A discussion of the interaction between tone and phonation, with special reference to Gurung

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A discussion of the interaction between tone and phonation, with special reference to Gurung

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1. INTRODUCTION[1]

Discussions of the phonetics of the interaction between tone and phonation are not uncommon. However, the interaction of these two features on a more abstract phonological level has not often been dealt with; in this paper, it is my aim to rectify that somewhat. To that end, I will deal with a phonetically counter-intuitive correlation, namely the correlation between breathy voicing and low tone, which is particularly common among the languages of the Himalayan foothills. In order to describe this interaction, I will adopt a representation of breathy voicing based on the Theory of Elements (Kaye, Lowenstamm & Vergnaud 1985), and the associated theory of phonological structure, Government Phonology (Kaye, Lowenstamm & Vergnaud 1990). I will specifically deal with the behaviour of tone in Gurung, a Tibeto-Burman language of Western Nepal, and examine how the representation I adopt impacts upon the analysis of tonal interactions in that language.

2. THE CORRELATION BETWEEN BREATHY VOICING AND LOW TONE

Contrastive breathy voicing is a common property of a wide range of languages in the South Asian region. In Indic languages (such as Hindi or Nepali) it is primarily a property of consonants, but in many Tibeto-Burman languages of the region it is mainly distinctive for vowels.

Breathy voiced consonants in Indic languages have been described in traditional grammars as 'voiced aspirates', and indeed breathy voicing does seem to have certain qualities in common with aspiration, phonetically speaking, in that the articulation of both involves a wider opening of the vocal folds than modal voicing (in the case of aspiration, extending past the release of the consonant in question). Clearly this is also a feature shared with simple voicelessness. Because breathy voicing would seem to be intermediate between modal voicing and voicelessness in this sense, and because voiceless and aspirated consonants are generally associated with high pitch to the exclusion of low tones, we might expect breathy voiced consonants to generally be associated with higher pitch than modal voice.

In many, if not most, languages of the region, however, exactly the opposite is the

[1] Much of the research that led to this paper was undertaken as part of a Master's dissertation at the School of Oriental and African Studies, supported by a studentship from the Arts and Humanities Research Council. Many of the figures in this paper are taken from that dissertation. I would like to thank my supervisor, Monik Charette, for her support. I would also like to thank Ek Gurung for providing me with the Maṭṭikhān Gurung data presented here.

case. Let us take, for example, the historical development of Punjabi. Unusually among Indic languages, Punjabi has lost breathy voiced consonants and in their place developed a system of tonal contrasts (at least on stressed syllables). According to Yip (2002), in Punjabi, the reflex of a breathy-voiced consonant in a stressed syllable is a rising tone if it is at the beginning of the syllable and a falling tone if it is at the end. All other consonants, including previously modal-voiced consonants, trigger a level tone. In other words, a lost breathy-voiced consonant triggers a low pitch at the nearest edge of the adjacent vowel. Obviously, this is the opposite of what we would expect if breathy voicing was linked to aspiration or voicelessness.

Table 1

Punjabi tones and their reflexes in Nepali (extrapolated from data given by Yip 2002 from Bhatia 1994)

Punjabi	**Nepali**
[ko^{HM}ɽa] 'leper'	[koɻ̈i]
[ko^{MH}ɽa] 'horse'	[g̈oɽa]
[ko^{M}ɽa] 'whip'	[kora]

We find a similar correlation between breathy voicing and low tone in many of the tonal Tibeto-Burman languages found in the hills of Nepal. This correlation has been noted for a long time in Tamangic languages such as Gurung and Tamang (see e.g. Glover 1969, Mazaudon 1973), but also exists in much more distantly related Tibetan dialects, including Walungge (Bartram 2010), spoken in the far east of Nepal, and possibly Gyalsumdo in the mid-western hills (Hildebrandt & Perry 2011). In these languages the link between breathy voicing and low tone is quite simple to see: low tone is simply generally accompanied by some degree of breathy voicing. In Gurung, for instance, all breathy-voiced syllables are associated with low tone, and, generally speaking, low-toned syllables are associated with breathy voice: low tone and breathy voicing do not contrast with one another. This link is problematic. As I have noted, it is difficult to explain as an articulatory effect, and traditional systems of phonological features, containing separate features [±breathy] and [±low tone] would not offer any particular explanation for this frequent association of breathy voice and low tone. It is my belief that, in order to properly encode this correlation, we must turn to a more abstract system of phonological features, such as the Theory of Elements which I discuss below.

