	*e.g.,*	3S____ EXIST *He's on the left side.*	Thing ____CLF good INTF *That thing is very good.*

[1] The state of affairs lexicalized in the semantics of certain activity predicates make them more complex—justifying their recognition as further verb categories (e.g., Accomplishments, Achievements, etc.)—some of which prohibit certain modifications, such as the use of progressive aspect (see Van Valin and LaPolla 1997).

Appendix C: Sociolinguistic interview schedules

Lalo Sociolinguistic Group Questionnaire[2]:

Informed consent

Participants	1.	2.	3.	4.
Given				
Not given				

Preliminary information

1. Questionnaire number:
2. Interview County, Township:
3. Community, Village：
4. Interviewer Name:
5. Date:
6. Language of elicitation:
7. Language of response
8. Interpreter used?
9. Comments (anything unusual or noteworthy about this interview):

Toponyms

1. Village name:
2. District name:
3. County name:

Ethnic titles

1. How do you say___? 我想学一点你们的话。_____咋个说？

    a. Autonym frame: 我是彝族（或我是腊罗巴）：

    b. Glossonym frame: 彝族话好听（或腊罗巴话）：

    c. Loconym frame: 我是（这个地方）的人：

    d. Menghua area: 蒙化:

[2] Based on: Nahhas, R. W., Kelsall, J., & Mann, N. (2005). RAID: Research and Instrument Design Tool. SIL International. AND Pelkey, Jamin R. (2008). The Phula languages in synchronic and diachronic perspective, La Trobe University, PhD dissertation.

e. Menghua people: 蒙化人：

i. Are you Mishaba?

2. Besides (answer to 3a), do you call yourself any other name?

   a. What does it mean?

3. What do the Han call you?

   a. Do you like this name?

4. What do [Bai/Dai/other ethnic groups] call you?

   a. Do you like this name?

Domains of language use

1. I want to ask you about what languages you use with people **in your house**. **In your house**, what languages do you speak…

	1.	2.	3.	4.	5.
…with your parents?					
…with your grandparents?					
…with your siblings?					
(if married) … with your spouse?					
(if have children) … with your children?					
…with your grandchildren?					

2. Next, I want to ask you about what languages you use **outside your house**. When you are **not in your house**, what languages do you speak…

	1.	2.	3.	4.	5.
…with Lalo people in your village?					
…with non-Lalo people in your village?					
…at a funeral?					
…at a village meeting?					
…with a village gov't worker?					
…with a township gov't worker?					

Children's language use

1. What language do Lalo children in this village speak first?

2. Do Lalo children speak any other languages **before** they start school?
   a. Yes or no
   b. What languages?

3. Do Lalo children speak any other languages **after** they start school?
    a. Yes or no
    b. What languages?
    c. At what grade are they able to speak these languages?

4. What language do the teachers speak to the children in first grade in order to explain things to them?
    a. Second Grade?
    b. Third Grade?

5. What language do Lalo children in the village speak when they
    a. play with Lalo children?
    b. play with non-Lalo children?
        i. (if not only Lalo) How do you feel about that?
        ii. (if not only Lalo) Why?
    c. …with Lalo classmates at school?
    d. …with non-Lalo classmates at school?
    e. …with their teacher?

6. Do your children ever speak anything other than Lalo at home?
    a. (if yes) What else do they speak?
    b. (For each language) How do you feel when they do that?
    c. (For each language) Why?

7. Do you think the Lalo children in this village speak Lalo well?
    a. Yes or no
    b. (if no) In what ways do they speak it not well?
    c. (if no) How do you feel about that?
    d. (if no) Why?

Cultural heritage

1. Where do the elders say the people of this village emigrated from before they came here?

2. In ancient times what place did your ancestors leave to immigrate to this region?

3. What annual festivals do you celebrate?

    a. What other Lalo villages celebrate these festivals with you (refer to map)?
    b. What other ethnic groups celebrate these festivals with you?

4. Other than speaking Lalo, how are Lalo people different from non-Lalo people?

	Different from whom	Different how
Customs （打歌）		
Dress		
Food		
Religion		
Housing		

5. What parts of being Lalo would you like to see your children continue?

    a. For example: customs, dress, housing style, food, language, festivals, religion

    b. Why?

Dialect perceptions

List of nearby villages from DMZ; map with nearby villages

1. Does X village speak Lalo the **same** as here?
    a. (If no) a little different or very different?
    b. Can you understand their Lalo?
    c. How do you feel about the way they speak?
    d. can you understand them when they talk?
    e. how do you feel about the way they talk? 你觉得他们说的怎么样?

2. Out of all the Lalo villages/towns, which village is the most important?
    a. Village/town

3. Out of all the Lalo villages/towns, where is Lalo spoken the best?
    a. Village/town
    b. Why?

Intermarriage

1. Is it common for Lalo people from this village to marry non-Lalo speaking people?
    a. Yes or no
    b. (if yes) What non-Lalo speaking people do they marry?

	Lalo man. . .		Lalo woman. . .	
	Han woman	other min. womn	Han man	other min. man
how many: few, some, half, most				
what language do their children speak?				
(if not Lalo) can the children also speak Lalo?				

2. What Lalo villages do you send brides to?
    - How many brides do you send: few, some, half, most?
    - Do the brides understand their Lalo?
    - How long does it take to understand?
    - Do they understand the brides' Lalo?
    - Do these villages send brides here?

Lalo Village Leader Sociolinguistic Questionnaire[3]

Informed consent

Participants	**1.**	**2.**	**3.**	**4.**
Given				
Not Given				

Preliminary Information

1. Questionnaire Number:
2. Interview County, Township, Village:
3. Interviewer Name:
4. Date:

Participant details

1. Gender:
2. What is your job?
3. What is the highest level of education you have completed?
   c. Level
4. Where were you born and where did you grow up?
5. What nationality are you?
6. What languages do you speak?

Demographics

1. How many houses are in this village?
2. What is the total number of people in this village? (adults and children)
3. How many houses are in this community?
4. What is the total number of people in this community? (adults and children)
5. Is this village all Lalo people or are there others living here as well?
   a. (if others, too) What groups live here?
   b. (if others, too) About how many houses in this village are from (each group)?
6. About how many people in this village are from (each group)?
7. (For each non-Lalo group) Do the (non-Lalo group) living in this village speak Lalo?
8. When you speak to (non-Lalo group), what language do you use?
9. What is the common last name people have in this village?

[3] Based on: Nahhas, R. W., Kelsall, J., & Mann, N. (2005). RAID: Research and Instrument Design Tool. SIL International. AND Pelkey, Jamin R. (2008). The Phula languages in synchronic and diachronic perspective, La Trobe University, PhD dissertation.

Folk History

1. When was this village first established?
2. Where did the people who established this village move from?
3. Do you still have contact with people from that place?
4. Where did the Lalo come from originally?
    a. When did they come to this area?
    b. Why did they leave their former home?
    c. Do people from there ever come here? Why?
    d. Do people from here ever go there? Why?

Periodic Market

1. What periodic market(s) do you usually go to?
2. What days do these markets occur on?
3. What other Lalo villages attend this market?
4. What other ethnic groups attend this market?

Travel

1. Do people from this village travel to other Lalo villages? List locations (Ask the following for each location.)
    a. Do very many go, or just a few?
    b. Are they able to speak to each other in Lalo or do they have to use another language?
    c. (if they use Lalo) Do you understand their Lalo?
    d. Do they understand your Lalo?
    e. (if they use Lalo) Do you have to change your accent to communicate?
    f. Do they come here too?
2. Are any of your young people now working in cities?
    g. Yes or no
    h. Where do they usually go?
        1. List locations
    i. (if yes) Do very many go or just a few?
    j. (if yes) While they live there, do they still speak Lalo?
    k. (if yes) Do they ever come back to live here (to stay)?

School

1. Is there a school in this village?
    a. Yes or no

b. (if yes) What levels are taught in the school?
c. (if yes) What is the language of instruction?
d. (if yes) What language(s) do the schoolchildren use with each other?

2. Do any children go to any other villages/towns for school?
    a. Yes or no
    b. (if yes) About what proportion of children go to secondary school?
    c. Where?
    d. (if yes) What is the language of instruction in that place?
    e. (if yes) What ethnic groups attend that school?
    f. (if yes) About what proportion of that school is from each language group?
    g. (if yes) What language(s) do the schoolchildren use there with the other children?
3. About how many years of education do children from this village usually complete?

Language Use

1. Other than Lalo, what languages are spoken **in this village**?
2. (for each LWC)
    a. Are there any types of people in this village who speak [LWC] poorly?
        i. What types
        ii. Why?
3. Not including Lalo, which of these languages is used by the most people?
    a. Language
    b. About what percent speak that language?
4. Are there Lalo people in the village who have stopped speaking Lalo?
    a. Yes or no?
    b. (if yes) Why?
    c. (if yes) Do you think this is good or bad?
    d. (if yes) Why?
5. Are there cassettes/CDs in Lalo?
    a. Do young people like to watch them?
6. What language is used at public meetings?
    a. Do people ever use Lalo in public meetings?
7. What language is used in official announcements?

Appendix D: Sample RTT score chart (CW-QY)

县乡村：
参与者号码： 同意 不同意
性别： 岁数：20－40 41-60 60＋
翻译者？ 是 否

个人	父亲	母亲	配偶
1.	1.	1.	1.
2.	2.	2.	2.
3.	3.	3.	3.
4.			
5.	5a.		
6.			
7.	7a.	7b.	

	段落	**重点**
1	四月份，我去山上放羊、砍柴	• 四月份 • 放牧 / 放羊
2	实际上，我们四个人都去，两个儿子	• 四父娘子
3	他们两母子，我们两父子在砍一棵树	• 两父子 • 砍柴
4	另外两母子在放羊	• 两母子 • 放羊
5.6	他们两母子放羊的地方和我们砍树的地方有一个山坡，相隔，相隔一个山坡，他们那天	• 他们 / 放羊地方 • 我们 / 砍树的地方 • 相隔一个山 / 岭岗
7.8	以为我砍柴已经砍好了，下午的时候，就试一下叫我，他们叫我之前	• 砍柴砍好了 • 叫我
9	试着砍一棵树，那个刀子的翻面	• 砍一棵树 / 砍柴 • 刀子
10	砍到我的脚，他们没来之前，我	• 砍到 • 脚 / 腿 / 膝盖
11	出了很多很多血，包扎也没有办法包扎，人影	• 出了很多血 • 没法包扎 / 止血
12	都没见，最后，他们两母子在山坡上来叫的时候	• 没人 • 他们两母子 • 在山坡上 来叫
13	松树底下流了很多血	• 松树底下 • 流了很多血

14.15	他们两母子以为我 出来了，所以说进来找我	• 找我
16.17	那时候，我流了很多血，可能流了一斤左右，流了斤把左右，那个血象杀猪时候一样在松树底下流了很多	• 血象杀猪的时候
18.19	最后他们两母子来了以后，问我怎么弄到的，我说是这样弄到的，用刀砍树的时候，那刀就反弹过来砍到脚	• 他们来了 • 问我怎么弄到的 • 我说是这样弄到的
20－21	然后他们两母子，我穿了一件衣服，他们就撕了我衣服上的布，用布包起来，但不能止血，最后我	• 衣服 • 用它包 • 不能止血

Translation:

Location of test (county, township, village)：

Participant No.：　　Informed Consent:　Agree　　Disagree

Sex：　　Age：20－40　　41.60 60＋

Interpreter used？　Yes　No

Screening questions	Father's language	Mother's language	Spouse's language
1.	1.	1.	1.
2.	2.	2.	2.
3.	3.	3.	3.
4.			
5.	5a.		
6.			
7.	7a.	7b.	

	Segment	Elements
1	In April, I went up to the hills to graze my sheep and cut firewood	• April • graze herd/graze sheep
2	Actually, it was the four of us, me, my wife and two sons	• me, my wife and two sons
3	My wife and one son; I and one son went to cut firewood	• father and son • cut firewood
4	Wife and son put the sheep out to graze	• wife and son • graze sheep
5.6	The place where my wife and son went to graze the sheep and the place we were cutting firewood was separated by a hill. That day they. . .	• the place wife and son went to graze the sheep • the place we were cutting firewood • separated by a hill
7.8	thought I had finished cutting firewood; in the afternoon they tried to call out to me, but before they called to me	• finished cutting firewood • call to me
9	I was trying to cut down a tree，and the back of the knife	• cutting down a tree • the knife
10	cut into my leg. Before they came to me，I	• cut into • leg/foot/knee
11	was bleeding heavily，and had nothing to wrap it with. No one . . .	• bleeding heavily • nothing to wrap/stop the

		bleeding
12	was around. Finally， my wife and son called me from the hill	• no one around • wife and son • called from the hill
13	At the foot of the evergreen tree, there was a lot of blood	• foot of the evergreen tree • a lot of blood
14.15	They thought I had come out， so they came looking for me	• looking for me
16.17	By that time, I had bled a lot， maybe a pound or so， bled a pound or so. There was so much blood at the foot of the tree, like after you kill a pig . . .	• so much blood, like after you kill a pig
18.19	Finally, they arrived and asked me how I did it. I said I did it this way: when I was using the knife to cut the tree, the knife bounced back and cut into my leg.	• they arrived • asked me how I did it • I told them how I did it
20－21	Then my wife and son. . .I was wearing a shirt; they took the shirt, ripped it and used it to wrap my leg, but it didn't stop the bleeding. Finally I . . .	• clothing/shirt • used shirt to wrap • couldn't stop the bleeding

Appendix E: Sample language data and Proto Lalo reconstructions

No	Gloss	Proto-Lalo	CW-QY	MD	YL
	A. Nature				
1	sky (a)	mo^{2}di^{2}ma^{3}	n̩^{21}di^{21}ma^{33}	i^{55}sɛ^{55}mo^{33}	ŋ̩^{21}kɔ̠^{21}
2	sky (b)	mo^{2}daŋ^{1}			
3	sun	a^{1}mo^{2}ɣi^{1}	a^{55}ŋ̠^{21}ɣ̩ɨ^{55}ma^{33}	a^{55}mi^{55}	a^{55}m̩^{21}tsʰa^{33}
4	sunshine	a^{1}mo^{2}tsʰa^{1}	a^{55}n̩^{21}tsʰa^{55}	a^{55}mi^{55}kʰi^{55}pʰɛ^{33}	a^{55}m̩^{21}tsʰa^{33} sai^{55}
5	moon	xa^{3}ba^{3}	xa^{33}ba^{33}kʰɨ^{55}	xo^{33}bo^{33}mo^{33}	xa^{33}ba^{33}kʰɨ^{33}
6	star	kjɛ^{1}	kɨ^{55}	a^{55}kɛ^{55}kɛ^{55}	kɛ˞^{33}
7	cloud	a^{1}mo^{2}ti^{1}	a^{55}n̩^{21}ti^{55}	mi^{55}kɨ^{21}	mi^{55}kʰɔ̠^{31}
8	wind	a^{1}mo^{2}hi^{1}	a^{55}n̩^{21}ɕy^{55}	a^{55}mi^{21}fi^{55}	mi^{21}he^{33}
9	rain	a^{1}mo^{2}ha^{1}	a^{55}ŋ̩^{21}ha^{55}	a^{55}mi^{21}xo^{55}	a^{55}m̩^{21}ha^{33}
10	lightning	a^{1}mo^{2}bja̠^{L}	a^{55}m̩^{21}ba̠^{21}	a^{55}m̩^{21}bæ^{21}	a^{55}m̩^{21}bɛ˞^{42}
11	thunder	a^{1}mo^{2}go^{2}	a^{55}ŋ̩^{21}ɣə^{21}	ŋ̩^{21}gu^{21}	m̩^{21}go^{21}
12	rainbow (a)	a^{1}mo^{2}se^{1}ɣi^{1}daŋ^{1}		a^{55}sɛ^{55}ɣɨ^{33}	ɣɨ^{45}bɨ^{21}ɕio^{55} lo^{42}
13	rainbow (b)	a^{1}mo^{2}tsʰa^{1}ɣi^{1} daŋ^{1}	a^{55}n̩^{21}tsʰa^{55}ʔɲɛ̠^{33}də^{55}		
14	snow	va^{2}	va̤^{21}	mi^{55}pʰu^{55}	va^{21}
15	water (a)	ɣi^{1}	ɣɨ^{55}	ɣɨ^{55}	ɣɨ^{33}
16	water (b)	gje̠^{H}		ŋ̩^{33}gɛ̠^{33}	
17	fog	mu^{1}	mu^{55}ɣɨ^{33}	mi^{55}kɨ^{21}	mi^{55}kʰɔ̠^{31}
18	frost	ʔni^{1}pʰu^{1}	i^{55}fʏ̩^{55}	mi^{55}pʰu^{55}	i^{55}fʏ̩^{33}
19	dew	kjy^{2}	ky̤^{21}	tsɿ^{21}ɣɨ^{55}	lu^{33}suei^{21}
20	hail	ʔlo̠^{H}ha^{1}	ʔlo^{33}ha^{55}	ko^{21}sɛ^{21}	va^{21}
21	earth	ʔmi^{1}di^{2}	mi^{55}	mi^{55}mo^{33}loʔ^{33}	ai^{33}tsʰɿ^{21}bə^{33}
22	soil	e^{2}tsʰi^{2}	i^{21}tsʰɿ^{21}	n̩^{21}tɕʰi^{21}na̠^{33}	mi^{33}
23	mud	e^{2}haŋ^{2}	i^{21}hə^{21}	u^{33}na̠^{33}	ai^{33}tsʰɿ^{21}la^{53}
24	river (a)	ɣi^{1}dzaŋ^{2}/ma^{3}		ɣɨ^{55}dza^{21}	ɣɨ^{55}xo^{31}
25	river (b)	laŋ^{1}dzaŋ^{2}			

