Tonal F_0 Variation in Manange (Tibeto-Burman, Nepal): A Case Study

Abstract: This study examines F_0 variation in the lexical tone system of Manange (Tibeto-Burman, Nepal), with an eye to within- and between-speaker patterns of variation. Of particular relevance are the sociolinguistic and phonological dimensions of merger-type changes that are observed for some speakers and absent for others. An acoustic phonetic examination of tone in Manange with primarily z-score normalization as the basis for generalizations, while useful in impressionistically restoring some dimension of parallelism with the auditory properties, obscures the sub-phonemic mechanisms at play behind the cases of leveling. In addition to z-score portrayal, the significance of F_0 as indicative of the four tones are also considered via comparisons of means procedures (Analysis of Variance). These procedures have the added benefit of illustrating the specific dimensions of merger. In particular, most cases here involve a phonetic merging of the two lower tones. This merger is sociolinguistically stratified, aligning with modified notions of social network. Also of interest here is the resulting single acoustic "lowered" tone derived from tones /1/ and /4/, which stands in contrast to many predictions about the behavior of voiceless aspirated initials in tonogenetic and tone change scenarios.

1 Introduction

A common technique employed for acoustic phonetic studies of tone is via so-called 'raw' (individual or averaged) F_0 values (or else semi-tones, an octave-based derivative of F_0), usually represented with pitch-trace graphics (e.g. Fromkin ed. 1978 for a general overview; Watters 1999, 2002, 2003, Chelliah 1997, and Coupe 2007 for applications with Tibeto-Burman languages, Michaud and Mazaudon 2006 for Sino-Tibetan and Mon-Khmer comparison, Riad and Gussenhoven eds. 2007 for crosslinguistic approaches). The use of raw F_0 values allows for an acoustic-phonetic snapshot of pitch properties, giving a nice overview of the difference between relative tonal heights and level-contour distinctions, for example.

However, it has also been shown that normalized data representations are methodologically superior, as the transformation minimizes idiolectal skewing tendencies, thereby illuminating the 'real' acoustic patterns for the language (or dialect) as a whole (Earle, 1975). In comparison to tonal portraits with raw F_0 data, normalized data frequently portray more robust and more neatly delimited tone category separation within and across groups of speakers. Normalization procedures have been successfully used in the description of the pitch-acoustics for Sinitic languages like Wu Chinese, Shanghai Chinese and Hong Kong Cantonese (Rose 1987; 1993; Li et al 2004) and also for Vietnamese (Honda 2006), for example. Such procedures have also been used for cross-dialectal tonal

comparison (e.g. Rose 2006). In addition, Bauer et al (2003) have used normalization procedures in their description of high-tone merger for some speakers of the Hong-Kong Cantonese dialect.

This study reports on the acoustic-phonetic properties of the four-way lexical tone system in the Manange language.[1] In particular, it is a case study of the F_0 patterning of lexical tone using parallel data from a sample of nine native speakers, with an eye to how impressionistic observations of both averaged values as well as normalized values accurately represent the auditory properties and potential for within- and cross-speaker tonal variation. While tonal distinctions are perceptually salient for all Manange speakers surveyed, there have been some marked changes to the F_0 properties for certain speakers. In particular, there is an apparent merger to the lower two of the four tones. The details of this apparent low-tone merger vary somewhat from speaker to speaker, but the merger itself may be predicted via a modified social network strength approach, modeled loosely on work by L. Milroy (1987).

Also included in this analysis is commentary on methodological issues associated with analysing cross-speaker tone properties based primarily on an impressionistic

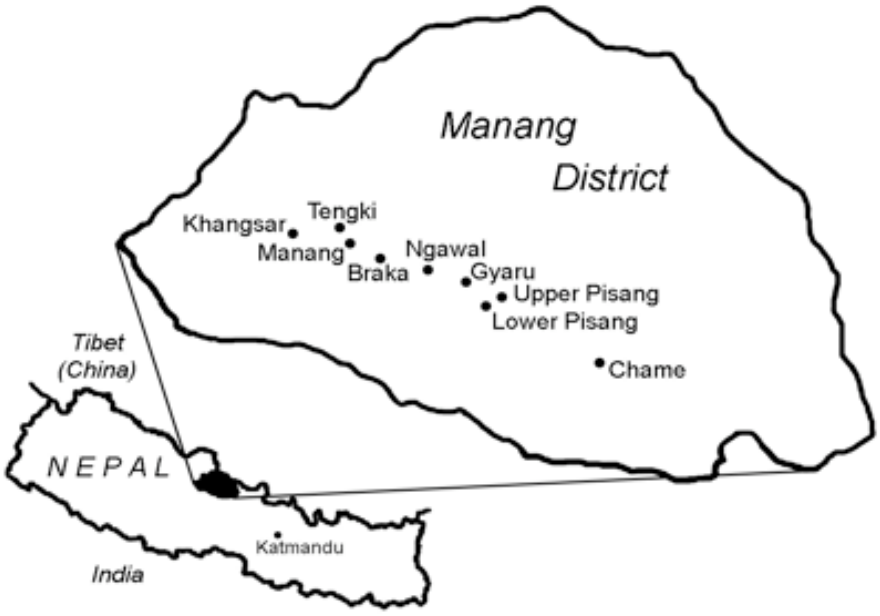
[1] I am grateful to the Manange speech community for their continued willingness to work with me as I study their language, in particular: Cheta Gurung, Chongta Gurung, Chimi Yance Gurung, Eden Gurung, Kanca Gurung, Kunjung Gurung, Maya Gurung, Ongma Gurung and Sangita Gurung. I am also grateful to Ritar Lhakpa Lama for ongoing assistance with data collection. I wish to thank Phil Rose and Martin Barry for discussions on issues of F_0 normalization. All errors are my own.

observation of normalized values. In a situation like this, even normalization, a methodologically superior approach under most circumstances, hides some potentially interesting catalysts for tone change. The details of this merger are better appreciated via Analysis of Variance (ANOVA) procedures.

3. Language Background and Auditory Dimensions of Tone

Manange is a Sino-Tibetan language (sub-family: Tibeto-Burman, sub-group: Bodish lower-level grouping: Tamangic) spoken by members of a single ethnic group of between 3,000 and 5,000 people, and is located in the Manang district of northern Nepal, where it is one of the dominant ethno-linguistic groups.[2]

Map 1. Location of Manange-Speaking Villages[3]



[2] Manange, is also known by its endonyms: *ŋjeshaŋ*, *ŋjeshaŋte*, or *ŋjaŋmi* 'our language/our people,'. Alternative spellings in Cooke (1985 a, b, c) and in van Spengen (1987) include *Nyisang* and *Nyishang*, *Nyishangba*, respectively.

[3] Map courtesy of Joshua Wilbur

Manange can currently be considered as a small but relatively viable language, with some prospect for endangerment (using Kincade's 1991 terminology). Although the speaker population is under 5,000, there is continued transmission of Manange to younger generations, despite the emigration of some speakers from Manang to Kathmandu generations ago. Factors contributing to an observed small-scale shift away from Manange include increased access to formal education in Nepali (Indo-European, the national language of Nepal), as well as the general prestige of Nepali in terms of socio-economic advancement of Mananges who are born and raised in Kathmandu. Factors contributing to retention of Manange include positive within-ethnic group identity and various prestige factors, including the comparative wealth and social status that Mananges have accrued as entrepreneurs (cf. Hildebrandt 2003; Rogers 2004 for reports on Manange ethnic group history and self-identification).

Of relevance to this study is the fact that Manange is an isolating tone language and lacks phonemic voicing opposition for obstruent consonants in onset position (i.e. all onset obstruents are either voiceless or voiceless aspirated).[4] Additionally, the language is similar to the other Bodish languages in that it displays a system of four "word-tones" (Mazaudon 1978; 1988; Hildebrandt 2003; 2004; 2005). The domain of a tone melody is the phonological word, including all (morphologically) bound inflectional or derivational

[4] Nepali is non-tonal, with a four-way obstruent voicing opposition: e.g. /b, b^h, p, p^h/ (Acharya 1991).

morphemes, and the same number of tones that are found on monomorphemic lexical root words are also found on (and are spread across) polysyllabic and polymorphemic stem words.[5] The four phonemic tones are primarily identified by their distinctive pitch contrasts and secondarily by aspiration contrasts for initial stop or affricate consonants.

Table 1 outlines the relevant phonetic characteristics for each tone in monosyllabic words, including Chao Yuen-ren's numeric auditory pitch descriptions and Voice Onset Time properties for initial consonants, when applicable (Hildebrandt 2003: 15).

Table 1. Auditory Properties of Four Manange Tones

Tone	Chao	Auditory Properties	Onset Consonant Properties
/1/	22	Low & Level	Not Applicable
/2/	44	High & Level	Not Applicable
/3/	52	High & Falling	If initial C is [+obstruent], unaspirated
/4/	42/32	Mid & Falling	If initial C is [+obstruent], aspirated

Of special interest is the consonant Voice Onset Time (V.O.T.) (aspiration) properties of obstruent-initial words found in tones /3/ and /4/. Table 2 provides representative near-minimal sets for obstruent-initial and sonorant-initial words belonging to

[5] As such, tone in Manange and in other Tamangic Tibeto-Burman languages is different from a system of pitch-accent, whereby the distinctive pitch features are linked to the stress-prominent syllable in a word. While uncommon, Tibeto-Burman languages with pitch-accent are attested, e.g. Prinmi (Ding 2001).

each of the four tones (Hildebrandt 2003: 15-16). Segments marked with an asterisk (*) at judged impossible in the respective tone groups.

