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The word-level prosodic system of Mangghuer

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THE WORD-LEVEL PROSODIC SYSTEM OF MANGGHUER

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ABBREVIATIONS

ABL	**Ablative**	**PERF**	**Perfective**
ACC	Accusative	PL	Plural
C	Consonant	POSS	Possessive
CAUSE	Causative	PROG	Progressive
COND	Conditional	QUEST	Question
COP	Copulative	REFLPOSS	Reflexive possessive
DAT	Dative	R+F	Rising + falling
dB	Decibel	SUBJ	Subjective
f_0	Fundamental frequency		
FUT	Future	VOL	Voluntative
GEN	Genitive	V	Monophthong
Hz	Hertz	VV	Diphthong
IMPERF	Imperfective		
INST	Instrumental		
L+F	Low + falling		
L+H	Low + high		
LOC	Locative		
MP	Minimal pair		
ms/msec	Millisecond		
NEG	Negative		
NEG COP	Negative copulative		
NOMLZR	Nominalizer		
OBJ	Objective		

ABSTRACT

Mangghuer's prosodic system has been described as a stress system (Slater 2003), and alternately, because of a few minimal pairs, as a system that is undergoing tonogenesis. (Dwyer 2008). This thesis looks at new data to evaluate both of these claims. I analyze the prosody of native words and confirm that Mangghuer has a stress system. Duration is one of the indicators of stress, which has not been mentioned in previous literature. Potential minimal pairs are considered, including the minimal tone pairs that Dwyer found; her minimal pairs are not minimal pairs in my data. However, one set of nativized Chinese borrowings form a minimal tone pair by contrasting the pitch on the unstressed syllable. There are two pairs of words that have a high/falling distinction on the stressed syllable, which are not perceived as phonemically distinct. The high and the falling pitch distinctions are still associated with stress, but the evidence shows that the stress system is transitioning to a mixed prosodic system that uses both stress and tone.

CHAPTER 1
INTRODUCTION

This thesis discusses the prosodic system in Mangghuer. Mangghuer, a member of the nontonal Mongolic language family, is spoken in Qinghai, China. Chinese is also spoken in the region. There is a discrepancy in the literature concerning the prosodic system. Keith Slater analyzed Mangghuer's prosodic system as a stress system (Slater 2003: 73), while Dwyer (2008) proposed that tonogenesis is occurring in Mangghuer, which has resulted in a few minimal pairs based on pitch differences. In this thesis, I argue that Mangghuer is a stress language that is showing signs of developing a mixed prosodic system in which pitch is beginning to function like tone.

This thesis fills the literature gap concerning Mangghuer's prosodic structure by analyzing Mangghuer's word-level prosody with the help of extensive acoustic data. Slater (2003) did not use acoustic data in his grammar, and Dwyer (2008) presented acoustic data for a few of her minimal pairs. This thesis will delve into the disagreement between Slater (2003) and Dwyer (2008) to determine what is happening in the prosodic system. Because this thesis discusses duration co-occurring with stress, the thesis adds new information to the literature. This topic will interest linguists who have worked with Mangghuer as well as linguists who work with the languages spoken in the Amdo Sprachbund. Furthermore, this thesis shows how developing mixed prosodic systems can function.

1.1 Language Background

This section summarizes previous research important to understanding Mangghuer's prosodic system. Section 1.1.1 outlines pertinent information concerning the Mangghuer language. Section 1.1.2 discusses the prosodic system of a Chinese variety spoken in the area surrounding the Mangghuer language. Section 1.1.3 addresses the different claims made concerning Mangghuer's prosodic system.

1.1.1 Mangghuer

The Mangghuer language is a Mongolic language (Slater 2003: 1) spoken in Minhe County, Qinghai Province, China by some of the Monguor people (Slater 2003: 9, 10). Minhe County is part of the area known as the Amdo Sprachbund where many languages which share common features are spoken (Slater 2021). Mangghuer's phonological structure has changed to be similar to other languages spoken in the region, especially the Chinese languages (Slater 2003: 2). This includes some of the consonant phonemes which were changed to reflect Chinese pronunciation, because Mangghuer speakers are bilingual in Chinese and have borrowed an extensive amount of vocabulary (see Slater 2003, Section 2.1.4.1 for his discussion about this). The bilingualism and the lexical borrowing caused most of their consonant segments to become similar to the Chinese phonemes, although the uvular consonants from the Mongolic languages have not been influenced by the pronunciation change, so they remain in Mangghuer (Slater 2003). Table 1 shows the consonant phonemes with the orthographic symbols (primarily based on *Hanyu Pinyin*) in parentheses based on Slater's (2003:26) consonant chart.

Table 1. Consonant phonemes

	Labial	**Labial-velar**	**Alv’r**	**Palatal**	**Alveolo-palatal**	**Retroflex**	**Velar**	**Uvular**
Plosive	p^h (p) p (b)		t^h (t) t (d)				k^h (k) k (g)	q^h (kh) q (gh)
Fricative	f (f)		s (s)		ɕ (x)	ʂ (sh)		χ (h)
Affricate			ts^h (c) ts (z)		tɕ^h (q) tɕ (j)	tʂ^h (ch) tʂ (zh)		
Nasal	m (m)		n (n)				ŋ (ng)	
Liquids			l (l)			ɻ (r)		
Approx.		w (u, o, w)		j (i, y)				

Mangghuer has five vowels and two diphthongs: /a/, /e/, /i/, /o/, /u/, /aj/, and /aw/. The vowels /e/, /i/, and /u/ become voiceless in unstressed syllables when the onset consonant is voiceless (Slater 2003: 36). Phonetically the diphthongs are [ai] and [ao]. Table 2 shows the vowel phonemes based on Slater’s (2003:32) vowel chart.

Table 2. Vowel phonemes[a]

	Front[b]	**Central**	**Back**
Close	i[c]		u[d]
Mid	e		o
Open		a	

a. These IPA symbols match the letter used in the orthography (Slater 2003:32).

b. Phonetically, "most vowels are somewhat more central in pronunciation than the symbols might suggest" (Slater 2003:32).

c. /i/ has allophones [ɪ] and [ɨ] as well as [ʝ̞]. [ɪ] occurs in free variation. [ɨ] occurs after /s/ and /z/. When [ɨ] appears after a retroflex consonant it becomes rhotacized. [ʝ̞] occurs in free variation except that it cannot occur when /i/ occurs after a retroflex consonant. This spirantization causes this vowel to behave like a fricative phonetically[1] (Slater 2003:33), because the wave form and pitch become sporadic.

d. /u/ has allophones [ʊ] and [ʉ], but [ʉ] only occurs after the palatal consonants (Slater 2003: 35). When /u/ appears word initially, it has a spirantized onset [ᵛu] (Slater 2003: 36).

The maximal syllable template is $(C_1)(C_2)V(C_3)$ (Slater 2003:55). C_1 can be any of the consonants from Table 1 except /ŋ/, and C_2 can only be the glides /j/ and /w/ (Slater 2003: 55). The final consonant can be the glides /j/ and /w/, the rhotic or the nasals /n/ and /ŋ/ (Slater 2003: 55). In my data, I found that phonetically, the vowel glide sequence is a diphthong VV (see section 3.1.2-3.1.4). A word-final nasal is realized as nasalization on the preceding vowel, but it retains the length of the nasal so a vowel-nasal sequence is phonetically VV as well. Phonetically, a final rhotic is part of the vowel, so a vowel-rhotic sequence is V. This is because a vowel-rhotic sequence has the same duration as a vowel with no coda, based upon the vowel-rhotic sequences in my data.

[1] Spirantized vowels are phonologically vowels.

Mangghuer's syllable structure has been affected by contact with Chinese language varieties. Mongolic syllable structure allows for /b/, /d/, /g/, /m/, /n/, /ŋ/, /ɻ/, and /s/ as codas (Slater 2003: 65-66), and the Chinese language varieties allow only /n/, /ŋ/, and /ɻ/ as codas (Slater 2003:65). Now Mangghuer only has /n/, /ŋ/, and /ɻ/ as codas (Slater 2003: 65).

Uninflected words can contain one, two, or three syllables. Disyllabic uninflected verbs are the most common, but there are also quite a few monosyllabic verbs. However, there are only a few uninflected trisyllabic verbs. The same applies to nouns that lack enclitics.

Additional syllables often attach to the monosyllabic, disyllabic, or trisyllabic stems. This is because morphologically, Mangghuer is still an agglutinating language like the other Mongolic languages. Suffixes are used with verbs to mark aspect/tense and perspective (Slater 2003: 76). Enclitics are used on nouns to mark case (Slater 2003: 77), but an orthographic suffix is used to mark plural nouns. This suffix can function phonologically as a separate word, which is not typical suffix behavior. It can also function as part of the phonological word (see Section 4.4).

1.1.2 Mangghuer's Prosodic System

Slater (2003) claims that Mangghuer's stress system stresses the final syllable of a word and marks stress by a higher pitch and greater loudness than the unstressed syllables. A contrasting view claims that Mangghuer "is in the process of developing a contrastive pitch accent system modeled on the tonal realization of boundaries and applied to native lexical items" (Dwyer 2008: 113). Abramson (2004) claims that a language using a pitch accent system is not a true tone language, because a pitch accent only uses pitch to differentiate one or two syllables in a word. This use of the term appears to agree with how Dwyer (2008) uses the term, because even though she refers to the pitch as tone in the pitch accent system, she refers to the stressed syllable bearing tone. She does not mention the pitch on the unstressed syllables as tonal. A pitch accent system fits into the broader mixed prosodic system category, which is the term I will be using in this thesis.

Dwyer (2008) refers to this as a case of tonogenesis that is occurring because of a historical deletion as well as language contact. The historical deletions that occurred were the loss of vowel harmony as well as the final obstruents (Dwyer 2008: 112). Dwyer (2008) claims that the Mangghuer pitch accent system marks stress on the final syllable of a word by a high tone, but a low tone can be used on the stressed syllable instead, which occurs less frequently than the high tone. Phonetically, the high tone has a rising pitch (Dwyer 2008: 115-116).

According to Dwyer, most of Mangghuer's pitch patterns are still non-distinctive, as they have not resulted in minimal pairs yet (Dwyer 2008: 114). However, there are four minimal pairs that contrast only via pitch (Dwyer 2008: 117-121). Two different tones can appear on the stressed syllable. The first tone phonetically is a low-rising tone, but phonemically is a high level tone (Dwyer 2008: 115). The second tone that can appear on the stressed syllable phonetically is a low-falling tone, but phonemically is a low level tone (Dwyer 2008: 115-116).

Slater (2003) did not analyze any acoustical data. Dwyer (2008) tested for tone in Mangghuer by comparing the f_0 of two words with the same segments. She also measured vowel length and vowel quality (Dwyer 2008: 112), which are independent variables. Her speaker was a male (Dwyer 2008: 111). He is from "Xiakou Township, Minhe Hui and Mangghuer Autonomous County" and "fluent in Mangghuer, Modern Standard Chinese 普通话, the Minhe County Chinese dialect, and English" (Chen et al. 2005: iii).

Dwyer (2008) created sentences for each minimal pair containing each word. Example 1 shows the sentence she used for the potential minimal pair <bosi> "cloth" and <bosi> "louse":

(1)

Bosi-di	ange	bosi	bang.	
cloth-LOC	totally	louse	COP	
"There are	lice	all over	the cloth"	(Dwyer 2008:119)

The target words did have contrasting pitches in the above sentence and the other sentences she collected. She demonstrated that the minimal pairs she found contrast both in isolation and in a sentence. However, ideally it would be better to collect each target word in its own carrier sentence to avoid potential sentence level intonation interference when two target words are in the same sentence.

1.1.3 A Chinese Variety Spoken in the same Area as Mangghuer

This section discusses the prosodic system of a Chinese variety spoken in the same county as Mangghuer. Gangou Chinese is spoken in Minhe County, so it represents the Chinese variety that Mangghuer is in close contact with (Janhunen 2007: 98). Gangou and Mangghuer are becoming morphologically similar (Janhunen 2007:98). While Gangou has also been influenced by other languages in the region, Gangou phonologically belongs to the Northern Mandarin language group (Kerbs 2019: 5, 7). Gangou has three tones: high, low, and rising, which were derived from the four tones of Middle Chinese (Kerbs 2019: 54-55). Because Standard Mandarin also descended from Middle Chinese but has four tones, it is believed that two of the tones in Middle Chinese merged into one tone in Gangou (Kerbs 2019: 54-55).

1.2 Theoretical Background

This section addresses the theoretical background pertinent to the analysis of Mangghuer's prosodic system. Section 1.2.1 addresses the proposed definitions of "tone language," and Section 1.2.2 discusses tonogenesis. Section 1.2.3 addresses stress systems. Section 1.2.4 addresses the issue of what constitutes a mixed prosodic system.

1.2.1 Tone Languages

There are two different views concerning what qualifies as a tone language. Ratliff (2015) argues that a tone language must have two or more contrastive pitch levels or contours that are realized on most morphemes. Abramson (2004) also argues that a tone language must have tone on most morphemes. However, this is a minority view. In contrast, Hyman (2006), Yip (2002), and Snider (2018) all define a tone language as a language that utilizes pitch to change the lexical meaning "of at least some morphemes." In this thesis, I will be using the latter definition of a tone language: if some of the morphemes contrast for pitch in a meaningful way, then it is a tone language. This would apply to Dwyer's (2008) analysis of Mangghuer.

1.2.2 Tonogenesis

Tonogenesis is a process in which a language develops tone. This can occur because of a sound change in the language. Tone can also develop from a language's stress system. A language contact situation can also cause tonogenesis to occur. As mentioned in Section 1.1.2, Dwyer (2008:112-114) hypothesizes that Mangghuer is developing tone due to language contact, as well as due to historical deletion, as a result of which coda obstruents are no longer present. However, it is more common for tonogenesis to occur when certain phonetic features lead to pitch changes which then become phonemic (Hyslop 2007: 1). These phonetic features include voiced/voiceless consonants in the onset position, the glottal stop in coda position, voice quality, and vowel quality (Hyslop 2007: 2-5). Tonogenesis happens in a language when the pitch differences in words become perceptible to the speakers and the pitches begin to contrast (Yip 2002: 35). When speakers articulate a sound, they make the developing pitch differences of the vowel more distinct and the original sound affecting the change gets deleted, resulting in a phonemic pitch difference (Kanwal & Ritchart 2015: 4).

While process of sound changes described above is the most well-known cause of tonogenesis, in other languages an existing stress system gives rise to tonogenesis (Evans et al. 2018: 511). In other words, the pitch associated with stress becomes associated with tone instead. Most documented cases of this process occur in languages belonging to the Indo-European language family (Evans et al. 2018: 511). These include Swedish (Evans et al. 2018: 511), Norwegian (Lehiste 2004: 112), and Serbo-Croatian (Evans et al. 2018: 511; Lehiste 2004: 112). Some Tibetan varieties, belonging to the Tibetan-Burman language family, developed a tone system from its stress system (Caplow 2009). Heiltsuq, a language spoken in Northern Canada, also developed a tone system from its stress system (Wilson 1987: 321, 324-325).

Tonogenesis can also occur because of language contact and borrowing (Wilson 1987:321; Li 1986). The tonogenesis case study section discusses some of these languages. Language contact can influence a change in a language that then creates internal processes of change (Thurgood 1996). Different types of language contact include massive borrowing of loan words as well as bilingualism (Thurgood 1996:14-15). Bilingualism or even multilingualism is more likely to result in tonogenesis than simply borrowing words (Ratliff 2002:36). Non-tonal minority languages spoken in the same region as a majority tonal language are exposed to tone and may be influenced to develop tone (Premsrirat 2001: 48). Premsrirat claims that many non-tonal minority languages spoken in Southeast Asia are heading in the direction of developing tone or are developing tone (2001:47).

When a speaker of a tonal language also speaks a stress accent language, they may subconsciously associate the stressed syllable in the stress accent language with a high tone from their tonal language in a process known as "stress to tone mapping" (Steien & Yakpo 2020: 3).

1.2.3 Stress Systems

While tone is primarily indicated by f_0 at a lexical level, stress is typically indicated by a mixture of longer duration, greater amplitude, higher f_0, or less vowel reduction on a stressed vowel than on an unstressed vowel (Yakup & Sereno 2016: 62). F_0 usually tends to be more associated with sentence-level stress than word-level stress for stress systems (Yakup & Sereno 2016: 62). In general, duration and intensity are the primary cues for stress in stress systems, but there are a lot of variations cross-linguistically (Yakup & Sereno 2016: 62-63). Whatever cues are used, they highlight the syllable's prominence in the prosodic domain (Gordon 2010: 1).

Stress systems utilize many different patterns to determine stress placement. Some systems are binary (every other syllable stressed) and some are ternary (every third syllable stressed) (Gordon 2010: 3-4). Other stress systems have a fixed pattern that selects a syllable to receive the stress, such as the last syllable, the penultimate syllable, the first syllable, etc., and only that syllable is stressed, although some languages use more than one stress per word (Gordon 2010: 4).

1.2.4 Mixed Prosodic Systems

A number of languages have a mixed prosodic system. This happens when both stress and tone play a role in the language's prosodic system. Hyman (2006) defines a stress accent system as a system that requires the word to have one stressed syllable (obligatoriness) and only have one stressed syllable per word (culminativity). Considering Hyman's (2006) definition of a tone language as one that requires pitch to be used at the lexical level on at least some morphemes and his definition of a stress language as one that requires each word to have one stressed syllable and only one stressed syllable, a mixed system would borrow from each of these systems in different ways. The binary system of + or – stress and + or – tone helps describe what system the language uses, as there are four possible combinations that a language can use (Hyman 2006: 237). One of these four possible systems is a mixed prosodic system, which is + stress + tone.

A mixed prosodic system uses both stress and tone, but they do not need to occur on the same syllable in a word (Remijsen 2001: 42). In a mixed stress and tone system, it is likely that a difference in duration would be the prominent cue for the stressed syllable whereas a difference in pitch would be a cue for tone (Remijsen 2001: 51). In the case of tonogenesis, there may be an intermediary stage where pitch is associated with both stress and tone.

1.3 Language Case Studies

This section includes languages that are examples of these types of prosodic systems. Section 1.3.1 provides examples of languages involved in tonogenesis, and Section 1.3.2 provides examples of languages with mixed prosodic systems.

1.3.1 Tonogenesis Case Studies

The Qiang group of languages is in the Tibetan-Burman language family. The Northern language varieties are toneless and were most likely originally so, but some of the Southern varieties are developing tones (Evans 2001: 63-64). Mianchi has two tones (high and low) that can only appear on one accented syllable, but the placement of the accented syllable is free instead of fixed (Evans 2001: 69). The other syllables are tonal as well, receiving falling or rising tones, but they are not accented (Evans 2001: 70). Heihu is a Southern variety spoken near the North Qiang language varieties and only uses pitch to differentiate Chinese borrowed words from native words and other borrowed words, especially if the borrowing would result in homophones (Evans 2001: 74). Tonogenesis is happening in Mianchi because of phonological structure changes that introduced tone to the words (Evans 2001: 81), and tonogenesis is happening in Heihu in order to distinguish borrowings from native words.

Another group of languages that illustrates a tonogenesis process is the Cham languages spoken in Vietnam. Not all Cham languages are spoken in Vietnam, but the languages developing tonogenesis are.

The Cham languages, which are Austronesian languages, include many languages that have undergone tonogenesis to different extents. There are also some Cham languages which have remained atonal, which gives a good comparison point (Thurgood 1996: 3). In fact these languages were those whose speakers remained isolated while the languages that changed were in contact with the other languages (Thurgood 1996: 2, 3). All of the languages that underwent change were influenced by both external and internal influences. Initially, when the speakers of Cham arrived in Vietnam, the Proto Cham language was influenced by the Mon-Khmer languages, and began to mark stress on the final syllable of words, even though initially in Proto Cham words did not assign stress (Thurgood 1996: 2). From the external influence of receiving final word stress, Proto Cham then began both internal and external processes of change that took different routes as the language broke apart into multiple languages (Thurgood 1996).