26	ditch (a)	ɣi^{1}kʰa^{2}	ɣɨ^{55}kʰḁ^{21}	ɣɨ^{55}kʰo^{21}	wv̩^{33}kv̩^{33}
27	ditch (b)	laŋ^{1}ka̠^{L}	lu^{55}ka̠^{21}		
28	pond	ɣi^{1}by^{3}	ɣɨ^{55}by^{33}	ɣɨ^{55}dəŋ^{33}	a^{21}bə^{33}
29	puddle	ɣi^{1}by^{3}za^{2}		ɣɨ^{55}dəŋ^{33}jo^{21}	a^{21}bə^{33}za^{21}
30	well inside	tsɛ^{3}du^{2}	tsɛ^{33}də^{21}		
31	well outside	ɣi^{1}du^{2}	ɣɨ^{55}də^{21}	ɣɨ^{55}du^{21}	ɣɨ^{55}tɕin^{21}
32	mountain	kʰu^{1}dʒɛ^{2}	kʰə^{55}dʑ̤ɛ̤^{21}	kʰu^{55}dʒa^{21}	tə^{55}ta^{31}
33	cliff	ɣɛ̠^{L}	va̠^{21}tsɿ̠^{21}	va^{21}kʰu^{21}	i^{55}kʰɛ˞^{42}
34	valley	laŋ^{1}ka̠^{L}	kʰə^{55}dʑ̤ɛ̤^{21}tsɿ^{33}	la^{55}ka^{21}mo^{33}	li^{33}tɛ˞^{33}
35	cave	kʰu^{1}du^{1}	sy^{21}kʰə^{55}	kʰu^{55}dʒa^{21}kʰu^{55}	
36	hole	kʰu^{1}	kʰə^{55}də^{55}	ʝɛ^{21}kʰu^{55}	tu^{55}tu^{53}
37	gold	ʃɛ^{1}	ɕɛ^{55}	sɛ^{55}	tsai^{31}sɛ˞^{33}
38	silver	pʰu^{1}	fv̩^{55}	pʰu^{55}	tsai^{31}pʰu^{33}
39	iron	xy^{1}	ɕy^{55}	xə^{55}	xɨ^{33}
40	tin			la^{33}	ɕi^{33}
41	coal			mei^{21}	mei^{24}
42	stone	ka^{1}lu̠^{H}	ka^{55}lə̠^{33}	a^{55}lo^{33}kʰɛ^{33}	kou^{55}lu^{55}
43	sand	ʃa^{3}	ʂa^{33}tsɿ^{33}	a^{55}lu^{33}sei^{33}	ɕa^{33}
44	fire	a^{1}to̠^{L}	a^{55}to̠^{21}	a^{55}toʔ^{21}	a^{55}tu^{55}
45	flame	a^{1}to̠^{L}ʔly^{1}	a^{55}to̠^{21}ʔly^{55}	a^{55}to^{21}lə^{55}	a^{55}tu^{55}pʰai^{55}
46	smoke	ʔmu^{2}kʰo^{2}se̠^{L}	ŋ̩^{21}kʰə̤^{21}	ŋ̩^{21}kɨ^{21}sɿ^{21}	mi^{55}kʰə̠^{31}
47	night	he̠^{L}	hɛ̠^{21}	xɛ̠^{21}	xai^{55}
48	day	ʔni^{3}	ʔɲɛ^{33}	ni^{33}	ĩ^{33}
49	today	i^{2}ʔni^{3}	ʔɲiŋ^{33},iŋ^{33}	i^{21}ni^{33}	n̩^{21}ti^{55}ĩ^{33}
50	yesterday	a^{2}ʔni^{3}	aŋ^{33}	a^{21}ni^{33}	a^{21}ni^{33}
51	day before yesterday	ʃi̠^{H}ʔni^{3}	ʂəŋ^{33}	ɕi^{33}ni^{33}	sɿ^{33}ni^{33}
52	three days ago	ʃi̠^{H}ɣu^{2}ʔni^{3}	ʂʅ^{33}wuŋ^{23}	ɕi^{33}wu^{21}ni^{33}	sɿ^{33}wu^{21}ni^{33}
53	four days ago		ʔʐʅ^{33}ʔɲɛ^{33}n̩^{21}ti^{33}	lɨ^{33}ni^{33}wo^{21}sɛ^{53}	sɿ^{33}lu^{33}ni^{33}
54	tomorrow	a^{2}gy^{1}ʔni^{3}	a^{21}gy^{55}n̩^{33}	a^{21}gɨŋ^{55}	ɛ^{21}gɨ^{33}mi^{33}
55	day after tomorrow	tsʰa^{1}pʰe̠^{H}ʔni^{3}	tsʰa^{55}pʰɛm^{33}	tsa^{55}pʰin^{33}	tsʰa^{55}pe^{55}ni^{33}
56	three days from now	a^{2}pʰe̠^{H}ʔni^{3}	a̤^{21}pʰɛm^{33}	a^{21}pʰin^{33}	a^{21}pʰe^{55}ni^{33}

57	four days from now	a2ɣo3ʔni3		a21paŋ33	a21wu33ni33
58	year	kʰo̱L	kʰo̱21	kʰuʔ21	kʰo55
59	new year	kʰo̱Lxɨ̱L	kʰo̱21xɨ21	kʰu21xi21	kʰo55kʰo55lɛ42
60	this year	tʃʰi2ni̱H	tʂʰʅ22ɲiɛ̱33	tɕʰi21ni̱33	tɕʰi̱55ĩ53
61	last year	a2ni̱H	a̤21ɲiɛ̱33si55	a21ni̱33	a21ĩ53
62	year before last	ʃi̱Hni̱H	ʂʅ33ɲiɛ̱33si55	ɕi33ni̱33	sɿ33i̱53
63	three years ago	ʃi̱Hɣu2ni̱H	ʂʅ33wu21ɲiɛ̱33si55	ɕi33wu21ni̱33	sɿ33wu21i̱53
64	four years ago	a2ɣu2ni̱H		lɨ33kʰu21wo21sɛ53	sɿ33lu33i̱53
65	next year	ʔna2he̱L	na21ɲ̊ɛ̱21si55	nɛ21xɛ21	na21xai53
66	year after next	na(ŋ)1ni̱H	nə55ɲɛ̱33si55	no55niʔ33	nu55ĩ53
67	three years from now	na(ŋ)1ɣu2ni̱H	nə55wu21ɲɛ̱33si55	no55mo21niʔ33	nu55wu21ĩ53
68	four years from now			lɨ33kʰu21wa55ti33	nu55lu33ĩ53
69	daytime		iŋ33si55	la̱33	mi21li21ka33
70	dawn		a55ŋ̍21tʰi33la55	xo33məŋ21soŋ53	ŋ̍21tʰai33ɲa33
71	morning	da2ne̱L	a55ŋ̍21tʰi̥21si55	xɨ33pɨ55	pa33tsu21
72	noon	dza1dʒi2dza2	dza55dʑe33dza21va33		dza21i33dza21kɛ˞33
73	afternoon	a1mo2kʰɨ̱L	a55ŋ̍21kʰɨ̱21ji55	la21vã55	ŋ̍21kʰɨ53
74	dusk/evening	a1mo2ɣɨ1	a55ŋ̍21ɣɨ55ø55ji55	la21vã55wo21vɛ33	miɛ˞45tə42ɲa33
75	dusk/evening	a1mo2kʰɨ̱L			miɛ˞45tə42ɲa33
75	night	mo2kʰɨ̱Lse1	ŋ̍21kʰɨ̱21si55	ŋ̍21kɨ21sɿ55	sa33pʰi33
76	this evening	i2mi1	i21mi55	ɪ21mi55	ŋ̍21ti55sa33pʰi33
77	this morning	i2sy1ny1	i21sy55ny55	e21nə55	i21sə33nə33
	B. Animals				
79	cow	a1ni2	a55ŋ̍21	a55ni21	a45ni51
80	cow	a1ni2	a55ŋ̍21	a55ni21	a45ni51
80	buffalo	ɣo1ni2	ɣ̍55ŋ̍21	ɣɨ55ni21	ve45ni42
81	field cow	a1ni2ʃɛ1	a55ŋ̍21	a55ni21	a45ni53sɛ˞33

82	horse	a^{1}mju^{2}	tʃa̠ŋ^{21}	a^{55}mu^{21}	a^{55}mu^{21}
84	sow	a^{1}ve̠^{L}ma^{3}	a^{55}vɛ̠^{21}ma^{33}ky^{33}	a^{55}vɛ̠^{21}mo^{33}	a^{44}vei^{55}ma^{33}
85	piglet	a^{1}ve̠^{L}za^{2}	a^{55}vɛ̠^{21}za̤^{21}	a^{55}vɛ̠^{21}jo^{21}	a^{44}vei^{53}za^{31}
86	boar	a^{1}ve̠^{L}pa̠^{L}	vɛ̠^{21}pa̠^{21}	a^{55}vɛ̠^{21}xæ^{55}	a^{55}vei^{53}pa^{53}
87	wild boar (a)	a^{1}ve̠^{L}kaŋ^{2}		a^{55}vɛ̠^{21}te̠^{21}	
88	wild boar (b)	e^{2}ve̠^{L}	i̤^{21}vɛ̠^{21}		ai^{21}vei^{53}
89	goat	a^{1}tʃʰi̠^{L}	a^{55}tʂʰʅ̠^{21}	a^{55}tɕʰi̠^{21}	a^{44}tsʰɿ^{53}
90	ram	a^{1}tʃʰi̠^{L}pa̠^{L}	a^{55}tʂʰʅ̠^{21}pa̠^{21}	a^{55}tɕʰiʔ^{21}pʰi^{55}	a^{44}tsʰɿ^{55}pa^{53}
91	sheep	a^{1}ʒaŋ^{1}	a^{55}ʐu^{55}		ɲa^{33}
92	dog (a)	a^{1}kʰi^{2}	a^{55}kʰɨ̥^{21}		a^{55}kʰɨ^{21}
93	dog (b)	a^{1}na^{2}		a^{55}no^{21}	
94	cat (a)	a^{1}ne^{1}	a̤^{21}ni^{55}		a^{21}ni^{33}
95	cat (b)	a^{1}mi^{1}		a^{21}mia^{55}	
96	rabbit	hɛ̠^{H}tʰa^{3}la^{3}	ha̠^{33}tʰo̠^{33}lo̠^{33}		hɛ˞^{55}tʰa^{33}la^{33}
97	dragon	lu^{2}	ləŋ^{21}	ɣɨ^{55}dʒu^{21}	lɤ̠^{21}
98	animal	a^{1}dze^{2}	a^{55}dʑi̤^{21}a^{55}la̤^{21}		a^{55}dzə^{31}m̩^{21}
99	wild animal	dze^{2}kaŋ^{2}	ko̤^{21}dʑi̤^{21}	jɛ^{21}ka^{21}	də^{21}vv̩^{33}
100	bear	a^{2}ɣy^{1}	a̤^{21}jy^{55}	a^{55}ɣɨ^{55}	ɣɨ^{33}pa^{53}
101	tiger	la^{2}pa̠^{L}	la̤^{21}pa̠^{21}	lo^{21}pɑ̠^{21}	la^{21}dzɛ˞^{33}
102	leopard	zi̠^{L}	zɿ̠^{21}pa̠^{21}	lo^{21}pɑ̠^{21}sɛ^{55}ɣɨ^{33}	zɿ^{21}pa^{53}
103	wolf	ve^{1}	tʃʰa̠^{21}laŋ^{21}	a^{33}no^{21}ma^{33}nai^{31}	vei^{23}pʰə^{33}ma^{33}
104	monkey	mjo̠^{L}	a^{55}mo̠^{21}	a^{55}mu̠^{21}	a^{33}mo^{53}
105	otter	ʃy^{1}		boŋ^{24}	suei^{33}tʰa^{33}mao^{33}
106	weasel	hɛ̠^{H}la^{2}pa̠^{L}	ha^{33}la̤^{21}ɕɛ^{55}		vei^{23}pʰə^{33}ma^{33}za^{21}
107	pangolin	tʰaŋ^{2}kʰjɛ^{2}kʰy̠^{H}	tʰu^{21}kʰa^{21}kʰy^{33}	tsa^{21}kʰɛ^{21}	tʰa^{21}kʰɨ^{53}
108	muntjak deer	tʃʰɨ^{1}	tʂʰʅ^{55}	tsʰɿ^{55}	tsʰɿ^{53}pa^{53}
109	sambar deer	tsʰe̠^{L}		tɕʰɛ̠^{33}	tsʰai^{55}
110	porcupine	pu^{1}		pu^{55}	pv̩^{33}
111	rat	hɛ̠^{H}	a^{55}ha̠^{33}	a^{55}tɕʰɛ^{21}	ɛ˞^{44}hɛ˞^{53}
112	squirrel		ha̠^{33}tʂʰu^{21}pa̠^{21}	a^{55}tɕʰɛ^{21}mɛ^{21}bu^{33}	hɛ˞^{55}pɛ˞^{41}pɛ˞^{31}
113	chicken	a^{1}ɣe̠^{H}	a^{55}jɛ̠^{33}	a^{55}ji̠^{33}	a^{55}ji^{53}

114	rooster	a^{1}ɣe̱^{H}pʰo^{1}pa̱^{L}	a^{55}jɛ̱^{33}fi^{55}pa̱^{21}	a^{55}ji̱^{33}pʰi^{55}	a^{44}ji^{44}pa^{63}
115	hen	a^{1}ɣe̱^{H}ma^{3}ko̱^{H}	a^{55}jɛ̱^{33}ma^{33}ko^{33}	a^{55}ji̱^{33}mo^{33}	a^{55}ji^{55}ma^{33}
116	duck (a)	a^{1}bɛ^{2}		a^{55}bɛ^{21}	
117	duck (b)	a^{1}e̱^{H}			
118	goose	a^{1}ŋwa^{1}	a^{55}ŋø^{55}	a^{55}ŋo^{55}	o^{21}aŋ^{53}
119	bird	ŋja̱^{H}	a^{55}ɲɛ̱^{33}	a^{33}ŋa^{33}	a^{55}ɲa^{53}
120	swallow	py̱^{H}	a^{55}pø̱^{33}	a^{33}ŋa^{33}no^{21}ʔɛ^{55}	jan^{55}tsʅ^{33}
121	sparrow	dʒa^{1}mu^{2}	dƶɛ^{55}n̩^{21}	a^{33}ŋa^{33}dʒo^{55}ka^{33}l a^{21}	mi^{33}kə^{33}tɛ˞^{53}
122	sparrow	dʒa^{1}mu^{2}	dƶɛ^{55}n̩^{21}	a^{33}ŋa^{33}dʒo^{55}ka^{33}l a^{21}	mi^{33}kə^{33}tɛ˞^{53}
122	crow (a)	a^{1}ŋja̱^{H}bɛ̱^{H}	a^{55}ɲɛ̱^{33}ba̱^{33}		
123	crow (b)	a^{1}ne̱^{H}		a^{55}nɛ̱^{33}	a^{55}ni^{53}
124	magpie	a^{1}tʃɛ̱^{L}	a^{55}tʂa̱^{21}		a^{55}tsɛ˞^{53}
126	pheasant	a^{1}ʃu^{2}	a^{55}ʂə^{21}	a^{55}ji̱^{33}ka^{21}	to^{21}so^{21}
127	eagle	a^{1}dzy^{1}	a^{55}dzy^{55}	a^{55}dʒə^{55}	tsə^{33}ma^{33}
128	owl (a)	gy^{3}ly^{2}	wu^{33}ly^{21}	a^{33}ŋa^{33}lo^{21}pɑ̱^{21}	
129	owl (b)	xi^{1}hu^{3}			jɛ˞^{55}xu^{33}
130	bat	a^{1}py̱^{H}ma^{3}	mai^{33}ma^{21}ha^{33}	a^{55}pɑ̱^{33}	jiɛ^{33}tʰiɛ˞^{33}
131	frog	ʔmu^{1}pa̱^{L}	ə^{55}pa̱^{21}	u^{55}pɑ̱^{21}	a^{44}pɛ˞^{44}lɤ̱^{42}
132	toad	ʔmu^{1}pa̱^{L}	ə^{55}pa̱^{21}dzaŋ^{55}pʰy^{33}	u^{55}pɑ̱^{21}dzo^{55}jɛ^{21}	lai^{33}tui^{33}li^{31}
133	fish	ʔŋa^{2}	a̤ŋ^{21}	õm^{21}pa^{55}	aŋ^{21}
134	snake	la^{1}ʃɛ^{1}	la^{55}ɕɛ^{55}	lo^{33}ɕɛ^{55}	la^{33}sɛ˞^{33}
135	lizard		a̤^{33}mɛ̤^{33}lɛ^{21}ɑ^{22}wo^{33}	ɛ̃^{21}xã^{55}	
136	leech	ɣi^{1}ve̱^{L}	ɣɨ^{55}vɛ̱^{21}	ɣɨ^{55}vɛ̱^{21}	ɣɨ^{33}pai^{55}
137	spider		a^{33}mai^{33}	bom^{21}bɛ^{21}lɛ^{21}xɛ^{55}	xam^{33}pao^{21}
138	insect (a)	bo^{2}			
139	insect (b)	bi^{2}di^{1}	bʉ̤^{21}di^{55}	bi^{21}di^{55}	bi^{21}bi^{33}
140	ant	bo^{2}ʒo̱^{H}		bi^{21}ɕi^{55}	bi^{21}jao^{53}
141	termite	a^{2}ʒu^{2}			
141	termite	a^{2}ʒo̱^{H}pʰu^{1}	tʰu^{21}bʉ^{21}di^{55}	ɕi^{33}bi^{21}di^{55}	bi^{21}ma^{55}pʰy̩^{33}
142	mantis	a^{1}tʃʰi̱^{L}lo̱^{L}		i^{55}sɛ^{55}mo^{33}ga^{21}lɨ^{21} ɣɨ^{21}	tsʰai^{55}dza^{33}py̩^{33}
143	roach		pʉ^{55}tʂʅ̱^{21}	me^{33}sæ^{55}la^{55}	tsao^{44}m̩^{21}tʂɛ˞^{33}
145	honeybee	bja^{2}	ba̤^{21}	do^{55}ka^{33}bo^{21}	ba^{22}ɲo^{21}

146	wasp (a)	bja^{2}tu^{1}	ba̤^{21}də^{55}		ba^{22}to^{33}sɛ˞^{33}
147	wasp (b)	bja^{2}ʃɛ^{1}		bo^{21}sɛ^{55}	ba^{22}to^{33}sɛ˞^{33}
148	mosquito	ɣaŋ^{1}bi̠^{L}	ɣɨ^{55}ɕɛ^{55}n̩^{21}dzɿ̠^{33}	i^{55}sɛ^{55}kɛ^{55}kaŋ^{21}	ɲɛ˞^{33}m̩^{21}dzɿ^{53}
149	dragonfly	dʒɛ^{2}m̩^{2}kʰa^{3}la^{3}	dʑɛ̤ŋ^{21}kʰa^{33}la^{33}	bi^{55}ɕi^{55}li^{55}	tɕʰiŋ^{33}tʰiŋ^{33}
150	butterfly	bo^{2}ʔlu^{3}	vi̤^{21}ʔlə^{33}	a^{55}bɛ^{21}fu^{33}	kɛ˞^{55}lɛ˞^{55}pu^{21}
151	cricket	bɨ^{1}tʃɛ̠^{L}	bɤ̤^{21}tʂʅ̠^{21}	ɛ^{33}toŋ^{33}	a^{55}kʰɨ^{41}tsa^{21}pɛ˞^{33}lo^{21}
152	grasshopper	tʃɛ^{1}pu^{1}	a^{55}pa̠^{21}tʂə^{55}fv̩^{55}	tɕɛ^{55}pu^{55}	tsa^{33}pu^{33}
153	flea	kʰi^{2}xe^{1}	kʰɨ^{21}ɕi^{55}	ko^{21}xɛ^{55}	kʰo^{21}ɕi^{55}
154	louse	xe^{1}	ɕi^{55}	i^{55}pu^{55}	ɕi^{55}ma^{33}pʰu^{33}
155	centipede	ʃa^{1}xe^{1}	ʂa^{55}ɕi^{55}	sa^{55}xɛn^{55}	
156	earthworm	a^{1}di^{1}	ʂa^{55}kʰə^{33}bʉ̤^{21}di^{55}ʔɲi^{55}	a^{55}di^{55}	bi^{21}la^{33}kɛ˞^{55}
157	worm	bo^{2}di^{1}	bʉ̤^{21}di^{55}	bi^{21}di^{55}	bi^{21}bi^{33}
158	caterpillar		bʉ̤^{21}di^{55}ʔna^{33}	bi^{21}di^{55}tsʰɿ^{55}ɣɨ^{55}	bi^{21}sɿ^{21}pa^{53}
159	maggot	ho̠^{H}	vi̤^{21}	xo^{33}jo^{21}	ho^{53}
160	nest (a)	kʰi^{1}	kʰɨ^{55}	jɛ^{21}kʰɨ^{55}	tə^{33}tə^{33}
161	nest (b)	ty^{1}			tə^{33}tə^{33}
162	egg	fu^{3}	fv̩^{33}	jɛ^{21}fu^{33}	fv̩^{33}fv̩^{33}
163	wing	du^{1}le̠^{L}	də^{55}lɛ̠^{21}	du^{55}lɛ̠^{21}	dɤ̠^{33}lai^{53}
164	talon (a)	kʰi^{1}kji^{3}			
165	talon (b)	kʰi^{1}kaŋ^{3}	kʰɨ^{55}ko^{33}		
166	hoof	kʰi^{1}by̠^{L}	bø̠^{21}	kʰi^{55}bɑ̠^{21}	tʰi^{21}kʰɛ˞^{33}
167	horn	kʰo^{1}	kʰə^{55}	jɛ^{21}kʰɨ^{55}	kʰɤ̠^{33}
168	tail	ʔmɛ^{2}	ʔmɛ̤^{21}	jɛ^{21}mɛ^{21}	mɛ˞^{21}tʰɛ˞^{21}sɿ^{33}
169	tail	ʔmɛ^{2}pʰɛ^{2}			
170	tusk	dʒɛ^{1}	dʑɛ^{55}	jɛ^{21}dʑɛ^{55}	xu^{21}ja^{21}
171	cocks-comb	kjo^{1}	a^{55}jɛ̠^{33}kø^{55}	jɛ^{21}ko^{55}	kei^{33}
	C. Plants				
172	tree	si̠^{H}dze^{1}	sɿ̠^{33}dzɿ^{55}	ɕi^{33}dʑɛ^{55}	sɿ^{53}
173	pine tree	tʰaŋ^{2}dze^{1}	tʰu̥^{21}dzɿ^{55}	tʰu^{21}po^{33}dʑɛ^{55}	tʰa^{21}ɕy^{33}sɿ^{53}
174	fir tree	ʔŋy^{1}dze^{1}	nə^{55}dzɿ^{55}		a^{55}ji^{55}san^{33}sɿ^{53}
175	willow tree	ɣi^{1}mɨ^{2}dze^{1}	ɣɨ^{55}ŋ^{21}dzɿ^{55}		ɲɛ˞^{33}m̩^{21}sɿ^{53}
176	bamboo (a)	va^{2}	va̤^{21}ma^{55}	wan^{21}to^{55}	