3. THE THEORETICAL FRAMEWORK

3.1. The Theory of Elements

The Theory of Elements was first introduced by Kaye, Lowenstamm & Vergnaud (1985) and has since diversified into numerous versions. The central idea is that the bivalent, phonetically grounded features of traditional generative phonology are replaced by a much more restricted set of abstract, monopolar ELEMENTS. The

inventory of these elements is not generally agreed upon, but the most restrictive set which is widely accepted admits only six elements, labelled **A**, **I**, **U**, **L**, **H** and ʔ. Clearly this is far fewer than any set of features found in more conventional theories, and one might wonder how to express the sheer variety of segmental and other phonological contrasts that exist in the languages of the world.

Put simply, the answer is that these elements play different roles, dictated to them by phonological structure. The segment, for instance, is taken to be structured so that a single HEAD element licenses a number of OPERATORS, and elements correspond to different articulatory features, depending on whether they are heads or operators. The values of elements are also influenced by the place of the segment in wider phonological structure. For instance, elements in segments associated to nuclei may have different realisations to those associated to onsets. For example, **L**, the element which we will be concerned with, is taken to be realised variously as voicing in consonants, low tone in vowels, and nasality in both.

3.2. The notion of Licensing

Clearly, then, in order to have a sensible theory of phonological contrasts, we need a well-articulated theory of phonological structure. Generally speaking, this theory is provided by Government Phonology when dealing with the Theory of Elements,

In Government Phonology, phonological structure is formed by a network of LICENSING relations. Every part of this phonological structure is licensed by some other part, except for one, generally the nuclear point which receives primary stress. For instance, in tautosyllabic clusters the initial consonant is taken to license the other through a mechanism known as CONSTITUENT GOVERNMENT, while onsets are licensed by following nuclei through ONSET LICENSING. Segments are likewise licensed by the points with which they are associated. This network of relationships determines the articulatory realisation of the elements noted above.

3.3. Representing phonation

As I observed above, the link we have noted between low tone and breathy voice is not easily formalised in conventional feature theories. In element theories, on the other hand, we can implement it relatively easily by simply assuming breathy voice to be an alternative correlate of the element **L**. This creates a problem, however. It has generally been understood that a given phonological segment may contain at most one instance of any particular element. However, we have assumed **L** to be a marker of nasality as well as of low tone and breathy voice[2]. But in Gurung, contrastive nasality co-occurs quite freely with low tone and breathy voice; this problem is not restricted to Gurung by any means. In Newar, for instance, nasal stops contrast for breathiness.

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[2]Of course, there are languages where low tone is not associated with breathy voice, and vice-versa. However, just as the specific phonetic realisation of the vowel aperture elements **A**, **I** and **U** varies from language to language, so might the realisation of other elements. So, for instance, in one language **L** might simply represent low tone, in another breathy voice, and in another both.

In order to allow for this, then, **L**, when it represents breathy voicing and low tone, must be licensed through a different mechanism than the standard licensing of segments which is used to implement nasality. I shall call this mechanism TONAL LICENSING[3]. The idea that phonation contrasts such as breathy voice are in some way outside the segment has been proposed for independent reasons by Kehrein and Golston (2004), who state that laryngeal features are associated with syllabic constituents such as onsets and nuclei, rather than the segment. There are good reasons to suppose this analysis can be useful to describe certain phenomena in Gurung (outlined in Section 4), and so I will adopt it here. We can formalise this by the statement that elements may be tonally licensed by any syllabic constituent (subject to language-specific constraints).