Table 2. Near-Minimal Sets, Manange Tones

Tone	Obstruent-Initial	Sonorant-Initial
/1/	*pĩ* 'give', *p^{h}i* 'late'	*ŋĩ* 'old objects'
/2/	*pi* 'release', *p^{h}i* 'peel'	*ŋi* 'seven'
/3/	*pi* 'say' (**p^{h}*)	*ŋĩ* 'frightening'
/4/	*p^{h}Ii* 'four' (**p*)	*ŋi* 'two'

It should be noted that aspirated obstruent initial words are *not* observed for tone /3/, and unaspirated obstruent initial words are also *not* observed for tone /4/, a fact attributed to diachronic particularities in Manange and related languages (cf. Mazaudon 1978; 1988), and a point returned to in the final section. These words also illustrate that because sonorant-initial words are found in all four tones without phonation distinctions, the two contour tones /3/ and /4/ are contrastive tonemes, and not allotones conditioned by onset aspiration.

Most of what is currently known about tone in Tamangic languages is based largely on auditory descriptions largely informed by tonogenetic comparative-reconstruction literature (cf. Mazaudon 1977; 1978; Matisoff 1999), with a very small amount of acoustic-phonetic data available in scattered locations on only some languages (cf. Hildebrandt 2003

and 2005 for Manange; Michaud and Mazaudon 2006 for an acoustic comparison of Tamang tones with those in Naxi and Vietnamese). A reliance on auditory phonetic accounts alone has some shortcomings: these descriptions may be good for tonological comparison across languages in a very general sense, and they are appropriate for reconstruction and lexicostatistical purpose. However, they contribute less towards a deeper understanding of idiolectal, cross-speaker (within variety) and potential cross-variety variation within mutually intelligible systems as a whole. The rest of this study proposes to contribute to a better understanding of the acoustic nature of tone in Manange, including those sub-phonemic factors contributing to both cross-speaker variation and the potential rise of a prosodically different system.

4. Methods

The data for this study come from nine native speakers, all between the ages of 20-35 years at the time of the study, and all data were recorded in either Kathmandu or in the Manang District.[6] The recording equipment used was a Sony Walkman Professional analogue tape recorder and an Audio Technica headset microphone, in order to control for intervening amplitude variation or ambient noise interference. In the analogue-to-digital conversion, a

[6] It is acknowledged that nine speakers (including a single male speaker), and keeping age at a constant, may not constitute a representative sample based on the larger Manange-speaking population. However, given that the language community is itself quite small (fewer than 5,000 speakers total), and that access to and recording work with speakers in the rural Manang villages is not a simple task, the findings here still represent an important initial step in a consideration of the acoustics of tone and its variation.

sampling rate of 22,050 Hz. (16 bit sample size and monophonic audio channel) was used. In the original study, a total of 200 same words, controlled for onset manner and place, vowel quality, syllable structure and lexical category, were recorded from each speaker. However, in this study that original list has been narrowed to approximately 139 words divided amongst the four tones, which are either monosyllabic monomorphemic items (e.g. nouns, pronouns, numerals), or else verb stems plus a citation nominalizer suffix (e.g. *[4]nu-pʌ* 'sleep-NOM 'to sleep').[7]

Each word was elicited in two contexts: in isolation and in a clause-medial context, which is shown in example 1.

1. Frame-Medial Utterance of Target Word[8]

[1]ŋʌ = tse	[2]tʌ	[3]pi-tsi
1.SG = ERG	'horse'	say-PERF

'I said HORSE.'

This clause type was chosen because it was acceptable for words from all lexical classes. Note that word ordering in Manange is verb-final, so the target word always occurs clause-

[7] Due to occasional gaps, the dataset for speaker 5 is 132 words and for speaker 9 is 131 words. The breakdown of word-counts by tone is approximately: /1/ 45; /2/ 39; /3/ 29; /4/ 27. Overall, this slight skew reflects that across the lexicon there are more exemplars from tones /1/ and /2/ than from the other tones. This asymmetry has been noted for another Tamangic language (Risiangku Tamang) too (Mazaudon 1973).

[8] ABBREVIATIONS: 1.SG = first person singular pronoun; ERG = ergative clitic; PERF = perfective aspect suffix; superscript numerals indicate tone category affiliation. Manange is a wholly oral language, and there is no working orthography or script recognized or used by the language community. As such, all data collection occurred in elicitation-interview type settings where the intended meaning was requested in Nepali, and the answers provided in Manange.

medially (and therefore context-medially). Each word was elicited in both contexts three times, for a total of six utterances of the target word. For this study, only the medial instance of words taken from the clause-medial frame are used in the measurements and statistics.

All words were subject to acoustic analysis in either PC Quirer or Praat software, and for each word, F_0 measurements were taken at either three or six points in the duration of the word. For monomorphemic stems, these measurements were taken at the beginning of the vowel (with a buffer of 10 milliseconds from the edge of the onset), the mid-point, and the end-point of the vowel (again, with a buffer of 10 milliseconds from the ending edge of the nucleus). For bi-morphemic (bisyllabic) stems, these measurements were taken at the starting, mid-point and end-points of the stem vowel, plus again (using the same buffers) for the suffix vowel.[9]

It should be noted that as Manange has a word-tone system, one methodological problem with lumping nouns and verbs together into a single analysis is that the contour tones (/3/ and /4/) may show some skewing at the so-called "mid-point" on monosyllabic monomorphemic words in comparison to bi-morphemic bisyllabics. This is because the

---

[9] Rose (1987: 347) notes that special care must be taken to control for potential vowel durational differences when using randomization procedures. Manange does not have contrastive vowel length, and for all speakers, vowels in open syllables are somewhat longer than for closed syllables. These differences were controlled for manually by taking three measurement points from each morpheme/syllable in equidistant fashion from beginning, mid-point and end-points of the syllable nuclei.

"mid-point" measurement (point 3) on verbs is actually the "end-point" measurement on nouns. For this reason, it is acknowledged that statistical results for the point 3(mid-point) measurement are particularly susceptible to some skewing. An alternative would be to treat nouns and verbs separately; however, this would result in a rather low sample of words from which to draw generalizations, or else would necessitate a very lengthy treatment of separate lexical classes. At this point then, the classes are treated together.

All normalization and statistical procedures were done with R software. The normalization procedure used in R is similar to that advocated by Rose (1987): For each speaker, the normalized value is derived via the following calculation: $F_{0NORM} = (F_{0i} - F_{0\mu})/F_{0\sigma}$ (i.e. the individual F_0 value minus the sample average, divided by the sample standard deviation).[10] Since the data for this study were not randomly sampled and since the sample sizes are rather small, all statistical differences based on ANOVA procedures were assessed by permutation methods (cf. Janssen et al 2006 for discussion on application in linguistic studies), with all approximation based on 10,000 random permutations. In every case, the randomizations indicated certainty of significance, regardless of permutations, at or below the .05 level.