177	bamboo (b)	ma^{1}	ma^{55}dzɿ^{55}	mon^{55}dʑɛ^{55}	ma^{33}
178	bamboo shoot		ma^{55}bə̰^{33}	waŋ^{21}	ma^{33}mo^{53}
179	wheat	ʃa^{1}	ʂa^{55}	kʰa^{21}ɕɛŋ^{55}	sa^{33}
180	buckwheat	ga^{2}	ɦa̤^{21}sɛ̤^{21}	go^{21}	ga^{21}kʰa^{21}
181	millet	tsʰy̠^{L}	tsʰø̤^{21}	tsʰɑ̠^{21}	suei^{33}pai^{55}tsa^{33}
182	barley	zi^{3}	zɿ^{33}		zo^{33}
183	sorghum	ʔlu^{2}	ʔlə^{21}		kao^{33}liaŋ^{33}
184	job's tears	na^{2}baŋ^{2}sɛ^{2}	tsɿ^{55}ka^{55}	a^{55}mu^{21}tɕi^{55}la^{33}pɛ^{55}	ho^{55}sɛ˞^{41}
185	corn	ʃa^{1}mi^{2}	ʂa^{55}mṳ^{21},ʂam^{51}	sə^{55}nə^{55}	tɕi^{55}mɨ^{33}
186	ear of grain	ʔny^{1}	ʔny^{55}	jɛ^{21}vɛ̠^{33}	
187	peanut	loan	lɛ̤^{21}ti^{55}soŋ^{33},lo̠^{21}ti^{55}soŋ^{33}	a^{55}nu^{33}tʰa^{55}tʰa^{21}	lo^{21}soŋ^{33}
187	walnut	sa^{2}me^{1}	sɛ̤^{21}mi^{55}		sa^{21}mi^{33}
188	cotton	sa^{1}la^{2}	sa^{55}la̤^{21}	so^{55}lo^{21}	sa^{33}la^{33}xuɛ˞^{33}
189	ramie	dzi^{2}	dzɿ^{21}	dʑi^{21}	dzɿ^{21}sɛ˞^{21}sɿ^{53}
191	melon	pʰy^{2}	a^{55}pʰy̥^{21}	pʰən^{21}	
192	gourd	pʰy^{2}	a^{55}mṳ^{21}	a^{55}pʰɨ^{21}	a^{55}pʰɨ^{41}
193	cucumber	sa^{2}kje^{2}	sɛ̤^{21}kɛ̤^{21}	sa^{21}kɨ^{21}	sa^{21}kai^{21}
194	eggplant	ga^{1}zi^{3}	ɦa^{55}zɿ^{33}	aŋ^{55}kɛ^{55}lɛ^{55}	
195	vegetable	ɣaŋ^{2}tʃe̠^{L}	wṳ^{21}	ɣa^{21}	wy̩^{21}tsʰai^{33}
196	vegetable	ɣaŋ^{2}tʃe̠^{L}			wy̩^{21}tsʰai^{33}
196	cabbage greens	ɣaŋ^{2}	wṳ^{21}	ɣa^{21}pʰɛ^{55}	tɕʰiŋ^{33}tsʰai^{33}
197	radish	ɣaŋ^{2}tʃʰe^{1}	wṳ^{21}tɕʰi^{55}	ɣa^{21}tɕʰɛ^{55}	wy̩^{21}tsɿ^{21}
198	garlic	kʰa^{2}sy^{1}	kʰa̤^{21}sy^{55}	ko^{21}sɿ^{55}	kʰa^{21}sɨ^{33}
200	galangal		a^{55}ʂo^{33}lo^{33}	pa^{33}tʃa^{33}ji^{55}	kɛ˞^{33}no^{21}tʰu^{33}tʰu^{43}
201	chili pepper	pʰe^{1}	la^{55}tsɿ^{33}	ma^{55}pʰi^{21}	la^{33}tsɿ^{33}
202	fruit	sɛ^{2}	sɛ̤^{21}	jɛ^{21}ɕɛ^{21}	sɿ^{55}sɛ^{41}sɛ^{21}
203	peach (a)	sa^{2}vy^{2}	sø̤^{21}ʔø̤^{21}	tsʰa^{21}ɣɨ^{21}	
204	peach	sa^{2}vy^{2}	sø̤^{21}ʔø̤^{21}	tsʰa^{21}ɣɨ^{21}	
204	peach (b)	sa^{2}ʔly^{2}			
205	persimmon	mu^{2}bɛ^{1}	m̩^{21}bɛ^{55}		a^{55}m̩^{21}bɛ˞^{33}
206	banana	ʔŋja̠^{H}bjo^{2}be^{3}		a^{55}dʑi^{21}sɛ^{21}	

208	taro (b)	bi^{2}		bɨ^{21}	bi^{21}tʰo^{33}
209	tobacco		jin^{33}tsɿ^{33}	a^{55}kʰi̠^{21}	jo^{33}jo^{33}
210	grass (a)	ʃɨ^{2}by̠^{L}	ʂʅ̠^{21}		pə^{55}sɿ^{21}
211	grass (b)	mo̠^{L}		mo^{21}	
212	thatch		ʂʅ̠^{21}hə^{55}ʂʅ̠^{21}	ɨ^{55}sɿ^{21}	mao^{33}tsʰao^{33}
213	reed		a^{55}kʰa^{33}	o^{21}na^{21}	
214	mushroom	mo^{1}	mu^{55}lu^{55},ŋ^{55}lu^{55}	ma^{55}lɛ^{55}jɛ^{55}	m̩^{33}nai^{21}
215	seed	ʃɨ^{2}	ʂʅ̠^{21},ha^{55}ʂʅ̠^{21}	jɛ^{21}sɿ^{21}	sɿ^{21}kʰa^{33}
216	root	kji^{3}	tɕi^{33}	jɛ^{21}kɛ^{33}	kən^{33}tɕi^{33}
217	stem	dze^{1}		jɛ^{21}to^{55}	sɿ^{55}dzɿ^{33}
218	leaf	pʰe̠^{L}	pʰɛ̠^{21}	jɛ^{21}pʰɛ^{21}	sɿ^{55}pʰai^{55}
219	sprout	bɨ̠^{H}	bi^{33}	jɛ^{21}bɨʔ^{33}	dzɛ˞^{33}
220	flower	ga^{1}lu^{3}	ɦa^{55}lə^{33}ʔvɛ̠^{33}	gu^{55}lu^{33}	gɛ˞^{33}no^{33}
221	wood	si̠^{H}da^{1}	sɿ̠^{33}da^{55}	ɕiʔ^{33}	sɿ^{55}da^{33}
222	board (a)	pɛ^{3}			pɛ˞^{33}
223	board (b)	pʰe^{2}	ti̤^{21}pʰi̤^{21}	to^{21}pʰɛ^{21}	
224	stick	ʔmɛ^{1}tu^{1}	ʔmɛ^{55}tə^{55}kʰɨ^{55}		ka^{44}tsɿ^{33}
225	stick	ʔmɛ^{1}tu^{1}	ʔmɛ^{55}tə^{55}kʰɨ^{55}	a^{55}tũ^{55}	ka^{44}tsɿ^{33}
225	branch	si̠^{H}ka̠^{L}le̠^{L}	sɿ̠^{33}pʰḁ^{21}	ɕi^{33}ka^{21}la^{21}	sɿ^{55}lə^{21}
226	tree bark	si̠^{H}gi^{1}ko̠^{H}	sɿ̠^{33}gɨ^{55}	ɕi^{33}gi^{55}	sɿ^{55}gɨ^{33}gɨ^{33}
227	unhulled rice	tʃʰe^{1}se^{2}	tɕʰi^{55},tɕʰi^{55}sɛ^{21}	tɕi^{55}sɛ^{21}	tɕʰi^{55}sɛ˞^{41}
229	cooked rice	dza^{1}	dza^{55}	dzo^{55}	dza^{33}
230	glutinous rice	tʃʰe^{1}ɲa^{2}	tɕʰi^{55}nə̤^{21}	tɕʰi^{55}ɲa^{21}	tɕʰi^{55}ɲa^{41}
231	rice seedling	ʔli^{2}	ʔzʅ̠^{21}	lɨ^{21}	jaŋ^{33}
232	rice hulls	tʃʰe^{1}pʰɛ^{2}	tɕʰi^{55}pʰɛ̤^{21}	tɕi^{55}pʰæ^{21}	tɕʰi^{55}pʰɛ˞^{41}
233	chaff	ha^{1}/dza^{1}kjo^{2}	ha^{55}kø̤^{21}		
234	fruit peel	gi^{1}ko̠^{H}	gɨ^{55}ko^{33}	jɛ^{21}sɛ^{21}gi^{55}	gɨ^{33}gɨ^{33}
235	eggshell	kjo^{2}	fy̩^{33}kø̤^{21}	jɛ^{21}ko^{21}	kʰɛ^{21}kʰɛ˞^{53}
236	thorn	dzy^{2}	a^{55}dzy^{21}	a^{55}dʒə^{21}	dzə^{21}
237	moss (a)	ɣi^{1}ɲa̠^{H}be^{2}	bi̤^{21}	na^{33}xã^{33}	fu^{33}pʰi^{21}
238	moss (b)	ɣi^{1}me^{2}			
238	fern (a)	da^{1}vaŋ^{2}	da^{55}	da^{55}wo^{21}	
239	fern (b)	da^{1}kʰy^{1}			da^{33}gɨ^{33}

240	yeast	dy^{2}	dy^{21}	də^{21}	də^{21}
	D. Body Parts				
242	body	gu^{1}tsʰʅ$^{2/3}$	gɨ^{55}tʂ̥ʰʅ̥^{21}	gɨ^{55}tsʰʅ^{21}	go^{33}tsʰʅ^{33}
243	head (a)	nu^{2}dy^{1}	n̩^{21}dy^{55}	n̩^{21}də^{55}	n̩^{21}də^{33}
244	head (b)	nu^{2}kaŋ^{2}			
245	brains	ʔnu̠^{L}	ʔnə̠^{21}	pu^{55}no^{21}	no^{453}
246	forehead	ʔnu̠^{L}kaŋ^{1}	ʔnao^{21}ko^{55}	ŋ̩^{21}ko^{55}tɕɛ^{55}	no^{44}kʰo^{53}
247	head hair	n̩^{2}tsʰy^{1}	n̩^{21}tsʰy^{55}	n̩^{21}də^{55}tsʰə^{55}	n̩^{21}tsʰə^{33}
248	braid	n̩^{2}tsʰy^{1}pʰe^{2}	n̩^{21}tsʰy^{55}pʰi^{21}	n̩^{21}də^{55}tsʰə^{55}dʒa^{21}	n̩^{21}tsʰə^{33}pʰai^{31}
249	face	pʰjaŋ^{2}ʔmje̠^{H}	pʰu̥^{21}ʔmɛ̠^{33}	pʰɛ^{21}mɛ^{33}	pʰa^{21}mi^{55}
250	face	pʰjaŋ^{2}ʔmje̠H	pʰu̥^{21}ʔmɛ̠^{33}	pʰɛ^{21}mɛ^{33}	ba^{21}wɣ̩^{21}, pʰa^{21}mi^{55}
250	eyebrow	ʔmje̠^{H}tsʰam^{1}	ʔmɛ̠^{33}ha^{55}	mɛ^{33}ko^{55}tsʰə^{55}nə^{55}	mi^{55}tsʰə^{33}
251	eye	ʔmje̠^{H}sɛ^{2}	ʔmɛ̠^{33}sɛ^{21}	mi^{33}ɕɛ^{21}	mi^{55}sɛ˞^{41}
252	eyeball	ʔmje̠^{H}sɛ^{2}	ʔmɛ̠^{33}ʔly^{33}	mi^{33}ɕɛ^{21}ka^{55}ni^{33}	mi^{55}o^{33}lo^{33}
254	nose	ʔna^{1}kʰaŋ$^{2/3}$	ʔna^{55}kʰə^{33}	no^{55}kʰu^{33}	na^{55}kʰo^{21}
255	ear	ʔna^{2}paŋ^{1}	ʔna̤^{21}pu^{55}	no^{21}pa^{55}kɛ^{33}	na^{21}pu^{33}
256	cheeks	ba^{2}	ba̤^{21}kʰə^{55}tsʅ^{33}		ba^{21}wɣ̩^{21}te^{33}
257	mouth	kʰa^{2}pe̠^{L}	kʰa^{21}pʰɛ^{33}	mə^{33}tʃu^{55}	ma^{21}nɛ˞^{53}
258	lips (a)	mɨ^{2}la^{3}		n̩^{21}la̠^{33}	
259	lips (b)	mɨ^{2}be^{3}dzi^{3}	mʉ^{33}dzʅ^{33}		ma^{21}nɛ˞^{45}bɛ˞^{53}
260	teeth	sy^{2}	sy^{21}ɦa^{55}	so^{21}ko^{55}	sə^{21}
261	front teeth		a^{55}kʰai^{21}ma^{33}pʰɛ^{33}	dzo^{55}ko^{55}jo^{21}	ɣɨ^{21}ĩ^{33}su^{33}sə^{21}
262	back teeth			dzo^{55}ko^{55}mo^{33}	ŋa^{33}ni^{21}su^{33}sə^{21}
263	gums		sy^{21}ɦa^{55}kʰə^{55}tɕi^{33}	soŋ^{21}ko^{55}xo^{21}	
264	tongue	ʔla^{1}	ʔla^{55}	lɛ^{55}pɛ^{55}	la^{33}
265	beard	tsʰi̠^{H}	n̩^{21}tsʰʅ̠^{33}	m̩^{21}pɨ^{55}tʃʰʅ^{33}	fɣ̩^{21}tsʅ^{33}
266	chin	mu^{2}pɨ^{1}daŋ^{1}	n̩^{21}la^{33}dzʅ^{33}	m̩^{21}pɨ^{55}	ɕa^{33}ba^{33}kʰo^{33}
267	neck	li^{1}kaŋ^{2}tsi^{3}	ʐʅ^{55}tsʅ^{33}	lɨ^{55}bɨ^{55}	jĩ^{33}pu^{21}
268	throat	ly^{1}tʰy^{3}	ly^{55}tʰy^{33}	lɨ^{55}bɨ^{55}kʰoŋ^{33}kʰoŋ^{33}	jĩ^{33}tʰə^{21}
269	shoulder	pʰa^{1}kʰɛ^{2}dzʅ^{3}	pʰa^{55}kʰɛ̤^{21}ŋ^{21}dzʅ^{33}	lu^{55}pʰu^{21}dʒu^{33}	m̩^{21}pʰə^{21}
270	joint	vu^{2}tsi̠^{L}	wo̠^{21}tsʅ̠^{21}	xo^{21}ɣɨ^{21}tɕi^{21}	wɣ̩^{21}kɨ^{33}tsʅ^{54}tsʅ^{53}

271	hand/arm	le̠Lpʰe̠H/vu2	lɛ̠21pʰɛ̠33	lɛ21pʰɛ33	lei44pʰei53
272	hand		lɛ̠21pa33tʂaŋ21	lɨ21ɣɨ21	lei55tsa43pa33
273	arm		lɛ̠21ka33n̩21da55	lɨ21ɣɨ21tɨ21	lei45m̩42pa21
274	palm			li21tʰa33	
275	wrist	tsi̠L	lɛ̠21wo̠21tsɿ̠21	li21tʰa33tɕi21	lei44tsɿ55kuɛ˞42kuɛ˞21
276	elbow	tsi̠L	lɛ̠21kuai̠21tsɿ̠33	li21pi21ni̠33	lei44tsɿ55kuɛ˞42kuɛ˞21
277	finger	ʔni1	lɛ̠21ʔni55	li21ni55	lei55kʰɨ33
278	index finger		lɛ̠21ʔni55kʰɨ21sɿ33	li21ni55mo33	
279	pinkie finger	le̠Lʔni1za2	lɛ̠21ʔni55za̤21	tɛ55kɛ55nɛ55	lei55kʰɨ33za21
280	thumb	ma3	lɛ̠21ʔni55ma33ko̠33	li21mo33	lei55kʰɨ33ma33
281	fingernail	le̠Lku2sɛ2	lɛ̠21kə̤21sɛ̤21	li21ku21sɛ21	lei55kʰɨ33sɛ˞21
282	buttocks	daŋ1	tsʰɿ21tə33kʰə55	pʰɛ21dɛ21	tsʰɛ˞21bi33bi33
283	hip		du55pʰɛ̠21tsɿ33	da55ɣɨ21tʃo33	
284	foot/leg	kʰi1pʰe̠H	kʰɨ55pʰɛ̠33	kʰi55pʰɛ33	kɛ˞33vv̩21
285	leg	kʰi1	kʰɨ55pʰɛ̠33	kʰi55pʰɛ33	li21ku33
286	foot		kʰɨ55pʰɛ̠33	kʰi55tʰa33	kɛ˞33vv̩21
287	thigh		pʰa̤21tʰuei̤21	da55ɣɨ21pɨ55tsa21	li21ku33vɛ˞21
288	calf (of leg)		kʰɨ55wu21a55pʉ21	da55ɣɨ21na21kʰɛ33	li21ku33za21
289	sole (of foot)		kʰɨ55tsʰa̤21ti̤21tsɿ33	kʰi55tʰa33	kɛ˞33vv̩21ti33pɛ˞21
290	heel			kʰi55bi21ni33	
291	ankle (joint)	kʰi1ʔmje̠H	kʰɨ55ʔmɛ̠33sɛ21	a55tɕʰi21mɛ33ta33	kɛ˞33wv̩21lo21sɿ33
292	knee		ɦɛ55o33dzɿ33	bu55lu33kʰu55	kʰə44tsɿ44tʰɛ˞53
293	toe		kʰɨ55ʔni55	kʰi55ni55	kɛ˞33wv̩21lei55kʰɨ33
294	big toe		kʰɨ55ʔni55ma33ko̠33	kʰi55mo33	
295	chest			tu55kʰu21	pʰu21ɕoŋ33
296	back	ka(ŋ)2ta(ŋ)3si3	kə21ta33	pʰɛ55	zu55pa41
297	breast	a1tʃɨ̠Hbe̠H	a55tʂʅ̠33bɛ̠33	a55tʃɿ33	a55tsɿ55bi453
298	armpit	ka2	lɛ̠21ta̠21i55ta55kʰə33	li21ku21lɛ33	tsɛ˞21tsɛ˞55kʰo33
299	skin	gi1ko̠H	gɨ55	jɛ21gi55	xa21sai53
300	bone	ɣo2	ɦa̤21da55dzɿ33	xo21ɣɨ21	vv̩21kɨ33
301	rib	ʔny1	ʔly55	nɛ55kʰɛ55	nəŋ44kɨ55pa41

