A Short Theory About Tones

Jonathan Kaye

1. In this article I will discuss a theory of tones within the framework of government phonology (GP). Over the years the study of tonal systems in a variety of languages, particularly those of West Africa and China have led to certain generalisation concerning the structure of these systems. I have also come to the conclusion that there are at least 2 radically different types of tonal systems subject to constraints of a quite different nature. For reasons of space, I will limit myself to what may be called *templatic tonal systems* and leave discussion of the second type to a later work. I will begin with a brief introduction to the GP theory of phonological representations.

2. GP posits a set of elements defined as follows:

(1) E = {A, I, U, H, L, ? }

A *phonological expression* is defined as an ordered pair consisting of a head (H) and a set of elements called operators (O):

(2) Phonological Expression = (O,H)

such that:

i. O f E (O possibly empty)
ii H 0 E (possibly the identity element)
iii. H ó O

The particular elements that concern us here are H (High tone) and L (Low tone). A *tonal expression* is a phonological expression containing the H or L element as a member of the set O (operators). Examples of tonal expressions are given in (3) below.

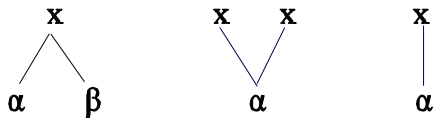
(3) a. ({H},A) b. ({L,A},I)

(3a) represents an "a" with a high tone, á; (3b) represents an "e" with a low tone, è.

Phonological expressions are associated to one or more *skeletal positions* which make up a phonological string. The *skeleton,* i.e. the sequence of skeletal positions allows for one-many and many-one relations between phonological expressions and skeletal positions. A phonological expression may be associated to more than one skeletal position and a skeletal position may have more than one phonological expression assoicated to it.

(4)

a. b. c.

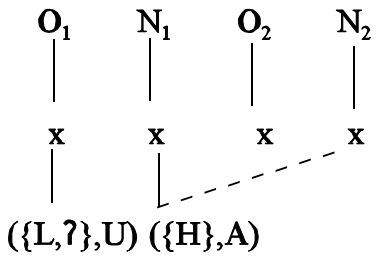


The three logically possible relations between the skeleton and phonological expressions are shown in (4). (a) illustrates the many (phonological expressions) - one (skeletal point) relation, (4b), the one-many and (4c) the one-one. In the case of (c), a may be empty. Skeletal points associated to constituents. In the cases studied in this article we need only concern ourselves with onsets (O) and nuclei (N). Constituents may have up to two skeletal positions (the branching cases) but for our purposes, only non-branching constituents will be considered. O's and N's come in pairs and are subject to the condition in (5) below.

(5) Constituent Licensing: Every nucleus can and must license a preceding onset. Every onset must be licensed.

With (5) in mind we can now see a complete phonological representation including constituents, skeletal points and phonological expressions as shown in (6) below.[1]

(6)



Mandarin maʊmother'

It should be noted that toneless nuclear expressions may also occur in tone languages. These are expressions containing neither H nor L as operators. They are typically transcribed as "mid" tones in 3 tone languages or as "low" tones in 2 tone languages. Thus, nuclear systems of tonal languages may contain expressions containing H as an operator, L as an operator, or neither H nor L as operators. The obvious question is whether tonal systems possess an expression containing **both** H and L as operators. There is some evidence that this is the case. I will present this evidence in a later section. In the next section I will elaborate a theory of templatic tonal systems.

3. Let us begin by discussing the possible inventories of tonal expression in any given linguistic system. I posit two main types of inventories: simple and complex. Complex systems are broken into 2 subcategories. The complete typology for tonal systems[2] is given in (7) below.

(7) A Classification of Tonal Inventories
A. Simple: H or toneless
B. Complex
i. H, L or toneless
ii. H, L, HL or toneless

My claim is that all simple tonal inventories (excluding contour tones - sequences of H's

and L's) consist of H or nothing. These are the 2 tone systems. Potentially 2 tone systems are three-ways ambiguous. They could be H and L, H and nothing or nothing and L. (7) makes the claim that 2 tone systems are not ambiguous. They can only be H and nothing. A language learner encountering a 2 tone system will immediately analyse such as system as having the element H available for tonal marking. The element L will not be available. Another way of looking at this case is to posit the following principles:

(8) i. L is available for tonal marking only if H is available.
ii. All tonal inventories must contain a toneless expression.

