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On Five-level Tone Systems

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In his long and productive career, Robert E. Longacre has carried out explorations of linguistic phenomena at levels from phonetics to discourse in language families from around the globe.[1] In his published work one finds an exceptional commitment to empirical discovery (witness, for example, the spirit of his 1964 grammar manual). In this contribution to honor our friend and colleague, we return to perhaps his first significant linguistic discovery, as reported in his article "Five phonemic pitch levels in Trique" (Longacre 1952). Growing out of his field experience in the late forties with this language from Mexico, this seminal work chronicles the frustration with his initial treatment of Trique tones and goes on to draw the conclusion that Trique has a tonal system with five contrastive levels (heights) of pitch. Since that time it cannot be said that five-level tonal systems have turned up in hordes, but there are now at least some even more obvious and unambiguous examples than Trique. Our modest aim here is to provide a brief overview of examples of some five-level tone phenomena not only from the Americas, but also from Asia and Africa.

[1]Support for some of this research (JAE) was provided by the Committee for Scholarly Communication with the People's Republic of China and the National Endowment for the Humanities for the period January–June, 1990. The data from Pa-hng and Shidong Kam analyzed here were collected respectively from Wan Rensheng, a Pa-hng civil servant from Laobao Township, Sanjiang County, Guangxi Province and from Long Yaohong, a Kam student of the Central Institute of Nationalities, Beijing.

1. Trique

In 1947, Longacre encountered in Trique of Oaxaca (Mexico) a complex tonal language that ultimately defied analysis as anything less than a five-term system. Initial hypotheses of three or four tone heights failed to account for all the contrasts recognized by native speakers when presented with Trique forms in controlled frames. Longacre's discovery, in this regard, flew in the face of the state-of-the-art summation by his colleague Kenneth Pike that:

> The number of permitted registers in various languages seems to be limited to two, three, or four: languages have been reported with more levels of perceived pitch than four, but apparently such numerous levels are not all contrastive or lexically significant, and would reduce to fewer phonemic registers. (1948:5–6)

Longacre's working hypothesis by 1949 of a five-level system in Trique was, further, confirmed by Pike himself in 1950 and reported in detail in Longacre 1952.

The Trique case is significant in the annals of tone study from both methodological and theoretical points of view.

As a case study of empirical research, involving the gathering of data, assembling it in relevant categories and constructing hypotheses to cover all instances of occurrence, Longacre's is a classic story in fieldwork. From a beginning hunch that perhaps three tones would suffice, research led on fairly quickly to the realization that four tones would be required to account for the clear instances of pitch contrasts. But then RESIDUES, nagging recalcitrant occurrences of tone, turned up that resisted inclusion in any of the four established categories.

The complete five-level inventory was finally reached by employing two methods: contrast in substitution frames and contrast in minimal sets. The substitution test is illustrated from Longacre's account (1952:69), as in (1), in which the tones of the final forms all vary in the same segmental and tonal context, varying correspondingly and, therefore, relevantly as to their meaning at the same time.[2]

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[2]In Longacre's system, ^{1} represents the highest pitch height and ^{5} the lowest. In the Y. R. Chao terminology the level pitch would be represented as a sequence of numbers with the highest being ^{55} and the lowest ^{11}. Thus, in addition to being scalar reversals, the Longacre system regards tones as points on a pitch scale, whereas the Chao system regards tones as stretches. Cf. the discussion of SPLITTERS and LUMPERS in §9.2. We have indicated which system is being used at each particular point in the text.

(1) *gu⁵du⁵ʔwe⁵ ku¹* 'I will sell bones'
gu⁵du⁵ʔwe⁵ jo² 'I will sell palm baskets'
gu⁵du⁵ʔwe⁵ ka³ 'I will sell squash'
gu⁵du⁵ʔwe⁵ ʔa⁴ 'I will sell nine'
gu⁵du⁵ʔwe⁵ za⁵ 'I will sell eleven'

The second method is essentially a noncontextual one in which forms that contrast only as to tone are assembled in partial sets (partial because no totally identical sequence of segments occurs with all the tones), as in (2).