302	stomach	he̱^{L}	hɛ̱^{21}ma^{33}ko̱^{33}	xo^{21}xɛ^{21}mo^{33}	xai^{55}m̩^{21}t^{h}ə^{53}
303	belly (a)	he̱^{L}ma^{3}dzɿ^{3}			
304	belly (b)	he̱^{L}py^{1}	hɛ̱^{21}pə^{55}də^{55}	xɛ^{21}pə^{55}	xai^{55}pɨ^{33}
305	navel	tʃ^{h}e̱^{H} du^{1}/^{2}	tɕ^{h}ɛ̱^{33}ma^{33}də^{21}	toŋ^{21}tsu^{55}lu^{33}	ts^{h}ai^{55}do^{41}
306	waist	dʒo̱^{L}	dʑo̱^{21}	dʒo^{21}	
307	kidney	di^{1}	di^{55}	ma^{55}laŋ^{33}	
308	intestines	he̱^{L}vu^{1}	hɛ̱^{21}v̩^{55}	xo^{21}wu^{55}	xai^{55}vv̩^{33}
309	heart	ʔni̱^{H}ma^{3}	ʔɲɛ̱^{33}ma^{33}	mo^{33}sɛ^{21}	i^{55}ma^{33}
310	liver	se^{2}tsɛ^{1}	sɿ^{21}tsɛ^{55}	xo^{21}sɿ^{21}	sɿ^{21}kɨ^{33}
311	liver	se^{2}tsɛ^{1}	sɿ^{21}tsɛ^{55}	xo^{21}sɿ^{21}	sɿ^{21}kɨ^{33}
311	lung	ts^{h}ɛ^{2}ma^{3}p^{h}u^{2}	ts^{h}ɿ^{21}fv̩^{21}	xo^{21}sɿ^{21}p^{h}ɑ^{21}	fei^{41}
312	bladder	ts^{h}i^{2}p^{h}u^{2}	sɛ^{21}pi^{21}	ɕi^{55}p^{h}u^{21}	ts^{h}a^{21}p^{h}o^{21}lo^{33}
313	gallbladder	ki^{1}	kɨ^{55}	ja^{21}ki^{55}	dan^{24}
315	sweat	kjɛ^{2}	kɨ^{21}	kɛ^{21}	kɛ˞^{21}
316	blood	si^{2}	sɿ^{21}	ɕiŋ^{21}ki^{55}	sɿ^{21}
317	snot	ʔny̱^{L}	ʔnø^{21}	nɑ̱^{21}	nəŋ^{453}
318	phlegm	ti^{2}k^{h}a^{2}	ti̤^{21}k^{h}a̤^{21}	ti^{21}ɣɨ^{55}	tɕi^{21}k^{h}ɛ˞^{21}
319	phlegm	ti^{2}k^{h}a^{2}	ti̤^{21}k^{h}a̤^{21}		tɕi^{21}k^{h}ɛ˞^{21}
319	saliva	ti^{2}ɣi^{1}	ti̤^{21}ɣɨ^{55}	pɨ^{21}sɿ^{21}ɣɨ^{55}	m̩^{21}p^{h}ai^{55}ɣɨ^{33}
320	milk	a^{1}tʃɨ̱^{H}	a^{55}tʂ̤ʅ̱^{33}	a^{55}tʃʅ̱^{33}	a^{55}tsɿ^{53}
321	excrement	k^{h}ji^{2}	ts^{h}ɿ̤^{21}	k^{h}i^{21}	ts^{h}ɿ^{21}
323	pus	bi^{1}	vi^{55}	bi^{55}ɣɨ^{55}	bi^{33}
324	sore (wound)	gɛ^{2}	ɦɛ̤^{21}	po^{33}no^{55}	pu^{55}na^{33}
325	body hair	ts^{h}y^{1}	ts^{h}y^{55}	ja^{21}tʃ^{h}ɿ^{55}	
326	penis	hɛ^{2}	hɛ̤^{21}	do^{21}bi^{55}	
327	vulva (a)	tu^{2}	tə^{21}	do^{21}bi^{55}	
328	vulva (b)	bje̱^{L}		bi^{33}la^{21}	bĩ^{21}tʂ^{h}ɛ^{33}
329	anus		ts^{h}ɿ^{21}tə^{21}k^{h}ə^{55}	p^{h}ɛ^{21}tɛ^{21}k^{h}u^{55}	
330	tendon	gju^{2}tʃa^{3}	gə^{21}tʂa^{33}	xo^{21}gu^{21}po^{33}tso^{33}	
331	breath	se̱^{L}xa^{1}	sɛ̱^{21}xa^{55}	sɛ^{21}xo^{55}	
332	strength	ɣa^{2}	va̤^{21}	vo^{21}	
	E. Society				
333	person	ts^{h}aŋ^{1}	ts^{h}u^{55}	ts^{h}a^{55}jo^{21}	ts^{h}u^{33}

334	male	ʒo̠^{L}	ʐo̠^{21}pa̠^{21}	jɛ^{21}pɑ̠^{21}	zu^{42}pa^{453}
335	female	za^{2}mɛ^{2}	ma̠^{21}ʔɲi^{55}u^{21}	n̩^{21}nə^{55}jo^{21}	za^{21}mɛ˞^{21}
336	Autonym	la^{2}lo̠^{H}pa̠^{L}	la̠^{21}ʔlo̠^{33}pa̠^{21}	lo^{21}lo^{33}pɑ̠^{21}	la^{21}lu^{453}
337	Autonym	la^{2}lo̠^{H}pa̠^{L}	la̠^{21}ʔlo̠^{33}pa̠^{21}	lo^{21}lo^{33}pɑ̠^{21}	la^{21}lu^{453}
337	Han Chinese	he̠^{L}/ha̠^{L}pa̠^{L}	ha̠^{21}pa̠^{21}	xɛ^{21}pɑ̠^{21}	xai^{53}pa^{53}
338	Non-Lalo	la^{2}bɨ^{2}	la̤^{21}bṳ^{21}		la^{21}bi^{21}
339	Yi/Lo				
340	Dai		tai^{214}	pɛ^{55}pɑ̠^{21}	bɛ˞^{55}ji^{53}
341	child	a^{1}ne^{1}za^{2}	a^{55}ɲi^{55}za̤^{21}	a^{55}ni^{55}jo^{21}	a^{21}ɲɛ^{33}ma^{53}
343	older man	a^{2}pa^{1}	a^{21}pa^{55}mu^{21}	a^{21}po^{55}ma^{21}	ts^{h}u^{33}mu^{21}pa^{53}
344	older woman	a^{2}p^{h}i^{2}	a^{21}fi^{21}mu^{21}	a^{21}p^{h}i^{21}ma^{21}	ts^{h}u^{33}mu^{21}ma^{33}
345	boy	su^{1}le̠^{L}pa̠^{L}	sɿ^{55}lɛ̠^{21}pa̠^{21}	su^{55}lu^{21}pɑ^{21}	sɛ^{33}lɛ^{55}za^{21}
346	girl	su^{1}le̠^{L}ma^{3}	sɿ^{55}lɛ̠^{21}ma^{33}	dʒo^{21}mɛ^{21}lɛ^{21}	za^{21}mɛ^{21}ə^{33}nə^{33}
347	friend		ta̠^{33}pɛ̠^{33}	tɕi^{55}ts^{h}a^{21}	ka^{33}ts^{h}o^{21}
348	enemy		ti^{33}ʐɛn^{33}	k^{h}ɨ^{21}jo^{21}	
349	host	si^{2}p^{h}a^{2}		ɕi^{55}p^{h}o^{21}	
350	host	si^{2}p^{h}a^{2}		ɕi^{55}p^{h}o^{21}	sɿ^{21}ma^{33}
350	guest	se^{1}ɣe^{3}	si^{55}ŋ̩^{21}	sɛ^{55}vɛ^{33}	sɿ^{55}vei^{33}
351	guest	se^{1}ɣe^{3}	si^{55}ŋ̩^{21}, siŋ̩^{53}	sɛ^{55}vɛ^{33}	sɿ^{55}vei^{33}
351	lame (a)	k^{h}i^{1}p^{h}a^{3}			
353	official	dzi$^{2/3}$	a^{55}ɣɨ^{21}a^{55}dzɿ^{33}		ɣ̠^{21}
355	low official	dzi$^{2/3}$		wu^{55}ɕi^{55}	ɣ̠^{21}za^{21}
356	emperor	vu^{1}te^{2}	huaŋ^{21}ti^{33}	wu^{55}tɛ^{21}	huan^{21}ti^{33}
357	doctor		ji^{33}sən^{33}	no^{55}ku^{33}su^{55}	na^{33}ko^{33}su^{33}
358	blacksmith		ɕy^{55}dɛ^{21}sɿ^{55}	a^{55}t^{h}o^{21}dɛ^{21}su^{55}	xɨ^{33}dai^{21}su^{33}
359	soldier	me̠^{L}	mɛ̠^{21}pa̠^{21}		mai^{53}
360	bride		k^{h}ɨ^{21}ma^{33}lɛ̠^{21}xɨ̠^{21}	k^{h}ɨ^{21}mo^{33}xɨ^{21}	ma^{21}nə^{33}xɨ^{53}
361	groom			mi^{21}xɨ^{21}	m̩^{21}dzɛ^{33}xɨ^{53}
362	widow	mɛ^{2}tʃ^{h}u^{2}ma^{3}	lɛ̠^{33}ma^{33}	mɛ^{21}tʃ^{h}u^{21}mo^{33}	mɛ˞^{21}ts^{h}ɿ^{21}ma^{33}
363	widower	me^{2}tʃ^{h}u^{2}pa̠^{L}	lɛ̠^{33}pa̠^{21}	mɛ^{21}tʃ^{h}u^{21}pɑ^{21}	mɛ˞^{21}ts^{h}ɿ^{21}pa^{53}
364	blind (a)	la^{3}tɛ^{1}			
365	blind	ʔmje̠^{H}tɛ^{1}/ɕa^{3}	ʔmɛ̠^{33}ɕa^{33}	mɛ^{33}tɛ^{55}	mi^{55}tɛ˞^{33}
366	deaf	ʔna^{2}baŋ^{2}	ʔna^{21}bu^{21}	t^{h}a^{21}	na^{21}bu^{21}

367	father's father	a^{2}pa^{1}	a^{55}ku^{33}	a^{21}po^{55}	a^{21}pa^{33}
369	GP father	a^{1}tsu^{2}	a^{55}ku^{33}	a^{21}po^{55}liŋ^{55}	a^{55}tsu^{21}pa^{53}
370	GP mother	a^{1}maŋ^{2}/tʰe^{1}	a^{55}mu^{21}	a^{21}pʰi^{21}liŋ^{55}	a^{55}tsu^{21}ma^{33}
371	GP mother	a^{1}maŋ^{2}/tʰe^{1}			a^{55}tsu^{21}ma^{33}
372	father	a^{1}ba^{2}	a^{55}ti^{33}	a^{55}bə^{21}	a^{55}tiɛ^{33}
373	mother	a^{1}ma^{3}	a^{55}ma^{33}	mə^{33}	a^{33}ma^{53}
374	wife's father	ʒo̠ᴸpʰa^{2}	ʐo̠^{21}pʰa̤^{21}	o^{33}vi^{55}	zu^{55}pa^{53}
375	wife's mother	ʒo̠ᴸma^{3}	ʐo̠^{21}ma^{33}	o^{33}ni^{55}	zu^{55}ma^{33}
376	older brother	a^{1}ka^{1}	a^{55}ka^{33}	a^{21}a^{55}	a^{55}kɨ^{33}
377	older sister	a^{1}tse^{2}	a^{55}tsi̤^{21}	a^{55}tɕi^{33}	a^{55}tɕiɛ^{21}
378	younger brother of a male	ɲe^{1}za^{2}	ɲɛ^{55}za̤^{21}	ɲɛ^{55}jo^{21}	ja^{33}tʰai^{33}zu^{55}pa^{53}
379	younger brother of a female	pʰa^{2}maŋ^{1}			
379	younger sister of a male	ʔny^{2}ma^{3}	ʔny^{21}ma^{33}		ja^{33}tʰai^{33}za^{21}mɛ˞^{21}
380	younger sister of a female	ɲe^{1}ma^{3}	ɲi^{55}ma^{33}	ɲɛ^{55}mo^{33}	
381	siblings		n̩^{55}ʔny^{55}	ɲɛ^{55}jo^{21}ɲɛ^{55}mo^{33}	a^{55}kɨ^{33}a^{55}tʰai^{33}
383	second sibling				ɛ˞^{33}mɛ˞^{21}
384	third sibling				sa^{33}mɛ˞^{21}
385	husband	dʒɛ^{1}	ŋ̍^{21}dʑɛ^{45}	n̩^{21}dʑɛ^{55}	m̩^{21}dzɛ^{33}
386	wife	mɛ^{2}ʔny^{1}	ma̠^{21}ʔny^{55}	n̩^{21}nə^{55}	mɛ˞^{21}nə^{33}
387	son	za^{2}	za̤^{21}	jo^{21}, zo^{21}	za^{21}
388	daughter	za^{2}mɛ^{2}	zɛ̤^{21}mɛ̤^{21}	jo^{21}mɛ^{21}, zo^{21}mɛ^{21}	za^{21}mɛ˞^{21}
389	daughter-in-law	kʰɨ^{2}ma^{3}	kʰɨ^{21}ma^{33}	kʰɨ^{21}mo^{33}	kʰɨ^{21}ma^{33}
390	son-in-law	ʔme̠ᴸɣo^{1}	mɛ̠^{21}v̩^{55}	miŋ^{24}	mei^{55}vv̩^{33}
391	brother's son	za^{2}du^{1}	za̤^{21}də^{45}	da^{55}du^{21}	za^{21}do^{33}
392	brother's daughter	za^{2}mɛ^{2}du^{1}	zɛ̤^{21}mɛ̤^{21}də^{45}	da^{55}mo^{33}	za^{21}mɛ^{21}do^{33}
393	sister's child	ʃa̠ᴸ	sa̠^{21}		
394	son's son	ʔli^{2}pa̠ᴸ	ʔzɿ^{21}pa̠^{21}	lu^{21}pa̠^{21}	i^{21}za^{21}

395	son's daughter	ʔli^{2}ma^{3}	ʔzʅ̠^{21}ma^{33}	lu^{21}mo^{33}	i^{21}ma^{33}
396	ancestor	pʰi^{2}pʰa^{2}	a^{21}fi^{21}a^{21}pʰa^{21}	a^{21}pʰi^{21}a^{21}po^{55}	pʰi^{21}pʰa^{21}
397	father's OB	ta^{55}tiɛ^{33}	pa^{21}ti̤^{21}	a^{55}jɛ^{21}	ta^{55}tiɛ^{33}
398	father's BW	ta^{55}ma^{33}	pa^{21}ti̤^{21}ma^{33}ko^{33}	a^{55}jɛ^{21}mo^{33}	ta^{55}ma^{33}
399	father's OS	ku^{33}ma^{33}	ku^{33}ma^{33}	a^{55}ti^{21}tɕi^{33}	ku^{33}ma^{33}
400	father's YB	a^{1}ʒe^{3}	a^{55}ʝi^{21}	a^{55}jɛ^{21}	a^{55}ʝei^{33}
401	mother's OB		a^{55}tɕo^{55}	a^{55}tɛ^{21}	a^{21}tɕo^{53}
402	mother's OS		ta^{55}ma^{33}	a^{55}ma^{21}	ji^{21}ma^{33}
403	male suffix	jaŋ^{2}pa̠^{L}	pa̠^{21}	jɛ^{21}pɑ̠^{21}	ja^{21}pa^{53}
404	female suffix	jaŋ^{2}ma^{3}	ma^{33}	jɛ^{33}mo^{33}	ja^{21}ma^{33}
405	father+children (CLF)	pa̠^{L}la^{2}	pa̠^{21}la̤^{21}	pɑ̠^{21}lɑ^{21}	pa^{55}la^{21}
406	mother+children (CLF)	ʔma^{3}la^{2}	ʔma^{33}la̤^{21}	mo^{33}lo^{21}	ma^{55}la^{21}
407	grandparent+grandchildren (CLF)	pi^{2}la^{2}	pi^{21}la̤^{21}		pʰi^{21}li^{21}
408	grandmother+grandchildren (CLF)	pi^{2}la^{2}	pi^{21}la̤^{21}		pʰi^{21}li^{21}
	F. Material Culture				
408	house	he^{1}	hi^{55}	xɛ^{55}	hei^{44}
410	wall	lu^{1}di^{3}	lu^{55}di^{33}	lu^{55}liŋ^{33}tɛ^{21}	tɕʰiaŋ^{24}
411	roof	he^{1}dzi^{3}		xɛ^{55}ɲo^{33}	hei^{44}ma^{33}dzʅ^{21}
412	tile	ŋwɛ^{2}pʰe^{2}	vɛ̤^{21}	bəm^{24}pʰɛ^{21}	
413	beam [main]		li^{55}mu^{55}kaŋ^{33}	a^{55}tʃa^{55}mo^{33}	liaŋ^{31}
414	beam [small]	he^{1}du^{2}	hi^{55}dv̩^{21}	a^{55}tʃa^{55}jo^{21}	hein^{44}dɤ̠^{21}
415	post		zʅ^{33}kʰə^{55}dzʅ^{33}	tɕi^{55}kʰu^{55}	tso^{21}zʅ^{33}
416	door	a^{1}kʰjɛ^{2}/^{L}	a^{55}kʰai̠^{21}	a^{55}ku^{33}kʰi^{21}	a^{55}kʰɛ˞^{21}
417	room	hi^{1}kɛ^{3}	hi^{55}ka^{33}	xɛ^{55}na^{33}	pɛ˞^{55}ta^{33}
418	fire	a^{1}to̠^{L}be̠^{L}	a^{55}to̠^{21}bɛ̠^{21}	a^{55}to^{21}kʰu^{21}pi^{55}	a^{44}tu^{44}bei^{53}
419	charcoal	sa^{2}ŋi^{2}	sɛ^{21}n̩^{21}tsʰʅ^{21}	sɛŋ^{21}kʰi^{21}	sa^{21}mi^{21}
420	charcoal	sa^{2}ŋi^{2}	sɛ^{21}n̩^{21}tsʰʅ^{21}	sɛŋ^{21}kʰi^{21}	sa^{21}mi^{21}
420	wet field	de^{1}mi^{1}	tɕʰi^{55}mi^{55}	dɛ^{55}	ti^{33}mi^{33}