4. IMPACT ON INTERACTIONS IN GURUNG

At this point I illustrate how adopting this representation for phonation can have an effect on phonological analyses, specifically taking Gurung as our case study.

4.1. Tone in Gurung monosyllables

Firstly, I will outline the tonal system of Gurung in monosyllables. Essentially, there are four tones: high, mid, and low level tones, as well as a low rising tone. Examples of words containing each of these in the Gurung dialect of Ghācok are shown in Table 2.

Table 2

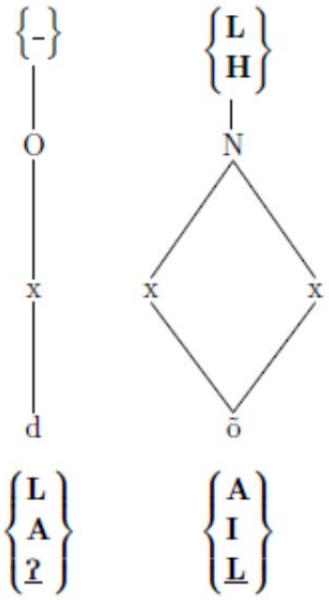
The tones of Gurung monosyllables (data from Glover 1969:28)

High	[mĩ^{H}] ‘eye’	**Mid**	[mi^{M}] ‘fire’
Low	[mi̤^{L}] ‘person’	**Rising**	[ŋ̤ĩ^{LM}] ‘two’

As can be seen, and as pointed out above, tones containing a low pitch co-occur with breathy voicing. It seems fairly clear how we should represent the high and low tones – namely with **H** (which, as well as high tone in vowels, is generally taken to be associated with voicelessness, aspiration and frication in consonants), and with **L**, respectively. The mid-tone can reasonably be assumed to be associated with neither element, and the rising tone is perhaps best understood to be associated with both. The form of this association is the tonal licensing relationship described above. In Figure 2 I illustrate how this might be visually represented.

[3] This is, of course, something of a misnomer, since we are assuming from the outset that phonation differences can be encoded through this form of licensing, and perhaps even other suprasegmentals such as pharyngealisation.

Figure 2
Representation of Maṭṭikhān Gurung [dǭ:^{LM}] ‘tree’



In this figure the nucleus tonally licenses both **L** and **H**, while the onset does not license any tonal element.

4.2. Co-occurrence constraints with Gurung consonants
Tones in Gurung do not occur freely on nuclei: they are constrained by the initial consonants of the word. There are two main constraints. Firstly, aspirated consonants may not appear with low tones (either level or rising). Contrariwise, voiced consonants *must* appear with low tones (or, equivalently, with breathy voicing). Tones may appear freely with all other consonants, as shown below.

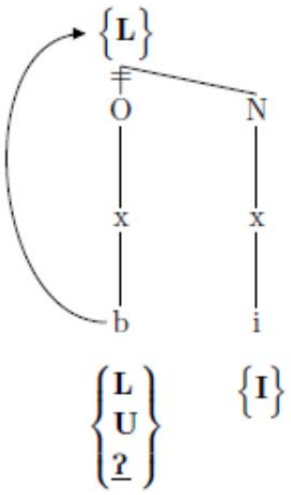
Table 3
Co-occurence constraints on Gurung tone (examples are Ghācok Gurung**,** from Glover 1969)