Complex tonal inventories involve both H and L in tonal expressions. As (8ii) states, all tonal involve a tonal expression. System with both H and L in play may also have both H and L as operators in the same expression. Such expressions are also realised as a "mid" tone, is a toneless expression, but with very different phonological behaviour. This is the case in some Kru languages of the Ivory Coast. These cases will be discussed below. In sum, I am claiming that the maximum number of level tonal contrasts on a single nuclear position is 3^3. Ibibio, a Cross-River Bantu Language (Nigeria) is an example of a simple tonal inventory (H and nothing). Putonghua (Mandarin) and most other Han languages have complex tonal inventories (H, L and nothing). Kru languages (Ivory Coast) such as Bété and Dida, have complex tonal inventories that include H-L expresions (H, L, HL and nothing). These 3 types appear to exhaust all the possibilities.

If nothing more needed to be said about tones we would expect that the following formula would be sufficient to predict the number of tonal combinations of a system with T tones over a string of N nuclei.

(9) T^N

In (9) T represents the number of tonal contrasts (2, 3 or 4) and N, the number of nuclei contained in the phonological string. If we consider a simple inventory such as that of Ibibio where N=2, then we would expect bi-nucleic Ibibio forms to display 2^2=4 tonal combinations; tri-nuclei forms should exhibit 2^3=8 possibilities, and so on. Of course such free distribution of tonal expressions is not found in any tonal system. In the next section I will discuss the various constraints that limit the co-occurrence of tonal expressons.

3. The following principles are proposed for templatic tonal systems. They do not necessarily hold for non-templatic systems. The notion *tonal pattern* is crucial for understanding these principles. Tonal patterns are often confused with tonal expressions (usually called simply "tones"). For example, it is said that Putonghua has 4 tones and that Cantonese has 5, 6, 8 or 9 tones. What Putonghua and Cantonese have are tonal patterns; they each only have 2 tonal expressions and one toneless expression (i.e. they both belong to class (7Bi)). Tonal patterns are properties of phonological words. These are minimal phonological domains - domain containing no internal domains. Phonological strings that are not phonological words cannot license tonal patterns and are always toneless.

(10) Templatic tone system principles

i. Extended OCP: A given tone my only appear once in a tonal pattern.

*HHL *HLH *H_H but _ _ _ is well formed.

ii. Every tonal pattern has a head.

A head my be defined positionally: the 1st tone of the pattern, or intrinsically: H is the head of the tonal pattern.

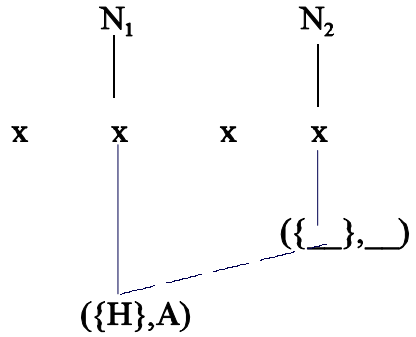
(10i) is an extension of the OCP (Obligatory Contour Constraint) first proposed by Leben 1973. Leben's original proposal excluded adjacent identical tones. (10i) is a natural extension of the OCP limiting the occurrence of any given tonal element, L or H, to a single occurrence with in a tonal pattern. (10ii) states that every tonal pattern must have a head. A tonal pattern is associated to several skeletal points. One of these points is designated as the head of the pattern. There appear to be 2 ways that the head of a tonal pattern can be identified:

i. The head may be defined positionally. Either the first or last position can be the designated head position. Heads are defined positionally in Cantonese, Ibibio and Southern Zhuang.[4]

ii. The head may be defined intrinsically. A position in a tonal pattern may be a head because of some specific property of its phonological expression. As we shall see Putonghua has an intrinsically defined head. The head of a tonal pattern is that expression containing the element H.

The next topic to be discussed is that of *tonal spreading* within a tonal pattern. Tonal spreading occurs when a tonal expression is adjacent to a toneless expression.[5] In such cases the tone element (H or L) may spread to the tonally empty position as shown below.

(11)



H _ spreading

We see an example of tonal spreading in (11) above. In this case the tonal pattern is defined as H _ (H followed by a toneless expression). The H element spreads rightward to occupy the operator position of the toneless expression. This yields a level high tone as its output. It is important to note that the level high tone as found in Putonghua, Cantonese, Southern Zhuang and Ibibio is not a sequence of two H's but rather a single H identified on 2 positions.