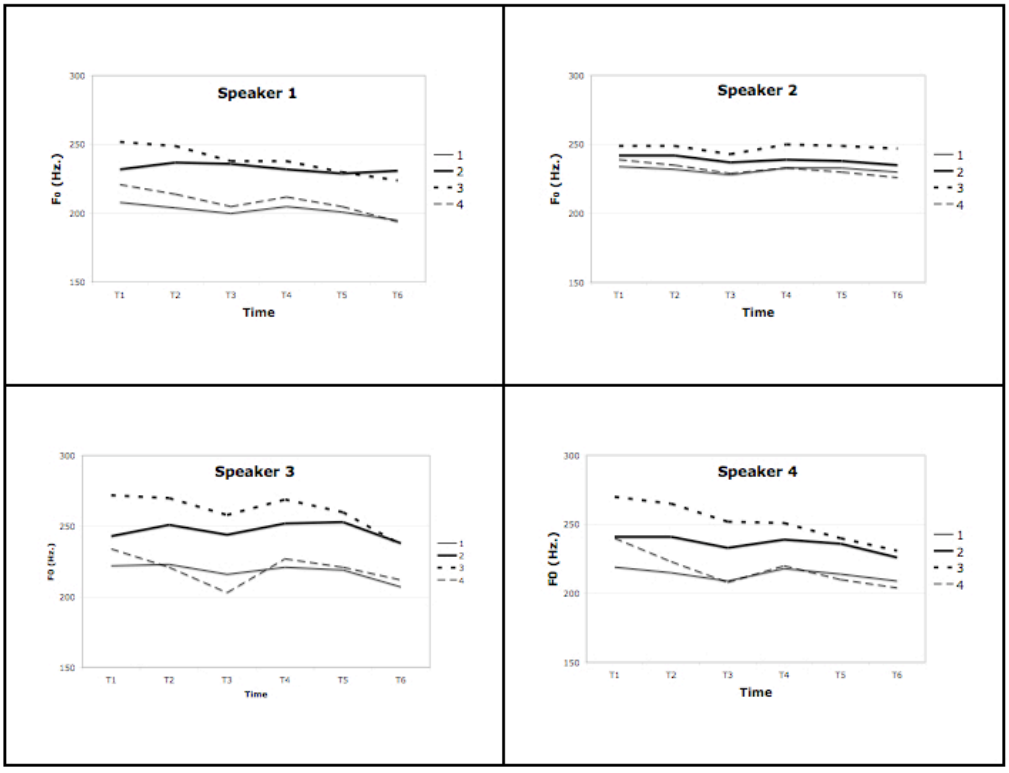
---

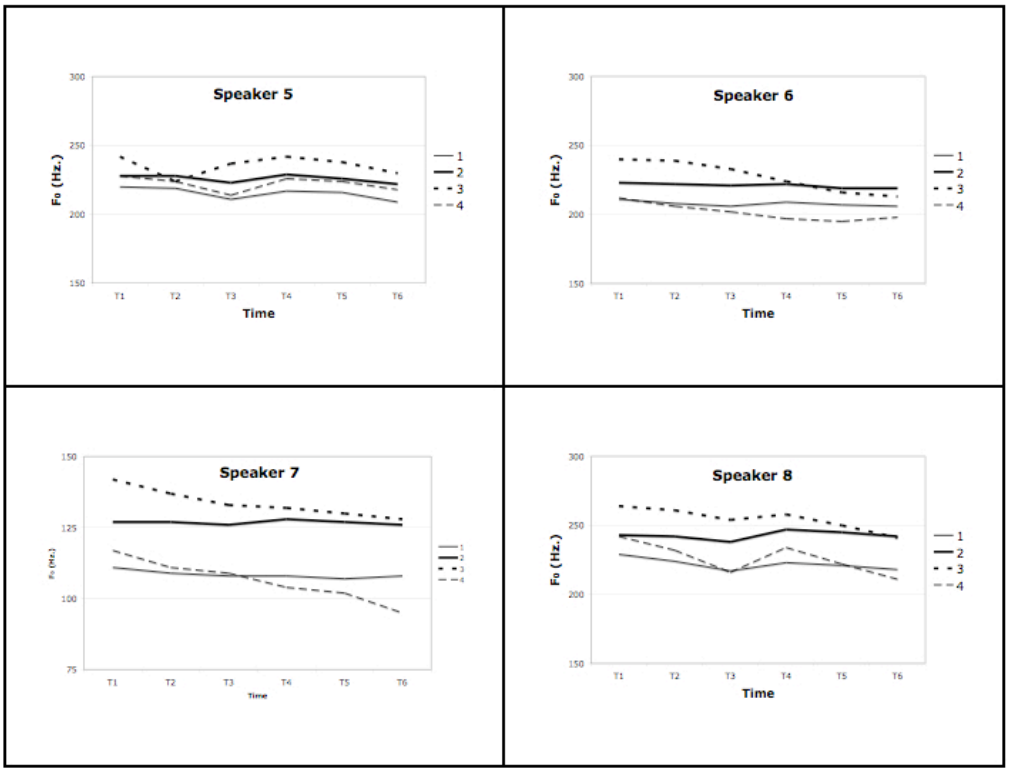
[10] It should be noted that these z-scores are not derived by the true population mean (i.e. all speakers in this study), as is standard practice. This is for a couple of reasons. First, as this is essentially the only acoustic analysis of Manange tone in any detail, an assumption of speaker-population homogeneity cannot (yet) be safely made. Second, the difference between the raw F_0 values for speakers like 1 and 2, for example, suggest that a more conservative normalization approach should be used until the acoustic profiles for different speakers are better understood. In particular, potential gender-based F_0 differences would be grounds for a modified population-based approach.

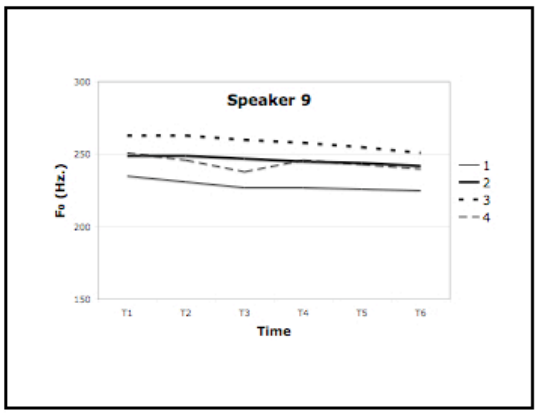
5. Acoustic Properties: A Visual Perspective

The raw and averaged F_0 patterns are presented in Figure 1, with F_0 traces across the six measurement points (T1 through T6) for each of the four tones for the nine speakers surveyed. Note that speaker 7 is male, while the rest are female. Note also that all pitch plots have a F_0 range on the Y-axis of 150 Hz. minimum-maximum difference.

Figure 1. Average F_0 Characteristics of Four Tones, Nine Speakers





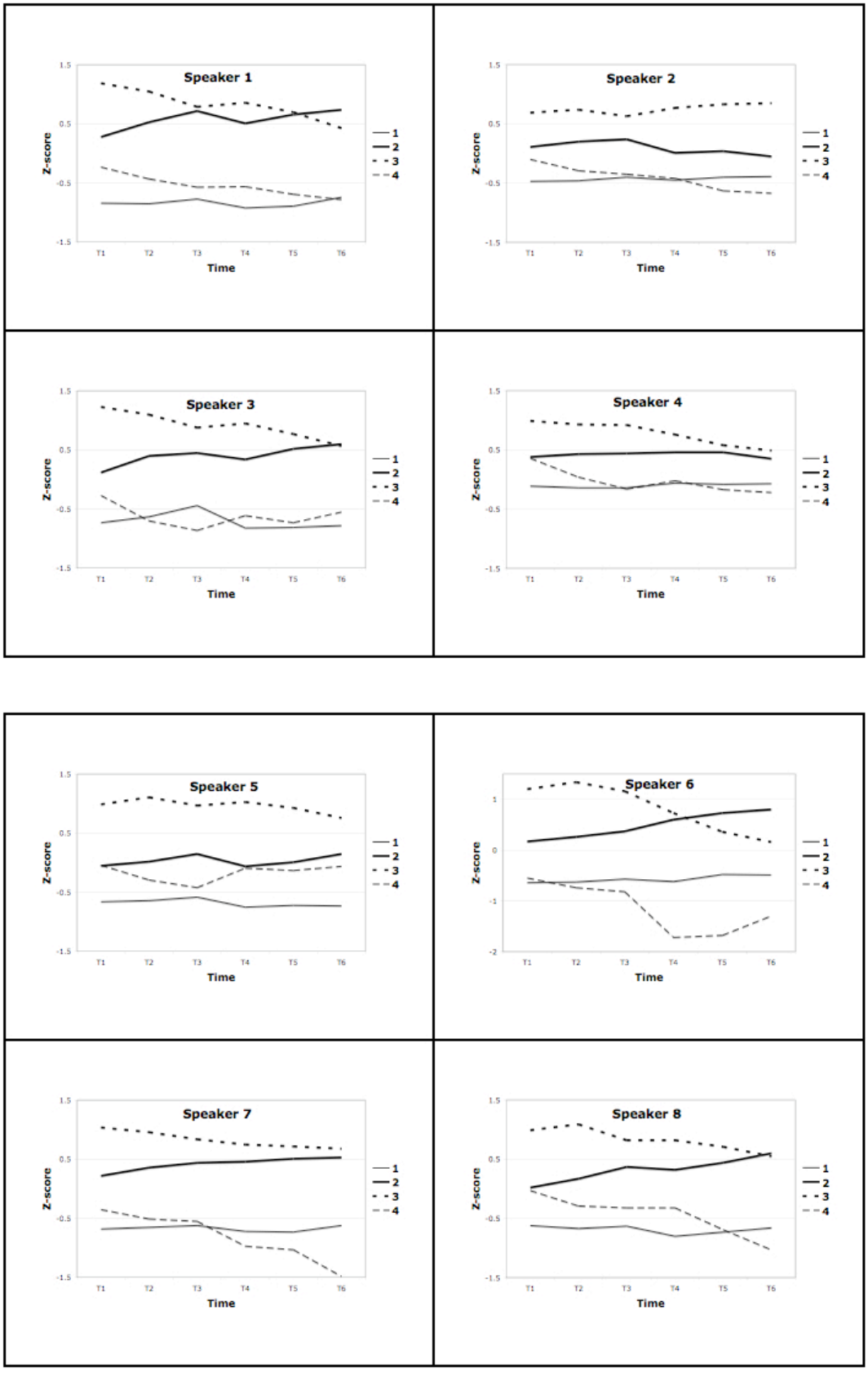


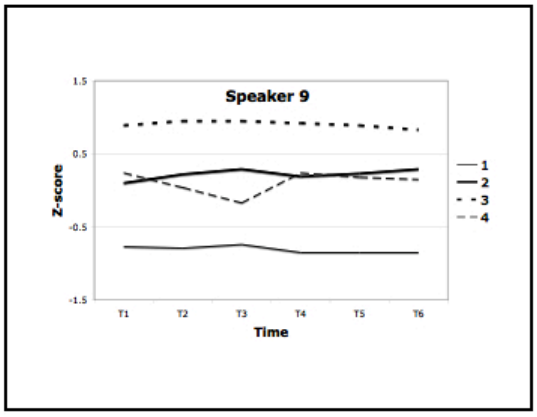
It should be noted that at this point, other than a 10 ms. buffer away from the nucleus edges, the means do not represent a special control for intrinsic segmental effects. Hildebrandt (2003) shows that overall, intrinsic pitch interactions are not significant enough to skew the overall properties significantly for any speakers in this survey.

The pitch traces in Figure 1 show considerable variation across speakers, with some traces showing the distinct high- vs. low-level and high- vs. low-falling trends that characterize Manange tone auditorily (e.g. Speakers 1, 3 and 4). For other speakers, there is something approximating a two-way split (e.g. Speakers 2 and 5). For still other speakers, some tones are acoustically distinct, but lack a level vs. falling distinction (e.g. Speakers 6, 7, 8 and 9).

With normalization procedures applied, the system appears clearer (visually) for more speakers, as shown with a plotting of the average z-score values across the six measurement points (T1-T6) in Figure 2. In all cases except for Speaker 6, the Y-axis is between 1.5 and -1.5 deviations from the mean.