	High tone	**Mid tone**	**Low level tone**	**Low rising tone**
Voiceless unaspirated stops	[to^{H}] 'what?'	[tĩ^{M}] 'heart'	[ts̤i̤^{L}] 'tuft'	[ta̤ː^{LM}] 'needle'
Voiceless aspirated stops	[p^{h}ũ^{H}] 'egg'	[t^{h}i^{M}] 'savings'	*	*
Voiced stops	*	*	[bi^{L}-] 'say'	[d̤ĩ^{LM}] 'house'
Nasal stops	[mĩ^{H}] 'eye'	[mĩ^{M}] 'name'	[m̤i̤^{L}] 'person'	[ŋ̤ĩ^{LM}] 'two'
Fricatives	[sə^{H}] 'ground'	[sə^{M}] 'tooth'	unattested?	[sə^{LM}-] 'heal'
Liquids	[li^{H}] 'face'	[ri^{M}-] 'rise'	[ja̤ː^{L}] 'go'	[le̤^{LM}] 'much'

The link between modal voicing on consonants and low tone/breathy voicing is not particularly surprising in the framework we have adopted since both are represented by the element **L**. Modal voicing has almost always been taken to be part of the segment, and this would seem to be independently desirable, for reasons outlined by Kehrein and Golston (2004). In particular, I assume it to act as an operator within a segment. We must describe how this element triggers a tonally licensed instance of **L** on the following nucleus.

This can be achieved by noting two language-specific constraints. Firstly, we must require that **L** and **H**, when acting as operators, must be tonally licensed by some constituent. Secondly, we must state that onsets are incapable of tonally licensing the element **L**. This means that it must be licensed by the nucleus, resulting in the low tone we see. Visually, we can represent the first constraint as requiring that the onset PROJECTS the element onto a tonal tier; I shall use this as a convenient shorthand.

Figure 3
Interaction between voiced onset and nucleus
(displaying Maṭṭikhān Gurung [bi̤^{L}] ‘say’)



Such a spreading relationship cannot account for the constraints on aspirates, since aspirates are distinguished by the element **H**, but may co-occur with mid-tone, which is not associated with any elements. However, the notion of tonal licensing which we have adopted does allow us to express the constraint. We must require that a nucleus tonally licensing some element may not license an onset which tonally licenses another.

In other words, we have three constraints which are active in Gurung, which result in the co-occurrence restrictions between consonants and tone that we see. These are perhaps best expressed as parameters, as follows:

Figure 4
Parameters involving tonal projection and licensing
(Gurung values shown in bold)

a. Tonal elements in operator position must be projected to the tonal tier (**y**/n)
b. The element L may be tonally licensed by the onset constituent (y/**n**)
c. Nuclei tonally licensing a particular element may license an onset which tonally licenses different element (y/**n**)

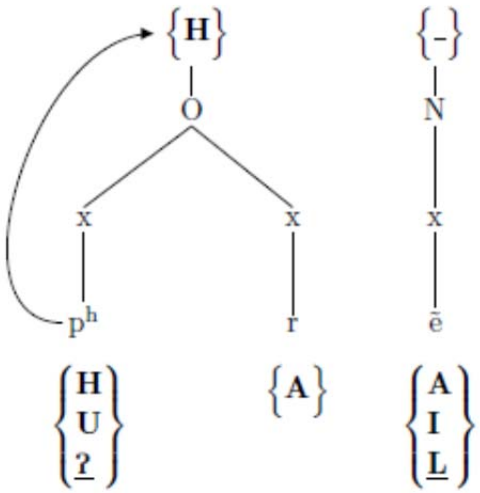
The value of the last of these parameters would be taken to be different in Central Tibetan (where aspirated consonants may appear quite freely with low tone), whereas the values of the first two parameters might be taken to be different in most Indic languages, where there is a contrast between breathy and modal voice in consonants (recalling that **L** may represent breathy voice when tonally licensed by some

constituent). The extent to which these parameters are genuinely universal or simply instances of more general parameters would require a much broader cross-linguistic study.

As mentioned in Section 3.3. there are reasons why it is desirable to assume that syllabic constituents tonally license elements, rather than the individual parts of those constituents. The main reason for this is the behaviour of initial consonant clusters. In these clusters, it is the *initial* component of the cluster which constrains the tonal contour on a vowel, rather than the component adjacent to the vowel in question. If it was the individual parts of a cluster which were responsible for tonal licensing, we would expect the reverse.