H spreading to an adjacent position occurs, at least optionally, in every language studied so far. It spreads from left to right in Putonghua, Cantonese and Ibibio. It appears to spread from right to left in Southern Zhuang. Spreading may be obligatory, as in

Putonghua and Ibibio, or optional, as in Cantonese and Southern Zhuang.

L spreading is observed in Putonghua (in tonal sandhi involving "tone3"). L is associated to 2 skeletal positions in Cantonese and Southern Zhuang but this may be a lexical association rather than actual spreading. Ibibio has a simple tonal inventory and so the element L plays no role in the tonal system.

In sum, the principles of templatic tonal systems in (10) along with the parameters involving spreading serve to define the properties of the various tonal systems that we will encounter.

A final point in this section concerns the status of multiply linked tonal expressons (i.e. tonal expressions associated to more than one position). Ideally, multiple linking would have a single source: spreading of a tonal expression from an adjacent position. A preliminary analysis of the Cantonese tonal system seems to call for lexically marked multiply linked forms. One way of expressing this phenomenon would be to stipulate that certain forms are lexically marked to permit/exclude spreading. This approach is far from elegant and surely further work needs to be done on the tonal systems that seem to require this device. The remaining piece of the puzzle concerns the *licensing constraints*, that is the recipes that define well-formed tonal patterns for a given language. We turn to this topic in the following section.

4. In this section I discuss how the specific tonal patterns found in a given language are specified. As already mention above in (9), the formula T^N defines the logically possible tonal patterns for a language containing T tonal contrasts (including tonelessness) over a string containing N nuclei. For concreteness, let us consider a language with a complex tonal inventory (H, L and nothing) whose tonal patterns are distributed over 2 nuclei. This gives us $3^2 = 9$ possible tonal patterns. In fact, all the logical possibilities are never realised in a given language. This is due both to general principles, such as those in (9) and to language specific combinatorial laws: the licensing constraints. The 9 possible tonal patterns for a 3-2 language (3 tonal contrasts-2 nuclei) are given below.

(12)	H H	_ H	L H
	H_	_ _	L _
	HL	_ L	L L

These 9 possibilities are immediately reduced by the extended OCP (10i). No pattern may contain two instances of the same tonal element.[6]

(13)	~~H H~~	_ H	L H
	H_	_ _	L _
	HL	_ L	~~L L~~

The 9 possibilities are now reduced to 7. In a language with obligatory tone spreading from left to right, table (13) will be interpreted as (14).

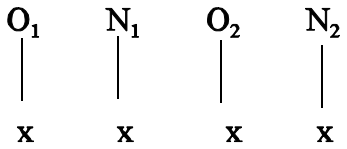
(14)	~~H H~~	_ H	L H
	H_ = "H H"	_ _	L _ = "L L"
	HL	_ L	~~L L~~

Note the sequence, H-nothing, L-nothing are interpreted as level high and level low, respectively. These possible patterns are further reduced by the licensing constraints -

recipes for defining well formed patterns for a given language. The form of these licensing constraints will be illustrated in the sections dealing with analyses of specific tonal systems.

5. I will begin this section with the analysis of the Putonghua. Putonghua, like other Han languages is templatic. The structure of its minimal phonological words is fixed and can be characterised by the following template:[7]

(15)



The Han template

The Han template consists of 2 O-N pairs. There is a further stipulation that only the first 3 positions (O_1, N_1 and O_2) are available for lexical, non-tonal marking. The N_2 position can only receive phonological material from N_1 and this, only in case O_2 is empty. Putonghua tonal patterns are defined with respect to (15) and so 2 nuclear positions are available for tonal marking.

Putonghua is said to have four "tones" as shown below.

(16) Putonghua Tonal Patterns
1. Level High
2. High Rising
3. Low Rising
4. High Falling

In reality (16) displays the 4 tonal patterns of Putonghua. These patterns include one level tone, 2 rising tones and one falling tone. As we will see there is nothing arbitrary about this set of patterns. Based on a very simple licensing constraint and on the structure of the theory of tone presented above, exactly this set of patterns can be generated. Let me know present the parameters of the Putonghua tonal system.