In the Cham language change process, the final stress caused disyllabic words to become monosyllabic words as vowels dropped out and consonants turned into consonant clusters (Thurgood 1996: 3). In Eastern Cham, as the basic pattern changed from disyllabic to monosyllabic, the syllables with initial obstruent onsets began to contrast high pitch with all of the syllables with the other onsets, which have lower pitch (Thurgood 1996: 16-17). This resulted in atonal words becoming tonal (Thurgood 1996: 5).

Other Cham languages developed a more complex tonal system. The language with the most developed tonal system is Tsat, which has five tones. It is spoken on Hainan island, so the Tsat speakers were bilingual in the local Chinese variety and had many lexical borrowings from Chinese (Thurgood 1996:22-23; Ratliff 2002: 36). A tonal Tai-Kadai language was also spoken on the island (Ratliff 2002:36). While the Tsat tonal system is not the same tone system of either of the two tonal languages spoken on the island, the number of tones and the pitch value for each is similar (Ratliff 2002: 36). It is likely that the external effect of multilingualism exerted more influence on the internal tonogenesis process in Tsat than the borrowing of words (Ratliff 2002:35). This is because nontonal languages that borrow words from tone languages do not have to borrow them with the tones, especially if they cannot perceive the tones (Ratliff 2002: 35). However, when speakers of nontonal languages learn a tonal language well, in situations of significant language contact, it can result in the tonal system influencing the prosodic system of their original language (Ratliff 2002: 36). That results in borrowings having a tone associated with them that is similar to the language it was borrowed from (Ratliff 2002: 36).

Punjabi, an Indo-European language spoken in India, has undergone tonogenesis. The process began when voiced aspirated consonants began to lose voicing and aspiration, which resulted in pitch distinctions on the following vowels between the original voiceless aspirated consonants and the historical voiced aspirated consonants, because the pitch on the following vowel was affected as the distinctions were lost (Kanwell & Ritchart 2015: 4). The four-way contrast of the consonants (voiced aspirated, voiced unaspirated, voiceless aspirated, and voiceless unaspirated) became a three-way contrast between voiced unaspirated, voiceless aspirated, and voiceless unaspirated (Kanwell & Ritchart 2015: 3-4). The voiced aspirated consonants /bʰ/, /dʰ/, /ɖʰ/, /ʤʰ/, and /gʰ/ merged with the voiceless unaspirated consonants /p/, /t/, /ʈ/, /ʈʃ/ and /k/ (Kanwell & Ritchart 2015:1). The words that originally had the voiced aspirated consonants received a falling tone (Kanwell & Ritchart 2015: 1). However, this only accounts for about ten percent of the words in Punjabi because the other consonant phonemes not affected by this change retained their distinctness and did not induce vowel pitch differences (Evans et al. 2018: 525). Because of this, tone is “sparsely used” in Punjabi (Evans et al. 2018: 526). However, even though this resulted in only a few minimal pairs, the tonal contrast present is recognized as phonological by native Punjabi speakers (Evans et al. 2018: 526). Punjabi is a case of tonogenesis where tone has a “low functional load” but it is still used to distinguish some lexical words (Evans et al. 2018:526).

1.3.2 Mixed Prosodic System Case Studies

Punjabi is one of a group of language varieties in the Punjab region of India that utilize stress and tone together. Dhillon (2010) refers to them as “stress to tone languages.” In a stress to tone language such as Punjabi, Gojri, and Dogri, the one tone in the word falls on the stressed syllable (Dhillon 2010: 49, 67, 78). When suffixes are attached to words, it causes the stress to shift to a different syllable, and the tone moves with the stress (Dhillon 2010: 49). Another linguist noted that duration is an indicator of stress in Punjabi (Bhatia 1993).

Another language that utilizes both stress and tone in its prosodic system is Kurtöp (Tibetan-Burman language family) (Hyslop 2021: 553). Kurtöp has some minimal tone pairs, as well as more words that are in the process of becoming minimal pairs, so Kurtöp is still undergoing tonogenesis (Hyslop 2021: 555). This language has one stressed syllable that falls on the first syllable of the root word, but the tone varies between occurring on the stressed syllable or one of the unstressed syllables (Hyslop 2021: 557). The stress and the tone do not need to be realized on the same syllable.

Another language with a mixed prosodic system utilizing stress and tone is Papiamentu, a creole language spoken in the Dutch Caribbean that has been influenced by both West African and Indo-European languages (Rivera-Castillo & Pickering 2004: 261-262). Primary stress is fixed penultimately (Rivera-Castillo & Pickering 2004: 264). The acoustic cue for stress in Papiamentu is duration, and the acoustic cue for tone is pitch (Rivera-Castillo & Pickering 2004: 267). The tone system includes processes such as spreading that are common in African tone languages (Rivera-Castillo & Pickering 2004: 265). Tone can be on either the stressed or the unstressed syllable (Rivera-Castillo & Pickering 2004: 265). The placement of stress and tone results in minimal pairs (Rivera-Castillo & Pickering 2004: 265). When stress and a high tone fall on the same syllable, the high tone is higher in pitch (Rivera-Castillo & Pickering 2004:274).

Other tonal languages have been documented to shift their tone to a stressed position. In Zulu and Xhosa, high tones shift to the metrically strong position in the final foot (Goldsmith 2010). Fasu places the high or low tone on the stressed syllable (Hyman 2006: 238). Obligatory placing of stress is on the “nuclear syllable” which also carries the tone while the other syllables do not carry stress or tone (Loeweke & Loeweke 1965: 94).

1.4 Thesis Roadmap

The remainder of this thesis is structured as follows. Chapter 2 provides the methodology. Chapter 3 discusses Mangghuer’s stress system. Chapter 4 presents the minimal pair data from the second speaker and provides speaker perception. Chapter 5 discusses evidence from the second speaker of a developing mixed prosodic system. Chapter 6 summarizes the thesis.

CHAPTER 2

METHODOLOGY

This chapter describes the methodology for the analysis of Mangghuer's prosodic system. Section 2.1 presents the speakers. Section 2.2 provides data collection information, and Section 2.3 discusses the analysis methodology.

2.1 Speaker Information

One data set was spoken by Zhu Yongzhong in 1994. The data was recorded on cassette tapes with the use of a one-point stereo microphone. It was later digitized. Zhu was born in 1970 and "is a Mangghuer native of Zhujiaola Village, Zhongchuan Township" (Chen et al. 2005: iv). Zhu "is fluent in Minhe Mangghuer, several local Chinese dialects, as well as Modern Standard Chinese and English" (Chen et al. 2005:iv). He is referred to in this thesis as the first speaker.

The rest of the data sets were recorded in 2021 and 2022 by the second speaker. Bayar Bashi was born in 1989 and is also a Mangghuer native speaker. He was born in Qing'er Village, Zhongchuan Township, which is located in Minhe County in Qinghai, China. Bayar Bashi reported that he grew up speaking Mangghuer at home, used Mandarin as his school language, and learned Qinghai Chinese in college. He recorded the data using a Zoom Handy recorder in WAV format, except for the fifth data set testing speaker perception,[2] which he recorded on his cell phone. He is referred to as the second speaker in this thesis.

I listened to both speakers' three utterances of each word, but only did acoustical analysis on the second utterance. Only the second speaker spoke the folktale sentences and the carrier sentences. For the second data set, the folktale sentence was said once. In the third data set, the

[2] Only the second speaker was available to ask judgment questions.

folktale sentence was said twice, and in the fourth data set, the carrier sentence was said twice for each target word.

2.2 Data Collection Information

The analyses presented in this thesis are based on five datasets. The first data set is 187 nouns and verbs of Mangghuer origin spoken in isolation chosen from a wordlist that Slater recorded in 1994. The wordlist is based upon the vocabulary from ***Folktales of China's Minhe Mangghuer*** (Chen et al. 2005). The majority of words selected from the wordlist were native Mangghuer nouns and verbs. These particular words were selected to determine word prosody, because I expect that native Mangghuer words will show the main prosodic system. These words consist of uninflected verbs as well as the inflected forms when suffixes are attached. Nouns and their encliticized forms are also included. The uninflected/not encliticized words are either monomorphemic or dimorphemic when derivational morphology is used in the forming of the word.

The second data set is a wordlist of 29 potential minimal pairs and 5 potential minimal sets consisting of both native and borrowed words spoken in isolation and in a folktale sentence. Words qualify as potential minimal pairs if they have the same segments. These words with the same segments were tested to see if they were pronounced with a different pitch. These words consist of the four minimal pairs that Dwyer (2008) presented as well as 26 potential minimal pairs and 4 potential minimal sets that I selected from Slater's Lexical Data to collect as data[3]. I selected an example sentence for each word from ***Folktales of China's Minhe Mangghuer*** in order to give context to the word as well as to encourage the speaker to utter the borrowed words in Mangghuer instead of code switching. However, there is no guarantee that he did not code switch.

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[3] One of Dwyer's minimal pairs in her data ended up being a set for me, because I found another word in the lexical data to turn the pair into a set.

The third data set consists of 21 pairs and 3 sets from the second data set and 17 additional words with no contrasting word from the first data set that are read in the context of a folktale sentence. The pairs/sets were chosen from the second data set because they formed what appeared to be minimal pairs, so I wanted to measure to see if they used pitch in consistent ways. The 17 words were chosen from the first data set, because the first speaker used a different pitch pattern than the majority of his words used, so I wanted to verify the observations about pitch made in the first data set.

The fourth data set consists of the words from the third data set spoken in a carrier sentence. The carrier sentence is **Mangghuer pujighe "X" surji chibar bang**: “The Mangghuer word ‘X’ is simple to learn.”[4] The second speaker helped construct the sentence using natural Mangghuer. This sentence was constructed so that all of the target words fit into it without suffixes/enclitics being attached to the words for grammatical reasons.

Finally, the fifth data set consists of 12 potential minimal pairs/homophones from the fourth data set. The speaker was asked if the words in each pair were pronounced the same. Whenever the speaker answered that the words were pronounced differently, he was asked why. All of the potential minimal pairs that had different pitch patterns[5] in earlier data sets were chosen, as well as a few homophone pairs to verify both minimal pairs and homophones. See the Appendix for the wordlists used for each data set.

2.3 Analysis Methodology

I analyzed the first data set before collecting the other data sets. First, I analyzed disyllabic uninflected verbs for their stress patterns, as disyllabic words (nouns and verbs) are the most common in Mangghuer. I compared the uninflected verbs with an available paradigm set from

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[4] <Mangghuer > = Mangghuer. <Pujighe> is a native noun meaning “word.” <surji> is a native verb meaning “learn.” <Chibar> is a native adjective meaning “simple” and <bang> is a native copulative.

[5] This includes the words that contrast both in isolation and a carrier sentence as well as the words that only contrast in isolation but are homophones in the carrier sentence.

the data to determine what their stress patterns are. Any verbs that had the same inflection were compared to the others. I analyzed monosyllabic verbs with their paradigms. I also analyzed the trisyllabic words lacking suffixes/enclitics.

Mangghuer nouns are marked with enclitics, while verbs are marked with suffixes. I initially categorized nouns and verbs separately because there might have been a difference in stress pattern between them, but there was no difference in how nouns and verbs receive stress, so I combined them in subsequent analyses. I compared the words based upon the number of syllables. I also divided the words based upon their syllable structure. Phonetically, the vowel plus glide sequence and the nasalized vowels are VV, and the vowel plus rhotic sequence forms a V.

I did the same process for the words from the second data set. Table 3 shows the syllable structure for the disyllabic and trisyllabic words analyzed from the first and second data sets.

Table 3. Syllable structure of disyllabic and trisyllabic words analyzed

Syllable Structure	**# of words from the first speaker**	**# of words from the second speaker**
(C)(C)V.C(C)V	40	30
(C)(C)V.C(C)VV	11	N/A
CVV.CVV	6	4
CVV.CV	17	2
(C)(C)V.C(C)V.CV	45	N/A
(C)(C)V.CV.C(C)VV	10	N/A
CV.C(C)VV.CV	2	N/A
CVV.CVV.CV	6	N/A
CVV.CV.CV	3	N/A
C(C)VV.CV.CVV	1	N/A
CV.C(C)VV.CVV	1	N/A

CVV.CVV.CVV	1	N/A

I transcribed the pitch patterns impressionistically (low, high, rising, or falling) as well as marked the stressed syllable for each of the words being investigated. I imported the audio file for each word to Praat (Boersma & Weenink: 2022) for acoustic analysis. Text grids were created segmenting the vowels of all the words, so that they could be used in a script. I marked the beginning point of the vowel where the soundwave began to show a repeating soundwave pattern typical of vowels, the intensity began to rise, and the first and second vowel formants began to have a steady state. I marked the end point of the vowel when the soundwave stopped repeating the pattern consistently, the intensity was falling, and the first and second vowel formants stopped having a steady state. A change in the spectrogram also occurred that helped mark boundaries. All of these guidelines led to the boundary being placed at the same location in the word, but not all of the cues were equally helpful. Word-finally there was a lot of echo as the sound faded, which was not included with the vowel. The same intensity drop and formant strength used to determine the endpoint of the final vowel helped determine the end point for the word medial vowel(s). Spirantized vowels were segmented based upon the same criteria.

Figure 1 shows boundaries placed on the vowels when the sound wave becomes irregular.

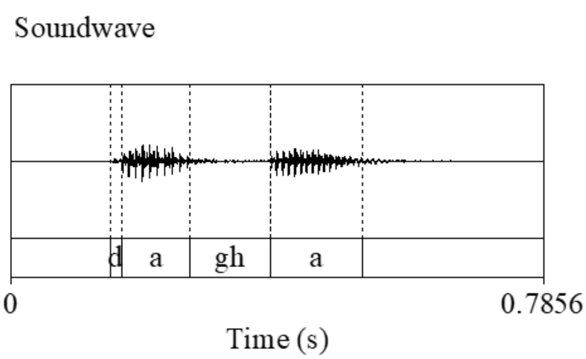

Figure 1. Soundwave segment of <dagha> "follow"

Figure 2 shows the relative decrease in intensity that occurs at the boundaries.

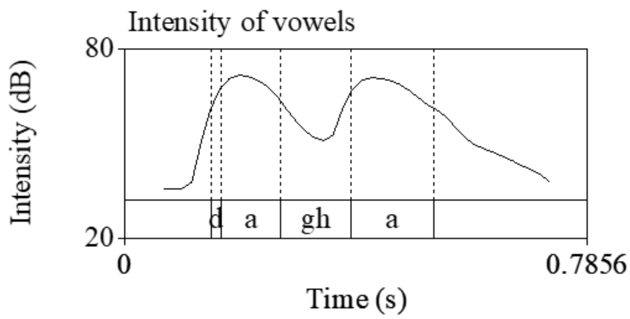

Figure 2. Segmentation of <dagha> "follow"

based upon rising and falling intensity

Figure 3 shows the steady state of the first and second formants at the beginning and end point boundaries. When the formants began to be more sporadic than consistent for the final vowel, it was one of the signs that the following audio was background noise and echo, not part of the vowel.

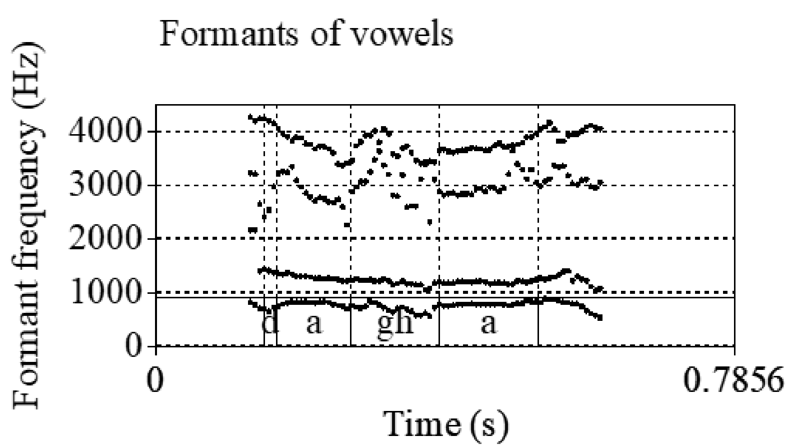

Figure 3. Formant segmentation of <dagha> "follow"

Figure 4 shows segmentation based upon a wideband spectrogram.

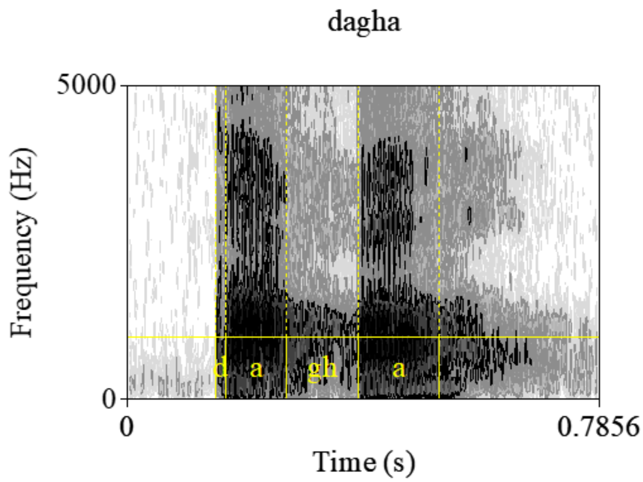

Figure 4. Spectrogram of <dagha> "follow"

After the words from the first and second data sets were segmented in this manner, I ran the recordings and text grids through a Praat script. The script made measurements of f_0, duration, and loudness at three time points: 25%, 50%, and 75% of the way through the duration of the vowel. It also made measurements for the average value. Then, I outputted the data from the script to an Excel table.

I organized the measurements based upon vowel type as well as pitch patterns to help analyze the data. Words with the same vowel in each syllable, words containing monophthongs, and words containing diphthongs were considered separately when comparing the duration between the vowels in the word. Words with the same pitch patterns were grouped together to compare which pitch patterns were the most common. While this organization was done by impressionistic listening first, the acoustic data helped further organize the data, especially concerning vowel duration.

I segmented the third and fourth data sets. This includes the folktale sentences as well as the carrier sentence data. However, I did not run the script for this data. I primarily used this data to analyze pitch patterns. For the sentence data, I segmented the sentences by word so that I could verify the pitch pattern for each word. I also segmented the same folktale sentences collected as data on a different day to compare the consistency between the data sets.

CHAPTER 3
STRESS

I examined uninflected words as well as words with suffixes and enclitics added and found that there is no difference in how these words receive stress. Mangghuer has a fixed stress position. Stress falls on the final syllable of words with monomorphemic roots in isolation, monomorphemic roots with derivational suffixes attached, and the inflected forms of these words.[6] Stress is regularly signaled by longer duration as well as a difference in pitch. Pitch on the stressed syllable can be either a high or a falling pitch.

Testing for stress includes searching for other features present besides f_0, such as duration and intensity, that have a perceptible difference between the stressed vowel and the unstressed vowel. It is important to be careful not to add any information from the surrounding sounds when segmenting (Baart 2010: 105-106). The last feature, intensity, usually is measured by choosing a frame 20-30 milliseconds long, which includes at least two periods of the sound wave so that the average amplitude can be calculated. The value is measured in root mean square (rms), but the intensity is the square of that and is measured in decibels (dB) (Baart 2010: 108).

One linguist included a table of weak versus meaningful differences for pitch, duration, and intensity in her dissertation (Caplow 2009: 92), which is helpful for determining what the acoustic cues of stress are in Mangghuer. Caplow based these values on experimental studies performed on various languages. I used her values to help determine perceptibility of different cues for stress in the Mangghuer data. I decided to use her perceptible difference values to determine if there were systematic perceptibility differences for pitch, duration or intensity in Mangghuer. I chose perceptibility as the cue, because my data was not specifically collected to

[6] Polymorphemic word roots, except for a root and a derivational suffix forming a polymorphemic root, are outside the scope of this thesis.

test the different acoustic parameters for stress. Table 4 is a modified table from Caplow (2009:92).