Figure 2. Average Z-Score Transformations, 9 Speakers





The normalized pitch traces in Figure 2 show much more tone category separation. For speakers 1, 3, 4 and 8, there is greater overall separation, particularly at the starting measurement points. For Speakers 2 and 5 there is considerable overlap for tones /2/ and /4/ (and /1/ and /4/ for speaker 5). For speakers 6 and 7 there is overlap at the starting points of tones /1/ and /4/ in particular. Speaker 9's data shows a greater overlap for tones /2/ and /4/.

6. Analysis of Variance (ANOVA) Procedure

However, even with a z-score transformation, the visual information in Figures 1 and 2 can be potentially misleading. The question still exists as to what degree the tone categories (whether represented by raw or normalized F_0 values) are themselves significantly distinct. In other words, the question remains: Despite a visual cue to category separation, are the measurements behind the visuals robust enough to warrant a four-way distinction phonetically?

An ANOVA procedure employs several measures of variability among sample means from different categories (in this case, the categories being the four tones). If the variance is small enough for each category, and if the means for the categories are different enough, an ANOVA procedure will reaffirm (or statistically support) the category separations. A post-ANOVA pairwise comparison also allows for inspection of individual tone-group pairings. The result of an ANOVA done on the z-score values, shown via a combination of means plots for each tone at each measurement point, T1 through T6 (including the p-value summary for between-groups effect at each point), and also a post-ANOVA Tukey HSD pairwise comparison (on the bottom half) is shown for Speakers 1, 3 and 4 in Figures 3 through 5 (with a p value below .05 indicating significance).

Figure 3. Means Plots & Post-ANOVA Tukey HSD Pairwise Comparison, Speaker 1

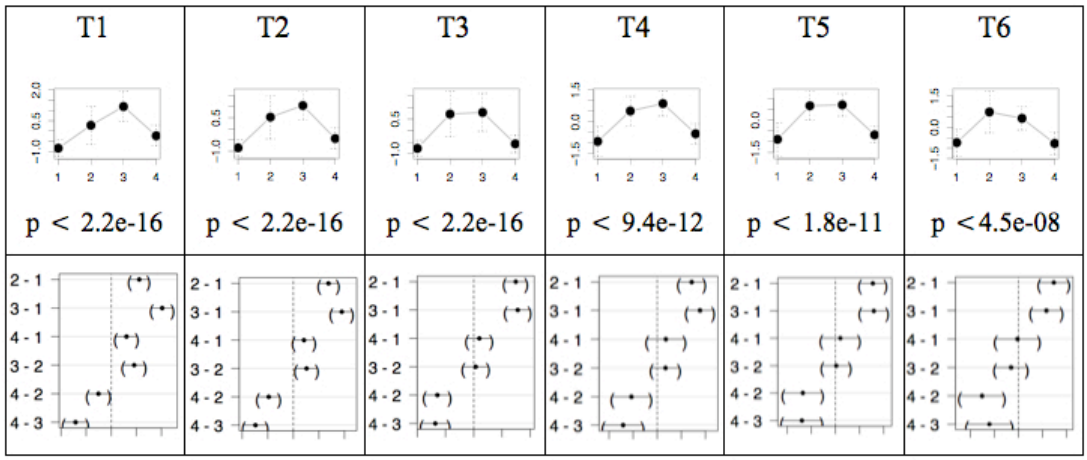


Figure 4. Means Plots & Post-ANOVA Tukey HSD Pairwise Comparison, Speaker 3

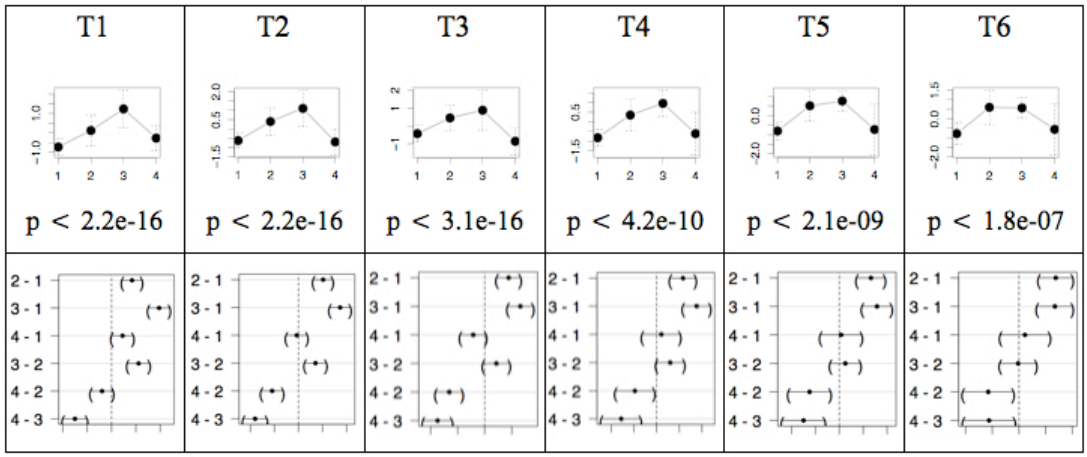
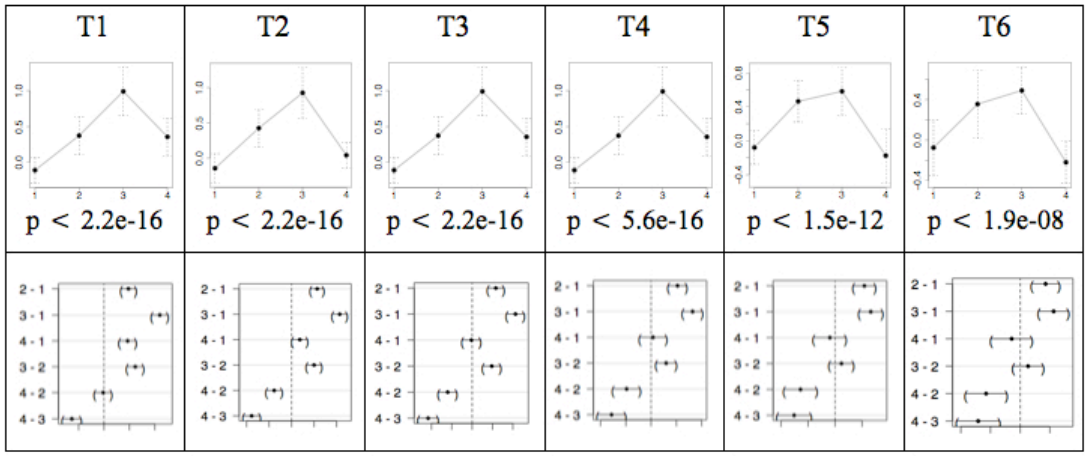


Figure 5. Means Plots & Post-ANOVA Tukey HSD Pairwise Comparison, Speaker 4



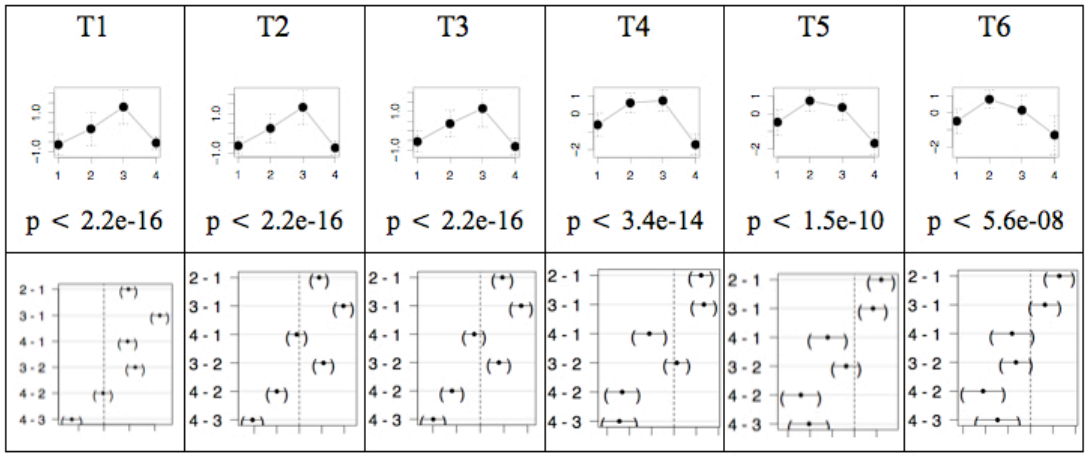
The ANOVAs and associated visuals in Figures 3 through 5 indicate that the variability across the four tones in comparison with the variance of individual values for tokens from each tone is enough to reject the null hypothesis, but that the Tukey's HSD pairwise analysis shows some propensity for overlap for certain tones at specific points (specifically in cases where the upper and lower variance ranges cross the 0-intercept axis).[11] This

[11] One gap in this format of data-presentation is that there is still a lack of a truly quantified way of discriminating any one tone from any other in a positive and absolute sense (i.e. there is no way to say that

mainly occurs at later measurement points in the TBU for all three speakers, especially as the trajectories of the contour tones (/3/ and /4/) cross into the acoustic space of the level tones (/1/ and /2/). For these three speakers, the acoustic details are in line with the auditory properties of Manange tone as it has been described in all accounts.

A somewhat different scenario emerges with the results for four other speakers in this sample. These ANOVAs are replicated for speakers 6 through 9 in Figures 6 through 9, respectively.

Figure 6. Means Plots & Post-ANOVA Tukey HSD Pairwise Comparison, Speaker 6



tone /1/ differs from tone /3/ by *"n"* sum-total standard deviations, for example). At this time, the main observational goal is to survey the ways that the tones are significantly distinct from each other (or not) at different measurement points on the TBU, and to consider such differences in light of possible sociolinguistic factors. For now, an overall picture of absolute tonal distinctions remains available through only a visual perspective, e.g. Figures 1 and 2.