421	dry field	mi^{1}bɛ^{1}	mi^{45}	kʰu^{55}dza^{21}dɛ^{55}	m̩^{33}bɛ˞^{33}
422	garden	ɣaŋ^{2}(kʰy^{1})mi^{1}	wu^{21}mi^{45}	ɣa^{21}mi^{55}	kʰei^{33}ka^{33}
424	granary	gɨ^{1}tʰu^{2}	ha^{55}sɛ^{21}gɨ^{21}tʰə^{21}	dʒo^{55}ka^{21}	
425	shrine	ne^{2}he^{1}	ŋ̩^{21}hi^{55}	va^{21}	nai^{21}hei^{33}
426	tomb	mo̠^{H}/^{L}bɛ^{1}	mo̠^{21}bɛ^{55}	liŋ^{21}dʒo^{55}	m̩^{55}bɛ˞^{33}
427	graveyard	mo̠^{H}/^{L}bɛ^{1}kʰy^{1}	mo̠^{21}bɛ^{55}kʰy^{55}		
428	head		ʔmɛ^{55}n̩^{21}ɕɛ^{33}	a^{55}tʃo^{33}	m̩^{21}tʰə^{53}
429	headdress		ʔmɛ^{55}n̩^{21}ɕɛ^{33}	a^{21}ta^{21}	
430	hat	nu^{2}tsi^{2}	n̩^{21}tsɿ^{21}	a^{21}tsu^{21}	n̩^{21}tsɿ^{21}
431	earring	ʔna^{2}vaŋ^{2}	ʔnɛo^{53}	nu^{21}su^{55}	na^{33}vv̩^{21}
432	bracelet	le̠^{L}go^{1}	lɛ̠^{21}a^{21}wo^{55}	lu^{21}gu^{55}	lei^{55}go^{33}
433	ring	ku^{3}	tɕɛ^{55}tʂʅ̠^{21}	li^{21}ni^{55}sɛ^{33}	kai^{55}tsɛ˞^{33}
434	clothing	pʰja(ŋ)^{1}	pʰu^{55}	lo^{21}pʰa^{55}	pʰa^{33}
435	collar	pʰja(ŋ)^{1}kʰjɛ^{2}	pʰu^{55}kʰɛ^{21}	pʰa^{55}lu^{21}kʰu^{55}	pʰa^{33}kʰɛ˞^{21}
436	sleeve	pʰja(ŋ)^{1}le̠^{L}	pʰu^{55}lɛ̠^{21}	pʰa^{55}lɨ^{21}ɣɨ^{21}	pʰa^{33}nai^{53}
437	button	pʰja(ŋ)^{1}sɛ^{2}	kʰɨ^{55}ta^{33}	pʰa^{55}sɛ^{21}	pʰa^{33}sɛ˞^{21}
438	palm rain cape	ga^{1}by^{1}	gɨ^{55}by^{55}	ɕi^{55}kʰuai^{55}	ga^{33}bɨ^{33}
439	pants	ʔla^{2}	ʔla̤^{21}	lo^{21}	la^{21}
440	belt		ʔla̤^{21}kʰɨ^{55}ɕɛ^{33}pɛ^{33}tɕa^{33}	lo^{21}po^{33}tso^{33}	la^{21}kʰo^{33}sɛ˞^{21}
441	shoes	kʰi^{1}ne̠^{H}	kʰɨ^{55}nɛ̠^{33}	kʰɨ^{55}nɛ^{33}	kʰei^{55}ni^{53}
442	cloth	ʔmɛ^{1}	ʔmɛ^{55}	mɛ^{55}	pʰiao^{21}
443	baby sling		a^{55}kɨ^{55}ti^{33}	a^{55}tso^{33}	ɛ˞^{55}vv̩^{53}
444	shoulder bag	ta^{2}la^{2}py^{3}	tɛ̤^{21}lɛ̠^{21}py^{33}	ta^{21}pə^{33}	ta^{21}pɨ^{33}
445	blanket (a)	ʔla^{2}ba^{2}	ʔla^{21}ba^{21}	la^{21}bo^{21}	ɛ˞^{55}vv̩^{53}la^{21}ba^{21}
446	blanket (b)	ʔmɛ^{1}bo^{3}			
447	pillow	nu^{2}ka̠^{L}du^{1}	ŋ̩^{21}ka̠^{21}də^{55}	i^{21}kʰa^{21}du^{55}	m̩^{21}ka^{55}dɤ̠^{33}
448	pillow	nu^{2}ka̠^{L}du^{1}	ŋ̩^{21}ka̠^{21}də^{55}	i^{21}kʰa^{21}du^{55}	m̩^{21}ka^{55}dɤ̠^{33}
448	mat	gɨ^{1}pʰu^{2}	gɨ^{55}fv̩^{21}	sa^{33}fu^{21}	pɛ˞^{33}fv̩^{21}
449	mat	gɨ^{1}pʰu^{2}	gɨ^{55}fv̩^{21}	sa^{33}fu^{21}	pɛ˞^{33}fv̩^{21}
449	rice powder	mu^{3}	dza^{21}kʰa^{55}mʉ^{33}	dzo^{55}mu^{33}	tɕʰi^{33}fv̩^{33}ga^{21}m̩^{33}
451	porridge		dza^{55}hə^{21}ɣɨ^{24}	dzo^{55}ma^{21}næ^{33}	dza^{21}fv̩^{21}la^{53}
453	lard	tsʰɛ^{1}	tsʰɛ^{55}	xo^{21}tsʰɛ^{55}	tsʰɛ˞^{33}

454	salt	tsʰa^{2}bo̱^{H}	tsʰa^{21}bo̱^{33}	la^{21}ba^{21}kʰɨ^{55}	tsʰa^{21}mi^{55}mi^{53}
455	meat	xa^{2}	xa̤^{21}	xo^{21}	xa^{21}
456	soup	ɣaŋ^{2}ɣi^{1}	wu^{21}tɕɛ̱^{21}ɣɨ^{55}	a^{21}tɕɛ^{21}ɣɨ^{55}	m̩^{21}m̩^{33}
457	liquor	dʒi^{1}	dʐʅ^{45}	dʑi^{55}	dzɿ^{33}
458	tea	la^{2}	la̤^{21}ɣɨ^{55}	la^{21}pʰo^{21}	la^{21}ɣɨ^{33}
459	sugar (a)	ʃa^{1}ba^{2}	ʂa^{55}ba^{21}	bɨ^{21}tʃʰɿ^{55}	
460	sugar (b)	ʃa^{1}da^{2}			
461	jaggery	ʃa^{1}da^{2}(ʔni^{1})	ʂa^{55}da^{55}	bɨ^{21}tʃʰɿ^{55}tɛ^{33}	
462	saw	ɣɨ̱^{L}tsy^{3}	ɣɨ̱^{21}tsy^{33}	ɣɨ^{21}tsə^{33}	ɣɨ^{55}tsɿ^{33}
463	knife	a^{1}tʰa^{2}	a^{55}tʰa̤^{21}	a^{55}tʰo^{21}	a^{55}tʰa^{21}
464	kitchen knife	a^{1}tʰa^{2}ba^{2}	a^{55}tʰa̤^{21}ba̤^{21}	a^{55}tʰɛ^{21}lɛ^{21}	bo^{33}tao^{33}
465	pointed knife	a^{1}tʰa^{2}le̱^{L}	a^{55}tʰa̤^{21}lɛ̱^{21}	a^{55}tʰɛ^{21}lɛ^{21}n̩^{21}də^{55}pu^{55}	a^{55}tʰa^{21}tʰi^{33}
466	sickle	n̩^{2}tsʰo̱^{H}	liaŋ^{55}tao^{33}	n̩^{21}tʃʰu^{33}	n̩^{21}tsʰu^{53}
467	hatchet	a^{1}tsʰo̱^{H}	a^{55}tsʰo̱^{33}	a^{55}tʃʰu^{33}	a^{55}tsʰu^{53}
468	hoe	tse^{2}	tsi^{21}tsʰo̱^{33}	tɕɛ^{21}mo^{33}	tsai^{21}
469	plow	si̱^{H}go̱^{L}	sɿ̱^{33}wo̱^{21}	mo^{21}kʰi^{21}	so^{33}ko^{53}
470	yoke	la^{2}le̱^{H}	la̤^{21}lɛ̱^{33}	i^{55}kai^{51}	a^{55}ni^{55}wan^{21}taŋ^{33}
471	thing	dʒe^{1}ku^{1}	xa^{55}ŋa^{55}	kʰo^{55}mo^{33}	dzɛ˞^{55}ko^{33}
472	loom		dzɛ̱^{33}	dzaŋ^{21}, koŋ^{21}	ɟi^{53}
473	needle	ɣy̱^{L}	a^{55}jø̱^{21}	wa̱^{21}	a^{55}ɣɨ^{53}
474	awl		tɕao̱^{21}sa^{33}	mo^{55}wo̱^{21}	tsuei^{33}tsɿ^{33}
475	thread	kʰi^{1}	kʰɨ^{55}	kʰi^{55}tso^{33}	kʰɨ^{33}
476	thread ball		kʰɨ^{55}ʔly^{33}	kʰi^{55}tso^{33}sɛ^{21}	kʰɨ^{33}tʰɛ˞^{21}
477	rope		i^{55}tsʰɿ^{55}	po^{33}tso^{33}	vɛ˞^{33}tsa^{33}
478	chain	ʃo̱^{H}		tɕɛ^{55}mo^{33}	xɨ^{33}so^{53}
479	horse whip	la^{2}kʰo̱^{H}	lei^{45}pʰi^{21}	tso^{55}wai^{55}	la^{21}ti^{33}
480	winnowing basket	ʔva^{1}	ʔva^{55}ma^{33}	o^{55}mo^{33}	oaŋ^{33}
481	bamboo sieve	ʔva^{1}kɨ^{1}	ʔva^{55}kʰɨ^{55}tsɿ^{33}	oŋ^{55}ki^{55}	aŋ^{21}kɨ^{33}
482	whetstone	a^{1}tʰa^{2}sɛ^{2}ka^{1}lu̱^{H}	a^{55}tʰa̤^{21}sɛ^{21}ka^{55}lə^{33}	a^{55}tʰo^{21}sɛ^{21}ko^{55}lu^{33}	xɨ^{33}sɛ^{21}lo^{53}
483	millstone	ni̱^{L}	ɲiɛ̱^{21}lə^{21}	mo^{55}	wai^{53}
484	hammer		tɕʰue^{21}	tɛ^{21}lu^{55}	xɨ^{33}tsʰuən^{21}

485	chisel		tso^{33}tsɿ^{33}	xɨ^{55}tʰɛ^{21}	
486	rice huller	tsʰy^{1}	tsʰi^{55}lə^{21}	kʰo^{21}naŋ^{21}	tsʰə^{33}
487	rice pounder		tsʰa^{21}lu^{21}	kʰo^{21}, kʰoŋ^{21}	lei^{55}tsʰə^{33}
488	mortar		tsʰa^{21}lu^{21}	ma^{55}pʰiŋ^{21}kʰoŋ^{21}	tsʰa^{21}tsʰo^{33}
489	pestle		tsʰa^{21}ti^{21}sɿ^{33}		tsʰa^{21}tsʰo^{33}bi^{55} bi^{53}
490	medicine	nɛ̱/e̱^{H}tsʰi^{2}	ʔnɛ̱^{33}tsʰɿ^{21}	na^{33}tɕʰi^{21}	nɛ˞^{55}tsʰɿ^{41}
491	medicine	nɛ̱/e̱^{H}tsʰi^{2}	ʔnɛ̱^{33}tsʰɿ^{21}	na^{33}tɕʰi^{21}	nɛ˞^{55}tsʰɿ^{41}
492	bamboo basket		kʰa^{33}lə^{55}	kʰa^{33}lu^{55}	pɛ˞^{33}lo^{33}
493	broom	gɨ^{1}si̱^{H}	gɨ^{55}sɿ̱^{33}	gɨ^{55}sɿ^{33}	gɛ˞^{33}sɿ^{53}
494	wok	a^{2}tʃʰɛ^{1}	a^{55}tɕʰɛ^{55}	a^{55}tsʰa^{55}pɛ^{33}	a^{21}tsʰɛ˞^{33}
496	barrel	ʔnu^{1}	ə^{55}lə^{55}pi^{55}	tʰaŋ^{53}	õ^{33}
497	washbasin	laŋ^{2}	pʰu^{21}ʔmɛ^{33}tsʰɿ^{21}pʰu̥^{21}	pan^{21}doŋ^{33}	pʰa^{21}ni^{55}tsʰɿ^{21}lo^{21}
498	bag	la^{1}ʔli̱^{L}	pa̱^{21}kʰɛ̥^{21}	mɛ^{33}nɛ^{33}	dzɿ^{21}no^{33}
499	comb	m̩^{2}pjɨ^{2}	m̩^{21}pʉ^{21}tɕɛ̱^{33}	ŋ^{21}pɨ^{21}	m̩^{21}pai^{21}
500	fine toothed comb	m̩^{2}pjɨ^{2}dzi^{1}	m̩^{21}pʉ^{21}dzɿ^{55}	ŋ^{21}pɨ^{21}dʑi^{55}	m̩^{21}pai^{21}mo^{53}
501	bowl	a^{1}kje^{2}	a^{55}kai^{21}	i^{55}ɕɛ^{21}	a^{55}kai^{41}
502	small bowl	a^{1}kje^{2}za^{2}	a^{55}kai^{21}	i^{55}ɕɛ^{21}jo^{21}	a^{55}kai^{41}za^{21}
503	large bowl		pa^{55}tʰu^{33}	i^{55}ɕɛ^{21}mo^{33}	a^{55}kai^{41}ɣɛ˞^{21}
504	chopsticks	a^{1}dʒu^{3}	a^{55}ɖʐə^{33}	a^{55}dʒu^{33}	a^{55}dzə^{33}
505	bed	gy^{2}	gyn^{21}	go^{21}tsa^{33}	gɨ^{21}
506	ladder	de̱^{H}go̱^{L}	dɛ̱^{33}wo̱^{21}	dɛ^{33}gu^{21}	di^{45}gɨ^{21}
507	firewood	si̱^{H}	sɿ̱^{33}	ɕi^{33}	sɿ^{53}
508	manure	kʰi^{2}	kʰɨ̥^{21}	kʰi^{21}	kʰɨ^{21}
509	road (a)	gja^{1}ma^{3}	ga^{55}ma^{33}	go^{55}kɑ^{33}	
510	road (b)	gja^{1}ka^{3}		go^{55}kɑ^{33}	
511	road (c)	ka^{3}kɨ̱H			ka^{33}kɨ^{53}
512	bridge	dzy^{1}	dzy^{55}	ɣɨ^{55}dʑɛ^{55}	dzə^{21}dzə^{33}
513	market	dʒi^{3}	dʐʅ^{33}	ba^{55}dʑi^{33}	kai^{33}tsɿ^{33}
514	money	gi^{2}pʰe^{2}	gɨ^{21}pʰi^{21}	pʰi^{55}dʑɛ^{21}	ɣɨ^{33}ma^{33}
515	price	pʰo^{2}	fi^{21}	jɛ^{21}pʰi^{21}	pʰu^{21}
516	folksong		bɛ^{55}tsʰɛ^{55}	bɛ^{55}ko^{33}	xai^{53}
517	song		ko^{33}	ko^{33}	tsʰaŋ^{33}ku^{33}

518	story		ko^{21}pɯm^{21}	kam^{33}pɨm^{33}	ku^{21}sɿ^{33}
519	word (written)		tʰiau^{21}tsɿ^{55}	su^{21}tu^{55}	sɤ̰^{21}
520	speech	ɣɛ^{1}ʔli^{1}	vɛ^{55}	da^{21}	bei^{55}ŋɛ^{33}
521	speech	ɣɛ^{1}ʔli^{1}	vɛ^{55}		bei^{55}ŋɛ^{33}
521	voice (a)	se̠^{L}	sɛ̠^{21}	ɕɛ^{21}tʰə^{55}	
522	voice (b)	kʰo^{2}tʰy^{1}		ɕɛ^{21}tʰə^{55}	kʰo^{21}tʰə^{33}
523	book	tʰo^{2}ɣu^{2}	tʰiau^{21}pɯm^{21}		
525	dream	ʒi̠^{L}ʔme̠^{H}	ʐʅ^{21}ʔmɛ̠^{33}	i^{21}mɛ^{33}kʰa^{55}	zɿ^{45}m̩^{43}kʰa^{33}
526	shadow	a^{1}ɣɨ^{3}	li^{55}ɣɨ^{33}	xo^{55}ɣɨ^{33}	ha^{55}ɣɨ^{33}
527	deity	ɣi^{1}sa^{1}	ɲi̤^{21}	nɛ^{21}	
528	God	ɣi^{1}sa^{1}	n̩^{21}ɕi^{55}	i^{55}sɛ^{33}mo^{33}tso^{33}	ɣɨ^{33}sɛ˞^{33}
529	soul (1)	ha^{1}	ha^{55}	a^{55}ɣɨ^{33}	ha^{55}ɣɨ^{33}
530	spirit (evil)	ne^{2}	la̤^{21}kɨ^{33}	pʰɛ^{55}	nai^{231}
531	boundary marker		kɛ^{55}tɕʰɨ^{21}a^{21}gə^{55}	jɛ^{21}dʑi^{21}	kai^{33}ɕĩ^{53}
531	fence	kʰy^{1}	kʰy^{55}	kʰə^{55}pɨ^{33}	pʰɨ^{33}sa^{53}
532	gun		tsʰiaŋ^{55}	a^{55}to^{21}ma^{21}	tɕʰiaŋ^{33}
533	bow	ta̠^{L}nɛ^{3}	ta^{21}na^{33}	ta^{21}na̠^{33}	tɛ˞^{55}no^{33}
535	arrow (head)		ta^{21}na^{33}mi̤^{211}n̩^{21}dy^{55}	mu^{21}jon^{21}də^{55}	
536	cage		ty^{55}	kʰa^{33}lu^{55}	lo^{21}lo^{21}
537	drum		ku^{21}	koŋ^{55}	
538	gong			jaŋ^{55}	mɑŋ^{33}
539	town		tʂ̠ʰəŋ^{21}ʂ̠ʅ^{33}		pa^{33}tsɿ^{33}
540	village	kʰa̠^{H}	kʰa̠^{33}	kʰa^{33}	kʰɛ˞^{53}
541	custom			li^{55}ki^{33}	ɕĩŋ^{33}
542	ritual tree			nɛ^{21}dʑi^{55}	
543	invocation		ʂ̠a^{33}fv̩^{33}	tə^{21}ka^{55}tsʰa^{55}to^{33}	to^{21}ko^{53}
544	bell		tɕi^{55}sɛ^{55}nə^{55}	xɛŋ^{55}	xə^{33}lə^{33}lə^{33}
545	flute	gjy^{2}ly^{2}	gy^{21}ly^{21}	də^{21}lə^{21}	ti^{21}li^{21}
546	gourd reed	by^{1}	by^{55}	bə^{55}	
547	pipe		jan^{33}tʰoŋ^{21}	a^{55}kʰɨ^{21}a^{33}da^{33}	
548	trap	va^{3}	va^{33}	voŋ^{33}	va^{33}
549	poison	do̠^{L}	to̠^{21}ʔnɛ̠^{33}tsʰɿ^{21}	tu^{21}na^{33}tɕʰi^{21}	tu^{55}
	G. Verbs				