(17) The Putonghua Tonal System

a	Inventory:	Complex (7Bi)
b.	Spreading:	H and L, Obligatory, Left to right
c.	Head:	Intrinsic (H)

The settings in (17) suffice to generate the set of Putonghua tonal patterns. Putonghua patterns consist of any combination of items in its inventory subject to the parameters in (17) above. Both H and L will obligatorily spread to an empty position to their right. This will be obvious in the case of H. Cases of L-spreading occur in the tone sandhi involving "tone 3" as we shall see below.

(17c) stipulates that Putonghua has an intrinsic head. Furthermore, every tonal pattern must have a head. I conjecture that the element H is the only possible intrinsic head. From this it follows that every licit tonal pattern in Putonghua must contain the element H, whatever else it may contain. The extended OCP (10i) limits each tonal pattern to exactly one instance of H. Table (12) shows the 9 logically possible tonal patterns for a language with a 3-way constrast whose patterns are defined over 2 nuclei. There are exactly 4 of these patterns that satisfy the requirement calling for one and only one H element in the pattern. These are shown in (18) below.

(18) Putonghua Tonal Patterns

1.	H _	Level High
2.	_ H	High Rising
3.	L H	Low Rising
4.	H L	High Falling

The 4 tonal patterns in (18) represent all and only the possible tonal patterns containing one H element. As can be seen, this represents a perfect fit with the traditional description of the Putonghua "tones", to wit, one level, 2 rising and one falling pattern. Recall that Putonghua has obligatory rightward H spreading. Accordingly the pattern H _ must be realised as a level high pattern.

Putonghua has 2 notable examples of tone sandhi, both involving L H tonal patterns ("tone 3"). The distribution of the L H patterns is given in (19) below.

(19)	Before L H	Elsewhere	Emphatic
	"Tone 2"	Low level	"Tone 3"

According to (19), a sequence of Tone 3 - Tone 3 yields the sequence Tone 2 - Tone 3. In any other context, Tone 3 is normally realised as a low level tone. Only when emphasised does Tone 3 appear in its lexical form - L H. Although the precise reasons why these changes take place remains obscure for the moment, the formal nature of these changes is quite straightforward. Consider first a sequence of Tone 3's. What formal change is required to convert this sequence to Tone2 - Tone 3?

(20) L H L H —> _ H L H

Deletion (or delinking) of the first L element will create a new pattern, _ H. This latter is of course, nothing other than Tone 2. Before all other patterns L H is realised as a level low tone. Once more the formal change is quite simple.

(21) L H X X —> L _ X X

Simply deleting (or delinking) the L element of this tonal patterns produces L _. Given Putonghua's obligatory spreading from left to right. The L element will spread into the now available position resulting in a level low tone. I will turn now to the analysis of the Ibibio tonal system.[8]

6. The Ibibio tonal system can be defined as shown below.

(22) The Ibibio Tonal System

a	Inventory:	Simple (7A)
b.	Spreading:	H, Obligatory, Left to right
c.	Head:	Positional, Initial

Ibibio has a simple tonal inventory with only H and nothing available. Like Putonghua, spreading is obligatory and from left to right. L spreading is not mentioned since L is not part of the Ibibio inventory. Unlike Putonghua, Ibibio has a positional head. The first nucleus of the domain is assumed to be the head of the tonal pattern.

Applying our T^N formula to Ibibio forms with 2 nuclei, we get the following possibilities:

(23)

H H	_ H
H _	_ _

Principle (10i) excludes the first possibility, H H. The remaining three patterns are indeed attested as shown below.

(24)

H _ –> HH	úfá 'new'	íyák 'fish'
_ H	iwá 'cassava'	ɯ tá 'shelf'
_ _	esO'hare'	ubed 'room'

As in Putonghua, the pattern H _ undergoes obligatory rightward spreading and is realised as a level high tone. Ibibio also manifests downstep (successive lowering of high tones in specific contexts) and certain morphology defined "falling tones". Discussion of these phenomena would take us beyond the scope of this article.

7. The Cantonese[9] tonal system has the following properties:

(25) The Cantonese Tonal System

a	Inventory:	Complex (7Bi)
b.	Spreading:	H, Optional, Left to right; L, Obligatory unless lexically marked
c.	Head:	Positional, Initial
d.	LC:	A tonal pattern has at most one tone.