Figure 7. Means Plots & Post-ANOVA Tukey HSD Pairwise Comparison, Speaker 7

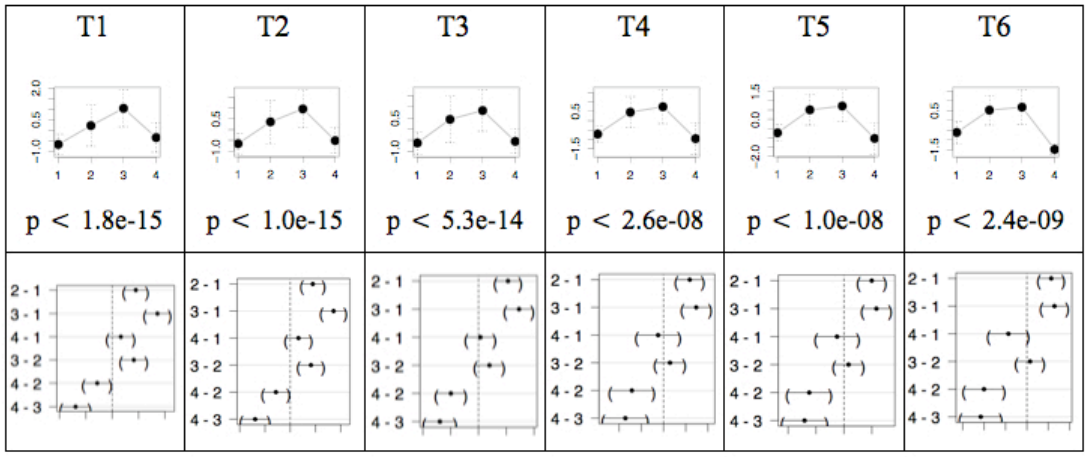


Figure 8. Means Plots & Post-ANOVA Tukey HSD Pairwise Comparison, Speaker 8

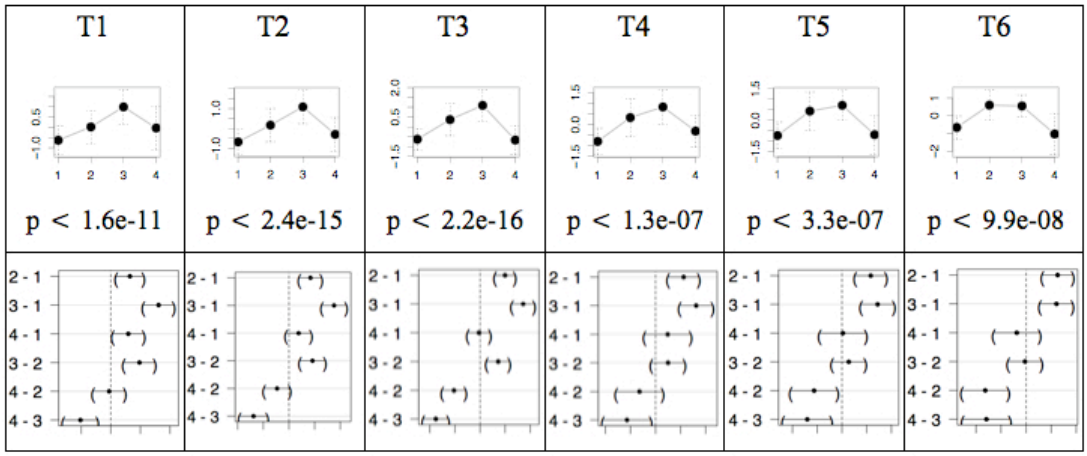
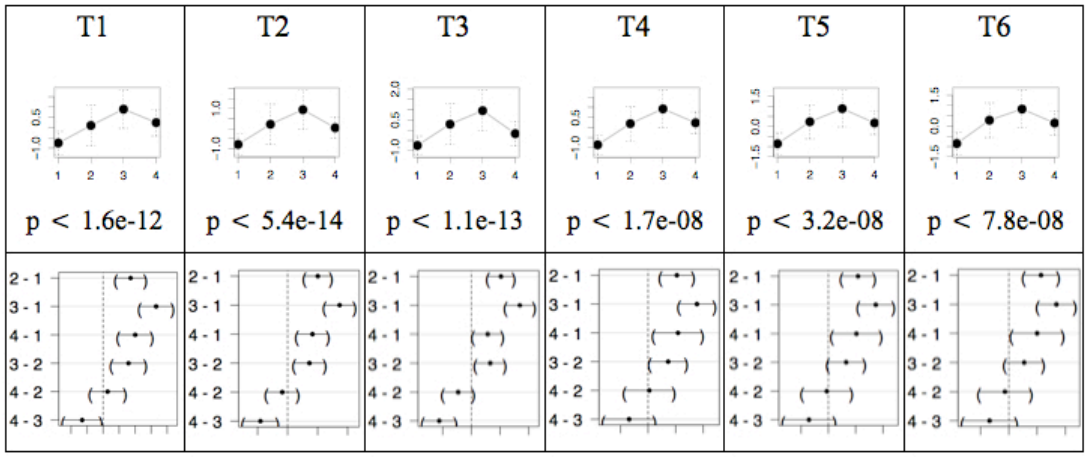


Figure 9. Means Plots & Post-ANOVA Tukey HSD Pairwise Comparison, Speaker 9



These procedures reveal an acoustic merger from a four-way system into a three-way system. For three of these four speakers (6, 7 and 8), the following generalization is schematicized in Figure 10.

Figure 10. Merger for Speakers 6 through 8

Tones	Speakers 1, 3, 4	Speakers 6-8
/2/	High Level	"High"
/3/	High Falling	"High Falling"
/1/	Low Level	"Low"
/4/	Mid-High Falling	

For speaker 9, the merger is not between tones /1/ and /4/, but rather between tones /2/ and /4/, with the other tones remaining significantly distinct at most measurement points. Some comment on speaker 9's patterns is provided in section 9.

For the remaining two speakers in this sample, speakers 2 and 5, the ANOVA results and accompanying visuals are shown in Figures 11 and 12.

Figure 11. Means Plots & Post-ANOVA Tukey HSD Pairwise Comparison, Speaker 2

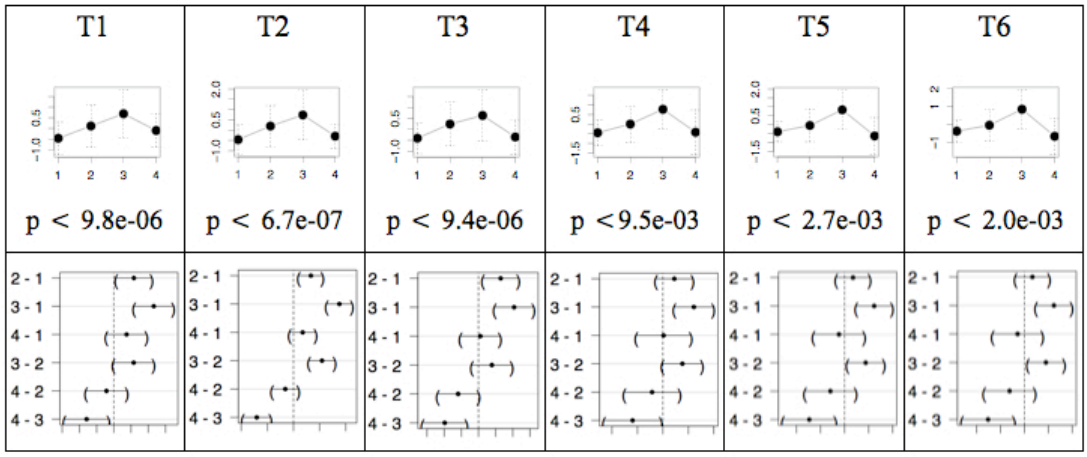
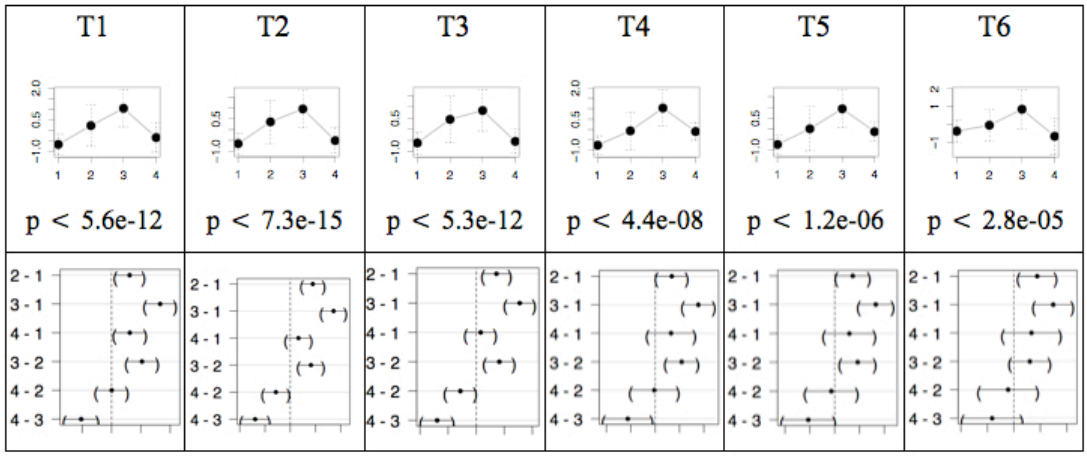


Figure 12. Means Plots & Post-ANOVA Tukey HSD Pairwise Comparison, Speaker 5



Figures 11 and 12 show that despite the overall significant category separation, there is a more profound collapse of categories, especially for speaker 2, where it is more difficult to establish whether or not any of the tones are ever significantly distinct acoustically in a pairwise comparison, with the exception of tones /1/ and /2/ at the starting three points. Speaker 5 shows more category separation, with evidence of a so-called ‘lower’ tone

grouping vs. a high-falling grouping. The details of this merger for these speakers is schematicized in Figure 13.