Table 4. Perceptible differences in acoustic parameters

Acoustic parameter	**Weak difference**	**Perceptible difference**
Pitch	1 Hz	10 Hz
Intensity	1 dB	5 dB
Vowel Duration	10-30 msec	$>$30 msec[a]

a. Caplow determined for her data that a vowel 50% longer in duration is a strong difference, but that any difference in duration above 30 msec is perceptible.

To be perceptibly different, the prominent syllable needs to be at least 30 milliseconds longer in duration, 5 decibels louder, or ten hertz higher in pitch than the duration, intensity, or pitch on the unstressed syllable. For pitch, this only applies to when the stressed syllable has a high pitch. A falling pitch is perceptibly different than an unstressed low pitch as well, but a drop in pitch of at least 10 hertz is needed for the fall to be perceptible. The average pitch of a falling pitch pattern is not an accurate representation of the difference between the pitches, and the falling pitch may have a smaller average value than the low level pitch. Caplow (2009) used a pitch slope to calculate the falling pitch on a stressed syllable, but I calculated the fall in pitch by subtracting the 75% point from the 25% point of the vowel. If the difference between the two points is greater than 10 hertz, the fall is perceptible.

I found that duration and pitch are reliable cues for stress in Mangghuer. However, intensity is not a reliable cue for stress in Mangghuer, as each syllable only differs by a few decibels. According to Caplow (2009) this difference in intensity is not perceivable by the human ear.

Section 3.1 discusses the stress pattern in disyllabic words. Section 3.2 addresses trisyllabic words, and Section 3.3 addresses quadrisyllabic words. Section 3.4 explores pitch, and Section 3.5 considers intensity. Section 3.6 provides a summary.

3.1 Disyllabic words

I discuss disyllabic words first because that is the most common number of syllables in Mangghuer words. Section 3.1.1 explores disyllabic words with monophthongs as the vowels. Section 3.1.2 addresses disyllabic words with a stressed monophthong and an unstressed diphthong, and Section 3.1.3 addresses disyllabic words with diphthongs as both vowels. Section 3.1.4 discusses disyllable words with a stressed diphthong and an unstressed monophthong as the vowels.

3.1.1 Disyllabic words with Monophthongs as the Vowels

Most words consisting of stems without suffixes/enclitics are disyllabic. Many of these words have monophthongs as the vowels. The other disyllabic words with monophthongs as the vowels are word stems with a suffix/enclitic attached. All of these words receive stress on the final syllable, whether the syllable belongs to the root or a suffix/enclitic. Table 5 shows examples of disyllabic words with monophthongs as vowels receiving stress on the final syllable.

Table 5. Stress of disyllabic words with monophthongs as the vowels

Word	**IPA**	**Morphology**	**Gloss**	**Speaker**
aˈla	[ala]	ala	"kill"	First
boˈni	[ponɨ]	bo=ni	"drum=ACC"	First
guiˈku	[kwikʰu]	gui-ku	"SUBJ:NEG:COP-IMPERF"	First
tieˈjie	[tʰjetɕje]	tiejie	"feed"	First
khuˈra	[qʰuɻa]	khura	"rain"	Second
wuˈge	[ᵛukə]	wuge	"word"	Second

88% of these words spoken by the first speaker use a longer duration on the stressed vowel than on the unstressed vowel. 97% of the words uttered by the second speaker have a longer duration on the stressed vowel than the unstressed vowel.

For the first speaker, the other 12% of the words, in which the stressed vowel does not have a perceptibly longer duration than the unstressed vowel, contain the stressed /i/ and /u/ vowels. These vowels are also shorter in duration in the unstressed syllables.

The second speaker consistently uses a perceptibly longer duration on the stressed /i/ and /u/ vowels than the unstressed vowels. Only one word was the exception. The first speaker's average difference in duration between the stressed and the unstressed vowel is 67 milliseconds, while the second speaker's average difference in duration between the stressed and the unstressed vowel is 137 milliseconds. Figure 5 shows the boxplot comparing the duration of the stressed vowel and the unstressed vowel for the two speakers.

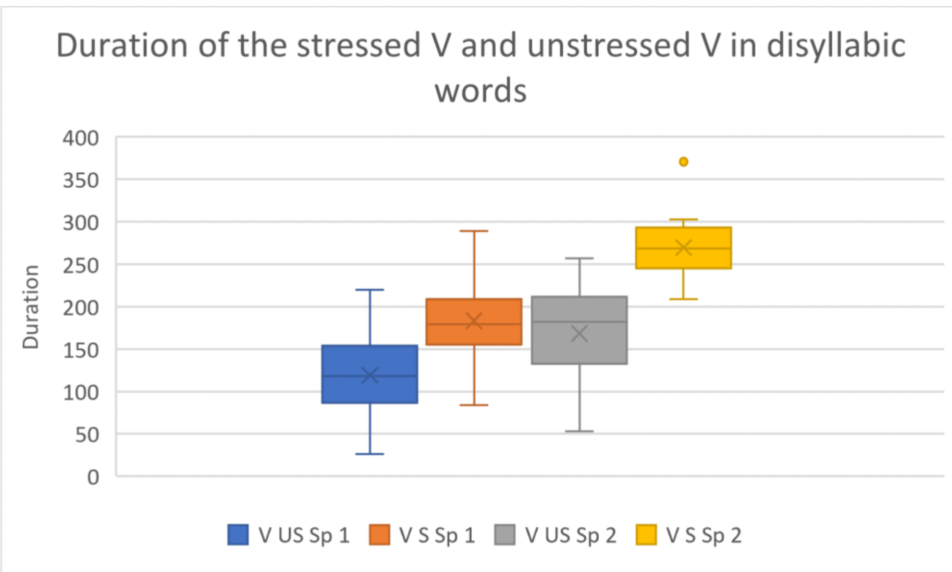

Figure 5. Boxplot for disyllabic words with monophthongs as vowels

3.1.2 Disyllabic words with a Stressed Monophthong and an Unstressed Diphthong

A small subset of disyllabic words in my dataset have a stressed monophthong and an unstressed diphthong. The most common diphthong is [ao]. One occurrence of [ai] appears in the data from the first speaker. In the data from the second speaker, only the words <chaoki> "fry" and <chaoki> "quarrel" have VV1-V2 as the vowels. Table 6 shows some examples of disyllabic words with a stressed monophthong and an unstressed diphthong receiving stress on the final syllable.

Table 6. Stress of disyllabic words with VV1-V2

Word	IPA	Morphology	Gloss	Speaker
daoˈda	[taota]	daoda	"call"	first
yaoˈni	[jaonɨ]	yao-ni	"go-SUBJ:FUT"	first
chaoˈki	[tʂʰaokʰɨ]	chaoki	"fry"	second

The first speaker uses perceptibly longer duration on the stressed monophthong than the unstressed diphthong in 59% of the words. The second speaker consistently uses longer duration on the stressed monophthong than on the unstressed diphthong in 100% of the words. The average difference in duration for the first speaker in the words with a perceptible difference is 41 milliseconds, but including the words with an imperceptible difference in duration the average is only 17 milliseconds. In comparison, the average difference in duration for the second speaker is 116 milliseconds. Figure 6 shows the boxplot for the duration of the stressed vowel and the unstressed vowel for the two speakers.

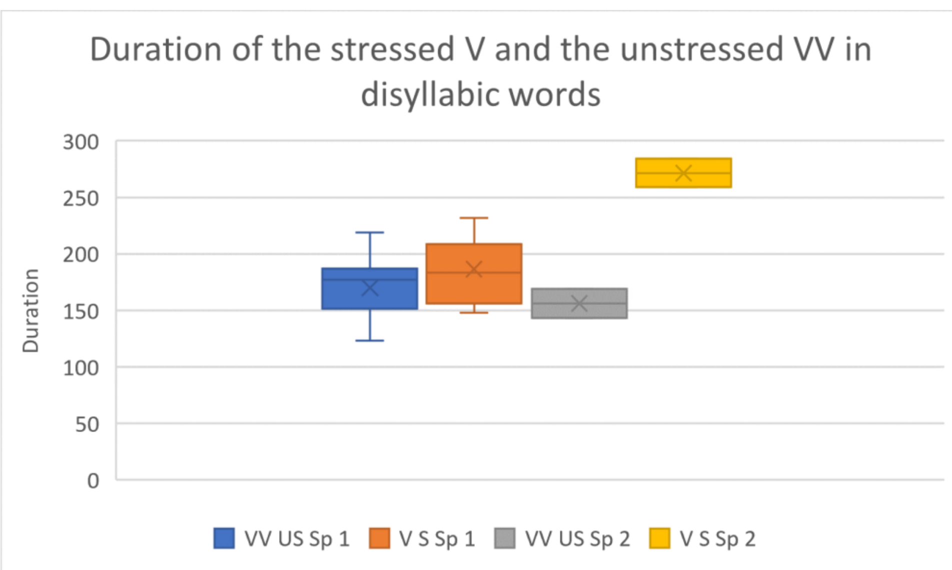

Figure 6. Boxplot for disyllabic words with VV1-V2 as the vowels

3.1.3 Disyllabic Words with Diphthongs as the Vowels

There are a few disyllabic words where both the stressed vowel and the unstressed vowel are diphthongs. 83% of the first speaker's words have a perceptible difference in duration. The first speaker's average difference in duration for disyllabic words with diphthongs as vowels is 45 milliseconds. No words with this syllable structure were recorded by the second speaker. Table 7 shows some examples of stress occurring on the final syllable of disyllabic words with diphthongs as the vowels.

Table 7. Stress of disyllabic words with diphthongs as the vowels

Word	IPA	Morphology	Gloss	Speaker
haiˈnang	[hainã]	hai = nang	"shoe = REFLPOSS"	first
naoˈjiang	[naotçjã]	nao-jiang	"see-OBJ:PERF"	first
taoˈlai	[tʰaolai]	taolai	"rabbit"	first

Figure 7 shows the boxplot of the differences in vowel duration for disyllabic words with diphthongs as the vowels for the first speaker.

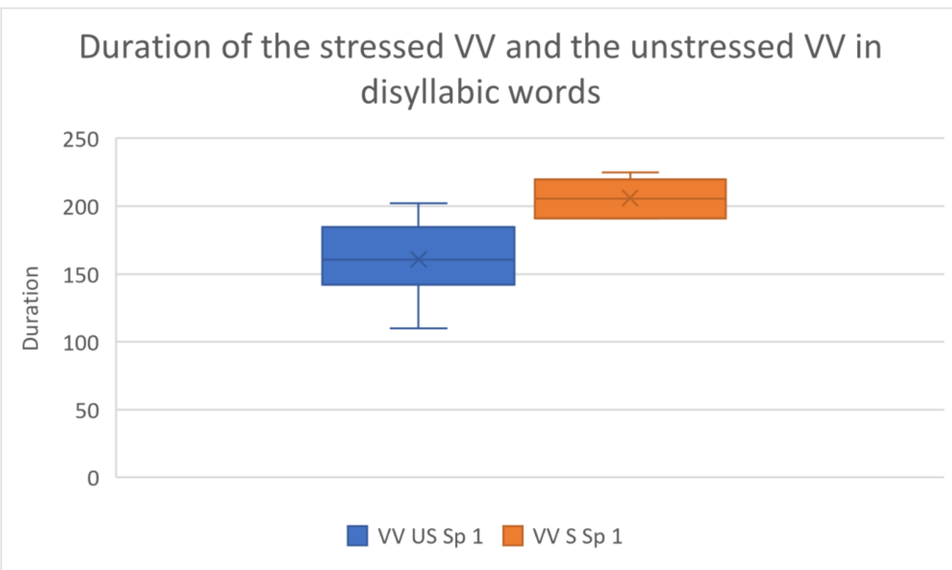

Figure 7. Boxplot for disyllabic words with diphthongs as the vowels

3.1.4 Disyllabic Words with a Stressed Diphthong and an Unstressed Monophthong

A number of disyllabic words have a stressed diphthong and an unstressed monophthong. For both speakers, 100% of disyllabic words with a stressed diphthong and an unstressed monophthong have a perceptible difference in duration between the vowels. The first speaker's average difference in duration is 90 milliseconds and the second speaker's difference in duration is 155 milliseconds. Table 8 shows the stress occurring on the final syllable of disyllabic words with a stressed diphthong and an unstressed monophthong.

Table 8. Stress of disyllabic words with V1-VV2

Word	IPA	Morphology	Gloss	Speaker
bo'nang	[ponã]	bo = nang	"drum = REFLPOSS"	first
mer'nang	[mə˞nã]	mer = nang	"road = REFLPOS"	first
khuo'sen	[q^{h}wosə̃]	khuosen	"drought"	second
wu'lan	[^{v}ulã]	wulan	"many"	second

Figure 8 shows the boxplot of the vowel duration for disyllabic words with a stressed diphthong and an unstressed monophthong for the two speakers.

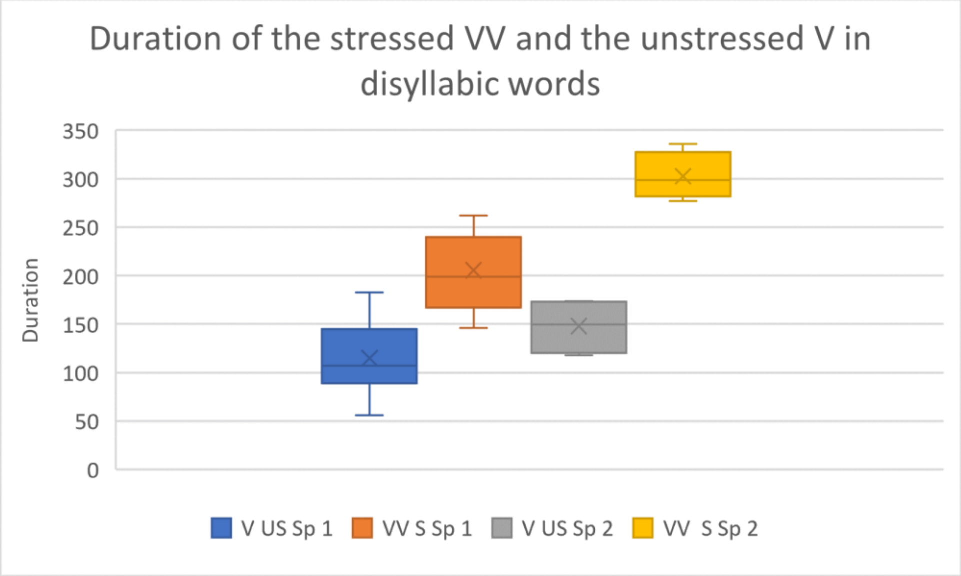

Figure 8. Boxplot for disyllabic words with V1-VV2 as the vowels

3.2 Trisyllabic words

There are a few trisyllabic words in the data that lack enclitics or suffixes. The majority of trisyllabic words are disyllabic words bearing one suffix/enclitic and monosyllabic words bearing two suffixes/enclitics. Only data from the first speaker is included in this section, because no trisyllabic words were spoken in isolation by the second speaker. The unstressed vowel with the longer duration of the two unstressed vowels is compared with the stressed vowel. Section 3.2.1 discusses trisyllabic words with monophthongs as all three vowels. Section 3.2.2 addresses trisyllabic words with a stressed monophthong and an unstressed diphthong. Section 3.2.3 discusses trisyllabic words with a stressed diphthong and an unstressed diphthong, and Section 3.2.4 addresses trisyllabic words with a stressed diphthong and an unstressed monophthong.

3.2.1 Trisyllabic Words with Monophthongs as the Vowels

There are 45 trisyllabic words uttered by the first speaker in isolation that have monophthongs as all three vowels. Table 9 shows examples of trisyllabic words with monophthongs as the vowels receiving stress on the final syllable.

Table 9. Stress of trisyllabic words with monophthongs as the vowels

Word	IPA	Morphology	Gloss	Speaker
andiˈge	[antɨkə]	andige	"egg"	First
taniˈbu	[tʰanɨpu]	tani-bu	"recognize-SUBJ:QUEST"	First

This includes a few words where there is a nasal in the coda position of the unstressed syllable. The duration of the vowel in these syllables is about the same as the unstressed /i/ and /u/ vowels in words with no coda. In trisyllabic words with monophthongs as the vowels, the stressed vowel is perceptibly longer in duration than the unstressed vowel 95% of the time. The average difference in duration between the stressed vowel and the unstressed vowel is 77 milliseconds. Seven of the words where the final vowel was /i/ or /a/ do not have a perceptible difference in duration. Figure 9 shows the vowel duration of the stressed vowel and the unstressed vowel with the longer duration of the two unstressed vowels of trisyllabic words with monophthongs as the vowels for the first speaker.

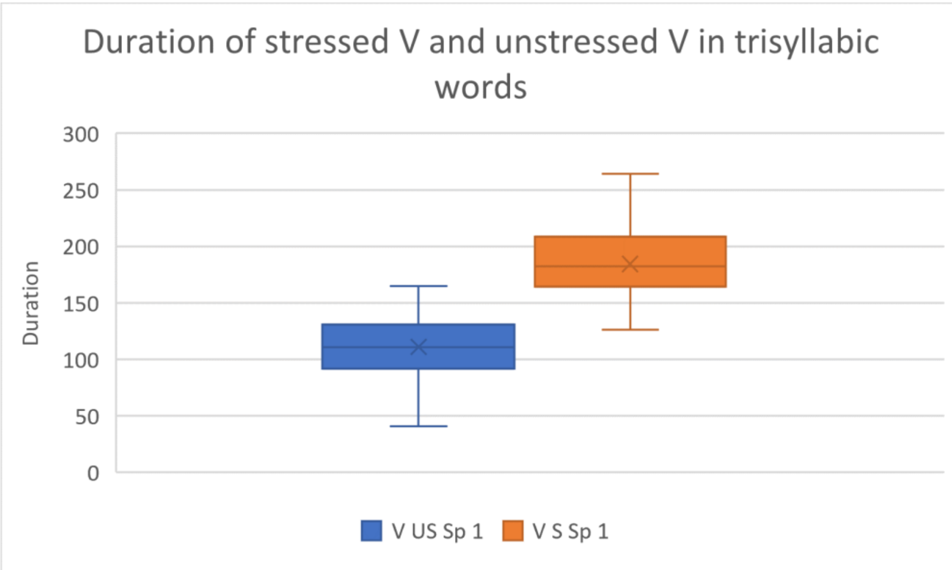

Figure 9. Boxplot for trisyllabic words with monophthongs as vowels

3.2.2 Trisyllabic Words with a Stressed Monophthong and an Unstressed Diphthong

The first speaker uttered nine trisyllabic words in isolation with a stressed monophthong and an unstressed diphthong. Table 10 shows stress occurring on the final syllable of these words.

Table 10. Stress of trisyllabic words with VV1-V2

Word	IPA	Morphology	Gloss	Morphology	Speaker
diaodu'ni	[tjaotunɨ]	diao=du=ni	"younger sibling =DAT=POSS"	diao=du=ni	first
nughuai'du	[nukwaidu]	nughuai=du	"dog=DAT"	nughuai=du	first
taolai'ni	[tʰaolaini]	taolai=ni	"rabbit=ACC"	taolai=ni	first

78% of these words have a perceptible difference in duration between the stressed monophthong and the unstressed diphthong. The average difference in duration between the stressed monophthong and the unstressed diphthong is 41 milliseconds. Figure 10 shows the boxplot for the vowel duration of trisyllabic words with a stressed monophthong and a stressed diphthong.