(2)				
	za²h	'I am eating'	*w:e¹²*	'straw mat'
	za³h	's/he is eating'	*w:e²*	'hair'
	za⁵h	'I am going to eat'	*w:e³*	's/he is fierce'
	za⁴³h	's/he is going to eat'	*w:e³⁴³*	'century plant'

Thus, through a series of such demonstrations each tone can be shown to be in contrast with all other tones in some set such as these, though not in all sets for any given tone. The recognition of five levels of tone is also clearly contingent on the decomposition of complex glides into their constituent levels, a factor Longacre (1952:73) acknowledges as contributing to the overall difficulty of the analysis. Specifically, tone 1 only occurs in combination with other tones.

From a theoretical perspective, Longacre's Trique work challenges and adjusts (as all scientific inquiry should) our universalist taxonomic doctrine on what the upper limits are for natural language tone levels. However, that "the presence of five phonemic pitch levels in Trique is incontrovertible" (1952:81) must be counterbalanced by the further observation (1952:77) that the system is "asymmetrical in that tonemic combinations involving the lower tones are comparatively numerous, while such combinations involving the two higher tones are comparatively few ... [and] the actual complexity of phonemic structure is no greater than that of [a] ... four-level system." Thus, one may be led to conclude that not only are five-level tone systems highly marked in any survey of world tone languages, but that upon closer inspection even those that do occur may maintain their distinction by something of a fragile margin.

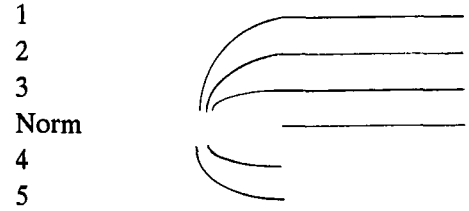
The phonetic facts of Trique further lead Longacre to suggest the possibility that five-level systems may turn out to be best understood:

> ... in terms of a hypothetical norm of the speaking voice and degree of departure from that norm. This norm seems to lie somewhere between the tones 3 and 4, since tones 1, 2, and 3

> strike up from somewhere near this relative pitch range and tones 4 and 5 strike down from it. (1952:80–81)

The situation Longacre seems to have in mind is something like that represented schematically in (3).

(3)

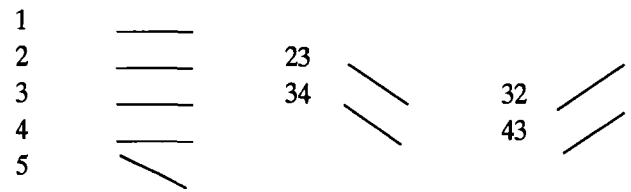


Whether this account of how five-level systems use their phonetic space has any universal basis is, of course, an empirical question that requires more investigation. As we shall point out below, however, a study of Gaoba Kam, a Kadai language of southern China, makes the identical claim on grounds apparently completely independently of Longacre's work. Our own investigation of a similar kind of Kam and a variety of Pa-hng showed mixed results; data from one language confirmed this view; the other did not.

2. Chinantec

Trique, as it turns out, is not the only Meso-American language with a five-level tone system. Skinner (1962:251) also reports that "Usila Chinantec demonstrates five phonemic tone registers occurring in almost all possible combinations in bisyllabic words." The tones may be represented as in (4), in which 1 is again high and 5 low. There are four phonetically level tones (1, 2, 3, and 4), while tone 5 actually starts just lower than 4 and falls sharply. The tone sequences, which also occur over single syllables, begin rather precisely at the tone height of the first tone of each sequence and either rise or fall in the direction of, but not fully reaching, the level of the second indicated tone.

(4)



As Skinner notes (254), these sequences all constitute a rather "shallow" contour, involving as they do only tones that are adjacent in height to one another. In comparison with Trique and Ticuna (§3), Skinner says:

> Usila Chinantec has fewer tones and tone sequences within the syllable—nine—than either Trique or Ticuna. Nevertheless, of the three languages, Usila Chinantec has the most complete filling in of possible tonal combinations in bisyllabic words having one tone per syllable. (1962:254)

To provide a few concrete instances of Usila Chinantec tone patterns we list the forms of (5). In the first column, tones 1–5 occur preceding a syllable with tone 1, while the second syllable of words in the second column illustrates the four tone sequences.