550	look at	ʔni^{1}	ʔɲi^{55}	i^{55}	vaŋ^{53}
551	see	mjaŋ^{1}	mu^{55}	i^{55}ma^{55}	va^{55}m̩^{33}
552	show		ʔɲi^{55}to^{33}	i^{55}to^{33}	gɨ^{21}vaŋ^{53}
553	listen	ʔna^{1}	ʔna^{55}	no^{55}	na^{33}
554	hear	gja^{2}	ga̤^{21}	po^{33}go^{21}	ga^{33}pa^{21}, na^{33}ŋa^{33}
555	eat	dza^{2}	dza̤^{21}	dzo^{21}	dza^{21}
556	feed	tʃa̠^{L}	dza̤^{21}to^{33}	tsɑ^{21}	tsa^{53}
557	feed animals	tʃa̠^{L}	tʂa̠^{21}	tsɑ^{21}	tsa^{53}
558	feed animals (liquid)	taŋ^{3}	tu^{33}	ta^{33}	
559	drink	daŋ^{1}	du^{55}	da^{55}	da^{33}
560	give to drink	taŋ^{3}	du^{55}to^{33}	da^{55}to^{33}	gɨ^{21}ta^{33}, ɣɨ^{33}tu^{33}
561	bite	kʰo̠^{L}	kʰo̠^{21}	kʰu^{21}	kʰo^{53}
562	chew	ga^{2}	ɦa̤^{21}	go^{21}	gua^{21}
563	lick	lɛ̠^{L}	la̠^{21}	la̠^{21}	liɛ˞^{53}
564	savor	my^{1}	my^{55}	mə^{55}	mə^{33}
565	swallow (a)	naŋ^{3}			
566	swallow (b)	gjo^{1}	ɦø^{55}	gɨ^{55}	gɨ^{33}
567	spit	pʰi̠^{L}	fɛ̠^{21}	pʰi^{21}	pʰai^{53}
568	vomit	pʰe̠^{L}	pʰɛ̠^{21}	pʰɛ̠^{21}	pʰai^{53}
569	suck		ɕi^{55}	tʃʰʅ^{55}	ɕi^{33}
570	blow (on)	ʔmy̠^{H}	ʔmʉ̠^{33}	mi^{33}	mi^{53}
571	say	be̠^{H}	bɛ̠^{33}	bɛ̠^{33}	bei^{53}
572	speak	tʰy^{1}	tʰy^{55}	tʰə^{55}	bei^{53}
573	tell	be̠^{H}gu^{2}	bɛ̠^{33}gṳ^{21}	bɛ̠^{33}gɨ^{21}	bei^{55}gɨ^{33}
574	call	ku^{1}	kə^{55}	ku^{55}	kɤ̠^{33}
575	ask	ʔna^{1}	ʔna^{55}	nə^{55}ĩ^{55}	mĩ^{21}
576	answer	po̠^{H}	po̠^{33}		ta^{24}
577	send for	tsʰɛ^{3}	tsʰɛ^{33}	tʰə^{55}tʰə^{21}	tʂʰɛ˞^{33}
578	smell	ny^{2}	ny̤^{21}	nə^{55}	nəŋ^{21}
579	touch	mo̠^{H}	mo̠^{33}	vo^{21}	mu^{53}
580	take	vu^{1}	vy̩^{55}	vy̩^{55}, vu^{55}	vy̩^{33}
581	grasp		tsa^{33}tɕɛ^{21}	sʅ^{21}	vy̩^{33}

582	grab		tʂua^{33}tɕɛ^{21}	tsu^{33}	vy̩^{33}
583	pick (a)	xa̠^{L}		xɛ̠^{21}	
584	pick (b)	tsʰɛ̠^{H}	tsʰa^{33}	tɛ̠^{55}	pʰɛ˞^{53}
585	rub	vɛ̠^{L}	va̠^{21}	va̠^{21}	vɛ˞^{53}
586	rip	tʃʰe̠^{L}	tɕʰɛ̠^{21}	ɕi^{33}	tɕʰi^{53}
587	twist	ʃɨ̠^{L}	ɲio̤^{21}	sɿ^{33}	nio^{21}
588	pick up	go̠^{H}	wo̠^{33}	gu^{55}	gu^{53}
589	catch		tʂə^{21}	tsu^{33}	tsɤ̪^{21}
590	scatter	ʃɨ^{2}	ʂʅ^{21},pi^{21}	sɿ^{21}	sɿ^{21}
591	throw away	ʔlo̠^{H}	ʔlo̠^{33}	u^{55}tsa^{55}pɛ^{33}	lu^{55}ei^{33}
592	pitch	ʔlo̠^{H}	ʔlo̠^{33}	lu^{55}	lu^{55}ei^{33}
593	toss	ʔlo̠^{H}	ʔlo̠^{33}	pɛ^{33}kɛ^{55}	lu^{55}ei^{33}
594	stretch (a)	dʒe^{3}	dʑi^{33}		
595	stretch (b)	dʒe^{2}			dzai^{21}
596	stretch (c)	tʃʰe^{3}	tɕʰi^{33}	tɕʰi^{55}	
597	pound	te^{2}	ti^{21}	tɛ^{21}	dzɿ^{21}
598	lift	tʃʰɛ^{2}		tɕʰɛ^{21}tu^{55}	dzai^{21}ti^{55}li^{33}
599	fold		tɕɛ^{55}	tɨ^{55}	dzɨ^{33}
600	squeeze	ni̠^{L}		ɲɛ^{33}	naŋ^{53}
601	pinch (a)	tsʰi̠^{L}		tsu^{33}tɕʰi^{21}	
602	pinch (b)	tso̠^{H}	tso̠^{33}	tsu^{33}tɕʰi^{21}	
603	massage	ʒi̠^{L}	tso̠^{33}	tsa̠^{55}	i^{53}
604	bend	go̠^{L}	vy̩^{55}wo̠^{21}	tsa^{55}gu^{21}	tsʰɿ^{21}
605	pull (a)	xi^{3}	tɕi^{33}		
606	pull (b)	gaŋ^{1}	wo^{55}	ga^{55}	gu^{33}
607	push	dy^{2}	tʂə̠^{33}	də^{21}	
608	kick	tʃʰɛ̠^{H}	tʂʰa^{33}	pɛ^{55}	tʂʰɛ˞^{53}
609	kneel	gɨ^{2}tɛ^{1}	ni̤^{21}gɨ̤^{21}	ta^{55}ku^{21}	go^{21}
610	sit (a)	ni^{1}	ni^{55}		tsʰo^{53}
611	sit (b)	di^{1}		di^{55}	tsʰo^{53}
612	carry, on back	bo^{2}	vi̤^{21},mɛ^{55}	bi^{21}	bi^{21}
613	carry, in arms	te̠^{H}	tɛ̠^{33}	tɛ̠^{55}	ti^{53}
614	carry, by hand	tʃʰɛ^{2}	tʰi̤^{21}	tɕʰɛ^{21}	tʰi^{21}

615	carry, mid pole	py^{2}	py^{21}	pə^{21}	pɨ^{21}
616	fall	ʔly^{2}	ʔly^{33}	bɛ^{33}	
617	lean	e̱^{H}		ɛ̃^{33}	
618	spend night	he̱^{L}	hɛ̱^{21}	xɛ̱^{21}	xai^{53}
619	rest	na^{2}	na̤^{21}	no^{21}	ɕa^{55}la^{21}
620	sleep (a)	ʒi̱^{L}da(ŋ)^{2}		ʝiʔ^{21}	zɿ^{55}ta^{55}
621	sleep (b)	ʔne̱^{L}da^{2}	ʔɲɛ̱^{21}da^{21}		
622	put to sleep	xi̱^{L}		ɕiʔ^{21}	
623	awake	xa̱^{L}	ɦɛ^{55}xa̱^{21}	tʃɿ^{33}mɨ^{55}	han^{55}tə^{33}
624	awaken	ku^{2}xa̱^{L}	kə^{55}xa̱^{21}	ni^{21}	kɤ̱^{21}haŋ^{55}
625	do (work)	pe^{1}	pi^{55},mʉ^{55}	mu^{55}	pai^{33}, m̩^{33}
626	labor	mja^{2}ni^{2}ʔmu^{1}	lo̱^{21}mʉ^{55}	lo^{21}mu^{55}	ma^{21}ni^{21}m̩^{44}
627	to plow	mja^{2}	mi^{21}	mo^{21}ɛ^{33}	ma^{21}
628	dig (a)	kɛ̱^{L}		ka̰ʔ^{21}	kɛ˞^{53}
629	dig (b)	ku^{2}	kə̤^{21}		
630	plant (a)	kʰa^{3}	kʰa^{33}	kʰo^{33}	kʰa^{33}
631	plant (b)	tɛ^{1}	tɛ^{55}	tɛ^{55}	tɛ˞^{33}
632	water	xy^{2}	ɕy̤^{21}	xø^{21}	
633	slice (a)	tsʰe̱^{H}	da̱^{33}	su^{33}	tsʰai^{33}
634	slice in half	bɛ^{2}	bɛ^{21}	bɛ^{21}	tsʰai^{33}
635	split	kʰjɛ^{2}	kʰɛ̤^{21}	kʰɛ^{21}	kʰɛ˞^{21}
636	chop	kʰe̱^{H}	kʰɛ̱^{33}	da̱^{33}	kʰɛi^{53}
637	reap	ɣi̱^{L}	ɣɨ̱^{21}	ɣɨʔ^{21}	ɣɨ^{53}
638	whittle	tʃʰo̱^{H}	tʂʰo̱^{33}	pu^{55}	ɕu^{53}
639	stab (a)	dʒe̱^{L}			
640	stab (b)	gu̱^{L}	gə̱^{21}	gɨ^{33}	
641	stab (c)	tʰe̱^{L}		tɛ^{21}	
642	pull up (a)	tʃi̱^{H}	tʂʅ̱^{33}	tɕi̱^{55}	
643	pull up (b)	pɨ̱^{H}			pu^{53}
644	graze; herd	ʔlo̱^{L}	lo̱^{21}	luɛ̱^{33}	i^{33}
645	raise animals	hu^{1}	hə^{55}	xu^{55}	su^{33}
646	lead along	si^{3}	sɿ^{33}	tɕi^{33}xɛ^{33}	gu^{33}
647	buy	vɛ^{1}	vɛ^{55}	vɛ^{55}	vɛ˞^{33}

648	sell	vu^{2}	a̤^{21}	vu^{21}, vuŋ^{25}	vy̩^{21}
649	count (a)	ɣo^{3}			
650	count (b)	gjaŋ^{1}	gu^{55}	ku^{33}tʃa^{55}	
651	count (c)	tʃa^{1}		ku^{33}tʃa^{55}	
652	teach	ʔma^{2}	ʔma̤^{21}	mo^{21}	
653	teach/train	tsaŋ^{3}			ɣɨ^{55}tu^{53}
654	study	dzaŋ^{1}	dzu^{55}	dza^{55}	ɣɨ^{53}
655	cook; boil	tse̱^{L}	tɕɛ̱^{21}	tɕɛ̱^{21}	tsai^{53}
656	fry (stirfry)	ʔlu^{1}	ʔlə^{55}	lu^{55}	lɤ̱^{33}
657	steam (a)	se̱^{L}			
658	steam (b)	pu^{2}	pʉ^{21}	pu^{21}	pu^{21}
659	hunt	kaŋ^{2}dzi^{2}de^{2}	ko^{21}dʑi^{21}dɛ^{21}	tʃʰɿ^{55}tʃu^{21}	ga^{53}
660	shoot (a gun)	bɛ̱^{H}	ba̱^{33}	ba̱^{33}	bɛ˞^{55}
661	hit (a target)	tʰu^{3}	tʰə^{33}	ja^{33}	bɛ˞^{55}ŋa^{33}
662	kill	se̱^{L}	sɛ̱^{21}	ɕɛ̱^{21}	sai^{53}, xɛ˞^{53}
663	die	xɨ^{1}	xɨ^{55}	xɨ^{55}	xɨ^{33}
664	sharpen	sɛ^{2}	sɛ̤^{21}	sɛ^{21}	sɛ˞^{21}
665	grind	gaŋ^{3}	wu^{33}		gu^{33}
666	winnow	ʔva^{1}	ʔva^{55}	o^{55}	oaŋ^{33}
667	ladle out	kʰo̱^{L}	kʰo̱^{21}	vi̱^{33}	kɛ˞^{33}
668	wear	vi̱^{L}	jɛ̱^{21}	vɛ̱^{21}	vai^{53}
669	wear (hat)	kʰo̱^{H}	kʰo̱^{33}	kʰu̱^{33}	tɨ^{53}
670	wear (turban)	so̱^{L}		kʰu̱^{33}	tɨ^{53}
671	wear (upper clothes)	vi̱^{L}	jɛ̱^{21}	vɛ̱^{21}	vai^{53}
671	clothe	ʔvi̱^{L} tu^{3}/gu^{2}	jɛ̱^{21}gṳ^{21}	vɛ̱^{21}	vai^{53}gɨ^{21}
672	take off	ʔli̱^{L}	ʔʐʅ̱^{21}	lɨ^{21}	li^{53}
673	roll up	ʔly^{3}	ʔly^{33}	lɨ^{33}	tɕuɛ˞^{21}
675	comb	pjɨ^{2}	pʉ^{21}	pɨ^{21}	pai^{21}
676	dye		ʐaŋ^{21}	xu^{33}	zei^{33}
677	sew	gu̱^{L}	gə̱^{21}	gɨ̱^{21}	gɤ̱^{53}
678	mend; patch	ʔnɛ̱^{L}	ʔna̱^{21}	na̱^{21}	nɛ˞^{53}
679	weave	dzɛ̱^{L}	pi^{55}	dʒa̱^{21}	
680	plait; braid	pʰe^{2}	pʰi̥^{21}		pʰai^{21}

681	make the bed	kʰaŋ^{2}	kʰo^{21}	kʰɑ^{21}	tou^{21}
682	sweep	si̠^{H}	sɿ̠^{33}	sɿ̠^{33}	sɿ^{53}
683	open	pʰu^{3}	fv̩^{33}	pʰu^{33}	pʰu^{33}
684	close	tsʰɨ^{21}	tsʰɿ^{21}	tsʰɿ^{21}	tsʰɿ^{21}
685	shut (a)	tsʰɨ̠^{H}	tsʰɿ̠^{33}		
686	shut (b)	mi̠^{H}		mi̠^{33}	mi^{53}
687	put down	ta̠^{L}	ta̠^{21}	to^{33}	pʰɨ^{21}
688	release	pʰjy^{2}	pʰu̥^{21}	pʰɨ^{21}	pʰɨ^{21}
689	hang	kɛ^{1}	kɛ^{55}	xɛ^{33}	kɛ˞^{33}
690	tie into a bundle	pʰɛ^{3}	zo^{21}	pʰɛ^{33}	pʰɛ˞^{33}
691	tie; bind	pʰɛ^{3}	pʰɛ^{33}	tʰɨ^{21}	pʰɛ˞^{33}
692	tie a belt	so̠^{L}			sei^{53}
693	untie	pʰɨ^{1}	pʰʉ^{55}	pʰɨ^{55}	pʰu^{33}
694	load	kɛ^{3}	kɛ^{33}	kɛ^{33}	ho^{33}
695	take out	vu^{1}tʰe̠^{L}	v̩^{55}tʰɛ̠^{21}	vu^{55}to^{33}	vv̩^{33}tu^{33}la^{21}
696	press	tsu^{1}	tʂ̩ə^{55}	tə̃^{55}	ho^{33}
697	bury	ty^{2}	ty^{21}	tə^{21}	tə^{21}
698	hide (thing)	tʃɛ^{1}	tʂ̩ʅ^{55}	tɕɛ^{55}	tsɛ˞^{33}
699	hide (self)	vy^{2}	jy^{21}	zɿ^{21}	bə^{21}
700	choose	se^{1}	si^{55}	ɕɛ^{55}	sei^{33}
701	pile up	kʰjo^{3}	kʰø^{33}	pə^{33}	ɣa^{33}
702	nail		tʰiɛ̠^{21}	tʰɛ^{21}	tĩ^{33}
703	want	li^{1}	ʐʅ^{55}	nɨ^{55}	ʝi^{33}
704	obtain (a)	ɣa^{3}	va^{33}	vo^{33}	
705	obtain (b)	mɛ^{3}		mɛ^{33}	mai^{55}ŋa^{33}
706	receive	sy^{1}	ɕy^{55}	sə^{55}	sə^{33}
707	lose	pʰi̠^{L}	fɛ̠^{21}	pʰi^{21}, pʰiɛ^{21}	pʰiɛ^{53}, pʰi^{53}
708	seek	tʃa^{3}	tʂ̩a^{33}	i^{55}tʰə^{21}	tsa^{33}
709	use	zy^{2}	zy^{21}	zə^{21}	zə^{21}
710	play	ga^{3}	ɦa^{33}	go^{33}	gei^{21}ke^{33}
711	win (a)	ɣa̠^{L}			
712	win (b)	ha̠^{L}	ha̠^{21}	xɑ̠^{33}	
713	sing	ga^{3}	ɕɛ^{55}	go^{33}mu^{55}	ga^{33}