Figure 13. Merger for Speakers 5 and 6

Tones	Speakers 1, 3, 4	Speakers 2, 5
/1/	Low Level	"Low"
/2/	High Level	
/4/	Mid-High Falling	
/3/	High Falling	"High"

7. Discussion

Clearly the ANOVAs suggest some degree of acoustic category merger, although the details of are variable across even this small sample of nine speakers. For some speakers, the merger is partial and invariably involves some "lower" grouping vs. a "mid" and a high and falling grouping. For other speakers, there is marginally an acoustic low-high opposition.

One question to be addressed at this point is whether or not it is realistic to assume that speakers like 2 and 5 even operate with a tonal representation like anything described in Table 1. At this point, only qualitative observations are available as a response. Hildebrandt (2003: 172-173) notes that some urban-located Manange speakers evidence a more fuzzy conceptualization of the four-way system that is conceptually intact for urban-located speakers. Despite this fuzzy categorization however, even speakers 2 and 5, who

show more drastic phonetic collapse of tone groups still recognize and produce many different instances of tonal minimal pairs and sets illustrating a four-way difference in many cases. With urban-based speakers like 2 and 5, and with other speakers, it is still easy to identify tonal minimal pairs and sets. At any rate, the data from speakers 2 and 5 represent a more overwhelming acoustic F_0 merger, and as such, cases like this warrant special focus, as the rate at which both production and perception of tone may be changing in Manange is of potentially great importance to larger questions in areas of sound change in-progress.

Assuming that all Manange speakers still operate with an extant conceptualization of four contrastive tones, at least for most of the lexicon, another question is why this type of change, in particular for speakers who show only a partial merger (e.g. speakers 6 through 8). This question can be dealt with on both a level that considers the effects of Nepali-Manange language contact along with a variety of social factors, as well as factors inherent to the tone system itself.

8. Sociolinguistic Dimensions of the Merger

Looking to the speakers who show a phonetic merger, from a contact and usage perspective, one hypothesis is that this change is hastened in particular for those Manange speakers who have lived in Manange-Nepali bilingual environments, with more restricted lifelong access to Manange and more regular access to Nepali from an early age. In a general sense, this would be viewed as a kind of contact-induced tone change-in progress, with a prediction

that the changes (at an acoustic phonetic level) are affecting some Manange speakers before others. In other domains of Manange grammar, contact-effects have been noticed, including changes to word-order strategies based on analogy with ordering in Nepali, clause-combining strategies modeled on Nepali, and an increase in both open- and closed-class loanwords from Nepali (Hildebrandt 2007).[12] The loss, leveling or merger of tones in settings of language contact have been similarly reported for Wutun Chinese-Tibetan contact (Li 1983; 1986), for varieties of Chinese in contact (Lien 1986; Edmonson 2001) and also for Ma'a, a Cushitic language in contact with Bantu (Thomason 2001).

However, the details of the sociolinguistic environment in which contact-induced language change in languages like these are only more rarely explored. The situations and contexts in which Manange and Nepali are used by these speakers is actually rather complex, and it would be misleading to assume that language use amongst Manange people is as simple as a "Manange-vs.-Nepali" scenario. All Mananges are at least marginally bilingual in Nepali (in addition to fluency in other Bodish languages), but the cultivation and continuity of Manange ethnic identity is continually reinforced via close family connections, the group's economic wealth through the trade and tourist industries, a

[12] It is interesting to note that other than these changes to the tone system across speakers, the segmental system of Manange is largely intact, even for those speakers with more lifelong restricted access to the language. As such, whatever contact-influence that can be attributed to these changes, the segmental properties have been largely immune to them, contra Chambers (1997), for example.

relatively prestigious representation in social and political arenas, and the regular celebration of their rich heritage.

Despite these factors weighing in favor of the continued preservation and transmission of Manange, and due in part to the more recent temporary and long-term relocation of Manange families to Kathmandu, the situations in which Manange is used vs. Nepali (and with whom) have become more complex and multilayered, and more skewed towards Nepali, for some speakers than for others. As such, it becomes instructive to further explore these scenarios of Manange practice vis-à-vis Nepali for different speakers surveyed here.

The concept of *community of practice* has been successfully invoked as social factor that corresponds with the details of linguistic variation. It may be defined here a "collection of individuals negotiating and learning practices that contribute to a satisfaction of a common goal (Meyerhoff 2002: 530)." In this case, at least one vehicle of such a practice would be language, i.e. the continued practice of Manange in order to reaffirm the vitality of this ethnic group. In this case, such a concept would feasibly apply to *all* Manange members at some level, not just to components of the group where more extreme contact effects are observable. Regardless of degree of Manange and/or Nepali use, all Mananges positively evidence language practices which purposely reinforce their ethnic group cohesion and vitality.

A closer look at the specific domains in which Manange (or Nepali) is practiced (including with whom and for which types of communicative goals) may shed more light on the dynamics of structural variation and change. Social networks are considered as a way to capture the dynamics underlying speakers' interactional behavior as a fixed social category via an examination of the accumulation of different relationships contracted and undertaken with others (L. Milroy 1987; J. Milroy 1992; Eckert 2000; L. Milroy 2005). The dimensions of these relationship types can vary widely, but are usually grouped roughly into situations that are more intimate/domestic versus those that are more public, even though they occur at regular intervals.

In this case, the question is what types of interactional networks the Manange speakers considered in this survey participate in, and how these network types may correlate with increased phonetic tonal variation. In companion with the acoustic data collection, Hildebrandt (2003) undertook questionnaire-based interviews with all speakers at the time of the survey in order to ascertain a number of language usage-related information types, including:

- Location of birth and long-term residence
- Languages used with immediate family members, friends, and language choice on a daily basis in both private (domestic) and public domains
- Linguistic background of parents and spouse (if relevant)

- Degree (if any) of formal education and in which language(s)
- Self-reported attitudes towards Manange transmission and domains of use within the Manange community
- Self-reported attitudes towards Nepali transmission and domains of use within the Manange community

The results of these interviews have been converted into a modified *Network Strength Scale* (based loosely on L. Milroy 1987), with the following four descriptive characteristics receiving a score of 3 ("strongly Manange-oriented"), 2 ("mixed Manange-Nepali-oriented") or 1 ("strongly Nepali-oriented"), tallied in Table 3:

1. The speaker was born and raised in Manang, where Manange is the local lingua franca and dominant regional vehicle of everyday communication in most contexts
2. The speaker voluntarily engages and associates with other Manange speakers in leisure and domestic (private) environments (i.e. the nature of the local or "exchange network" of the speaker e.g. Milardo 1988)
3. The speaker's workplace is Manange-owned and occupied, and main clientele are Manange speaking individuals (i.e. the nature of the more extended "interactive network" of the speaker)
4. The speaker shows evidence of *voluntary* involvement in communicative situations where Manange is likely to be spoken (meant to capture one dimension of the

community of practice of Mananges, in particular the degree of formal education in Nepali that speakers may have received. This application is inspired by Eckert (2000), where the community of practice is a related concept to social network, especially via the identification of specific and conscious sites of interaction where social meaning may be linguistically indexed)

Table 3. Speaker Scores, Modified Network Strength

Speaker	Born & Raised in Manang	Exchange Network	Interactive Network	Formal Education	Total	/1/ & /4/ Merged?
1	2	3	3	3	11	No
2	1	2	1	1	6	Yes
3	3	3	3	3	12	No
4	3	3	3	3	12	No
5	1	3	1	2	7	No
6	1	2	1	1	5	Yes
7	3	3	2	2	10	Yes
8	3	3	3	3	12	No
9	3	3	3	3	12	No

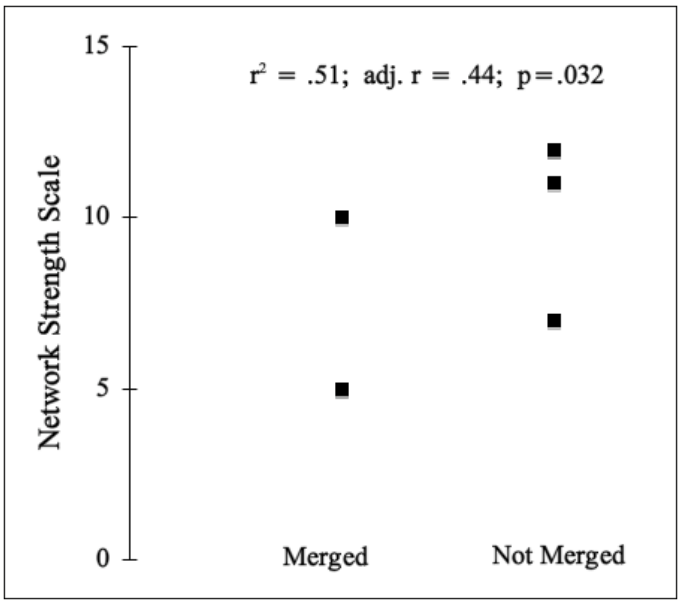
As indicated in Table 3, four of the nine speakers were either born and raised in Kathmandu. Speaker 1 receives a score of 2 for this dimension, as she moved to Kathmandu when she was a teenager and represents somewhat of a hybrid status in terms of location. In terms of "exchange network", which reflects communicative practices along more regular and intimate dimensions, speakers 1, 3, 4, 5, 8 and 9 self-report largely monolingual Manange use with both immediate and extended family members. Speakers 2 and 6 self-report some Nepali usage with siblings and some (younger) family members, and some Manange use with other relatives and close confidants. With respect to "interactive network", reflecting practices within frequent and long-term but non-domestic settings, speakers 1, 3, 4, 8 and 9 report a continuation of Manange use in work situations as well as in communication with other community members. In particular, speaker 1 owns and operates a Manange-style restaurant in Kathmandu. Speakers 3, 4, 8 and 9 all work in domestic and/or agricultural settings. Speakers 5 and 7 both work in more mixed language usage scenarios (import-export and trekking industries), and so report mixed language usage. Speakers 2 and 6 work or interact mainly in Nepali language scenarios (a Kathmandu Hotel and speaker 6 was a student at the time of the study, mainly hanging out with non-Manange classmates and friends after school). Along the lines of formal education, speakers 1, 3, 4, 8 and 9 have had very little or no formal education in their

lives; speakers 5 and 7 report some formal education, and speakers 2 and 6 have received education to college and/or university level.