Applying the licensing constraint (LC) of (25d) we generate the following tonal patterns:

(26)

a. H _	c. _ L	e. _ _
b. _ H	d. L _	

(26a) contains the H _ pattern. As indicated in (25b), H may optionally spread rightward to a tonally empty position. A form like *maw* 'cat' with the tonal pattern H _ may be pronounced either with a level high tone (spreading takes place) or a falling from high to nothing (spreading does not take place). There are context where spreading must take place or where spreading may not take place, but in general both forms are possible. The pattern (26b) represents a rising tone from nothing to high. This pattern occurs in words like *yam* 'drink' and *yu* 'fish'. The pattern _ H (26c) is a tonal pattern falling from nothing to low. The pattern L _ (26d) is quite interesting. Cantonese appears to require a formal mechanism not found in either Putonghua or Ibibio. There are 2 possible realisations of

the L _ pattern: (1) a low rising (from L to nothing) if no spreading takes place and (2) a low level tone if spreading does take place. Examples I have found are *low* 'old' and *yaw* 'friend' where no spreading takes (low rising) and *9o* 'hungry' and *yi* '2' where spreading does take place. Both patterns have the lexical representation L _. The are distinguished by a lexical mark on one or the other pattern. Either a form such as *9o* will contain a lexical mark indicating that spreading must take place, or a form such as *low* will contain a lexical mark indicating that spreading cannot take place. In the former case spreading normally does not take place; in the latter case, spreading is assumed to occur unless otherwise indicated. Some evidence indicates (at least for younger speakers) that spreading normally occurs and that the marked forms are low rising pattern. Chao 1947:24 distinguishes *yi* (_ H) 'chair' from *yi* (L _) 'ear'. Guangzhou speakers today pronounce both forms with the _ H pattern. I have noted several other examples where the shift appears to be eliminating the non-spreading L _ cases. I have not found cases where _ H and L _ merge as L _. This indicates the L spreading in Cantonese is obligatory except for a shrinking number of lexically marked forms.

Cantonese is also said to contain 3 "entering tones. These patterns are found only in forms whose O_2 position contains p, t or k, the "clipped syllables". These 3 phonological expression have the effect of rendering the N_2 inaccessible for tonal licensing. If follows that these clipped syllable only have one nucleus available for tonal marking and it is predicted that there can only be 3 entering tones: H, L or nothing. This prediction is correct. The relevant forms being: *yat* (H) '1', *gök* (_) 'leg' and *sik* (L) 'eat'.

8. To| is a Tai language spoken in Guangxi Province, China. It is a member of the Southern Zhuang subgroup. The specific variety in question is spoken in the village of Hongkui, Tiandeng County in Guangxi. The tonal properties of To| follow.

(27) The To| Tonal System

a	Inventory:	Complex (7Bi)
b.	Spreading:	H, Optional, Right to Left; L, Obligatory, Right to left
c.	Head:	Positional, Initial
d.	LC:	A tonal pattern has at most one tone.

To| differs from the Han languages in that it has an expandable template. That is, many minimal phonological words share the same structure as those found in Han languages, viz., $O_1N_1O_2N_2$. There is an additional possibility: the augmented template which has the form $O_1N_1O_aN_aO_2N_2$. This template contains an additional ON pair, O_aN_a which may contain no lexical material. In such cases the nuclear material from N_1 spreads to N_a surfacing as a so-called long vowel.

(28)

Normal Template		Augmented Template	
nap	'like'	xiip	'smell'
di9	'top'	oók	'out'
4a9	'nose'	4aa9	'body'

The To| tonal system contains the identical LC as that found in Cantonese: each tonal pattern can contain at most one tonal element (H or L). This allows for the same set of tonal patterns as those found in Cantonese.

(29) H _ L _ _ _
_ H _ L

The tonal patterns of (29) correspond to the observed tonal system of To. Consider the following forms:

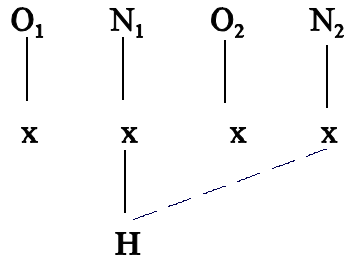
(30)	a. nam	'water'	Nan	'force'	High falling
	b. kaw ~ kaw	'white'	gin ~ gin	'eat'	High rising/High Level
	c. gaw	'very'	hoy	'lime'	Low rising
	d. 3u9	'meal'	iaw	'break'	Low level
	e. Taa	'I'	li9	'monkey'	Toneless ("mid")

The observed "tones" align quite well with the tonal patterns generated by the LC in (27d).