(5)	*o¹nó¹*	'lard'	*a²ló²³*	'small pheasant'
	a²ló¹	'mule'	*o¹kuâ?³²*	'dirt'
	si³tá¹	'authorities'	*si¹kué³⁴*	'my hand'
	ma⁴ló¹	'Tuxtepec'	*i⁴cié⁴³*	'truth'
	u⁵ló¹	'Palantla'		

3. Ticuna

The first reported instance of a five-level tone system in South America is Anderson 1959 on Ticuna, a language spoken by some 21,000 people in the northeastern Amazon regions of Peru, Colombia, and Brazil (Grimes 1988:135).

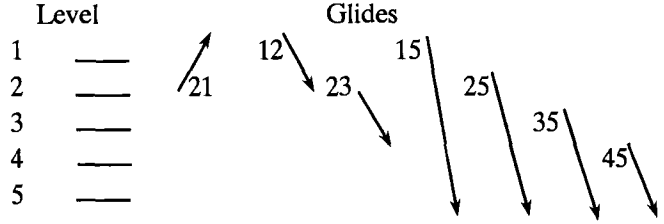
Anderson's narrative of the trial and error saga so familiar to the field linguist in confronting a complex problem in virgin linguistic territory is reminiscent of Longacre 1952. The Andersons began in 1953 with a hopeful initial hypothesis that the forms for 'woman' and 'howler monkey' differed minimally merely by stress placement as /'nge?e/ vs. /nge'?e/, respectively. This system shortly proved incapable, however, of handling in any consistent fashion all of the prosodic differences with which they were presented. Further data now seemed to indicate that perhaps a three-tone scheme was needed, which could represent the above pair as /nge?è/ 'woman' vs. /nge?e/ 'howler monkey' (with mid-tone vowels unmarked), and other pairs such as /ma?è/ 'grass' vs. /má?e/ 'wasp'.

But after seven months of research in the field, the three-tone system also had to yield to an even richer hypothesis to account for the numerous instances of further tonal contrasts that had emerged. Alerted to the discovery by Longacre of a five-level system in Trique and aided by Pike's

Mexican-trained ear at a field workshop in 1955, a five-tone scheme was posited which resolved all the remaining problematic Ticuna pitch phenomena.

The Ticuna tones and tone sequences number a total of twelve, which may be represented as in (6), where 1 is high and 5 low. Ticuna thus involves a five-height system with five level pitches and seven glides or sequences, one of which is rising (21) and all other falling.

(6)



Under the five-height tone hypothesis the Andersons were now able to provide a coherent representation for, among many others, the trisyllabic forms of (7).

(7)	*ca³na³mu¹*	'I weave it'
	ca³na³mu⁴	'I send it'
	ca³na³mu⁵	'I eat it (raw fruit)'
	ca³na³mu³⁵	'I spear it'

4. Miao-Yao

Interestingly enough, in the same year (1947) that Longacre was discovering five-levels of tone for Trique, Chang was publishing in Chinese (and perhaps thus not widely noted in the West) concerning five-level systems in Miao-Yao (Hmong-Mien) languages of China, Vietnam, Laos, and Thailand. These languages possess some of the more complex phonological systems of Southeast Asia.

Prosodically, Miao-Yao employs three to twelve tones, of which as many as five have been described as having level (i.e., noncontour) pitch trajectories in some varieties. These monosyllabic languages provide particularly clear examples of tonal systems whose pitch dimensions must allow for five independent heights. That these five tones are manifested in rather straightforward fashion as contrastive stretches of simple steady-state pitch on differing monosyllabic morphemes serves to dramatize the reality of a five-height system. Recall the difficulty Longacre initially encountered in

the case of Trique wherein the upper-most tone height (tone 1) does not occur alone, but derives by abstraction as a feature of a more complex tonal contour. It was also pointed out that only four of the Usila Chinantec tones are phonetically level, the fifth being a contour that falls from below tone four to something even lower, thus necessitating a fifth height for the system.