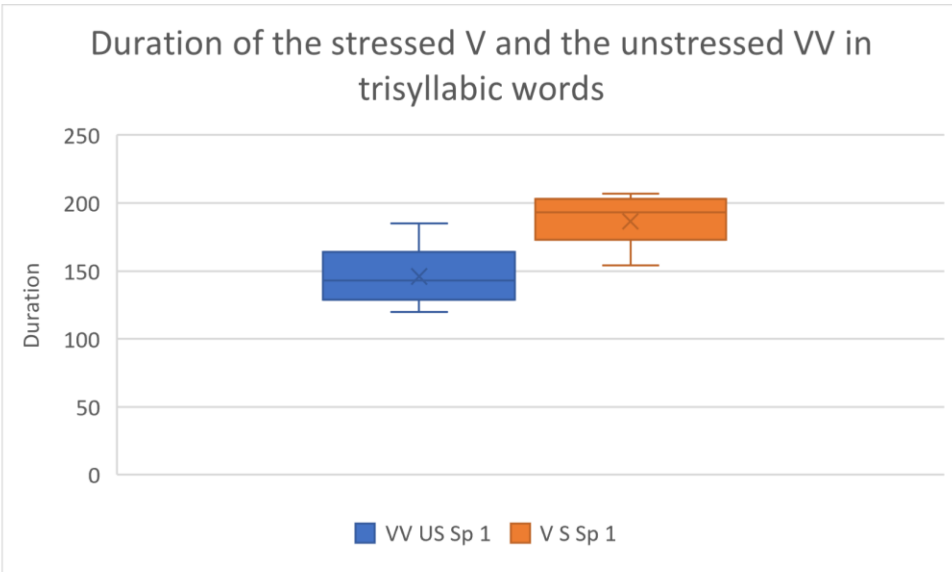

Figure 10. Boxplot for trisyllabic words with Stressed Monophthongs and Unstressed Diphthongs

3.2.3 Trisyllabic words with Diphthongs as the Vowels

There are a few trisyllabic words with diphthongs as the vowels. 100% of the words have a perceptible difference in duration between the stressed diphthong and the unstressed diphthong. The average difference in duration is 60 milliseconds. Table 11 shows stress occurring on the final syllable of trisyllabic words with a stressed diphthong and an unstressed diphthong.

Table 11. Stress of trisyllabic words with VV1-VV2

Word	IPA	Morphology	Gloss	Speaker
terghaiˈnang	[tʰɚqainã]	terghai = nang	"head = REFLPOSS"	first
maidieˈsang	[maidjesã]	maidie-sang	"know-PERF"	first

Figure 11 shows the boxplot of the difference in duration between the stressed diphthong and the unstressed diphthong.

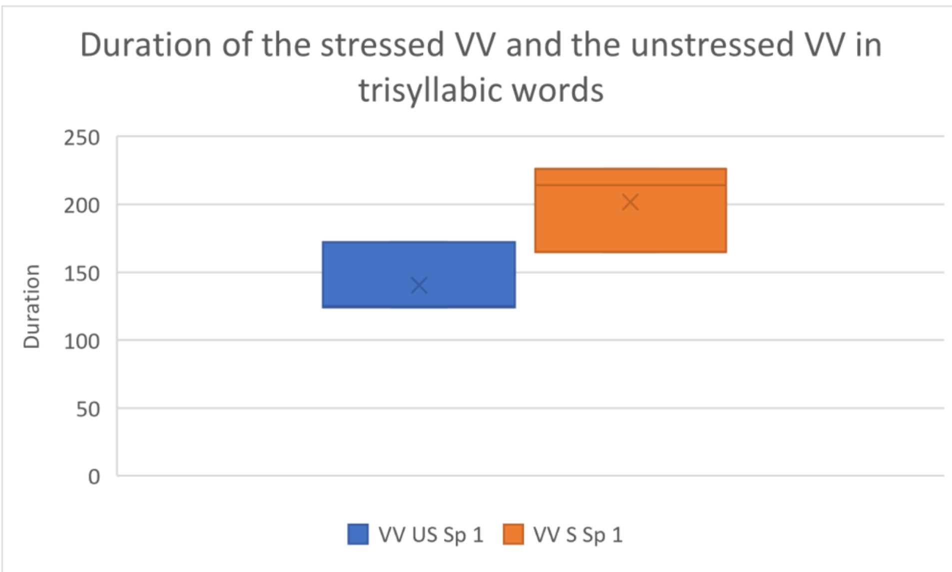

Figure 11. Boxplot for trisyllabic words with a stressed diphthong and an unstressed diphthong

3.2.4 Trisyllabic Words with a Stressed Diphthong and Unstressed Monophthong

Ten words spoken by the first speaker are trisyllabic words with a stressed diphthong and an unstressed monophthong. Table 12 shows the stress occurring on the final syllable of words with a stressed diphthong and an unstressed monophthong.

Table 12. Stress of trisyllabic words with V1-VV2

Word	IPA	Morphology	Gloss	Speaker
agha'diao	[aqadjao]	aghadiao	“friend”	first
ala'jiang	[alatɕjã]	ala-jiang	“kill-OBJ:PERF”	first
kaker'nang	[kʰakʰɚnã]	kaker=nang	“cake=REFLPOSS”	first

90% of these words have a perceptible difference in duration between the stressed diphthong and the unstressed monophthong. The average difference in duration between the stressed diphthong and the unstressed monophthong is 95 milliseconds. Figure 12 shows the vowel durations for the stressed diphthong and the unstressed monophthong.

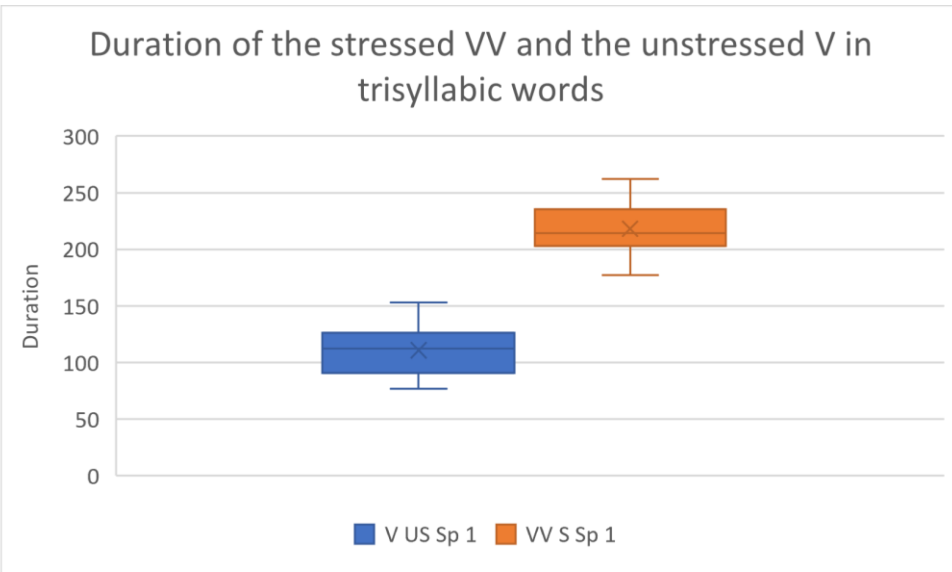

Figure 12. Duration of the stressed diphthong and unstressed monophthong in trisyllabic words

3.3 Quadrisyllabic Words

There are only a few quadrisyllabic words in the first data set. These include the trisyllabic words that receive a suffix/enclitic and disyllabic words that can receive two suffixes/enclitics.

All quadrisyllabic words receive stress on the final syllable like the disyllabic and trisyllabic words.

3.4 Pitch

I impressionistically transcribed syllables with a low, high, or falling pitch. Pitch is reliably different on stressed syllables, as a high or a falling pitch appears on the stressed vowel. This is relevant to the main argument of the thesis, that tonogenesis is occurring, which is discussed in Chapter 4. Figure 13 shows a boxplot of the difference between the 25% point and the 75% point of the high and falling pitch.[7]

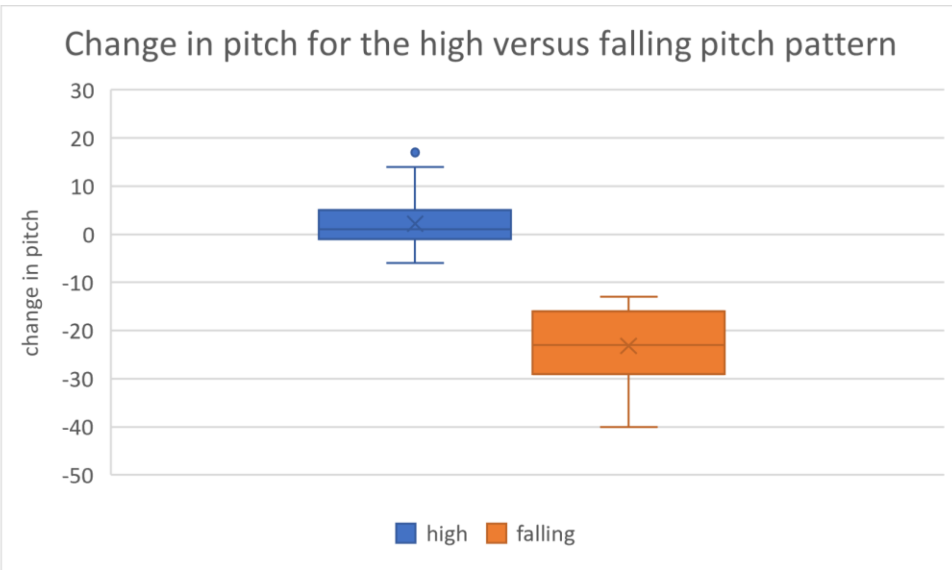

Figure 13. Pitch on Stressed Syllable

The unstressed vowel has a low pitch. 86% of the first speaker's words have a high pitch on the stressed syllable. The other 14% have a falling pitch on the stressed syllable. This pattern is the same for nouns and verbs. 90% of the words with the high pitch on the stressed syllable have a perceptible difference in pitch in comparison to the low pitch on the unstressed

[7] A positive number indicates a rise in pitch and a negative number indicates a fall in pitch.

vowel. A number of the stressed nasalized vowels tend to have a lower pitch than the non-nasalized vowels, which constitute the exceptional cases in which the pitch difference is not perceptible. The average difference in pitch between the stressed syllable and the unstressed syllable is 19 hertz.

When a falling pitch is used to indicate stress, 100% of the falling pitches have a perceptible fall in f_0 between the 25% point and the 75% of the vowel. The average drop in f_0 is 23 hertz.

The second speaker only spoke uninflected words in isolation. 41% of these words have a high pitch on the stressed syllable and 59% of the words have a falling pitch on the stressed syllable. 100% of the words with a low + high pitch pattern have a perceptible difference in pitch between the stressed syllable and the unstressed syllable. Words with the Low + Falling pitch pattern cannot be tested in the same way. Determining the perceptible difference for that pitch pattern is outside the scope of this thesis. The average difference in pitch between the stressed syllable and the unstressed syllable is 63 hertz. The second speaker's pitch patterns are discussed more in Chapters 4-5.

3.5 Intensity

Intensity is not a reliable cue for stress. While the data from the two speakers indicates that it does not play a role, more speakers, and data collected to check specifically for intensity, are needed to provide substantial evidence concerning intensity's role in indicating stress. The average difference in intensity in disyllabic words between the stressed syllable and the unstressed syllable for the first speaker is 2 decibels and for the second speaker it is 1 decibel. According to Caplow (2009:92), this is not a perceptible difference in intensity.

3.6 Summary

Based on data from two speakers, stress is realized by a longer duration on the stressed syllable than the unstressed syllable(s). Stress is also realized by a different pitch on the stressed syllable than the unstressed syllables(s). Based on the data I analyzed, stress is placed on the final syllable in uninflected words and their inflected forms, which confirms Slater's (2003) analysis of where stress is placed. Longer duration being realized as an indicator of stress adds new information that Slater (2003) did not describe. A difference in pitch is a realization of stress which also confirms Slater's (2003) analysis, but because of the falling pitch it is more complicated than Slater (2003) described. A stress system chooses a prominent syllable and uses a variety of cues such as duration and pitch to indicate stress, and the prominent syllable is usually fixed. The data from both speakers confirms that Mangghuer has a stress system, because longer duration and a different pitch always occur on the final syllable, although the second speaker's data shows evidence for a more complex prosodic system that is discussed in Chapters 4-5.

CHAPTER 4
POTENTIAL TONE

For a language to be tonal as discussed by Hyman (2006), at least some of the morphemes need to distinguish lexical meaning by a difference in pitch. This chapter proves that there are pitch differences in a series of words that differ by a high/falling pitch distinction on the stressed syllable. However, other than one phonemic tone pair consisting of borrowed words with a derivational suffix, pitch is not yet realized as tone. The recognized pair of nativized borrowings is not sufficient proof to classify Mangghuer as a tone language. This tone pair and the words with the high/falling pitch distinction on the stressed syllable provide evidence that Mangghuer's stress system is beginning to develop a mixed prosodic system that uses both stress and tone. However, because there are only a few potential minimal pairs emerging, it shows that the developing tone has a low functional load in Mangghuer's prosodic system.

All data in this chapter is from the second speaker, including the perception data[8]. Currently, tones are only present in borrowed words, but native words use pitch distinctions. Disyllabic words have a low + high[9] (L + H) or a low + falling (L + F) word-level phonetic pitch pattern. There is a high/falling pitch distinction on the final syllable that is not recognized as phonemic by the speaker. Some orthographic words with <si> attached function prosodically as two words and use a rising + falling (R + F) pitch pattern. Borrowed words that are prosodically one word can also use the rising + falling pitch pattern, but native words do not use this pitch pattern. So far, only one pair of nativized borrowed words has a pitch contrast that is considered phonemic in the language by the second speaker. Both native and borrowed monosyllabic words use either a rising-falling[10] (R-F) or a high pitch (H).

---

[8] The first speaker was not available for questioning.

[9] The + symbol indicates a syllable boundary.

[10] A – indicates that both pitch patterns are on the same syllable.

The graph below shows the number of words in each category from the second and fourth data sets. This includes the phonemic tone pair as well as the words with the high/falling pitch distinction, homophones, and orthographic words that are prosodically two words. Only a small number of words where no contrasting word[11] is available are included in the data for this chapter, because the data was primarily collected to test for phonemic tone pairs. The vertical axis indicates the number of words that displayed each pitch pattern, which are shown in Figure 14.

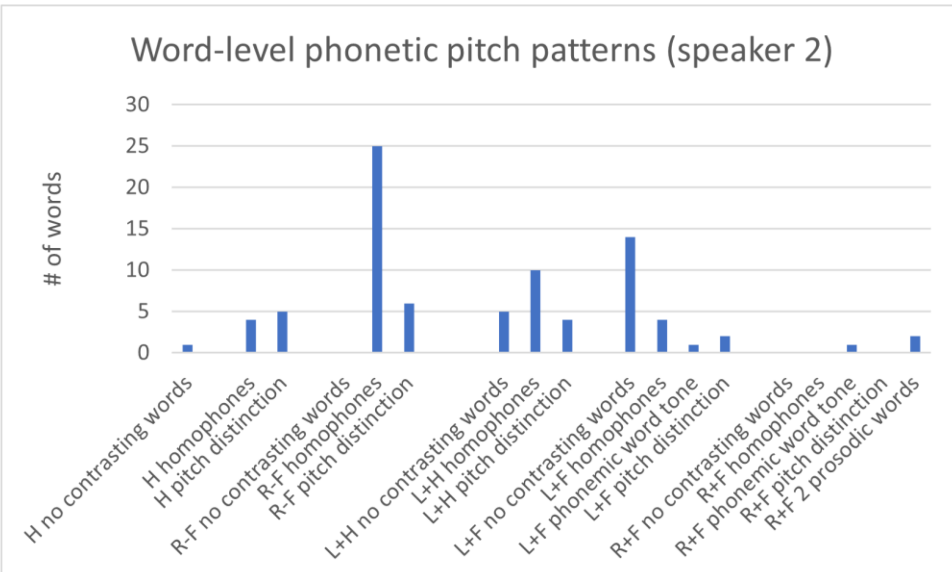

Figure 14. Second speaker's word-level phonetic pitch patterns

The remainder of this chapter is organized as follows. Section 4.1 discusses words with the high/falling pitch distinction. Section 4.2 addresses a phonemic tone pair consisting of nativized Chinese borrowings. Section 4.3 discusses words that contrast in isolation, but not in the carrier sentence. Section 4.4 introduces words that are disqualified, because they vary in prosodic complexity. Section 4.5 addresses minimal pairs that Dwyer found, but that are not

[11] No homophones or words that use a high/falling or a high/rising-falling pitch distinction are in the data that provide contrast with these words

minimal pairs in my data. Section 4.6 discusses homophones. Section 4.7 summarizes the findings of this chapter.

4.1 Words with a Pitch Distinction on the Stressed Syllable

There are three pairs of words that contrast in pitch when pronounced in isolation and in a carrier sentence, although the second speaker does not perceive them as different. Words with a pitch distinction on the stressed syllable use an apparent consistent contrast in isolation and in a sentence.

The first pair of words with the high/falling pitch distinction is <ayi> "fear" (L+F) (native word) and <ayi> "aunt" (L+H) (Chinese borrowing).

<Ayi> "fear" is pronounced with a L+F pitch pattern both in isolation and a carrier sentence. Figure 15 shows the L+F pitch pattern when pronounced in isolation.

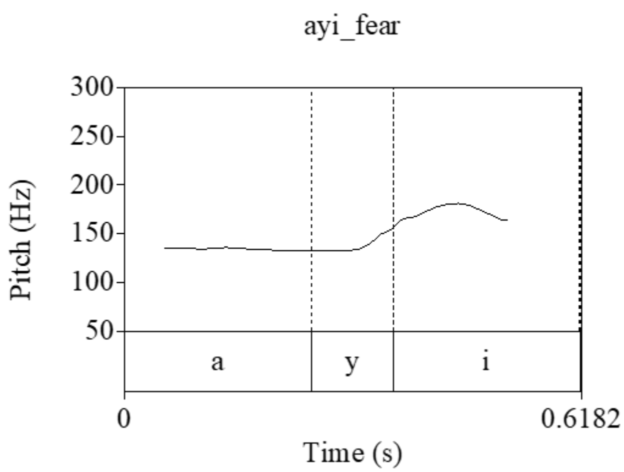

Figure 15. L+F pitch pattern of <ayi> "fear" in isolation

In isolation, the falling pitch pattern is no longer trackable half way through the vowel because the spirantization of the /i/ causes the pitch to be sporadic for the remainder of the vowel. The same process happens to the /i/ when the word is uttered in a carrier sentence. Figure 16 shows the pitch track for the word <ayi> "fear" pronounced in the carrier sentence.

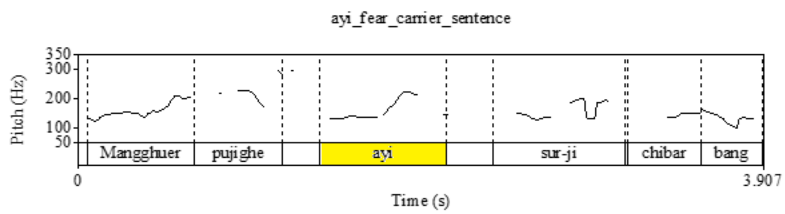

Figure 16. L+F pitch pattern of <ayi> "fear" in the carrier sentence

In the carrier sentence, <Mangghuer> "Mangghuer" is a noun with a L+H pitch pattern. <Pujighe> is a monomorphemic word meaning "word." This is the only word in the data where the speaker does not use a consistent pitch pattern throughout the data. The falling pitch is part of the intonation pattern for declarative sentences. When he pauses before the target word he treats <pujighe> as the end of a intonational phrase within a declarative sentence, so he pronounces it with the falling pitch. The target word appears next in the sentence. <Sur-ji> "learn" is a verb with the L+H[12] pitch pattern. The word starts with a slight fall, which happens word initially on some words, but the pitch levels out and is considered a low pitch. <Chibar> "easy" is an adjective, which this thesis does not address the prosody of. <Bang> has a falling pitch, which is the intonation pattern that occurs at the end of a declarative sentence.