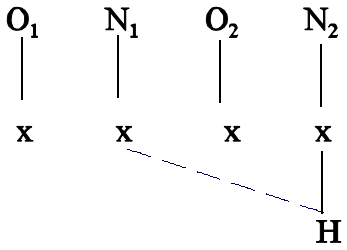
(31)	a. H _	High falling	b. _ H	High Rising/Level		
	c. L _	Low rising	d. _ L	Low level	e. _ _	Toneless

As mentioned above the tonal LC in To is identical to that of the Cantonese system. The different realisations arise from the difference in the direction of tonal spreading (Cantonese leftward, To rightward). In both languages High spreading is optional. The spreading is leftward in Cantonese so H _ may be realised as a High level or High falling depending on whether spreading takes place or not. To has rightward spreading so the pattern _ H is realised as High level or High rising depending on the spreading behaviour. In both languages L spreading is obligatory. In Cantonese there exist lexically marked forms that block the spreading; in To no such forms exist and _ L uniformly produces a Low level tone.

(32)



Cantonese High Level/Falling



To High Level/Rising

9. Two final points remain to be discussed in this article. In a previous section, I suggested that evidence from non-templatic tonal systems indicate that tonal expressions containing both H and L as operators can exist. Let us consider some data from Kpokulu-Bété spoken in the Ivory Coast.[10] A common manner diminutive formation in Kpokulu is to add *yu* 'child' to a stem. Consider the forms below.

(33)	g^{w}e 'dog'	g^{w}eyù 'puppy'
	sèpu-ɬ cat'	sèpuyu0 kitten'

We see in(33) that the lexical tone of *yu* is L. In the first example *yù* follows the toneless stem g^we and retains its lexical tone. In the second case *yù* follows a stem ending in a superhigh tone[11] and *yu* surfaces with a mid tone. I assume that a high tone spreads rightward within a domain and merges with the low tone yielding an expression with both H and L as operators. The tonal realisation of this expression is a mid tone. It could be argued that L simply deletes (or delinks) following a high tone but further evidence show that this is not the case.

The first piece of evidence comes from a small set of infinitives which contain an mid falling tone on a single skeletal position. Since adding a low tone to a toneless position would simply create a low-tones position (zero plus low equals low), the "mid tone" with which the low tone shares a position must have phonological content. This content can only be a phonological expression containing both H and L in its set of operators.

The second piece of evidence to support a ({L,H,...},...) expression comes from the tonal distribution in nouns. The patterns C_1vC_2v never surface as such unless C_2 belongs to the set of "opaque consonants": {b, d, j, g, v, z}. These are consonants which contain L as an operator and have the effect of blocking any tone spreading from their left. In cases where C_2 is transparent to tone spreading the pattern surfaces as C_1vC_2v0 with the final nucleus surfacing with a mid tone. This is assumed to be the result of the high (or superhigh) tone spreading from left to right and combining with the existing low tone to form a mid tone. The relevant examples are shown below.

(34)	Opaque C_2		Transparent C_2	
	b0gU	'book'	kpoh-u0	'rat'
	gájà	'carp'	3Uk^{w}a0	'hole'
	9^{w}ídì	'virile man'	k^{w}ála0	'turtle'

The second point concerns the status of superhigh vowels found in a number of Kru languages and doubtless elsewhere.[12] Consider the following forms from Vata, a Kru language of the Ivory Coast:

(35)	a. n le	'you eat'	n lé	'I eat'	n lì	'you ate'
	b. n lá	'you call'	n la¬	'I call'	n lâ	'you called'
	c. n bi	'I walk'	n blé	'I slide'		

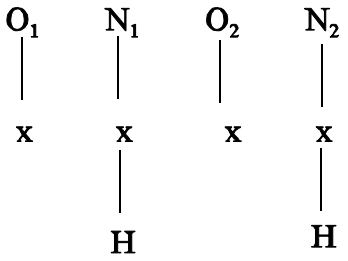
In (35a) we have the verb *le* which is lexically toneless. It appears as such following a low toned pronoun. The high tone of the pronoun n spreads to the toneless stem to produce to level high tones. The final form contains the perfective low tone suffix which spreads to the right yielding a low tone (zero plus low equals low).[13] (35b) shows the behaviour of a high toned verb. This verb surfaces with a high tone when preceded by a low toned pronoun and with a superhigh tone when preceded by a high toned pronoun. (35c) shows that both events are blocked if an initial opaque consonant separates the pronoun from the first verbal nucleus.