For the moment, this scale will be applied to only one specific query, namely whether the speaker's modified social network score on this scale corresponds with the observed /1/-and-/4/ merger, which is variably attested across the speaker sample as a whole (the presence/lack of a merger is also indicated in the final column of Table 3). Given that these two tones, by definition (low level and mid falling), overlap in acoustic space, particularly at later points in the TBU, the presence or absence of a distinction will be determined in this case only at the *beginning* measurement point of the word (i.e. Time 1).

A linear regression procedure was performed in order to see if the presence of a merger corresponds with a lower overall score of Manange network strength (and vice-versa). The results, displayed via a scatter-plot, and including the r-squared, adjusted r-score and significance value are shown in Figure 4.

Figure 4. Regression: Adjusted Social Network-by-presence/absence of /1/, /4/ merger



The results indicate that with this small sample, there is a (weakly) significant correlation between the presencse/absence of a merger and the overall score on this adjusted Network Strength Scale. In other words, in this preliminary study, 44% of the absence or presence of a tone /1/ & /4/ merger can be explained by network strength scale. Specifically, speakers with scores indicating more intense domestic and workplace connections to Nepali, and who voluntarily engage in Nepali-speaking endeavors outside of home and work show more cases of a merger of tones /1/ and /4/ at the start of, and generally throughout the TBU. These findings indicate at least preliminarily that the degree (and possibly the rate) of this phonetic merger is hastened in an environment of more profound contact with Nepali, and open a path for future investigation of the relationship between factors such as social network and tonal variation across Manange speakers.

Interestingly, speaker 5 is the one speaker with a lower modified Network Strength score who also does *not* show a merger of tones /1/ and /4/ at the initial measurement point. However, for this speaker these tones do show significant overlap at other measurement points, and in fact, these tones also show significant overlap with tone /2/ at most measurement points in the TBU. Thus, even though her significance score stands separate in this specific query (and thereby result in a slightly weaker level of significance overall for this query), an argument could be made that she also belongs in the 'merger' grouping.

9. Phonological Dimension of the Merger

A question worthy of some discussion here is why it is tones /1/ and /4/ in particular that show this merger for most speakers (with the exception of speaker 9 who shows significant acoustic overlap for tones /2/ and /4/).

The majority of contemporary phonetic and phonological accounts of tone change focus on evidence and details behind *tonogenesis* (tone birth), in particular, examinations of cases of pitch-accent-to-tone (e.g. Silva 2006 on the emergence of tones in Seoul Korean) and acoustic, perceptual and phonological studies of the functional load of F_0 in incipiently tonal languages with (historically) phonation-prominent systems (cf. Andruski 2006 on Green Mong; Svantesson and House 2006 on Kammu; Duanmu 1992 on Lhasa Tibetan). Generally these studies report a correspondence between voiceless plain and aspirated onset consonants and a *high* tone emergence (cf. also Hyman and Schuh's tone raising scale 1974

where voiceless aspirated and then voiceless aspirated segments correspond with higher pitch, respectively). These findings are also apparently reaffirmed by studies of phonological loanword integration in tone languages where words with voiceless initials are reanalyzed in the borrowing language as *high*, and words with sonorant initials are reanalyzed as *low* (e.g. Hsieh and Kenstowicz's 2006/forthcoming study of Chinese and English loanwords into Lhasa Tibetan).

In the case of Manange, as with other Bodish Tibeto-Burman languages, the seemingly odd presence of aspirated initial words in *low* tones (e.g. /1/ and /4/) is due to particularities of tonogenesis in these languages. Martine Mazaudon (1977) reconstructs Proto-Tamangic as having two tones, *A and *B , with currently irretrievable pitch characteristics (169). Both of these proto-tones permitted voiced and voiceless initials (aspirated and unaspirated), as well as sonorant initials. Through time, the [+ voiced] feature of all obstruents in both of the proto-tones was lost, merging with the voiceless unaspirated initials. There was no merger for the *original* voiceless aspirated initials. Those words which were originally *voiceless unaspirated* retained a residual high pitch, while the words which were originally *voiced* retained a residual low pitch, but now had *voiceless aspirated* initials (a phenomenon seen in parallel tonogenetic situations in other families e.g. Svantesson and House 2006 for Kammu (Austro-Asiatic). The result in these languages today is a tone system comprised of two relatively higher and two relatively

lower tones, with one of the lower tones having only aspirated initials (if obstruent). This is the same situation as Manange tone /4/.

As such, modern Manange tone /4/ derives historically from a *low* tone, with aspiration in the modern system as a result of an intermediary process in Proto-tone *A, whereby a historical change like this occurred: *b > p^h > /˩p^h/. As a comparison, in Western Kammu, Svantesson and House report that voiced obstruent initials at the pre-tonal stage were reanalyzed as voiced aspirated (or murmured/breathy phonation). Later, the voicing of the initial consonant was lost (i.e. b > /p/), and the murmured phonation became realized as aspiration (i.e. /˩p^h/) (2006: 312). Thus, what modern /4/ and /1/ in Manange have in common is their *low* tone feature (in relation to tones /2/ and /3/).

Moving to a contemporary scenario, as noted by Hombert (1978: 104), if two tones are phonetically quite similar, under conditions favorable to change, they may move away or else they may merge. So here, it may be the low pitch shared by both tones which acts as a catalyst for this specific low tone merger. Thus, the unique properties that make up tone in Manange motivate a change with different resulting effects than observed in other cases of tone birth and change.[13]

---

[13] Once again, the aberrant /2/ and /4/ overlap for speaker 9 is something to be considered. One way of approaching her patterns is to consider whether the primacy of a "low" tone feature drives a lowering type of change (as with the other speakers in this survey) or whether the primary of (synchronic) onset aspiration in tone /4/ would drive a raising effect. As noted above, both types of phenomena have been observed, with the raising effect more commonly attested in modern cases of tonogenesis. This is a particularly interesting topic

A final issue worth brief exploration here is the motivation for a /1/ and /4/ merger, given that tone /1/ is low level and /4/ has a falling contour. The historical motivation for the contour-level distinctions in the Tamangic languages is still unclear and cannot be attributed to the effects of now-eroded final consonants, so unlike what has been observed in Lhasa Tibetan, as most Tamangic languages have retained their full array of final consonants (mainly final sonorants, but even in some cases final plosives) (Mazaudon 1977). As such, while a historical explanation is not available for the origin of the contour features in tones /3/ and /4/ at this time, it may simply be noted that in phonology and typology literature, contour tones are analyzed as more marked in comparison to level tones across languages, occurring less often and fewer in number than level tones, and subject to more prosodic domain-type restrictions (Yip 2002). For example, Gordon (2001) has noted that contour tones are frequently restricted to certain rhyme types (2001).

Turning to this study, in an environment of increased Nepali contact and asymmetrical Manange language usage and transmission, it may be a change towards the default or unmarked (level) feature that is favored in the context of these otherwise similar tone types.

---

in languages with relatively 'younger' tone systems, where the question of whether the functional load of onset consonant features vs. F_0 features on the nucleus has a greater impact on lexical discrimination, and then presumably, the direction of tone change. Such a question has been examined for dialects of Kammu, with mixed findings indicating that even in dialects with more advanced tonogenesis, where F_0 is more acoustically salient, speakers still seem to attune to both onset consonant V.O.T. properties as well as vowel pitch (Svantesson and House 2006: 327). At any rate, the patterns observed for speaker 9 indicate the ongoing need for a wider speaker survey combined with perception tests.

10. Conclusion

This study has provided a detailed acoustic portrait of tone in a language where the system has a number of interesting properties brought about by somewhat typologically and diachronically unique factors. Such studies of a system like this are still largely lacking in contemporary phonetic and phonological literature, and as such, the findings here add to our knowledge base of cross-linguistic tone properties and variation. This study has also served to survey the acoustic F_0 details across a range of speakers who have used Manange in different social contexts throughout their lives.

This study has also shown that despite category distinctiveness portrayed by z-score visualization, a process frequently advocated for acoustic studies of tone, z-score normalization must proceed with extreme caution in initial analyses, or in situations where the homogeneity of a speaker population cannot safely be assumed. In this case, z-scores are derived via individual sample members, and not by the pouplation. In addition, ANOVA procedures illuminate potentially profound and noteworthy variation, which may be indicative of a change-in-progress. In this case, a modified appeal to social networks captures some interesting facts about the sociolinguistic details and reasons behind this variation.