<Ayi> "aunt" is pronounced with a L+H pitch pattern in isolation, as Figure 17 shows (/i/ is spirantized here as well).

[12] The spirantization of the /i/ causes the pitch to act differently phonetically, but it returns to a high pitch. Perceptibly, it sounds like a high pitch.

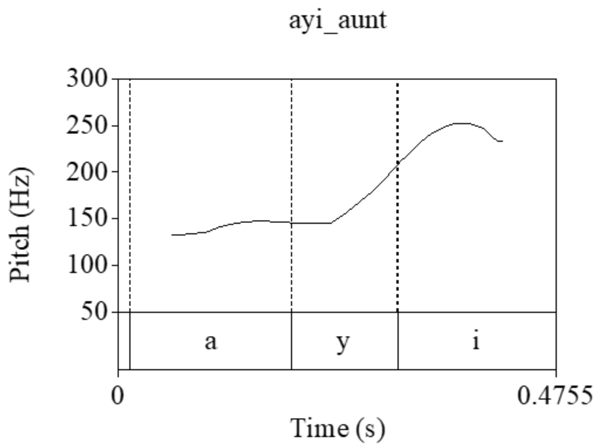

Figure 17. L+H pitch pattern of <ayi> "aunt" in isolation

While the /i/ in <ayi> "aunt" levels out for about 25% of the vowel, there is a slight fall in f_0 as the vowel becomes spirantized before the pitch track becomes untrackable. However, this fall was not perceptible when I listened. Also, the high pitch is level at about 250 hertz, but the falling pitch on the second syllable of <ayi> "fear" starts at 200 hertz before it starts to fall more drastically. In the carrier sentence, <ayi> "aunt" has a high pitch on the stressed syllable where the pitch is not affected by the spirantization, as Figure 18 shows.

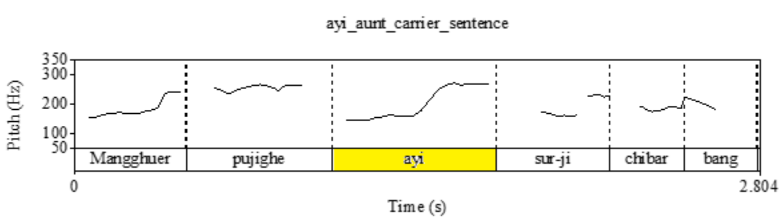

Figure 18. L+H pitch pattern of <ayi> "aunt" in the carrier sentence

It is important to note that the speaker produced <ayi> "aunt" (L+H) and <ayi> "fear" (L+F) consistently in the second, third, and fourth data sets, even though there was about a month in between the recording of each of these sets. In the fifth data set, when the speaker is questioned if <ayi> "aunt" and <ayi> "fear" are pronounced the same, he determined them to be pronounced the same. Because the difference between the L+H and L+F pitch patterns are not recognized, <ayi> "aunt" (L+H) and <ayi> "fear" (L+F) are not phonemic tone pairs. In the fifth data set, the speaker pronounced both <ayi> "aunt" and <ayi> "fear" with a L+F pitch pattern.

The second pair of words with the high/falling pitch distinction is <chaoki> "fry" (L+H) (Chinese borrowing with a Mangghuer derivational suffix) and <chaoki> "quarrel" (L+F) (Chinese borrowing with a Mangghuer derivational suffix). The pitch patterns for the two words are consistently different in isolation (data sets 2 and 4) and in a carrier sentence (data set 4). This is the same derivational suffix <-ki> even though each word uses a different pitch pattern on the suffix. <Chaoki> "fry" is pronounced with a L+H pitch pattern both in isolation and the carrier sentence. <Chaoki> "quarrel" is pronounced with a falling pitch pattern on the stressed syllable both in isolation and in a carrier sentence.

When the second speaker was questioned if <chaoki> "fry" and <chaoki> "quarrel" were pronounced the same, he determined them to be pronounced the same. Like <ayi> "aunt" (L+H) and <ayi> "fear" (L+F), <chaoki> "fry" (L+H) and <chaoki> "quarrel" (L+F) are words with the high/falling pitch distinction. These pitch patterns are not tones because the difference between them is not yet recognized. These words were also pronounced consistently in the second, third, and fourth data sets, but differently in the fifth data set when the speaker was asked if they were pronounced the same. In the fifth data set he pronounced both <chaoki> "fry" and <chaoki> "quarrel" with a L+F pitch pattern.

There is one pair of monosyllabic words that appear to make a contrast between a high and a rising-falling pitch pattern. <Gui> "run" (R-F) and <gui> "subjective negative copula" (H) are pronounced consistently in isolation and in the carrier sentence. In isolation <gui> "run" (native word) is pronounced with a R-F pitch pattern, as Figure 19 shows.

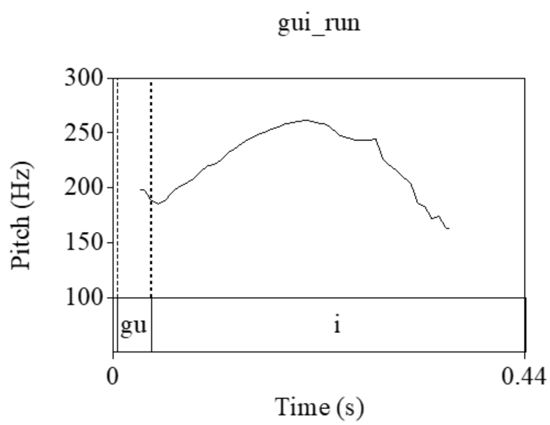

Figure 19. R-F pitch pattern of <gui> "run" in isolation

In the carrier sentence <gui> "run" is also pronounced with a R-F pitch pattern, as it was in isolation, as Figure 20 shows.

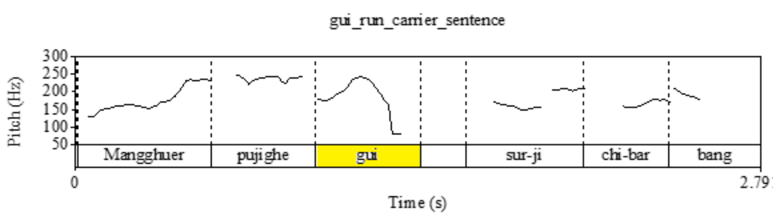

Figure 20. R-F pitch pattern of <gui> "run" in the carrier sentence

In isolation <gui> "subjective negative copula" (native word) is pronounced with a high pitch, as Figure 21 shows.

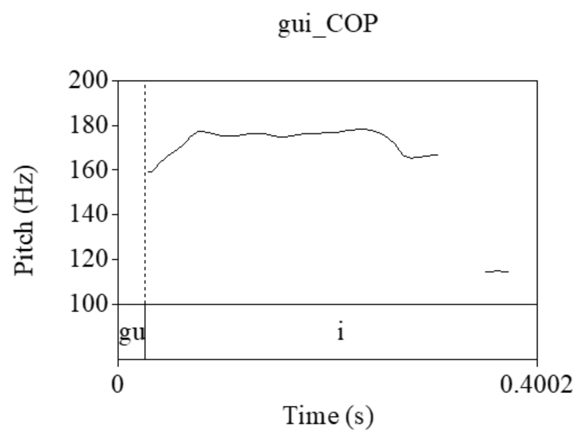

Figure 21. H pitch of <gui> "subjective negative copulative" in isolation

In the carrier sentence, <gui> "subjective negative copulative" is also pronounced with a high pitch, as Figure 22 shows.

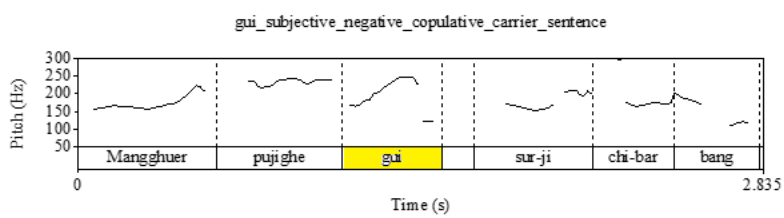

Figure 22. H pitch of <gui> "subjective negative copulative" in the carrier sentence

<Gui> "run" and <gui> "subjective negative copulative" were pronounced with consistent pitch patterns in the second and fourth data sets. However in the fifth data set when the speaker was questioned if <gui> "run" and <gui> "subjective negative copulative" are pronounced differently, he determined that they are the same and used the R-F pitch pattern to pronounce both words.

These three pairs of words with pitch distinctions show that some words consistently contrast in isolation and in a carrier sentence. These pairs with the high/falling pitch distinction include both native and borrowed words, which is important for demonstrating that the pitch pattern affects the prosody at a deeper level than just borrowings. However, the fact that the speaker does not recognize the contrast yet and is able to violate the consistent pitch pattern he used in isolation suggests that the pairs are at best marginally phonemic.

4.2 Chinese Borrowings Phonemically Contrastive Word Pair

One pair of nativized Chinese borrowings form a phonemically contrastive word pair, because they contrast both in isolation and in a sentence and the speaker recognizes them as different. These words contrast pitch on the unstressed syllable. However, this is different from pairs with the high/falling pitch distinction on the stressed syllable discussed in Section 4.1. <Jielie> "borrow" (R+F) (Chinese borrowing with a Mangghuer derivational suffix) and <Jielie> "meet" (L+F) (Chinese borrowing with a Mangghuer derivational suffix) are a phonemically contrastive word pair. <Jielie> "borrow" has a R+F word tone both in isolation and in the carrier sentence. Figure 23 shows the word tone for <jielie> "borrow" spoken in isolation.

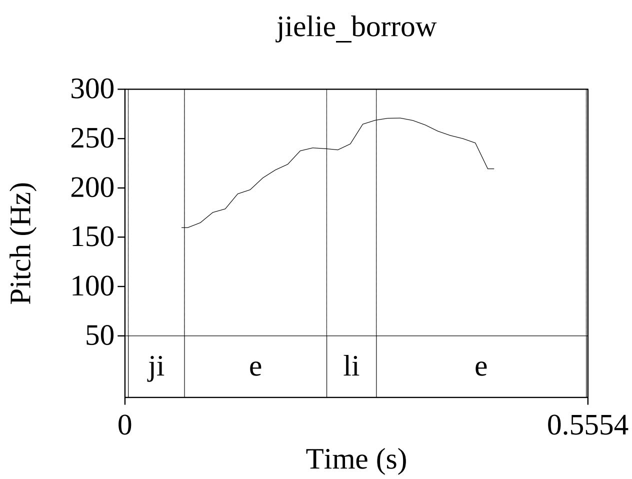

Figure 23. R+F word tone of <Jielie> "borrow" in isolation

Figure 24 shows the word tone of <jielie> "borrow" pronounced in the carrier sentence.

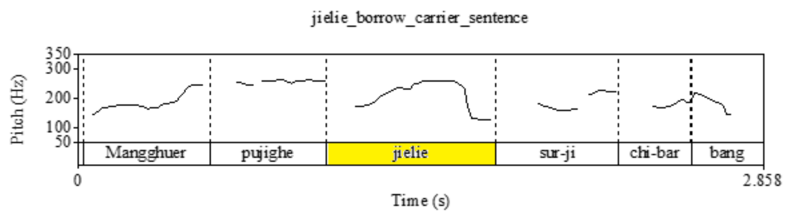

Figure 18. R+F word tone of <jielie> "borrow" in the carrier sentence

Figure 25 shows the L+F word tone pattern of <jielie> "meet" pronounced in isolation.

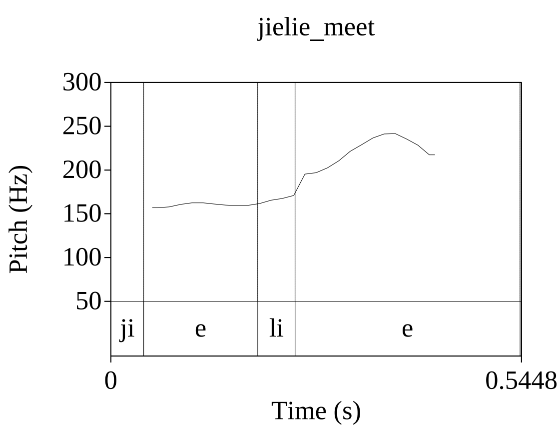

Figure 25. L+F word tone of <jielie> "meet" in isolation

Figure 26 shows <jielie> "meet" spoken in the carrier sentence.

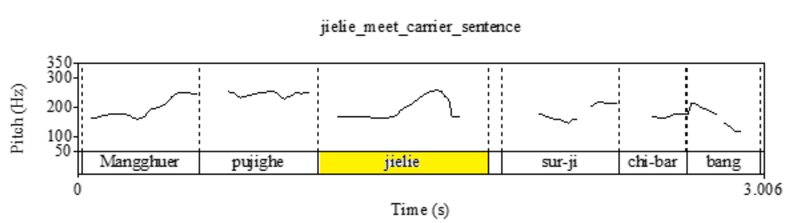

Figure 26. L+F word tone of <jielie> "meet" in the carrier sentence

The speaker perceives <jielie> "borrow" and <jielie> "meet" as being pronounced differently, so they are a phonemically distinct word pair. It is possible that the pitch on the first syllable corresponds with the tone for the word in the local Qinghai Chinese variety, but there is no way to verify the tones as the variety has not been extensively documented. The attached derivational suffix (same suffix for each word) receives the falling pitch pattern. Because the pitch patterns contrast at the word level, L+F and the R+F pitch patterns are phonemic word tones for these words.

However, even though based on Hyman's (2006) definition of a tone language, Mangghuer would be a tone language, it is not a tone language, because the phonemic contrast has only occurred in one pair of nativized borrowings so far. I believe that in order to be a tone language, the phonemic tone pairs need to include at least one native word. That is because the tone needs to extend into the native vocabulary in order to consider the language as a tone language.

4.3 Monosyllabic Words that Contrast in Isolation but not in the Carrier Sentence

There are some monosyllabic word pairs that contrast in pitch in isolation, but do not yet contrast pitch in the carrier sentence. Because of this, they do not provide evidence as convincing as the words presented in Sections 4.1-4.2 to show that Mangghuer is developing tone. Table 13 shows the monosyllabic words that contrast in isolation but not in the carrier sentence.

Table 13. Monosyllabic word pairs with pitch distinctions in isolation

Pitch Pattern	**H**	**R-F**
	Ber "honey" (native)	**Ber** "become" (native)
	Qi "flag" (CH)	**Qi** "seven" (CH)
	Xi "go" (native)	**Xi** "banquet" (CH)
	Yin "silver" (CH)	**Yin** "camp" (CH)

These words consistently use the same pitch pattern in the second and fourth data sets when spoken in isolation. All of these words were pronounced with a R-F pitch in the carrier sentence.

The speaker was questioned about all of these words in the fifth data set. The speaker determined that they are pronounced the same, and used the rising-falling pitch pattern on all of the words when he pronounced them for the fifth data set. The use of consistently contrasting pitch in isolation shows that the pitch contrast is heading in the direction of contrast, even though these word pairs do not currently contrast at the sentence level like the disyllabic words do.

4.4 Orthographic Words that are Prosodically Two Words

Dwyer (2008) claims the existence of two minimal pairs: <bosi> "cloth" (R+H) and <bosi> "louse" (L+F), and <dasi> "thread" (L+F) and <dasi> "we" (L+H).[13] There is another word <bosi> "get up" (native word) (L+F) in my first data set, but it is a homophone with <bosi> "louse" (L+F).[14] There is a possibility that in some of these words, the <si> is the plural marker. Slater (2003) claims that the plural marker <si> can either function as part of the word or as a separate word. In <da> <si> "we" there is evidence that this is the plural marker functioning as a separate word, and Slater (2003) also analyzed it as such. For <bos> <si> "cloth" there is not clear evidence that it is the plural marker, but it behaves similarly to <da> <si> "we." When the acoustic parameters for stress discussed in chapter 3 are examined for these orthographic words, the duration values suggest that both <bo> <si> "cloth" and <da> <si> "we" are prosodically two words. This disqualifies these words from forming minimal pairs with <bosi> "louse" and <dasi> "thread."

[13] These pitch patterns are the way Dwyer's speaker pronounced the words

[14] <Bosi> "get up" only appears in my data.

The first vowel of each of these orthographical words is longer in duration than is usual for an unstressed vowel in a prosodic word. The speaker's average duration of the unstressed penultimate vowel is 148 milliseconds. When the penultimate syllable of an orthographic word is the final syllable of the first prosodic word, the average duration is 234 milliseconds. This is a perceptible difference that signals whether the orthographic word is one or two prosodic words. <Bosi> "get up" has a difference in duration between the stressed and the unstressed vowel of 55 milliseconds and <bosi> "louse" has a difference in duration between the vowels of 49 milliseconds. <Bo> <si> "cloth" has a difference in duration between the two stressed vowels of only 30 milliseconds. Here, the difference in duration is not drastic, but it is different enough to be detectible when combined with a different acoustic parameter of pitch.

The rising pitch does not occur on the unstressed syllable of native words, as native words use a low pitch on unstressed syllables. This shows that <bo> <si> "cloth" (R+F) and <da> <si> "we" (R+F) are prosodically two words. The orthography is still in the process of being developed, so it is possible that these words could be written orthographically as two words. The rising pitch of the first prosodic word may have originated from the rising-falling pitch on monosyllabic words. All of the instances in the data where a single orthographic word is prosodically two words involve the <si> morpheme. Because of this, <bo><si> "cloth" (R+F) and <bosi> "louse" (L+F), and <dasi> "thread" (L+F) and <da> <si> "we" (R+F) are not minimal pairs in my data.

When the speaker was asked if <bo> <si> "cloth" and <bosi> "louse" were pronounced the same, he said no. He claimed that <bo> <si> "cloth" is pronounced "stronger" than <bosi> "louse." This could refer to different properties, but it is most likely that he meant that the prosodic differences cause both <bo> and <si> to be stressed in <bosi> "cloth" but that <bosi> "louse" only has one stressed syllable.

<Dasi> "thread" (L+F) also has a difference in duration between the stressed and the unstressed vowel of 54 milliseconds. <Da> <si> "we" (R+F) has a difference in duration between the stressed vowels of the two prosodic words of 43 milliseconds. When questioned,

the speaker perceived them as different for the same reason that <bo> <si> "cloth" and <bosi> "louse" are different. Therefore, I conclude that <Da> <si> "we" is also two prosodic words.

4.5 Minimal Pairs for Dwyer's Speaker that were not Minimal Pairs for the Second Speaker

Two of Dwyer's (2008) minimal pairs were not minimal pairs in my data. She discovered <qige> "ear" (L+H) (native word) and <qige> "see" (L+F) (origin unknown), and <wulang> "drinking" (native word) (L+H) and <wulang> "many" (native word) (L+F) (Dwyer 2008: 121).

The optional unstressed voiceless /i/ vowel is relevant here because my speaker uses voiceless vowels in these words, but Dwyer's speaker uses voiced vowels. The speaker in Dwyer's data pronounces the unstressed vowel in <qige> "ear" with a low pitch (Dwyer 2008: 121), while my speaker pronounces the unstressed vowel as voiceless.[15] Both Dwyer's (2008) and my speaker pronounce the stressed vowel with a high pitch. Dwyer's speaker pronounces the unstressed vowel of <qige> "see" with a low pitch (Dwyer 2008: 121), whereas my speaker pronounces the unstressed vowel as a voiceless vowel. Dwyer's (2008) speaker pronounces the stressed vowel with a falling pitch, whereas my speaker pronounces the stressed vowel with a high pitch. These words are homophones for my speaker.