Figure 5

Projection of tonal element by head of cluster (displaying Ghācok Gurung [$p^hrẽ^M$] 'adult man')



4.2. Tone on Polysyllables

The constraints above seem rather arbitrary – they introduce asymmetry between **L** and **H**, as well as between onsets and nuclei, and it may seem that there is not a great deal of motivation for such imbalances. However, patterns in polysyllables, in combination with the idea of LICENSING INHERITANCE, a well-established concept in the Government Phonology literature, puts them on somewhat firmer ground.

In Ghācok Gurung, polysyllables show more tonal variation than monosyllables, with bisyllables exhibiting five separate tonal patterns, displayed below:

Table 4
Tonal patterns of bisyllables in Ghācok Gurung (examples derived from Glover, Glover and Gurung 1977)

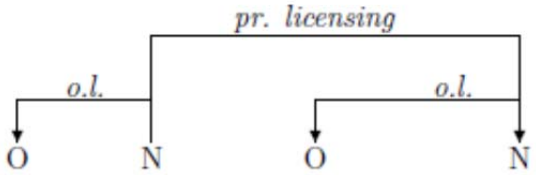
High rising	[mə^{M}di^{H}] 'lip'	**High falling**	[mə^{H}gi^{M}] 'buffalo'
Mid level	[nə^{M}mi^{M}] 'bird'	**Low level**	[pə̤^{L}li^{L}] 'foot'
Low rising	[maːˈ^{L}rə^{M}] 'yolk'		

It may be noted that low tones only appear on the second syllable of a word if the first syllable is also a low tone. Or, to put this in the language of licensing, **L** may not be tonally licensed by a nucleus in a non-initial syllable of a word (except by spreading). This is, of course, another curious asymmetry between **L** and **H** – **H** may occur quite freely in either syllable of a bisyllabic word.

We now have two instances of asymmetries between **L** and **H** – we assume that **H**, but not **L** may be licensed by onsets, and that **H**, but not **L,** may be licensed by nuclei in non-initial syllables. These can, in fact, be unified with the idea of licensing inheritance. The concept of licensing inheritance was first proposed by Harris (1997), and essentially states that components of phonological structure inherit their licensing potential, in an attenuated form, from other components which license them in turn. This means that components that are licensees generally have less licensing potential than their licensors.

It will be recalled that onsets are taken to be licensed by their nuclei through onset licensing. Likewise, Harris assumes that unstressed nuclei are PROSODICALLY LICENSED by stressed ones, thereby forming feet. Gurung words are generally initially stressed, meaning that initial nuclei are licensors of non-initial ones. In other words, both onsets and non-initial nuclei have the property of being licensees.

Figure 6
Licensing relations between syllabic constituents (o.l. = onset licensing)



We have, then, resolved the problem mentioned at the beginning of this section of an unwanted asymmetry between the behaviour of onsets and nuclei, by noting that it can be described quite naturally as an asymmetry between the relative licensing potential of licensor and licensee. There is still the problem of the unmotivated asymmetry between **L** and **H** in that licensees seem to be quite capable of tonally licensing **H**, but not **L**. Unfortunately I cannot offer any satisfying explanation from this, except to note that asymmetries between **L** and **H** are by no means unprecedented in the Government Phonology literature, with some radical approaches (such as Pöchtrager 2006, Pöchtrager and Živanović 2010) assuming

them to be entirely different in nature, taking **L** to be an element and **H** an emergent property of structure.

5. CONCLUSION

It can be noted that in this paper I have not explained why a link between breathy voice and low tone should exist. I have simply observed that there is such a link, and provided a formalisation so that this connection can be easily referred to by phonological analyses. The analysis I have presented of some data from Gurung here has relied on this formalisation and the theory of Government Phonology, and this has allowed me to express with a quite limited set of fairly natural parameters what would have required many more arbitrary rules in traditional generative phonology.

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