714	dance	ga^{3}kʰe/ɛ^{3}	ɦa^{33}kʰɛ^{33}	go^{33}tɛ^{21}	bə^{33}
715	dance	ga^{3}kʰe/ɛ^{3}	ɦa^{33}kʰɛ^{33}	go^{33}tɛ^{21}	bə^{33}
715	borrow (money)	tʃʰi^{2}	tʂʰʅ̥^{21}	tɕʰi^{21}	
716	borrow (thing)	ʔŋa^{2}	aŋ^{21}	o^{21}	aŋ^{21}
717	give back	si^{1}	sʅ^{55}	tsɑ^{55}	tə^{33}gɨ^{31}
719	compen-sate	de^{1}	di^{55}	sa^{55}mə^{55}ɣɨ^{21}	di^{33}
720	send	xɛ^{2}xa^{1}	xɨ^{21}a^{55}gu^{21}	xɛ^{21}xo^{55}ɛ^{55}	xa^{33}
721	wait	ʔlaŋ^{3}	ʔlə^{33}	la^{33}	lu^{33}
722	meet	tʰu^{3}dzi^{1}	dzʅ^{55}tʰə^{33}	dʒu^{21}lɛ^{55}	tou^{55}ŋa^{33}
723	meet	tʰu^{3}dzi^{1}	dzʅ^{55}tʰə^{33}		tou^{55}ŋa^{33}
723	marry a husband		gu^{21}	wu^{55}kɛ^{33}	fv̩^{33}dza^{21}
724	marry a wife	tsi^{1}	tsʅ^{55},ha̠^{55}	wu^{55}ko^{21}lo^{55}	mai^{55}tə^{33}la^{33}
725	scold	kʰa^{2}	wa̠^{21}	xɛ^{33}	tsʰao^{33}
727	hit; beat	dɛ^{2}	dɛ̤^{21}	dɛ^{21}	dai^{21}
728	rob; loot	ho^{3}	hə^{33}	fu^{33}	tɕʰiaŋ^{21}
729	steal	kʰo^{2}	kʰə̤^{21}	kʰɨ^{21}	kʰɔ̠^{21}
730	cheat	ke̠^{L}	kai̠^{21}	fu^{21}pa^{21}	lai^{53}
731	help	gja^{3}	ga^{33}	go^{33}ɣɨ^{21}	pai^{33}gɨ^{21}
732	cure	gu^{3}	ɣə^{33}	no^{55}gu^{33}	gɤ̠^{33}gɤ̠^{53}
733	divide	by^{1}	by^{55}	bɨ^{55}lɛ^{33}	bɨ^{33}
734	laugh	ɣɛ^{1}	gə^{55}	jɛ^{55}	ɣɛ˞^{33}
735	cry	ŋo^{1}	ŋə^{55}	ŋɨ^{55}	ŋɤ^{33}
736	love	sɛ^{2}	gə^{55},sɛ̤^{21},fi^{21}	goŋ^{25}	ɣai^{53}
737	like		sə^{21}	i^{55}di^{21}	kai^{33}
738	know	sɛ̠^{L}	sa̠^{21}	sa̠^{21}	sɛ˞^{53}
739	remember	xa̠^{L}	xa̠^{21}ka^{33}		tsəŋ^{44}ŋa^{33}
740	forget	ma^{2}xa̠^{L}	ma^{21}xa̠^{21}	mɑ^{21}xɑ̠^{21}ji^{33}	i^{33}pʰi^{33}
741	think (a)	di^{2}	di̤^{21}	dɨ^{21}	mɨ^{33}
742	think (b)	ga^{2}			ga^{21}
743	be angry		tsʰʅ^{21}	də^{33}mɨ^{33}	xo^{21}fɛ˞^{53}
744	hate	tsʰi^{2}	həŋ^{33}		
745	fear	gjo̠^{H}	guo̠^{33}	gu̠^{33}	gu^{53}
746	have	pɨ^{2}	pʉ^{21}	pɨ^{21}	pu^{21}

	courage				
747	can (well)	kʰɛ^{1}	kʰɛ^{55}	kʰɛ^{55}	kʰɛ˞^{33}
748	affirmative	ŋa^{1}	ŋa^{55}	ŋo^{55}	ŋa^{33}
749	is not	ma^{2}ŋa^{1}	ma^{21}ŋa^{55}	ma^{21}ŋo^{55}	m̩^{21}ŋa^{33}
750	have	dʒaŋ^{1}	dʐu^{55}	dʒa^{55}	dzu^{33}
751	not have	ma^{2}dʒaŋ^{1}	ma^{21}dʐu^{55}	ma^{21}dʒa^{55}	m̩^{21}dzu^{33}
752	walk	sy^{2}	sy̤^{21}	jɛ^{33}	
753	run (a)	gjɛ^{2}	gɨ̤^{21}	gɛ^{21}	gɛ˞^{21}
754	run (b)	pɨ^{1}			pɛ˞^{53}
755	ascend	de̠^{H}	dɛ̠^{33}	dɛ^{33}	di^{55}
756	descend	ze̠^{L}	zɛ̠^{21}	jɛ^{21}	zai^{55}
757	come	la^{1}	la^{55},li^{55}	lɛ^{55}	la^{33}
758	come up	de̠^{H}la^{1}	dɛ̠^{33}la^{55}	dɛ^{33}lɛ^{55}	di^{55}la^{33}
759	come down	ze̠^{L}la^{1}	zɛ̠^{21}ʐʅ^{33}	jɛ^{21}lɛ^{55}	zai^{55}la^{33}
760	go	ʒe^{1}	ji^{55}	jɛ^{33}	li^{33}, ʝi^{33}
761	go up	de̠^{H}e^{1}	dɛ̠^{33}li^{33}		di^{55}li^{33}
762	go down	ze̠^{L}ʒe^{1}	zɛ̠^{21}ji^{55}		zai^{55}ʝi^{33}
763	climb	ʔmɛ̠^{H}	ʔma^{33},pɛ^{33}	tʃʰa^{21}	mɛ˞^{53}
764	return	ty^{1}	ty^{55}	tə^{55}	tə^{33}
765	arrive	kʰje^{1}	tɕʰi^{55}	kʰɛ^{55}	tɕʰi^{33}
766	cross (over)	kjo̠^{L}	ky^{21}	kɨ^{21}	tɛ˞^{55}ji^{33}, gɨ^{21}ji^{33}
767	go through	ko̠^{L}	ko̠^{21}	jɛ^{33}dʒa^{33}	ko^{55}
768	exit	do̠^{H}	do̠^{33}	do^{33}	du^{55}
769	enter	dy^{2}	dy̤^{21}	gɨ^{33}	də^{21}
770	move back		di^{33}	su^{33}mɨ^{55}	tə^{33}
770	flee; escape	kʰu^{2}gjɛ^{2}	kʰə̤^{21}	kʰɨ^{21}gɛ^{21}	pɛ˞^{55}gɛ˞^{21}
771	chase	tʃu^{2}	tʂə^{21}	tʃu^{21}	ga^{53}
772	step on	kʰɨ^{3}	kʰɨ^{33}	ko^{33}	tɛ˞^{33}
774	stride		pa̠^{33}	gɨ^{33}	tɕʰa^{33}
774	ride	dzɛ^{2}	dzɛ̤^{21}	dʑɛ^{21}	dzɛ˞^{21}
775	exist; to be	dʒe̠^{H}	dʑɛ̠^{33}	dza^{33}	dzʅ^{55}
776	dry	ʔly̠^{L}	lø̠^{21}	lɑ̠^{21}	lə^{55}
778	(wind) blow	kʰy^{1}	a^{55}n̩^{21}ɕy^{55}kʰy^{55}	a^{55}mi^{21}fi^{55}	mi^{21}i^{33}kʰɨ^{33}

779	light (on fire)	to̠^{L}	ʔnɛ^{21},to̠^{21}	to^{21}	to^{53}
780	burn (a)	kʰu^{1}	kʰə^{55}, ba^{55}	tɕi^{33}	kʰo^{33}, pʰə^{21}, i^{33}
781	burn (b)	ty̠^{L}			
782	burn up	kʰu^{1}	kʰə^{55},ʔnɛ^{21}	tɕi^{33}pɛ^{33}	i^{33}jɛ^{33}
783	roast (in fire)		kʰə^{55}, ba^{55}	kʰu^{55}	kʰo^{33}
782	roast	kaŋ^{1}	ka^{55}, kʰaŋ^{55}	xõ^{55}, xu^{55}	ku^{33}
783	smoke	ʃɨ̠^{H}/^{L}	ŋ^{21}kʰə^{21}tə^{55}	sɿ^{21}do^{33}	mi^{55}kʰo^{21}du^{33}
786	overflow	ɣy̠^{L}	jø̠^{21}	jɑ̠^{33}	
787	float		pʰiau^{33}	la^{21}lo^{33}	pʰiau^{33}
787	crack open	be̠^{L}	bɛ̠^{21}	bɛ̠^{21}kæ^{55}	bai^{55}
788	collapse	by^{2}	by^{21}	bəɪŋ^{24}	bə^{21}
789	be short of	kʰɛ̠^{L}	tɕʰa^{33},kʰa̠^{21}	kʰa̠^{21}	tʰɛ˞^{53}
791	revolve	tʃaŋ^{1}	tʂu^{55}	tʃa^{55}	tsuɛ^{53}
792	fall; drop	tsʰe^{1}	tsʰi^{55},ka^{55}	tɕɛ^{55}a^{21}	bɛ˞^{33}
793	snap in two	tsʰe̠^{H}	tsʰɛ̠^{33}	tɕʰɛ^{33}a^{21}	tsʰei^{53}
794	break		tɕʰɛ̠^{21}	tɕʰɛ^{21}	tʰɛ˞^{53}
795	leak		ʂʅ^{33}	tsɿ^{33}mə^{33}	dɤ̠^{33}
796	boil	tsu^{1}	tsɿ^{55}	tsu^{55}	tsɤ̠^{33}
797	change		piŋ^{55}		pĩ^{53}
797	birth (a)	dza^{1}		dza^{55}	
798	birth (b)	ka^{2}			
799	birth (c)	tsʰy^{2}	tsʰy^{21}		
800	grow	ɣɛ^{2}	vɛ̤^{21}	ʝɛ^{21}	ɣɛ˞^{21}lĩ^{33}
803	fly	bjy^{1}	by^{55}	bə^{55}	bɨ^{33}
804	bark	lu^{3}	ʔlə^{33}	lu^{33}	lɤ̠^{33}
805	crow	bo^{1}	vi^{55}	bi^{55}	bi^{33}
806	lay (egg)	fu^{3}	fy̩^{33}	fu^{33}	fy̩^{33}
807	brood	ʔmy^{2}	ʔmṳ^{21}	mɨ^{21}	məŋ^{53}
808	sprout	bɨ̠^{H}	bʉ̠^{33}	bɨ̠^{44}	du^{55}
809	bud on trees	tsɛ̠^{L}	tsa̠^{21}		fɛ˞^{53}
810	bloom	ʔve̠^{H}	ʔvɛ̠^{33}	bɛ̠^{44}	vei^{53}
811	bear fruit	dʒɛ^{2}	dʑɛ̤^{21}	ɲɛ^{21}	dzɛ˞^{21}

812	rot (fruit)	pʰɨ^{2}	pʰʉ̤^{21}	tsʰɿ^{21}	mai^{53}
813	rot (meat)	haŋ^{2}	hə^{55}		
814	begin	tu^{1}		ko^{55}mə^{55}	pai^{55}ta^{33}
815	stop	na^{2}	na̤^{21}	no^{21}	na^{21}
816	remain		ta̠^{21}	ta^{21}ji^{33}	fai^{21}tai^{53}
816	write	ʔvɛ̠^{H}	ʔva̠^{33}	boʔ^{33}	vɛ˞^{53}
817	wash (self)	tsʰi^{2}	tsʰɿ^{21}	tɕʰi^{21}	tsʰɿ^{21}
818	get up	tu^{1}	tə^{55}la^{55}	tu^{55}lɛ^{55}	to^{33}li^{33}
820	sink		lo^{13}	tɕɛ^{33}ka^{33}	lo^{33}
821	finish		do̠^{33}	ga^{33}	pai^{33}tɛ^{33}lɛ^{33}
820	give	gu^{2}	gu^{21}	gɨ^{21}	gɨ^{21}
821	destroy	pʰe̠^{H}	pi^{55}pʰɛ̠^{33}	na^{21}to^{21}pɛ^{55}	
824	be standing	hy̠^{L}	hø̠^{21}	xɑ̠^{21}	xɨ^{53}
825	skin (animal)	tsʰi̠^{L}	tsʰɿ̠^{21}	gi^{55}kʰɨ^{21}	gɨ^{33}tsʰɿ^{53}
827	clear field			pʰɛ^{21}mə^{55}, pʰiŋ^{24}	ti^{33}mi^{33}pai^{33}
827	weed	mo̠^{L}	ʂʅ^{33}mo̠^{21}	mo^{21}mo^{21}	mo^{53}
828	stir (a)	gɛ̠^{H}	ga̠^{33}	ɣa^{33}	
829	stir (b)	baŋ^{2}			ba^{21}
831	weigh	tsʰi^{1}	tsʰɿ^{55}	tɕʰi^{55}	tuei^{33}
832	soak	ti̠^{H}	tiɛ̠^{33}	ti̠^{55}	tsʰoŋ^{53}
833	drown		tsʰiaŋ^{55}sɛ̠^{21}	po^{33}xɨ^{55}	tɕʰiŋ^{55}sai^{53}
834	swim	ɣi^{1}ga^{3}	ɣɨ^{55}ɦa^{33}	ɣɨ^{55}vɛ^{21}	ta^{55}õ^{53}
835	drill (a hole)	tʰu^{1}	tʰə^{55}	tʰu^{55}	tɕy^{33}
837	drive out	ga̠^{L}	ɦa̠^{21}	tʃu^{21}	ga^{53}
838	wither	gu^{3}	gə^{33}	gu^{55}	bɛ˞^{33}
839	cough	tsi^{2}	tsɿ^{21}	tsɿ^{21}	tsɿ^{21}
840	yawn (a)	ʔli̠^{L}ku^{3}		li^{21}xa^{55}	
841	yawn (b)	ha^{1}se^{3}/kʰaŋ^{2}	ha^{55}ji^{33}kʰa^{21},hai^{53}kʰa̤^{21}	li^{21}xa^{55}	xu^{33}xa^{33}dai^{21}
842	sneeze	ha^{1}	ɦa^{33}tʰio^{21}pi^{55}	ɕi^{55}tsa^{33}məŋ^{55}	tsʰoŋ^{53}
843	hiccup	ɨ̠^{H}	ti^{55}kɨ^{33}ɦou^{21}mʉ^{33}	ɛ^{33}fu^{33}kɨ^{33}	ɨ^{21}m̩^{33}
844	belch	ɨ̠^{L}	ti^{55}kɨ^{33}ɦou^{21}mʉ^{33}	ə^{21}	ɨ^{21}m̩^{33}
845	fart	bjo^{2}tsʰi^{2}bjo^{2}	zɿ^{21}tsʰɿ^{21}zɿ^{21}	vi^{21}tə^{21}	zɿ^{21}tsʰɿ^{21}zɿ^{21}
846	defecate	kʰji^{2}ɛ^{2}	tsʰɿ^{21}ɛ̤^{21}	ɛ^{21}	tsʰɿ^{21}ɛ˞^{21}

847	urinate	zi^{2}tʃʰe̠^{H}	zɿ^{21}tɕʰɛ̠^{33}	su^{21}	zɿ^{21}tɕʰi^{53}
848	scratch (a)	kje̠^{H}	tɕɛ̠^{33}	kɛ^{33}	
849	scratch (b)	ku^{2}			
851	live (b)	ka^{2}		ko^{21}	
852	exchange	pa^{1}	pa^{55}	po^{55}	pa^{33}
853	butt	tʰu^{3}	tʰu^{33}	tɛ^{21}	naŋ^{55}a^{33}, gɨ^{55}
	H. Adjectives				
854	white (a)	pʰu^{1}	fy̩^{55}	pʰu^{55}	pʰy̩^{33}
855	white (b)	ʔve̠^{H}	ʔvɛ̠^{33}		
856	black	ʔne̠^{H}	ʔnɛ̠^{33}	nɛ̠^{33}	ni^{53}
857	red	ʔni^{1}	ʔɲi^{55}f̩^{21}	ni^{55}	ʔi^{33}
858	yellow	ʃɛ^{1}	ɕɛ^{55}	ɕɛ^{55}	sɛ˞^{33}
859	blue	ʔni^{1}	ʔɲi^{55}tʂʅ^{33}	kʰiu^{55}, kʰi^{55}wu^{55}	tʂʰɛ˞^{33}
860	green	ʔni^{1}	ʔɲi^{55}tʂʅ^{33}	kʰɛŋ^{55}, kʰi^{55}mu^{21}	lo^{53}
861	grey	pʰɛ^{1}	pʰɛ^{55}	pʰa^{55}	pʰɛ˞^{33}
862	sharp (point)	tsʰy^{1}	tɕʰy^{55}	pu^{55}	tʂɛ˞^{33}
863	sharp (blade)	tʰe̠^{H}	ʔna^{55},tʰiɛ̠^{33}	du^{55}	tʰi^{53}
864	dull (a)	du^{2}	də^{21}		dɤ̠^{21}
865	dull (b)	ly^{3}	ly^{33}	lə^{33}	
866	round	va^{3}	a^{55}li^{55}va^{33}	ta^{55}lə^{33}	bə^{33}lə^{33}
867	flat	bɛ^{1}		ta^{21}go^{33}	bɛ˞^{33}
868	steep		teo^{21}	tæ^{33}	tə^{53}
869	situated straight		tʂʅ^{55}	dʒa^{21}	bɛ˞^{33}
870	situated crooked		ʂʅ^{21}	dʑɛ^{55}	wai^{33}
868	straight	dʒaŋ^{2}	tʂʅ^{13}		tsɿ^{24}
872	hard (a)	kʰa̠^{H}		kɛ^{55}mɨ^{55}	kʰa^{53}
873	hard (b)	xɛ^{1}	ɕɛ^{55}		
874	soft	nu^{2}	nə̤^{21}	nu^{21}	nɤ̠^{21}
875	bright	ba^{3}	ba^{33}	maŋ^{33}	liaŋ^{53}
876	dim; dark	ɣɨ^{1}	ɣɨ^{55}	wo^{55}vɛ^{55}	miɛ˞^{53}
877	clear (sky)	te̠^{L}	a^{55}m̩^{21}pɛ^{55}	tʃɿ^{55}mɨ^{55}	na^{33}li^{33}
878	overcast	ti^{1}	a^{55}n̩^{21}ti^{55}	mɨ^{55}	miɛ˞^{53}
879	full	bi^{3}	vi^{33}	bɨ^{33}	bi^{33}

880	beautiful	mɛ^{2}	mɛ̤^{21}	tɕi^{21}	i^{55}gɨ^{33}
881	ugly (a)	he^{1}	hi^{55}	ma^{21}tɕi^{21}	i^{55}ŋ̍^{21}gɨ^{33}
882	ugly (b)	ʔni^{1}ʃa̱^{L}			
883	fat (person)	tsʰu^{1}	zi^{45}	tsʰu^{55}	tsʰɤ̱^{33}
884	fat; fatty	tsʰu^{1}	zi^{45}	tsʰu^{55}	tsʰɤ̱^{33}
885	lean	ne̱^{L}	xa̤^{21}nɛ̱^{21}	xo^{21}nɛ̱^{21}	nai^{53}
886	thin (a)	gy^{1}		gɨ^{55}	
887	thin (b)	xe̱^{L}	ɦø̱^{21}		xai^{53}
888	clean	xaŋ^{1}	xu^{55}	xa^{55}	kan^{33}tɕiŋ^{21}
889	dirty		ma^{21}xu^{55}	ma^{21}xa^{55}	la^{33}tʰa^{53}
890	old (person)	maŋ^{2}	mṳ^{21}	mɑ^{21}	mu^{21}
891	young (a)	tʰy^{2}ɲa^{1}			tʰə^{21}ɲo^{33}
892	young (b)	le̱^{L}	lɛ̱^{21}		
893	young (c)	tʰy^{2}nu^{2}/^{1}	tʰy^{21}nə̤^{21}		
894	good	mɛ^{2}	da^{55}	na^{55}	kai^{33}
895	bad	pʰe̱^{H}	pʰɛ̱^{33}		
896	bad (b)	du^{1}			du^{33}
896	fast	ʔmjy̱^{H}	tsʰa̤^{21}	mɛ̱^{33}	məŋ^{53}
897	slow	gja^{1}	ga^{55}	ɲa^{55}	
898	wet (a)	tʃʰɨ^{2}		tsʰɿ^{21}	tsʰɿ^{21}
900	wet (c)	dzi^{2}			
901	wet (d)	ha(ŋ)^{2}			
899	dry	fɛ^{3}	fɛ^{33}	fɛ^{33}	fɛ˞^{33}
903	cooked; ripe	ʔmi^{3}	ʔmi^{33}	mi^{33}	mi^{33}
904	early	ne̱^{L}	nɛ̱^{21}	nɛ̱^{21}	nai^{53}
905	late	mja^{3}	mi^{33}	la^{33}mɨ^{55}	ma^{33}
906	easy (a)	sa^{1}			
906	easy	lɛ^{1}	lɛ^{45}	lɛ^{55}	lɛ˞^{33}
907	difficult	ʃa̱^{L}	ʂa̱^{21}	sɑ̱^{21}	saʔ^{53}
908	hot (temp.)	tsʰa^{1}	tsʰa^{55}	tsʰo^{55}	tsʰa^{33}
910	cold (body)	gjaŋ^{1}	gu^{55}		ga^{33}
911	warm	ly^{1}	ly^{55}	lə^{55}	lue^{33}mən^{21}
912	cool		lia̱ŋ^{21}	tɕʰi̱^{21}	lo^{33}xei^{33}