<Wulang> "drinking" (L+F) and <wulan> "many" (L+H) are not a minimal pair for my speaker, because the words contain different phonemes. My speaker claimed that <wulang>"many" is hardly ever said by anyone. Instead they say <wulan> "many," so he pronounces that word instead. This rules out the words as a minimal pair set in my data.

[15] Determining the tone of a voiceless vowel is outside the scope of this thesis.

4.6 Homophones

A number of the disyllabic and monosyllabic pairs/sets of words investigated as potential minimal pairs are pronounced as homophones. They are produced with the same pitch pattern in isolation and in the carrier sentence. Like the other data discussed above, the homophones are consistently pronounced with the same pitch. There are homophones for each word-level phonetic pitch pattern, which shows that there are still specific word level pitch patterns that words categorize under.

The most common pitch pattern for disyllabic homophones is the L+H pitch distinction. Table 14 shows the homophones in this category.

Table 14. Disyllabic homophones with the L+H pitch pattern in isolation

Homophone		
Bari	"be hoarse" (unknown[16])	"take" (CH)
Diere	"on" (native)	"pillow" (native)
Khura	"get" (native)	"rain" (native)
Musi	"fly" (native)	"wear" (native)
Shini	"new" (native)	"smile" (native)

Some homophone pairs display the L+F pitch pattern, as Table 15 shows.

Table 15. Disyllabic homophones with the L+F pitch pattern in isolation

Homophone		
Khuosen	"drought" (native)	"empty" (native)
Beghe	"hit" (Turkic)	"tree" (native)

One pitch pattern monosyllabic homophone pairs/sets is the R-F pitch pattern, as Table 16 shows.

[16] Slater's Lexical Data was relied upon for word origin and Slater was not able to track down the origin of every word in the lexicon.

Table 16. Monosyllabic homophones with the R-F pitch pattern in isolation

Homophone					
Bei	"cup" (CH)	"hundred" (CH)			
Dian	"gate" (M)	"hour" (CH)			
Qi	"seven" (CH)	"you" (native)			
Duar	"day" (native)	"exchange" (native)	"fill" (native)	"lead" (native)	"lick" (native)
Ge	"do" (native)	"once" (unknown)	"word" (native)		
Gher	"fire" (native)	"go out" (native)	"hand" (native)		
Ghuer	"two" (M)	"valley" (unknown)			
Hu	"give" (unknown)	"happiness" (CH)			
Ni	"open" (native)	"this" (M)			
Shu	"book" (CH)	"tree" (CH)			

Some of the monosyllabic homophone pairs use the high pitch, as Table 17 shows.

Table 17. Monosyllabic homophones with a H pitch pattern in isolation

Homophone		
Jian	"Arrow" (CH)	"Self" (native)
Shan	"Good" (CH)	"Stone" (native)

The speaker identified the five <duar> words as homophones in the first data collection session before the perception questions were asked. During the perception testing, some of the homophones were also asked about to confirm the consistency of the data. They were pronounced as homophones and he confirmed them as homophones, using the same pitch patterns in all data sets.

4.7 Summary

Some word pairs that have a pitch distinction on the stressed syllable contrast in isolation and in the carrier sentence, but the second speaker does not yet perceive them as different. One pair of nativized borrowings with a different pitch distinction on the unstressed syllable are recognized as phonemically distinct by the speaker. Multiple other words that do not have any contrasting words also consistently use one of the pitch patterns on the stressed syllable. The pitch of these words was consistent in the second through fourth data sets. The speaker deviated from these pitch patterns in the fifth data set, when he was questioned about perceiving a difference in how the words are pronounced. This data shows that the Mangghuer stress system is developing into a mixed prosodic system. This developing system will use stress and tone, but the tone has not yet been perceived as phonemic except in one pair of nativized borrowings.

CHAPTER 5

DEVELOPING MIXED PROSODIC SYSTEM

This chapter addresses the developing mixed prosody of words with a disyllabic stem and one or more suffixes/enclitics attached. All of the data in this chapter is from the second speaker. There are a number of words that the speaker spoke in isolation and also an inflected form in a folktale sentence. In these words, the high or falling pitch on the stressed syllable shifts to the new final syllable of the inflected word. This consistently occurs in the second through fourth data sets, when the speaker was not asked to pay attention to contrast. This phenomena provides evidence that a mixed prosodic system is developing. Section 5.1 discusses these words pronounced in isolation and in a sentence. Section 5.2 provides a summary.

5.1 Developing Mixed Prosody of Words

Stress moves to the final syllable of the inflected forms of words. A stressed syllable can have a high or falling pitch. The second speaker consistently uses the same pitch on the stressed syllable for a word and its inflected form. As discussed in Section 1.3.2, a language that assigns stress and tone to the same syllable is known as a stress to tone language (Dhillon 2010). Tone has the autosegmental feature of mobility, allowing tone to move many syllables away from its source (Yip 2002: 66). Mangghuer shows evidence for a developing stress to tone system, because both the high and falling pitch discussed in Chapter 4 shift syllables. Section 5.1.1 deals with the shifting high pitch, and Section 5.1.2 addresses the shifting falling pitch. The high pitch is not always level. Various characteristics of vowel pronunciation, such as spirantization, affect it. The high pitch is significantly higher in pitch than the falling pitch. The falling pitch has a more steady fall in pitch than the high pitch. Figure 27 shows two words with the L+H vs the L+F pitch patterns to compare the pitches and to provide an example of the differences in hertz. The high pitch in <qiergha> "cut" only falls 17 hertz. The falling pitch in <ala> "kill" drops 52 hertz.[17]

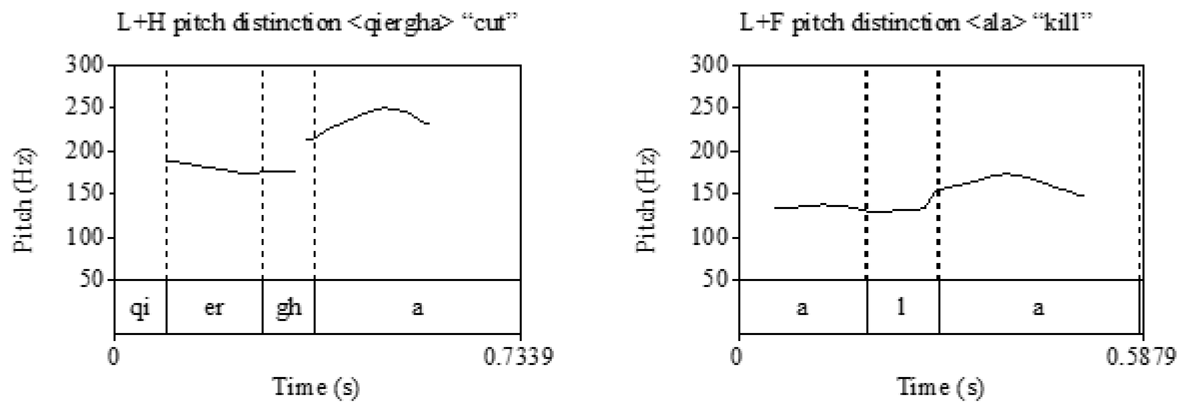

Figure 27. L+H vs L+F pitch patterns

5.1.1 Shifting High Pitch

<Qiergha> "cut" has a L+H pitch pattern when pronounced in isolation, as Figure 28 shows.

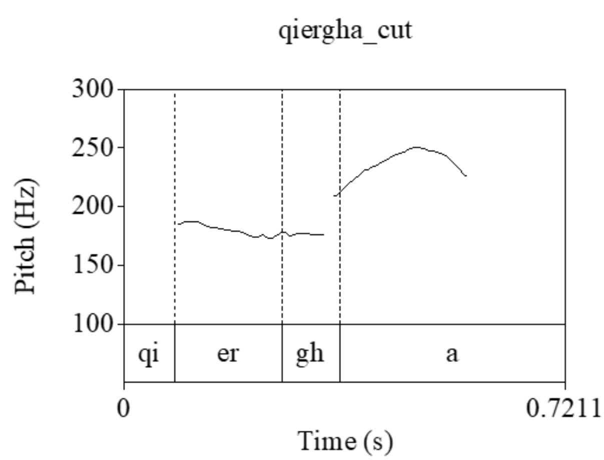

Figure 28. L+H pitch pattern of <qiergha> "cut" in isolation

[17] In the text grid, the pitch track picks up pitch at the end of the word that does not show up in the Praat picture.

When <qiergha> "cut" receives the suffix <-ji> "IMPERF" in a folktale sentence, the high pitch shifts to the final vowel in <qiergha-ji> "cut-IMPERF", as Figure 29 shows.

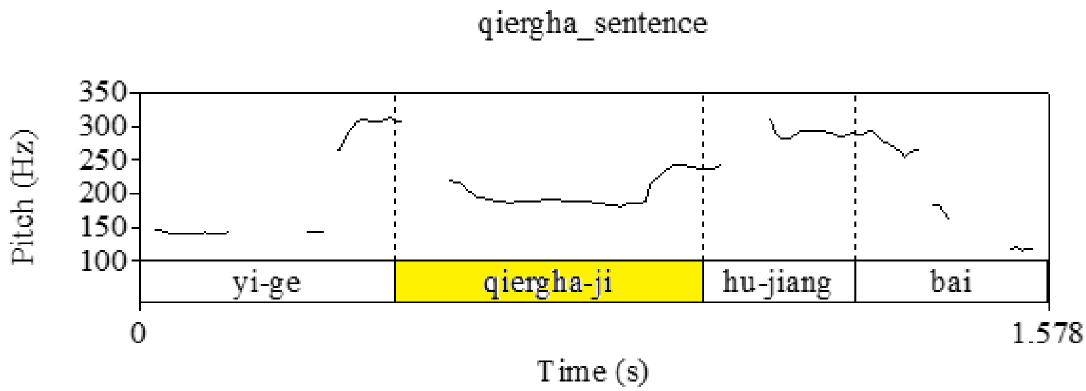

Figure 29. Shifting high pitch in <qiergha-ji> "cut-IMPERF"

<Diere> "pillow" has a L+H pitch pattern in isolation, as Figure 30 shows.

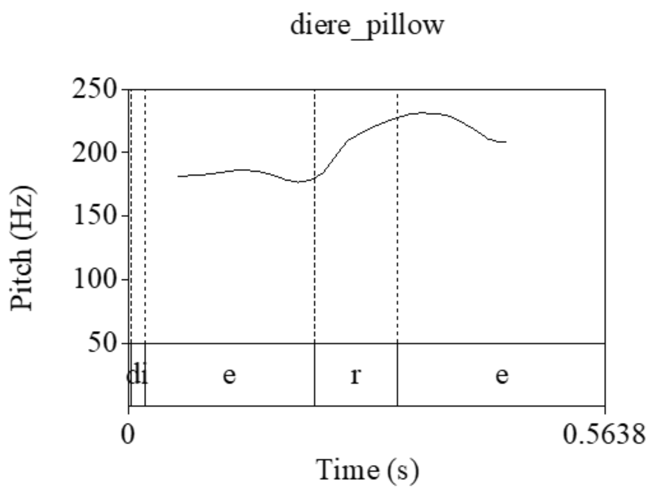

Figure 30. L+H pitch pattern of <diere> "pillow" in isolation

When the enclitic <du> "DAT" is attached to <diere> "pillow" forming the word <diere=du> "pillow=DAT", both the stress and the high pitch shifts to the final syllable, as

Figure 31 shows occurring in a folktale sentence.

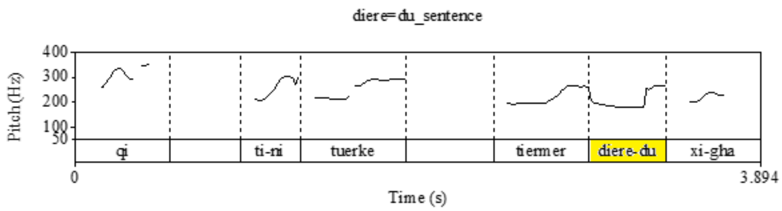

Figure 31. Shifting high pitch in <diere=du> "pillow=DAT"

The shifting high pitch is about 50 hertz higher in pitch when pronounced in the sentence above.

<Nidi> "door" is pronounced with a L+H pitch pattern both in isolation and the carrier sentence. In isolation there is a slight fall in pitch before the pitch track stops because of the spirantization. However, in the carrier sentence, after the slight fall, the pitch rises slightly and remains high for the duration of the vowel. Figure 32 shows the pitch pattern for <nidi> "door" pronounced in isolation.

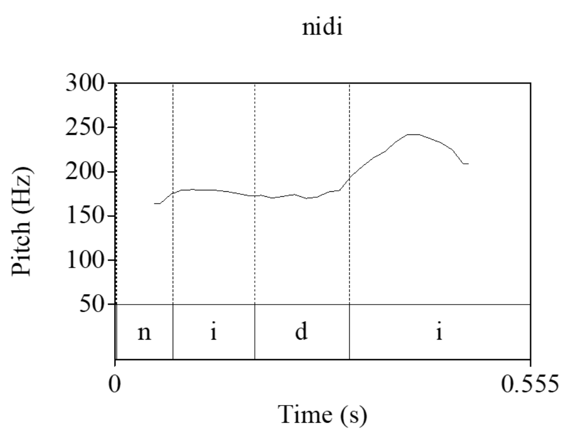

Figure 32. L+H pitch pattern of <nidi> "door" in isolation

When the enclitic <ni> "ACC" is attached to the word <nidi> "door" forming the word <nidi=ni> "door=ACC", the high pitch shifts to the final syllable. The reason for the rising-falling pitch on the first syllable is not clear. Figure 33 shows <nidi=ni> spoken in the sentence.

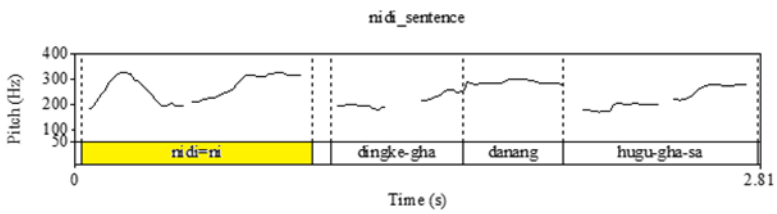

Figure 33. Shifting high pitch in <nidi=ni> "door=ACC"

<Bari> "take" is pronounced with a L+H pitch pattern, as Figure 34 shows. The high pitch on the second syllable is 278 hertz at the level point and drops 24 hertz, which is still less dramatic than the 50 hertz drop of the falling pitch.

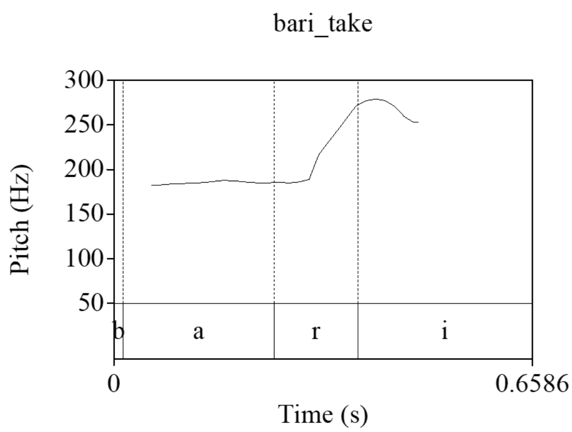

Figure 34. L+H pitch pattern of <bari> "take" in isolation

When the suffix <jiang> "OBJ:PERF" is attached to <bari> "take" forming the word <bari-jiang> "take-OBJ:PERF", the high pitch shifts to the final vowel, as Figure 35 shows. However, the difference in pitch levels is slight due to intonation patterns toward the end of the phrase.

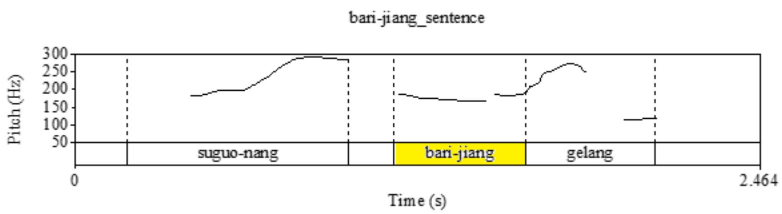

Figure 35. Shifting high pitch of <bari-jiang> "take-OBJ:PERF"

5.1.2 Shifting Falling Pitch

<Ala> "kill" is pronounced with a L+F pitch pattern, as Figure 36 shows.

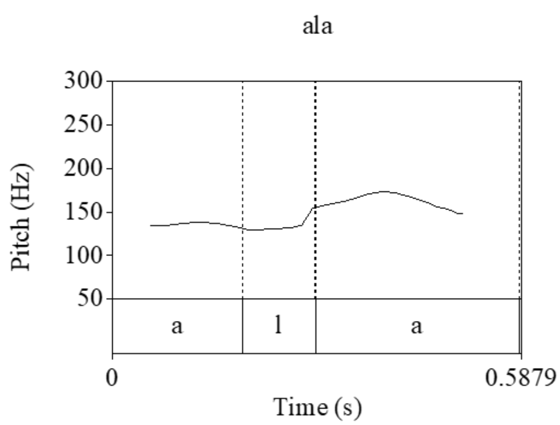

Figure 36. L+F pitch pattern of <ala> "kill" in isolation

When the suffix <ku> "IMPERF" is attached to <ala> "kill" forming the word <ala-ku> "kill-IMPERF", the falling pitch shifts to the final syllable. However, because of the higher pitch that the following word begins within the sentence, the falling pitch remains in the upper voice range, as Figure 37 shows.

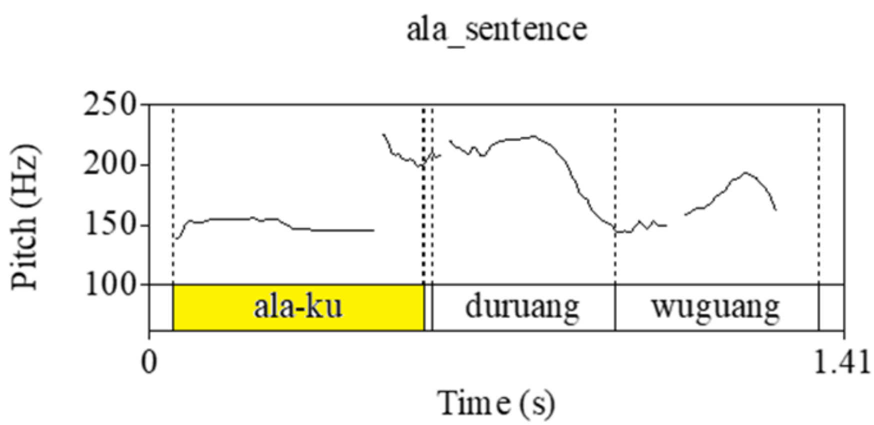

Figure 37. Shifting falling pitch of <ala-ku> "kill-IMPERF"

The word <nudu> "eye" is pronounced with a L+F pitch pattern in isolation, as Figure 38 shows. Here, the falling pitch on the second syllable falls 85 hertz.

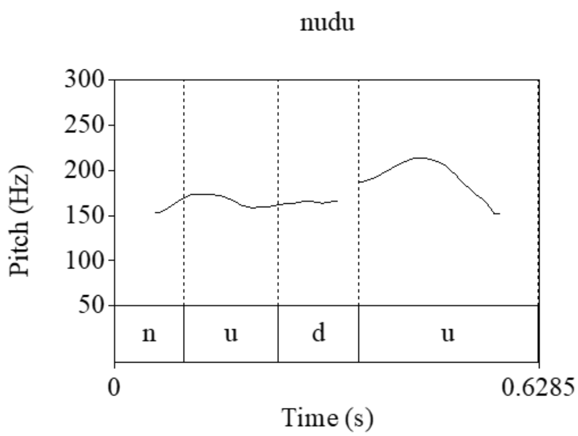

Figure 38. L+F pitch pattern of

<nudu> "eye" in isolation

When the enclitic <nang> "REFLPOSS" is attached to <nudu> "eye", forming a new word <nudu=nang> "eye=REFLPOSS", the falling pitch shifts to the final vowel, as Figure 39 shows occurring in a folktale sentence.