It is clear that the pronominal high tone is spreading to a toneless verb stem. What about the superhigh tone that occurs when a lexically high toned verb follows a high toned pronoun? A sequence of two adjacent H's form a tone foot. The rightmost H is interpreted as higher than the H to its left. This process is strictly local and does not result in other high tones becoming successively higher; there is no upstep. A glance at noun behaviour shows that this phenomenon is not restricted to verbs.

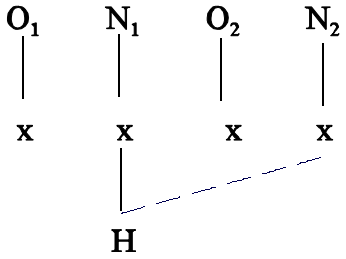
(36) sáka¬ ‘rice’ Némá ‘friend’

Now consider the tonal representation of these two forms.

(37)



sáka¬ ‘rice’



Némá ‘friend’

Notice that the form sáka¬requires two lexical H’s clearly violating the extended OCP (10i). The form Némá can be derived from a lexical H _ via rightward spreading of a high tone to the toneless nucleus. This results in a level high tone sequence. Obviously a detailed analysis of non-templatic systems such as Vata and Bété is required to established what other differences may be found between templatic and non-templatic systems.

In this article I have tried to show that a fairly simple theory of tones including some universal principles and a small set of language-specific parameters can successfully explain a fairly rich variety of tonal systems. The number of languages considered so far is small and the application of this theory to a wider empirical domain will surely result in an even more elegant system.

NOTES

1. I follow the normal pinyin Romanisation of Mandarin by indicating a high tone by a macron over the vowel.

2. This classification is meant to be completely general and not restricted to templatic tonal systems.

3. Vata, a Kru language (Ivory Coast) has 4 level contrasting tones:
low (n) la ‘(you) carried’ toneless (n) la ‘you carry’
high (n) la ‘(you) call’ superhigh (n) la¬I call’
In fact the superhigh tone is a high tone in a particular context.

4. Southern Zhuang is spoken in the Guangxi Zhuang Autonomous Region in China. My thanks to Xu Zhuo for her discussion of the Southern Zhuang tonal facts with me.

5. “Adjacent” in this context means “adjacent in the nuclear projection”.

6. Note that the extended OCP does not rule out the pattern _ _, a sequence of 2 toneless expressions. This principle refers to the **presence** of elements, not their **absence**.

7. See Chiu 1994, Goh 1997 and Pan 2000 for discussion of the template in a variety of Han languages.

8. Data on Ibibio were collected by the author during a 2 year period from1997 to 1999. My thanks to Rosemary Ekpo for providing the data and her many insights into its analysis.

9. The Cantonese analysis presented here is based on the variety spoken in Guangzhou. I am grateful to Zhu Yanping and Lin Qiuming for their invaluable help in this analysis.

10. Data on Kpokulu are from the author.

11. In these examples high and super high tones behave in an identical manner.

12. Nevertheless, many Kru languages display only 3 level tones on a given position.

13. A glance at the perfective form in (34b) shows that this is not a case of low spreading from the pronoun.

REFERENCES

Chiu, Andy. 1994. *Syllable structure of Taiwanese in the framework of government phonology*, MA dissertation, SOAS, University of London, London.

Goh, Yeng-seng. 1997. *The Segmental Phonology of Beijing Mandarin*, The Crane Publishing Co., Taipei.

Kaye, Jonathan. 2000. "A Fresh Look at Putonghua Onset-Rime Pairs", submitted to *Zhongguo Yuwen*.

Leben, W. 1973. *Suprasegmental Phonology*, Ph.D. dissertation, MIT, Cambridge.

Pan, Ning. 2000. *The Segmental Phonology of Yichang Chinese*, MA dissertation, Guangdong University of Foreign Studies, Guangzhou.