912	sour	tʃe^{1}	tɕi^{55}	tɕi^{55}	tsei^{33}
913	sweet	tʃʱɨ^{1}	tʂʰʅ^{55}	tsʰɿ^{55}	tsʰɿ^{33}
914	bitter	kʰa^{2}	kʰa̤^{21}	kʰɑ^{21}	
916	spicy (b)	dzi̠^{H}			dzɿ^{53}
917	salty		ɛ^{55}		kʰa^{21}
917	delicious	me^{1}	mi^{55}	mi^{55}	dza^{21}mi^{33}
918	insipid	bjɛ̠^{H}	ba̠^{33}	ba̠^{33}	bɛ˞^{53}
919	fragrant	sy^{1}(by^{2})ny^{1}	sy^{55}ny^{55},ʂo̠^{21}	bi^{21}sa^{21}	su^{33}bə̃^{21}nə^{33}
921	really stinky	tʃʱi^{2}(by^{2})ny^{1}	tʂʰʅ^{21}ny^{55}	tɕʰi^{21}nə^{55}	tsʰɿ^{21}bə̃^{21}nə^{33}
922	fishy smell	dzi^{2}ny^{1}	dzɿ^{21}ny^{55}	bi^{21}nə^{55}	xɛ˞^{33}bə̃^{21}nə^{33}
923	rotten	pʰɨ^{2}	pʰʉ̤^{21}	tsʰɿ^{21}, tɕʰi^{21}	la^{55}xɛ^{55}ja^{33}
924	full (stomach)	bo̠^{H}	bo̠^{33}	bo̠^{33}	bu^{55}
925	hungry	mɨ̠^{L}	mʉ̠^{21}	mɨ̠^{21}	mu^{53}
926	thirsty	si̠^{L}	sɿ̠^{21}	ɕi̠^{21}	sɿ^{53}
927	tired		va̤^{21}mʉ^{33}	ɲa^{55}mɨ^{55}	fɛ˞^{55}
928	blessed	ko̠^{L}sa^{1}	dʑɛ̠^{33}dɛ̠^{21}	wo^{21}sɿ^{55}	kai^{55}la^{21}
929	sad	ko̠^{L}ʃa̠^{L}	dʑɛ̠^{33}ma^{21}dɛ̠^{21}	tsa^{55}sɑ^{21}	kʰɨ^{53}
930	ashamed	ʃe̠^{L}taŋ^{1}	ɕɛ̠^{21}tu^{55}	ɕɛ̠^{21}ta^{55}	sai^{55}tu^{33}
931	itchy	dzi̠^{H}	dzɿ̠^{33}	dʑi̠^{33}	za^{21}
932	sick	na^{1}	na^{55}	no^{55}	na^{33}
933	intelligent	ʔlu^{1}	ŋ̩^{21}ŋə̠^{21}ʔlə̠^{33}	la^{55}mɨ^{55}	miao^{53}
934	proud			wo^{21}ta^{21}sɿ^{55}	ao^{53}
935	stupid	mɨ^{1}	mʉ^{55}	ŋə^{21}mɨ^{55}	ɛ˞^{53}
936	crazy	tʰɛ^{3}	tʰɛ^{33},fɛ^{21}	tʰɛ^{33}	tʰɛ˞^{33}
937	diligent	ʃa^{2}dɛ̠^{L}	n̩^{55}dɛ̠^{21}	ka̠^{21}	məŋ^{53}
938	busy		tɕin^{21}	ma^{21}	maŋ^{24}
939	capable		pʰa̠^{21}	pɛ^{55}kʰɛ^{55}	ta^{55}la^{33}
938	lazy (a)	ʃa^{2}ma^{2}dɛ̠^{L}	ʂa̠^{21}ma̠^{21}dɛ̠^{21}		
939	lazy (b)	baŋ^{1}		ba^{55}	bɛ˞^{33}za^{21}
942	poor	ʃa̠^{L}	ʂa̠^{21}	sɑ̠^{21}	sai^{55}i^{33}
943	alive (a)	ka^{2}			
944	alive (b)	zɛ^{1}dʒɛ^{2}	zɛ^{55}dʑɛ̤^{21}	tsa^{55}la^{21}	zɛ˞^{33}
945	brave		pʉ̤^{21}	mɔ^{33}jɛ^{21}	tan^{21}tsɿ^{33}ɣɛ˞^{21}

945	drunk	ʒe̠^{L}	jɛ̠^{21}		zai^{53}
946	backwards		di^{33}xo^{33}	vɛ^{55}di^{33}	ŋa^{33}ni^{21}
946	different	ma^{2}sy^{2}	ma^{21}sy^{21}	ma^{21}sə^{21}	m̩^{21}sə^{21}
948	sticky (a)	pɛ^{3}	pɛ^{33}na̠^{21}		
950	slick	maŋ^{3}	mu^{33}	mɑ^{33}	hua^{33}liu^{33}
951	tight	kʰɨ̠^{H}	kʰɨ̠^{33}	tʰa^{21}, tʰaŋ^{24}	tɕin^{21}
952	loose	loan	soŋ^{33}	ga^{21}	soŋ^{33}
952	expensive	kʰa̠^{H}	kʰa̠^{33}	kʰa̠^{33}	kʰa^{53}
953	cheap		fi^{21}da^{55}	lɛ^{55}	lu^{33}
954	correct		xo^{55}	dʒu^{21}	xɨ^{33}
954	far	vi^{2}	ɟi^{21}	və^{21}	vai^{21}
957	low	ʔni^{1}	ai̠^{21}	ni^{55}	tɕi^{33}
958	long	ʃi^{1}	ʂ̥ʅ^{55}	ɕi^{55}	sɿ^{33}
959	short	ʔɲy^{2}	ʔny̤^{21}	ni^{21}	nĩ^{21}
960	many	mja^{2}	kʰø^{55}	mo^{21}	ma^{21}
961	few	ne^{2}	ʔni̤^{21}	nɛ^{21}	ai^{21}
962	wide	fe^{1}		fɛ^{55}	
963	narrow	ʔɲa̠^{L}		ɲɑ̠^{33}	
964	big	ɣɛ^{2}	vɛ̤^{21}	ɟɛ^{21}	ɣɛ˞^{21}
965	little (a)	ɲa^{1}			ɲo^{33}
966	little (b)	ʒaŋ^{1}	u^{55}	ja^{55}	
967	deep	ʔne̠^{L}	nɛ̠^{21}	nɛ̠^{21}	nai^{53}
968	shallow	ma^{2}ʔne̠^{L}	ma̤^{21}nɛ̠^{21}	ma^{21}nɛ̠^{21}	
969	light	laŋ^{1}	lu^{45}	la^{55}	lu^{33}
970	heavy	li^{2}	ʐʅ^{21},kɨ^{55}ɲi^{55}	wu^{55}lu^{21}	ɟi^{21}
971	thick (2d)	tʰu^{1}	tʰə^{55}	tʰu^{55}	tʰɤ̠^{33}
972	thin (2d)	ba^{2}	ba̤^{21}	bo^{21}	ba^{21}
973	thick (3d)	ta^{3}	ta^{33}	kɛ^{55}	ɣɛ˞^{21}
974	thin (3d)	tsʰi^{1}	tsʰɿ^{55}	mu^{33}	mo^{53}
977	three	sa^{1}/^{3}	sa^{33}	sa^{55}	sa^{33}
978	four	ʔli^{3}	ʔʐʅ^{33}	lɨ^{33}	ji^{33}
979	five	ŋa^{2}	ŋa̤^{21}	ŋo^{21}	ŋa^{21}
980	six	kʰo̠^{L}	kʰo̠^{21}	kʰu̠^{21}	kʰo^{53}
981	seven	xɨ^{2}	xɨ^{21}	xɨ^{21}	xɨ^{21}

982	eight	he̱^{L}	hiɛ̱^{21}	xɛ̱^{21}	xai^{53}
983	nine	ko^{3}	kə^{33}	kɨ^{33}	kɤ̱^{33}
984	ten	tsʰe^{1}	tsʰi^{55}	tɕʰɛ^{55}	tsʰei^{33}
985	eleven	tsʰe^{1}ti̱^{L}	tsʰi^{55}ti̤^{21}	tɕʰɛ^{55}tɕʰi^{21}	tsʰei^{33}tɕʰi^{53}
986	twelve	tsʰe^{1}ni^{2}	tsʰiŋ̩^{52}	tɕʰɛ^{55}ŋ̩^{21}	tsʰei^{33}ni^{21}
987	twenty	ni^{2}tse^{1}	n̩^{21}tsi^{55}	n̩^{21}tɕʰɛ^{55}	n̩^{21}tsei^{33}
988	twenty one	ni^{2}tse^{1}ti̱^{L}	n̩^{21}tsi^{55}ti̤^{21}	n̩^{21}tɕɛ^{55}tɕʰi^{21}	n̩^{21}tsei^{33}tɕʰi^{53}
989	hundred	ha^{1}	ha^{55}	xo^{55}	ta^{21}ha^{33}
990	thousand	tu^{1}	tə^{55}	xɛn^{55}	tɕʰĩ^{33}
991	half (a)	kʰy^{2}	kʰy^{21}	kʰə^{21}	
992	half (b)	bɛ^{2}			a^{33}bɛ^{21}
993	half (c)	bɨ^{1}			
993	bowlful	kje^{2}	kɛ^{21}	ɕɛ^{21}	a^{21}kai^{53}
994	arm spread	ly^{1}	ly^{55}	lə^{55}	a^{21}lə^{33}
995	handspan	tʰy^{1}	tʰy^{55}	tʰə^{55}	a^{21}tsa^{21}
997	1S	ŋa^{1}	ŋa^{45}	ŋa^{55}	ŋa^{33}
998	1PL	ŋa^{1}tsa^{3}	ŋa^{33}tsa^{33}		
999	1PL	ʔŋa^{2}		ə^{55}xɨ^{33}	ŋa^{53}
1000	1PL inclusive	a^{2}va^{2}	a̤^{21}va^{21}	ə^{21}	
1001	2S	ni^{1}	ŋ̍^{55}	ni^{55}	ni^{33}
1002	2PL	ɲa^{2}			ɲa^{21}
1003	2PL	ni^{1}tsa^{3}	n̩^{33}tsa^{33}	ni^{55}xɨ^{33}	
1004	3S	(ʒ)aŋ$^{2/3}$	wu^{33}	jɛ^{21}	ja^{33}
1005	3PL	ʒaŋ^{3}tsa^{3}	wu^{33}tsa^{33}		
1006	3PL	(ʒ)aŋ$^{2/3}$		jɛ^{21}xɨ^{33}	ja^{21}
1007	3SR (another)	su^{1}	sɿ^{55},tse^{55}ɣɨ^{21}	su^{55}	piɛ^{33}ni^{33}su^{33}
1008	self	ɛ^{1}mɛ^{3}	kua^{33}	dʒəŋ^{21}	tɕa^{33}kɨ^{53}
1009	another (thing)		tse^{13}	su^{55}	wai^{55}ĩ^{33}
1010	POSS	ɣi^{2}	ɣi^{21}	la^{33}	ɣi^{21}
1011	this (1)	tʃu^{1}	tʂ̤ʅ^{55}	tsʰa^{55}	tsɿ^{53}
1012	this kind		tʃa^{55}si^{33},tʂ̤ʅ^{55}ʐṳ^{21}	tsʰa^{55}jan^{55}	tsɿ^{55}ja^{53}
1013	here (1)		tʂ̤ao^{55}ko^{55}	tsʰa^{55}tʰɛ^{21}	tei^{33}hei^{33}
1014	that one		na^{55}tʂ̤ʅ^{55}ma^{55}	kʰɨ^{55}wa^{33}	nə^{33}ja^{53}

1015	that (higher)	na(ŋ)^{1}	nao^{55}	nə^{55}	nə^{33}ja^{53}
1016	that (lower)			kʰɨ^{55}	nə^{33}ja^{53}
1017	that (far)		kua^{33}	nə^{55}na^{33}	nə^{33}ja^{53}
1018	there		nao^{55}kuo^{55},dʑio^{55}ko^{55}	ta^{21}ka^{55}	nei^{33}hei^{33}
1019	in front (a)	u^{2}si^{1}	ʔɲi^{21}di^{21}	wo^{21}sɛ^{55}	ɣɨ^{21}hei^{33}
1020	in front (b)	u^{2}by^{2}	ʔɲi^{21}di^{21}		
1021	on the other side			næ^{55}xɛ^{21}	tai^{55}ku^{21}lai^{21}
1022	behind (a)	i^{2}se^{1}		pʰɛ^{21}tɛ^{21}kɛ^{55}	ŋa^{33}ni^{21}
1023	behind (b)	ɣa^{1}du^{3}	lɛ^{45}də^{33}		ŋa^{33}ni^{21}
1024	between	ka̠^{L}kaŋ^{1}	ka^{21}kə^{55}	ka^{55}dʒʅ^{33}	ka^{33}la^{33}
1025	left	ʔvɛ^{2}	ʔvɛ̤^{21}si^{55}	vɛ^{21}sɿ^{55}	tʰa^{21}pʰiɛ^{33}bei^{33}lei^{33}
1026	right	ʒa^{1}	jɛ^{55}si^{55}	dʒə^{55}sɿ^{55}	suən^{33}sou^{21}bei^{33}lei^{33}
1027	beside	ba^{2}ta^{3}	ba̤^{21}tai^{53}	jɛ^{21}dʒə^{55}	dzə^{33}lai^{21}
1028	side	ba^{2}dzi^{1}	be̤^{j21}	dʒə^{55}	piɛ^{33}piɛ^{33}lai^{21}
1029	upon	ka̠^{L}	ka̠^{21}si^{55}	ka̠^{21}xɨ^{55}, kæ^{21}kɨ^{55}	õ^{33}lai^{21}
1030	beneath		ṳ^{21}si^{55},da^{55}kʰə^{33}	ti^{21}xɨ^{55}	ta^{33}lai^{21}
1031	inside	kʰjo^{2}	kʰø̤^{21}si^{55}	jɛ^{21}na̠^{33}	kʰɨ^{21}hei^{33}
1032	outside		i^{55}si^{55}	nə^{55}sə^{55}	wai^{55}ĩ^{33}
1033	everywhere		a^{21}di^{55}li^{55}	tɕʰi^{21}di^{55}sɛ^{33}	tao^{33}tsʰu^{33}
1034	who?	a^{2}sa^{2}	a̤^{21}sa̤^{21}	a^{21}so^{21}	a^{21}sa^{21}
1035	what?	a^{1}tsa^{1}	a^{55}tsa^{55}	a^{55}tsa^{55}	a^{33}tsa^{53}
1036	where?	a^{2}di^{1}	a̤^{21}di^{55}	a^{21}ta^{21}ka^{55}, a^{21}lɛ^{21}ka^{55}	a^{21}di^{55}hei^{33}
1037	why?	a^{1}tsa^{1}pe^{1}	a^{55}tsa^{55}ŋ̍^{21}ka^{33},a^{55}tsa ŋ^{53}ka^{33}	a^{55}tsa^{55}pɛ^{55}	a^{21}di^{55}bə^{21}
1038	which?	a^{2}da^{1}	a̤^{21}da^{55}	a̤^{21}da^{55}ji^{33}	a^{21}di^{55}ə^{33}
1039	how?		a̤^{21}da^{55}si^{33},a̤^{21}sɿ^{55}	a^{21}dɛ^{55}pɛ^{55}	a^{21}kʰə^{21}lə^{33}
1040	how much?	a^{1}ma^{3}	a̤^{21}da^{55}ma^{33}sɿ^{21}	a^{21}di^{33}mo^{33}	kʰa^{33}ma^{33}
1041	now	tʃu^{1}tʰa^{1}	tʂʅ^{55}pʉ^{55}	a^{21}mɛ^{33}sɛ^{55}	a^{55}tɕʰi^{33}
1042	just now	a^{2}ʃu^{3}	a̤^{21}su^{33}	a^{21}xɛ^{55}	n̩^{55}tɕʰi^{33}
1043	before (sequential)		vv̩^{55}dʑi^{55}	və^{55}sɿ^{21}	ka^{33}m̩^{33}
1044	after			vɛ^{55}di^{33}	ŋa^{33}ni^{21}

1045	before (temporal)		ʔɲi̤^{21}di̤^{21}	tɕʰi^{21}də^{55}sɛ^{33}	nei^{55}ni^{33}kʰo^{33}
1046	formerly			dza^{21}ko^{33}lɑ^{55}	a^{21}i^{55}sɿ^{55}i^{53}
1047	already		xa^{55}	ka^{33}la^{33}	ji^{21}tɕĩ^{33}
1048	immediatel y		la^{45}lou^{21}	tɕʰi^{33}tʰa^{33}	a^{55}tɕʰi^{33}
1049	frequently	bɨ^{1}	bʉm^{21}bʉm^{21}	dza^{33}dza^{33}	ka^{55}mɛ^{33}
1050	slowly	a^{2}de^{3}de^{3}	a̤^{21}di^{33}di^{33}	a^{21}ja^{33}	a^{21}di^{33}di^{33}
1051	quickly	ʔmjy̠^{H}	xa^{55}tsʰa^{21}kʰɛ^{55}	mɛ^{55}mɛ^{55}	tiɛ^{33}məŋ^{53}
1052	very		a̤^{21}xɨ^{55}	tɕia^{55}	
1053	most		xa^{55}	su^{55}kɑ^{21}kʰəŋ^{55}	tɕi^{33}tɕi^{33}
1054	all		xa^{55}dʐu̥^{55}a^{55}ka^{33}	ko^{33}	taʔ^{21}ai^{33}
1055	again		tse^{45}	kɛ^{55}	da^{21}
1056	really		da^{55}ma̤^{21}da^{55}	jɛ^{21}tɛ^{21}	da^{55}n̩^{21}da^{33}
1054	not (NEG)	ma^{2}	ma̤^{21}	ma^{21}	m̤^{21}

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