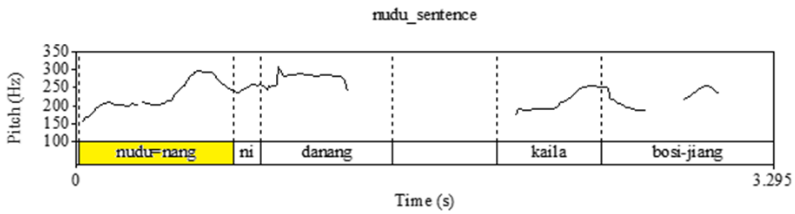

Figure 39. Shifting falling pitch in <nudu=nang> "eye=REFLPOSS"

5.1.3 Words Appearing in Phrase-final Position

The carrier sentence provides evidence that declarative phrases use a falling pitch in the phrase-final position for words that in isolation use the high/falling pitch distinction on the stressed syllable. As discussed in Chapter 4, Section 1, when the speaker has a long pause before the target word in the carrier sentence, the word before the target word has a falling pitch on the stressed syllable. When the speaker does not pause or only paused briefly before the target word, the previous word has a high pitch on the stressed syllable. When a word appears at the end of a declarative phrase, the stressed syllable always receives a falling pitch, even if the word receives a high pitch on the stressed syllable in isolation or when not appearing phrase finally.

We can see this phenomenon with <musi> "fly." Figure 40 shows the pitch pattern of <musi> "fly" spoken in isolation, where the spirantized /i/ affects the high pitch. Here, the fall is 50 hertz, which is more drastic than usual, but the 25% of the vowel is a high level pitch before the spirantization. This is a cue that it is a high pitch.

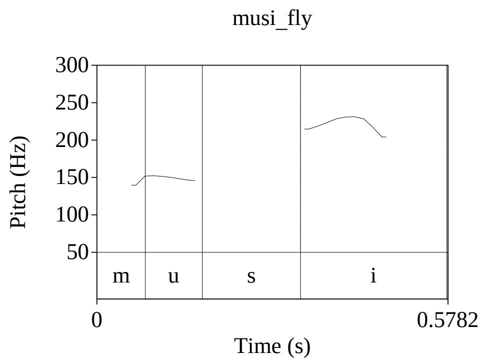

Figure 19. L+H pitch pattern of

<musi> "fly" in isolation

When <musi> "fly" occurs in the carrier sentence, the high pitch occurs on the stressed syllable, as it did in isolation, as figure 41 shows.

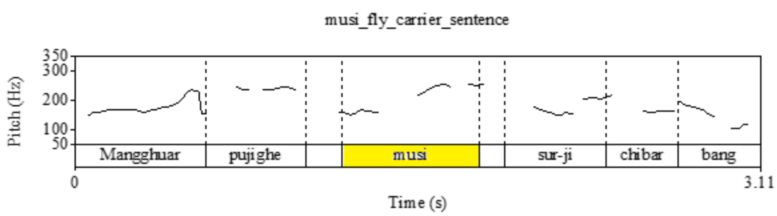

Figure 41. L+H pitch pattern of <musi> "fly" in the

carrier sentence

When an inflected form of <musi> "fly" (L+H), <musi-lang> "fly-OBJ-IMPERF", appears phrase finally in a folktale sentence, the high pitch lexical contrast is neutralized by the phrase-final falling pitch of declarative phrases, as Figure 42 shows.

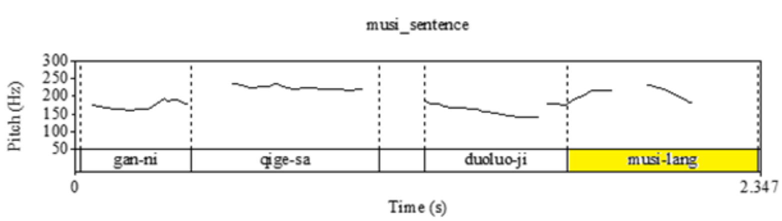

Figure 42. H pitch on <musi-lang> "fly-OBJ-IMPERF"

being neutralized by phrase level intonation

<Chenli> “hear” is pronounced with a L+F pitch pattern, as Figure 43 shows.

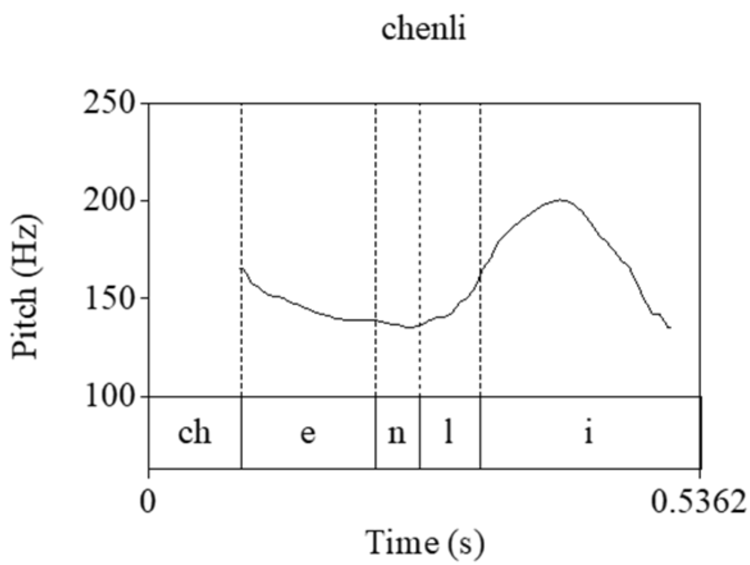

Figure 43. L+F pitch pattern of <chenli> “hear” in isolation

An inflected form of <chenli> “hear”, <chenli-ji> “hear-IMPERF”, appears phrase finally in the folktale sentence, and the falling pitch lexical contrast is the same as the final-phrase intonation, as Figure 44 shows.

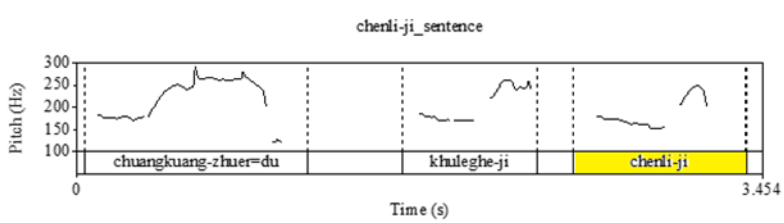

Figure 44. L+F pitch pattern of <chenli> “hear” appearing phrase-finally

5.2 Summary

The shifting high/falling pitch distinction with the stressed syllable in a paradigm shows evidence for a developing mixed prosody system. This type of system, in which the tone moves with the stressed syllable is known as a stress to tone system (Dhillon 2010). The fact that this phenomena occurs both in isolation and at the sentence level in the second speaker's data demonstrates that it has the potential to be a functioning mixed prosody system. However, because the speaker does not yet perceive the difference between the high and falling pitch patterns, the tone aspect of the system is not phonemic yet. When the difference is perceived as phonemic, then the system will be a mixed stress and tone system.

CHAPTER 6

CONCLUSION

Mangghuer has a stress system that is showing signs of becoming a mixed prosodic system. Currently, a high or falling pitch occurs on the stressed syllable. There are two pairs of words that contrast the high pitch and the falling pitch on the stressed syllable, but the speaker does not recognize them as phonemically distinct. However, because of the consistency which with the second speaker subconsciously uses the pitch patterns, it is likely that they will become phonemic tones one day. This would result in a mixed prosodic system using stress and tone. In addition to this, there is already one phonemic tone pair of Chinese borrowings with a Mangghuer derivational suffix attached that contrast pitch on the unstressed syllable.

Section 6.1 addresses the aspects of the stress system, and Section 6.2 discusses the tone system. Section 6.3 suggests the possibility that there may be a change between the speakers, whose data was recorded 25 years apart. Section 6.4 summarizes the thesis.

6.1 Stress System

Mangghuer stresses the final syllable in uninflected words and their inflected forms as well as uninflected words with derivational morphology attached. Section 6.1.1 discusses the stress system. Section 6.1.2 explores further research that can be done in reference to Mangghuer's stress system.

6.1.1 Stress

Mangghuer stresses the final syllable in words lacking suffixes/enclitics as well as words with suffixes/enclitics attached. Stressed syllables generally have longer duration and a higher pitch than unstressed syllables. When suffixes and enclitics are attached to the word stem, forming a new prosodic word, the stress shifts to the final syllable.

However, in a number of words, a falling pitch appears on the stressed syllable instead of the high level pitch. The first speaker is inconsistent with his use of pitch, as the available paradigms show that he does not use the same pitch pattern on the stressed syllable throughout a paradigm. The second speaker is consistent with his pitch. Unstressed syllables receive a low pitch for both speakers. There is one word in the second and fourth data set (second speaker) that has a rising pitch on the unstressed vowel, but it is a nativized Chinese borrowing.

6.1.2 Further Research

First, a wider selection of speakers need to be recorded in a controlled manner that is conducive to testing prosody. This controlled data recording should include a larger corpus of words both native and borrowed, compound words, and words written as one orthographic word that may actually be two words. A statistical analysis should be done to test what the correlates to stress are.

6.2 Pitch Distinctions in a Developing Mixed Prosodic System

Mangghuer is showing signs of developing a mixed prosodic system from its stress system. Section 6.2.1 discusses the developing tonal aspect of the mixed prosodic system and section 6.2.1 explores further research that is needed.

6.2.1 Developing Tone

The high pitch and the falling pitch, both associated with the stressed syllable, create a high/falling pitch distinction. There are two pairs of words that contrast. Furthermore, the second speaker uses the pitches consistently. However, the speaker does not perceive the difference, and in addition when questioned directly he pronounced them the same.

It is important to note that 25 years earlier the first speaker was not consistent with the pitch pattern he used on the stressed syllable of a word and its available paradigm selected on data based upon the folktales. The developing consistent use of pitch by the second speaker raises the possibility that there is a developing mixed prosodic system that the speaker does not yet perceive.

6.2.2 Further Research

The potential minimal pairs discussed in Chapter 4 should be collected from a wider speaker population and the speakers' perception should be tested as well. In addition, the words found to have the L+F pitch pattern could be tested to see if there are any contrasting words with a different pitch pattern that could form minimal pairs. Along with this, other contemporary speakers' data can be collected to confirm or disconfirm the consistency of the data that the second speaker displayed. Also, the process of the developing mixed prosodic system should be observed over time, for example in the speech of subsequent generations, to determine if it is progressing to tonal distinctions or if the use of the pitches has become inconsistent again.

The reason why tone is developing to form a mixed prosodic system can be explored. It is unclear where the falling pitch occurring on some stressed syllables originated from. Because of extensive language contact and borrowing, I suspect there are both internal and external causes working together in the development of the mixed prosodic system. Section 1.2.2 discusses how this has occurred in other languages.

The second speaker uses consistently longer duration on the stressed syllable than the first speaker did. This could be because as a tonal contrast emerges, duration becomes a more prominent cue for stress. Data from more speakers is needed to determine if this is the case.

6.3 Changes between Speakers

There are a number of words that the first speaker pronounced with different pitch patterns in isolation than the second speaker did 25 years later. This suggests that a change in pitch is occurring, however more speakers are needed from each era in order to be conclusive. All of the words in Table 18 the first speaker pronounced with a L+H pitch pattern, and the second speaker pronounced these words with a L+F pitch pattern.

Table 18. Words with different pitch patterns between the two speakers

word	Gloss
<ami>	“life”
<nadu>	“play”
<nudu>	“eye”
<terghai>	“head”
<tiejie>	“feed”
<wuge>	“word”
<wulang>	“drinking”
<zhaler>	“hired: farmhand”

These words provide evidence that a pitch change may have been occurring in the language in the past 25 years. It is important to note that the first speaker did not use the high and the falling pitch on the stressed syllable in a distinguishable way. His data only shows evidence for a stress system, because while he used a different pitch on the stressed syllable of a word than the unstressed syllable, he did not consistently use the same pitch pattern on stressed syllables in a paradigm. Table 19 shows the paradigm of <ri> “come” with pitch patterns as pronounced by the first speaker.

Table 19. First speaker’s paradigm of <ri> “come”

word	Pitch pattern
<ri>	H
< ri-ba>	L+H
<ri-bu>	L+H
< ri-gha>	L+H
< ri-ji>	L+H
<ri-jiang>	L+H

<ri-ku>	L+H
<ri-lang>	L+H
<ri-ni>	R+F
<ri-sa>	L+H
<ri-sang>	L+H
<ri-gha-ba>	L+L+H
<ri-gha-ku>	L+L+H
<ri-ku-ni>	L+L+H
<ri-kuniang>	L+L+H
<ri-sang-ni>	L+L+F
<ri-tala>	L+L+H
<ri-tula>	L+L+H

25 years later, as Chapters 4-5 discuss, the second speaker used high and falling pitches consistently on individual words when he was not asked to pay attention to contrast. The change in pronunciation between speakers in a 25 year period provides evidence that a change may be occurring in the prosodic system. It is possible, though, that one of these systems is how most people speak and the other system is how one person speaks. More speakers from each era are needed to allow us to make a definitive conclusion.

6.4 Summary

Mangghuer is a stress language. The stress system is showing signs of developing into a mixed stress and tone system because of the different pitch patterns that occur on the stressed syllable. Native words as well as a number of borrowed words (some with a native derivational suffix attached) use either a L+H or L+F pitch pattern. Both the high and the falling pitch pattern are currently associated with stress. The first speaker uses the high and the falling pitch pattern inconsistently in word paradigms, but 25 years later the second speaker uses these two different pitches consistently. This also occurs in two different potential minimal pairs contrasting the L+H with the L+F pitch pattern that the speaker does not perceive as phonemically distinct yet. The next step in the process could be for the speakers to recognize the distinction as phonemic, resulting in a high tone or a falling tone that can occur on the stressed syllable in a mixed prosodic system.

APPENDIX: WORDLISTS

First Data set spoken by the first speaker:

Word	Pitch Pattern	Gloss
1. ala	L + F	"kill"
2. ama	L + H	"mouth"
3. ami	L + H	"life"
4. basi	L + H	"excrement"
5. bieqin	L + H	"illness"
6. bieri	L + H	"wife"
7. bo = nang	L + H	"drum = REFLPOSS"
8. bo = ni	L + H	"drum = ACC"
9. bula	L + H	"bury"
10. bura	L + H	"finish"
11. burer	L + H	"calf"
12. chenli	L + H	"hear"
13. chuna	L + H	"wolf"
14. dagha	L + H	"follow"
15. ghazha	L + H	"bite"
16. ghazher	L + H	"ground"
17. gui-ji	L + H	"run-IMPERF"
18. gui-jiang	L + H	"run-OBJ:PERF"
19.gui-ku	L + H	"SUBJ:NEGCOP-IMPERF"
20. gui-lang	L + H	"run-OBJ:IMPERF"

21. gui-sar	L + H	"run-PROG"
22. jiari	L + F	"kill"
23. kaker	L + F	"cake"
24. kuergan	L + H	"husband"
25.kuer-ku	L + H	"arrive-IMPERF"
26. luosi	L + H	"be: hungry"
27. maner	L + H	"agate"
28. meghe	L + H	"village"
29. mer = du	L + H	"road = DAT"
30. mer = nang	L + F	"road = REFLPOSS"
31. mer-si	L + H	"road-PL"
32. miangu	L + H	"silver"
33. moran	L + H	"river"
34. mori	L + H	"horse"
35. musi	L + H	"fly"
36. nadu	L + H	"play"
37. nara	L + H	"sun"
38. nidi	L + H	"door"
39. nudu	L + H	"eye"
40. ri-ba	L + H	"come-SUBJ:PERF"
41.ri-bu	L + H	"come-SUBJ:QUEST"
42. ri-gha	L + H	"come-CAUSE"
43. ri-ji	L + H	"come-IMPERF"
44. ri-jiang	L + H	"come-OBJ:PERF"
45. ri-ku	L + H	"come-IMPERF"
46. ri-lang	L + H	"come-OBJ:IMPERF"
47. ri-ni	R + F	"come-SUBJ:FUT"

48. ri-sa	L + H	"come-COND"
49. ri-sang	L + H	"come-PERF"
50. ruo-gha	L + H	"enter-CAUSE"
51. ruo-ji	L + H	"enter-IMPERF"
52. tani	L + H	"recognize"
53. tara	L + H	"wheat"
54. tiejie	L + H	"feed"
55. wuge	L + H	"word"
56. yarri	L + F	"look: for"
57. yila	L + H	"cry"
58. zhaler	L + H	"hired :farmhand"
59. daoda	L + H	"call"
60. daogher	L + F	"sound"
61. hai = nang	L + H	"shoe = REFLPOSS"
62. kao = du	L + H	"son = DAT"
63. kao-si	L + F	"son-PL"
64. nao-a	L + H	"see-VOL"
65. nao-ji	L + H	"see-IMPERF"
66. nao-jiang	L + H	"see-OBJ:PERF"
67. nao-ku	L + F	"see-IMPERF"
68. nao-la	L + H	"see-PURP"
69. nao-sa	L + H	"see-COND"
70. yao-a	L + H	"go-VOL"
71. yao-da	R + F	"go-after"
72. yao-ji	L + H	"go-IMPERF"
73. yao-jiang	L + H	"go-OBJ:PERF"
74. yao-ku	L + F	"go-IMPERF"

75. yao-lang	L + H	"go-OBJ:IMPERF"
76. yao-ni	R + F	"go-SUBJ:FUT"
77. yao-sa	L + H	"go-COND"
78. yao-sang	L + H	"go-PERF"
79. yao-sar	L + H	"go-PROG"
80. yao-wa	L + H	"go-VOL"
81. ala-gha	L + L + H	"kill-CAUSE"
82. ala-ji	L + L + H	"kill-IMPERF"
83. ala-jiang	L + L + H	"kill-OBJ:PERF"
84. ala-ku	L + L + H	"kill-IMPERF"
85. ala-lang	L + L + H	"kill-OBJ:IMPERF"
86. ala-sa	L + L + H	"kill-COND"
87. ala-sang	L + L + H	"kill-PERF"
88. ama = di	L + L + H	"mouth = LOC"
89. ama = du	L + L + H	"mouth = DAT"
90. ama = la	L + L + H	"mouth = INST"
91. ama = nang	L + L + H	"mouth = REFLPOSS"
92. amang = du	L + L + H	"opening = DAT"
93. ama = ni	L + L + H	"mouth = POSS"
94. ami = nang	L + L + H	"life = REFLPOSS"
95. ami = ni	L + L + H	"life = ACC"
96. andige	L + L + H	"egg"
97.bieri = nang	L + L + H	"wife = REFLPOSS"
98. bura-ji	L + L + H	"finish-IMPERF"
99. bura-jiang	L + L + H	"finish-OBJ:PERF"
100. bura-ku	L + L + H	"finish-IMPERF"
101. dalu = du	L + M + H	"shoulder = DAT"