At this time, there is a continued need to gather acoustic data from more Manange speakers, including a more balanced gender representation, as well as from speakers of

different ages. There is also a need to match the production observations in this study with more systematic perception investigations. If such investigations reinforce the current observation that the production of Manange tone is changing (merging) at a faster rate than lexical (and category) discrimination, this makes for an extremely interesting case of sound-change-in-progress (cf. Labov 2006 for discussion on assumptions about production-perception mismatches in sound change scenarios). Such investigations may also reveal additional information on the phonological dimensions of Manange tone and its variation.

References

Acharya, Jayaraj (1991). *A Descriptive Grammar of Nepali and an Analyzed Corpus.* Washington, D.C.: Georgetown University Press.

Andruski, Jean E. (2006). Tone clarity in mixed pitch/phonation-type tones. *Journal of Phonetics* 34: 388-404.

Bauer, Robert S., Kwan-Hin, Cheung & Pak-Man, Cheung (2003). Variation and merger of the rising tones in Hong Kong Cantonese. *Language variation and change* 15: 211-225.

Chambers, J. K. (1997). *Sociolinguistic theory.* Oxford: Blackwell.

Chelliah, Shobhana Lakshmi (1997). *A Grammar of Meithei.* Berlin: Mouton de Gruyter.

Cooke, Merritt Todd (1985a). Outposts of trade: Migratory patterns of the Nisyang traders of Nepal. *Kroeber Anthropolgical Society Papers* 65/66.

Cooke, Merritt Todd (1985b). Social change and status emulation among the Nyishangte of Manang. *Contributions to Nepalese studies* 13(1): 45-56.

Cooke, Merritt Todd (1985c). *The people of Nyishang: Identity, tradition, and change in the Nepal-Tibet borderland*. University of California, Berkeley.

Coupe, Alec (2007). *A grammar of Mongsen Ao.* Berlin: Mouton de Gruyter.

Ding, Picus Shizhi (2001). The pitch-accent system of Niuwozi Prinmi. *Linguistics of the Tibeto-Burman Area* 24(2): 57-84.

Duanmu, San (1991). An autosegmental analysis of tone in four Tibetan languages. *Linguistics of the Tibeto-Burman Area* 15: 65-91.

Earle, M.A. (1975). *An acoustic phonetic study of North Vietnamese tones, Monograph 11.* Santa Barbara: Speech Communication Research Laboratories Inc.

Eckert, Penelope (2000). *Linguistic Variation as Social Practice.* Oxford: Blackwell.

Edmonson, Jerold A. (2001). Ying, yang, borrowing, shift and convergence: Asian tone in developmental perspective. . *Plenary address at the NEH conference on unified approaches to developmental linguistics, University of Tulsa.*

Fromkin, Victoria (Ed.) (1978). *Tone: A linguistic survey.* New York: Academic Press.

Gordon, Matthew (2001). A typology of contour tone restrictions. *Studies in language* 25: 405-444.

Hildebrandt, Kristine A. (2003). *Manange Tone: Scenarios of Retention and Loss in Two Communities*. University of California.

Hildebrandt, Kristine A. (2004). A grammar and glossary of the Manange language. In Genetti, C. (Ed.), *Tibeto-Burman Languages of Nepal: Manange and Sherpa.* Canberra: Pacific Linguistics. 2-189.

Hildebrandt, Kristine A. (2005). A phonetic analysis of Manange segmental and suprasegmental properties. *Linguistics of the Tibeto-Burman Area* 28(1): 1-36.

Hildebrandt, Kristine A. (2007a). Manange. In Matras, Y. & Sakel, J. (Eds.), *Grammatical Borrowing in Cross-linguistic Perspective.* Berlin: Mouton de Gruyter. 283-300.

Hildebrandt, Kristine A. (2007b). Tone in Bodish languages: Typological and sociolinguistic contributions. In Miestamo, M. & Wälchli, B. (Eds.), *New Challenges in Typology*. Berlin: Mouton de Gruyter. 77-100.

Hombert, Jean-Marie (1978). Consonant types, vowel quality, and tone. In Fromkin, V. (Ed.), *Tone.* New York: Academic Press. 77-111.

Honda, Koichi (2006). F0 and phonation types in Nghe Tinh Vietnamese tones. 454-459.

Hsieh, Feng-fan & Kenstowicz, Michael (2006/forthcoming). Phonetic knowledge in tonal adaptation: Standard Chinese and English loanwords into Lhasa Tibetan. *Journal of East Asian Linguistics*.

Hyman, Larry M. & Schuh, Russel G. (1974). Universals of tone rules: Evidence from West Africa. *Linguistic Inquiry* 5: 81-115.

Janssen, Dirk P., Bickel, Balthasar & Zúñiga, Fernando (2006). Randomization tests in language typology. *Linguistic Typology* 10: 419-440.

Kincade, M. Dale (1991). The decline of native languages in Canada. In Robins, R. H. & Uhlenbeck, E. M. (Eds.), *Endangered Languages.* Oxford and New York: Berg. 157-176.

Li, Charles (1983). Languages in contact in Western China. *Papers in East Asian languages* 1(31-51).

Li, Charles (1986). The rise and fall of tones through diffusion. *Proceedings from the 12th meeting of the Berkeley Linguistics Society.* 173-185.

Li, Yujia, Lee, Tan & Qian, Yao (2004). Acoustical F0 analysis of continuous Cantonese Speech. *ACM Transactions on Asian Language Information Processing (TALIP)* 3(3): 169-180.

Lien, Chinfa (1986). Tone merger in the dialects of Nothern China. *Journal of Chinese Linguistics* 14(2): 243-291.

Matisoff, James (1999). Tibeto-Burman tonology in an areal context. In Kaji, S. (Ed.), *Proceedings of the Symposium 'Cross-Linguistic Studies of Tonal Phenomena: Tonogenesis, Typology and Related Topics'.* Tokyo: Institute for the Study of Languages and Cultures of Asia and Africa. 3-32.

Mazaudon, Martine (1973). *Phonologie Tamang: Étude Phonologique due Dialecte Tamang de Risiangku (Langue Tibéto-Burmane du Népal).* Paris: SELAF.

Mazaudon, Martine (1977). Tibeto-Burman tonogenetics. *Linguistics of the Tibeto-Burman Area* 3(2): 1-123.

Mazaudon, Martine (1978). Consonantal mutation and tonal split in the Tamang sub-family of Tibeto-Burman. *Kailash* 6(3): 157-179.

Mazaudon, Martine (1988). The influence of tone and affrication on manner: Some irregular manner correspondences in the Tamang group. *21st International Conference on Sino-Tibetan Languages and Linguistics.* Lund, Sweden. 1-14.

Meyerhoff, Miriam (2002). Communities of practice. In Chambers, J. K., Trudgill, P. & Schilling-Estes, N. (Eds.), *The handbook of language variation and change.* Malden, MA: Blackwell. 526-548.

Michaud, Alexis & Mazaudon, Martine (2006). Pitch and voice quality characteristics of the lexical word-tones of Tamang as compared with level tones (Naxi data) and pitch-plus-voice-quality tones (Vietnamese data). *Speech Prosody.* Dresden. 823-826.

Milardo, R.M. (1988). Families and social networks: An overview of theory and methodology. In Milardo, R. M. (Ed.), *Families and social networks.* Newbury Park,CA: Sage. 13-47.

Milroy, James (1992). Social network and prestige arguments in sociolinguistics. In Bolton, K. & Kwok, H. (Eds.), *Sociolinguistics today: International perspectives.* London and New York: Routledge. 146-162.

Milroy, Lesley (1987). *Language and social networks, 2nd edition.* Oxford: Blackwell.

Milroy, Lesley (2005). Social networks. In Chambers, J. K., Trudgill, P. & Schilling-Estes, N. (Eds.), *The Handbook of Language Variation and Change.* Oxford: Blackwell. 549-572.

Riad, Tomas & Gussenhoven, Carlos (Eds.) (2007). *Tones and Tunes.* Berlin: Mouton de Gruyter.

Rogers, Clint (2004). *Secrets of Manang.* Kantipath, Kathmandu: Mandala Publications.

Rose, Phil (1987). Considerations in the normalisation of the fundamental frequency of linguistic tone. *Speech Communication* 6: 343-351.

Rose, Phil (1993). A linguistic-phonetic acoustic analysis of Shanghai tones. *Australian Journal of Linguistics* 13: 185-220.

Rose, Phil (2006). Zooming-in on Ouijang Wu: Tonal homogeneity and acoustic reconstruction in a small sub-group of Chinese dialects. *Proceedings of the 10th*

Annual Meeting of the Berkeley Linguistics Society, University of Auckland, New Zealand: 58-63.

Silva, David J. (2006). Acoustic evidence for the emergence of tonal contrast in contemporary Korean. *Phonology* 23(287-308).

Svantesson, Jan-Olof & House, David (2006). Tone production, perception and Kammu tonogenesis. *Phonology* 23: 309-333.

Thomason, Sarah G. (2001). *Language contact: An introduction.* Washington, D.C.: Georgetown University Press.

van Spengen, Wim (1987). The Nyishangba of Manang: Geographical perspectives on the rise of a Nepalese trading community. *Kailash* 8(3): 131-277.

Watters, Stephen A. (1999). Tonal contrasts in Sherpa. In Yadava, Y. P. & Glover, W. W. (Eds.), *Topics in Nepalese Linguistics.* Kathmandu: Royal Nepal Academy. 54-77.

Watters, Stephen A. (2002). The sounds and tones of five Tibetan languages of the Himalayan region. *Linguistics of the Tibeto-Burman Area* 25(1): 1-66.

Watters, Stephen A. (2003). An acoustic look at pitch in Lhomi. In Kansakar, T. R. & Turin, M. (Eds.), *Themes in Himalayan languages and linguistics.* Heidelberg, Germany and Kathmandu, Nepal: South Asia Institute and Tribhuvan University. 249-264.

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