102. diere = du	**L + L + H**	**“pillow = DAT”**
103. erber = du	**L + L + H**	**“breast = DAT”**
104. erghuosi	**L + L + H**	**“thorn”**
105. ertang = ni	**L + L + H**	**“gold = ACC”**
106. gediesi	**L + L + H**	**“stomach”**
107. ghazher = du	**L + L + H**	**“ground = DAT”**
108. ghazher = nang	**L + L + H**	**“ground = REFLPOSS”**
109. hangbura	**L + L + H**	**“finish”**
110. kaker = nang	**L + L + H**	**“cake = REFLPOSS”**
111. kuergan = ni	**L + L + H**	**“husband = POSS”**
112. maner = la	**L + L + H**	**“agate = INST”**
113. meghe = du	**L + L + H**	**“village = DAT”**
114. meghe = ni	**L + L + H**	**“village = GEN”**
115. miangu = ni	**L + L + H**	**“silver = GEN”**
116. miangu-si	**L + H + F**	**“silver-PL”**
117. moran = du	**L + L + H**	**“river = DAT”**
118. mori = ni	**L + L + H**	**“horse = ACC”**
119. nidi = ni	**L + L + H**	**“door = ACC”**
120. nudu = du	**L + L + H**	**“eye = DAT”**
121. nudu = nang	**L + L + H**	**“eye = REFLPOSS”**
122. nudu = ni	**L + L + H**	**“eye = POSS”**
123. nukuang = du	**L + L + H**	**“hole = LOC”**
124. nukuo = sa	**L + L + H**	**“hole = ABL”**
125. ri-gha-ba	**L + L + H**	**“come-CAUSE-SUBJ:PERF”**
126. ri-gha-ku	**L + L + H**	**“come-CAUSE-IMPERF”**
127. ri-ku-ni	**L + L + H**	**“come-IMPERF-NOMLZR”**
128. ri-kuniang	**L + L + H**	**“come-OBJ:FUT”**

129. ri-sang-ni	**L + L + F**	**"come-PERF-NOMLZR"**
130. ri-tala	**L + L + H**	**"come-before"**
131. ri-tula	**L + L + H**	**"come-when"**
132. ruo-gha-jiang	**L + L + H**	**"enter-CAUSE-OBJ:PERF"**
133. ruo-gha-lang	**L + L + H**	**"enter-CAUSE-OBJ:IMPERF"**
134. tani-bu	**L + L + F**	**"recognize: SUBJ:QUEST"**
135. tani-jiang	**L + L + H**	**"recognize-OBJ:PERF"**
136. tiangere	**L + L + H**	**"heaven, sky"**
137.tiejie-gha	**L + L + H**	**"feed-CAUSE"**
138. tiejie-ji	**L + L + H**	**"feed-IMPERF"**
139. tiejie-ni	**L + H + F**	**"feed-SUBJ:FUT"**
140. wuji = ni	**L + L + F**	**"take: note = GEN"**
141. wuji-sa	**L + L + H**	**"take: note-COND"**
142. wula = di	**L + L + F**	**"mountain = LOC"**
143. wula = du	**L + L + H**	**"mountain = DAT"**
144. wuni-gha	**L + L + H**	**"ride-CAUSE"**
145. wuruang = du	**L + L + H**	**"place = DAT"**
146. wuruang = ni	**L + L + F**	**"place = ACC"**
147. yarri-ji	**L + L + H**	**"Look: for-IMPERF"**
148. yarri-la	**L + L + H**	**"look: for-PURP"**
149. daoda-la	**L + L + H**	**"call-PURP"**
150. daoda-lang	**L + L + H**	**"call-OBJ:IMPERF"**
151. daogher-ku	**L + L + F**	**"sound-IMPERF"**
152. daola-sar	**L + L + H**	**"sing-PROG"**
153. diao = du = ni	**L + L + H**	**"younger: sibling = DAT = POSS**
154. maidie-jiang	**L + L + H**	**"know-OBJ:PERF"**
155. maidie-lang	**L + L + H**	**"know-OBJ:IMPERF"**

156. maidie-sang	**L + L + H**	**"know-PERF"**
157. yao-gha-lang	**L + L + H**	**"go-CAUSE-OBJ:IMPERF"**
158. yao-ku-ni	**L + L + H**	**"go-IMPERF-NOMLZR"**
159. bura-gha-ji	**L + L + L + H**	**"finish-CAUSE-IMPERF"**
160. hangbura-jiang	**L + L + L + H**	**"finish-OBJ:PERF"**
161. hangbura-ku	**L + L + L + F**	**"finish-IMPERF"**
162. hangbura-ya	**L + L + L + H**	**"finish-VOL"**
163. ama = du = nang	**L + L + L + H**	**"mouth = DAT = REFLPOSS"**
164. amang = du = nang	**L + L + L + H**	**"opening = DAT = REFLPOSS"**
165. bieri = du = nang	**L + L + L + H**	**"wife = DAT = REFLPOSS"**
166. wuni-gha-ji	**L + L + L + H**	**"ride-CAUSE-IMPERF"**
167. ghazher = du = nang	**L + L + L + H**	**"ground = DAT = REFLPOSS"**
168. mori = du = nang	**L + L + L + H**	**"horse = DAT = REFLPOSS"**
169. nukuang = du = nang	**L + L + L + H**	**"hole = LOC = REFLPOSS"**
170. tiangere = sa	**L + L + L + H**	**"heaven = ABL"**
171. nughuai = du = nang	**L + L + L + H**	**"dog = DAT = REFLPOSS"**
172. terghai = du = ni	**L + L + L + F**	**"head = DAT = POSS"**
173. terghai = la = nang	**L + L + L + H**	**"head = INST = REFLPOSS"**
174. aghadiao	**L + H + F**	**"friend"**
175. manlai	**L + H**	**"forehead"**
176. terghai	**L + H**	**"head"**
177. nughuai	**L + H**	**"dog"**
178. taolai	**L + H**	**"rabbit"**
179. diao	**H**	**"younger: sibling"**
180. gui	**H**	**"SUBJ:NEG:COP"**
181. kao	**R**	**"son"**
182. mer	**H**	**"road"**

183. ri	**H**	**“come”**
184. ruo	**H**	**“enter”**
185. yao	**H**	**“go”**

Second Data set spoken by the second speaker:

Word	Pitch Pattern	Gloss	Origin
1. ayi	**L+F**	**“fear”**	**M**
2. yin	**R-F**	**“camp”**	**CH**
3. ber	**H**	**“honey”**	**M**
4. qi	**H**	**“flag”**	**CH**
5. qier	**H**	**“money”**	**CH**
6. musi	**L+H**	**“fly”**	**M**
7. beghe	**L+F**	**“tree”**	**?**
8. gui	**H**	**“SUBJ:NEG:CO”**	**M**
9. jian	**H**	**“arrow”**	**CH**
10. wulang	**L+F**	**“drinking”**	**M**
11. wulan	**L+H**	**“many”**	**M**
12. bei	**R-F**	**“hundred”**	**CH**
13. hu	**R-F**	**“happiness”**	**CH**
14. bari	**L+H**	**“be hoarse”**	**?**
15. ber	**R-F**	**“become”**	**M**
16. beghe	**L+F**	**“cut”**	**M**
17. ni	**R-F**	**“open”**	**M**
18. duar	**R-F**	**“exchange”**	**M**
19. hu	**R-F**	**“give”**	**?**
20. musi	**L+H**	**“wear”**	**M**
21. bei	**R-F**	**“cup”**	**CH**
22. diere	**L+H**	**“pillow”**	**M**
23. chaoki	**L+H**	**“fry”**	**CH**
24. shini	**L+H**	**“new”**	**M**
25. bari	**L+H**	**“take”**	**CH**
26. diesi	**L+F**	**“rope”**	**M**
27. dasi	**L+F**	**“thread”**	**M**
28. gui	**R-F**	**“run”**	**M**
29. qiergha	**L+H**	**“cut”**	**CH**
30. gher	**R-F**	**“fire”**	**M**
31. qi	**R-F**	**“you”**	**M**
32. duar	**R-F**	**“fill”**	**M**

33. suguo	∅ + F	“axe”	M
34. khuosen	L + F	“empty”	M
35. jielie	L + F	“meet”	CH
36. shu	R-F	“book”	CH
37. khura	L + H	“get”	M
38. duar	R-F	“lick”	M
39. duar	R-F	“day”	M
40. ge	R-F	“word”	M
41. dian	R-F	“hour”	CH
42. shu	R-F	“tree”	CH
43. qi	R-F	“seven”	CH
44. ayi	L + H	“aunt”	CH
45. khuosen	L + F	“drought”	M
46. khura	L + H	“rain”	M
47. yin	R-F	“silver”	CH
48. gediesi	L + L + H	“stomach”	M
49. ge	R-F	“once”	?
50. jielie	R + F	“borrow”	CH
51. suzu	∅ + H	“hair”	M
52. jian	H	“self”	M
53. suguo	∅ + F	“curse”	M
54. bosi	R + F	“cloth”	M
55. qige	∅ + H	“see”	?
56.shan	H	“good”	CH
57. qige	∅ + H	“ear”	M
58. chaoki	L + F	“quarrel”	CH
59. ghuer	R-F	“two”	M
60. duar	R-F	“lead”	M
61. suzu	∅ + F	“water”	M
62. ghuer	R-F	“valley”	?
63. bosi	L + F	“get up”	M
64. gher	R-F	“hand”	M
65. gher	R-F	“go: out”	M
66. ni	R-F	“this”	M
67. dasi	R + F	“we”	M
68. shan	H	“stone”	M

69. dian	**R-F**	**“gate”**	**M**
70. xi	**R-F**	**“banquet”**	**CH**
71. xi	**H**	**“go”**	**M**
72. diere	**L + H**	**“on”**	**M**
73. ge	**R-F**	**“do”**	**M**
74. shini	**L + H**	**“smile”**	**M**
75. bosi	**L + F**	**“louse”**	**M**

Third and Fourth Data set spoken by the second speaker:

Word	Pitch Pattern	Gloss	Origin
1. ayi	L + F	"fear"	M
2. yin	R-F	"camp"	CH
3. terghai	L + F	"head"	M
4. ala	L + F	"kill"	M
5. wuge	L + F	"word"	M
6. chenli	L + F	"hear"	M
7. ber	H	"honey"	M
8. qi	H	"flag"	CH
9. jiari	L + F	"kill"	M
10. nudu	L + F	"eye"	M
11. tiejie	L + F	"feed"	M
12. musi	L + H	"wear"	M
13. yimeghe	L + L + F	"village"	M
14. beghe	L + F	"tree"	?
15. gui	H	"SUBJ:NEG:CO"	M
16. jian	H	"arrow"	CH
17. bei	R-F	"hundred"	CH
18. bari	L + H	"be hoarse"	?
19. ber	R-F	"become"	M
20. beghe	L + F	"hit"	M
21. ni	R-F	"open"	M
22. musi	L + H	"wear"	M
23. bei	R-F	"cup"	CH
24. kuergan	L + H	"husband"	M
25. diere	L + H	"pillow"	M
26. chaoki	L + H	"fry"	CH
27. shini	L + H	"new"	M
28. khuoran	R + F	"courtyard"	M
29. wuji	L + F	"take: note"	M
30. bari	L + H	"take"	M
31. dasi	L + F	"thread"	M
32. gui	R-F	"run"	M
33. qi	R-F	"you"	M

34. zhaler	**L + F**	**"hired: farmhand"**	**M**
35. ami	**L + F**	**"life"**	**M**
36. bieri	**L + H**	**"wife"**	**M**
37. jielie	**L + F**	**"meet"**	**CH**
38. nidi	**L + H**	**"door"**	**M**
39. khura	**L + H**	**"get"**	**M**
40. kangker	**R + H**	**"cake"**	**M**
41. ge	**R-F**	**"word"**	**M**
42. dian	**R-F**	**"hour"**	**CH**
43. qi	**R-F**	**"seven"**	**CH**
44. ayi	**L + H**	**"aunt"**	**CH**
45. khura	**L + H**	**"rain"**	**M**
46. yin	**R-F**	**"silver"**	**CH**
47. ge	**R-F**	**"once"**	**?**
48. jielie	**R + F**	**"borrow"**	**CH**
49. suzu	**∅ + H**	**"hair"**	**M**
50. jian	**H**	**"self"**	**M**
51. bosi	**R + F**	**"cloth"**	**M**
52. qige	**∅ + H**	**"see"**	**?**
53. shan	**H**	**"good"**	**CH**
54. qige	**∅ + H**	**"ear"**	**M**
55. chaoki	**L + F**	**"quarrel"**	**CH**
56. suzu	**∅ + F**	**"water"**	**M**
57. bosi	**L + F**	**"get up"**	**M**
58. ni	**R-F**	**"this"**	**M**
59. dasi	**R + F**	**"we"**	**M**
60. shan	**H**	**"stone"**	**M**
61. dian	**R-F**	**"gate"**	**M**
62. xi	**R-F**	**"banquet"**	**CH**
63. xi	**H**	**"go"**	**M**
64. diere	**L + H**	**"on"**	**M**
65. ge	**R-F**	**"do"**	**M**
66. nadu	**L + F**	**"play"**	**M**
67. shini	**L + H**	**"smile"**	**M**
68. bosi	**L + F**	**"louse"**	**M**

Fifth Data Set (Second speaker) Perception test:

1. Bosi “cloth” and bosi “louse”

2. Bosi “get up” and bosi “louse”

3. Dasi “thread” and da si “we”

4. Ayi “aunt” and ayi “fear”

5. Chaoki “fry” and chaoki “quarrel”

6. Jielie “borrow” and jielie “meet”

7. Gui “run” and gui “SUBJ:NEG:CO”

8. Ber “become” and ber “honey”

9. Xi “banquet” and xi “go”

10. Beghe “hit” and beghe “tree”

11. Yin “camp” and yin “silver”

12. Musi “fly” and musi “wear”

REFERENCES

Abramson, Arthur. 2004. The plausibility of phonetic explanations of tonogenesis, in G. Fant, H. Fujisaki, J. Cao, and Y. Xu (eds.), *From Traditional Phonology to Modern Speech Processing. Festschrift for Prof. Wu Zongji*. Beijing: Foreign Language Teaching and Research Press. 17–29.

Baart, Joan L. G. 2010. *A field manual of acoustic phonetics*. Dallas: SIL International.

Bhatia, T.K. 1993. *Punjabi: A cognitive descriptive grammar*. London and New York: Routledge.

Boersma, Paul and Weenink, David. 2020. *Praat: Doing phonetics by computer*. Version 6.1.16. (https://www.fon.hum.uva.nl/praat/)

Caplow, Nancy. J. 2009. *The role of stress in Tibetan tonogenesis: A study in historical comparative linguistics*. University of California, Santa Barbara: Doctoral Thesis.

Chen, Zhaojun, Li, Xingzhong, Lü, Jinliang, Slater, Keith W, Stuart, Kevin, Wang, Xianzhen, Wang, Yongwei, et al. 2005. *Folktales of China's Minhe Mangghuer*. München: Lincom Europa.

Dhillon, Rajdip Kaur. 2010. *Stress and tone in Indo-Aryan languages*. Yale University, New Haven: PhD Dissertation.

Dwyer, Arriene M. 2008. Tonogenesis in southeastern Monguor. *Lessons from Documented Endangered Languages* (Typological Studies in Language) 78. 111–128.

Evans, Jonathan. 2001. Contact-induced tonogenesis in southern Qiang. *Language and Linguistics* 2.2. 63-110.

Evans, J., Yeh, W.-C. and Kulkarni, R. (2018), Acoustics of Tone in Indian Punjabi. Trans Philologic Soc, 116. 509-528. https://doi-org.ezproxy.library.und.edu/10.1111/1467-968X.12135

Goldsmith, J. (2010). Prosodic trends in the Bantu Languages. In H. Hulst & N. Smith (Ed.), *Autosegmental Studies on Pitch Accent* (pp. 81-94). Berlin, New York: De Gruyter Mouton. https://doi-org.ezproxy.library.und.edu/10.1515/9783110874266.81

Gordon, M. (2010). Stress Systems. In The Handbook of Phonological Theory (eds J. Goldsmith, J. Riggle and A.C.L. Yu), to appear. http://gordon.faculty.linguistics.ucsb.edu/Gordon_2010_Stresssystems.pdf

Hyman, Larry M. 2006. Word-prosodic typology. *Phonology* 23(2, Between Stress and Tone). 225–257.

Hyslop, Gwendolyn. 2007. Toward a typology of tonogenesis. *Association for Linguistic Typology (2007)*. Online:

https://www.researchgate.net/publication/228392923_Toward_a_Typology_of_Tonogenesis

Hyslop, Gwendolyn. 2021. Between stress and tone: Acoustic evidence of word prominence in Kurtöp. *Language Documentation & Conservation* 15. 551-575.

Janhunen, Juha. 2007. Typological interaction in the Qinghai Linguistic Complex. In *Studia Orientalia*, 85–103. Helsinki: Finnish Oriental Society.

Kanwal, Jasmeen and Ritchart, Amanda. 2015. An experimental investigation of tonogenesis in Punjabi. 18th *International Congress of Phonetic Sciences (2015)*. Online: https://www.internationalphoneticassociation.org/icphs-proceedings/ICPhS2015/Papers/ICPHS0929.pdf

Kerbs, Richard. 2019. *The phonology of Gangou: a Chinese variety of the Amdo Sprachbund*. Helsinki, University of Helsinki: MA Thesis.

Lehiste, Ilse. 2004. Bisyllabicity and tone. First International Symposium on Tonal Aspects of Language, *TAL* 111–114. Online: http://sprosig.org/tal2004/tal2004-Beijing/Lehiste.pdf

Li, Charles N. 1986. The rise and fall of tones through diffusion. *Proceedings of the Twelfth Annual Meeting of the Berkeley Linguistics Society*. 173–185.

Loeweke, Jean May and Loeweke, Eunice. 1965. The phonological hierarchy in Fasu. *Anthropological Linguistics*, *7*(5). 89–97.

Premsrirat, Suwilai. 2001. Tonogenesis in Khmu dialects of SEA. *Mon-Khmer Studies: A journal of Southeast Asian Linguistics and Languages* 31. 47–56.

Ratliff, Martha. 2002. Timing tonogenesis: evidence from borrowing. *Proceedings of the Twenty-Eighth Annual Meeting of the Berkeley Linguistics Society: Special Session on Tibeto-Burman and Southeast Asian Linguistics* (2002). 29-41. Online: https://journals.linguisticsociety.org/proceedings/index.php/BLS/article/download/1043/827

Ratliff, Martha. 2015. Tonoexudus, tonogenesis, and tone change. *The Oxford handbook of historical phonology*. 245-261.

Remijsen, Albert C.L. 2001. *Word-prosodic systems of Raja Ampat languages*. Utrecht, The Netherlands: LOT.

Rivera-Castillo, Yolanda & Pickering, Lucy. 2004. Phonetic correlates of stress and tone in a mixed system. *Journal of Pidgeon and Creole Languages* 19(2). 261–284.

Slater, Keith W. 2003. *A grammar of Mangghuer: a Mongolic language of China's Qinghai-Gansu sprachbund*. London: Routledge.

Slater, Keith W. 2021. Introduction: Language contact in the Amdo Sprachbund. *Himalayan Linguistics,* 20(3). 1-7.

Snider, Keith. 2018. *Tone analysis for field linguists*. Dallas: SIL International.

Steien, Guri Bordal & Kofi Yakpo. 2020. Romancing with tone: On the outcomes of prosodic contact. *Language*. Linguistic Society of America 96(1). 1–41.

Thurgood, Graham. 1996. Language contact and the directionality of internal drift: the development of tones and registers in Chamic. *Language* 72(1). 1–31.

Wilson, Stephen. 1987. The development of tone in Heilstuq. *Proceedings of the Thirteenth Annual Meeting of the Berkeley Linguistics Society*. 321–329. Online: https://heiltsuk.arts.ubc.ca/wp-content/uploads/2020/03/1823-1790-1-PB.pdf

Yakup, Mahire & Sereno, Joan A. 2016. Acoustic correlates of lexical stress in Uyghur. *Journal of the International Phonetic Association.* 1–17.

Yip, Moira. 2002. *Tone*. Cambridge: Cambridge University Press.