In an English-language version of his original work, Chang (1953:375) discusses ten varieties (seven in detail) of Miao-Yao in terms of their phonetic implementations of the eight historical proto-tone categories (A1, A2; C1, C2; B1, B2; D1, D2),[3] here listed respectively simply as tones I - VIII. Two varieties of Miao-Yao (MTK[4] and YYT) illustrate five-height systems in which an unambiguous level pitch is associated with each height along with three other contour pitch stretches, as indicated in (8) and (9). Observe that level tones can turn up in any of the proto categories (including VII in other lects).

(8) MTK

I	II	III	IV	V	VI	VII	VIII
mid-high level	high falling	high level	mid-low level	high rising	mid level	low rising	low level

(9) YYT

I	II	III	IV	V	VI	VII	VIII
rising	mid level	mid-low level	low level	high level	high-mid level	high falling	low falling

[3]Tone categories in Asia are usually defined by their historical sources; but, regrettably, there is confusion in the traditional notations, inasmuch as Chinese scholars use the Chinese names given to Middle Chinese tone categories for the proto tones of other languages and numbers, grouped pairwise 1/2, 3/4, 5/6, 7/8 (and sometimes even 9/10) for contemporary reflexes, whereas the Thai tradition uses A, B, C, and D for the proto tones and A1/A2, B1/B2, C1/C2 and D1/D2 (or D1S/D2S and even D1L/D2L) for contemporary reflexes. But B1/B2 corresponds to 5/6 and C1/C2 to 3/4; thus, either B and C are reversed or 3/4 and 5/6 are reversed.

[4]MTK is Hei (black) Miao of Shitungk'ou (Shidongkou) village of Taikung (Taigong) County, Kueichow (Guizhou) Province. This village is the same one cited by Kwan (1966); both Chang and Kwan having the field research of Fang Kuei Li as their source. From Kwan's description the Black Miao inhabit the banks of the Qingshui River, which flows from central Guizhou out the eastern border. Shidong, Taijiang (Taixian) County is located about 50 km northeast of the capital of SE Miao-Kam Autonomous District at Kaili.

In a later paper, Chang assembled further data towards a reconstruction of the Proto-Yao tone system. He notes in passing that:

> Yao, in contrast to Miao, has a complicated system of finals: vowels may occur in final position, or they may be followed by *-y*, *-w*, *-p*, *-m*, *-t*, *-n*, *-k* (in some dialects *-ʔ*), or *-ng*. Miao, on the other hand, has a complicated system of initials, with both simple consonants and consonant clusters, which Yao for the most part lacks. (1966:303)

With these kinds of syllabic reductions and segmental shifts, it is perhaps not surprising that the phonetic character of the tones has varied so greatly. In fact, though he associates the Proto-Miao initial consonants with each Proto-Yao tone and cites Yao cognates in six dialectal variants, it is again not surprising that Chang merely lists the phonetic tone correspondences rather than suggesting a proto shape for each tone. That is, though five-level tone systems occur in Miao-Yao, they appear to be highly marked and cannot be reconstructed as original.

A study of a Black Miao location of Guizhou (Ch'ing Chiang Miao) by Julia Kwan, a student of Fang Kuei Li, also described a five-level tone system. Her research (1966:27–33) provides the details in (10), here recast in the form of the Miao-Yao data in (8) and (9). A comparison of Kwan's CCM with Chang's MTK shows only a minor variation; namely, CCM has a mid-rising tone v, while MTK reflects a high-rising v.[5]

(10) CCM

I	II	III	IV	V	VI	VII	VIII
mid-high	high	high	mid-low	mid	mid	low	low
level	falling	level	level	rising	level	rising	level
44	51	55	22	35	33	13	11

By way of summary, the five level tones above may be located historically in terms of the classic voiced-voiceless initial bifurcation of Asian tone systems, as in (11).

(11)

	*A	*C	*B	*D
*Voiceless initials	I level	III level	V	VI
*Voiced initials	II	IV level	VI level	VIII level

[5]This difference is unexplained since, presumably, Kwan used data from the same location as Chang, both based on Li Fang Kuei's fieldwork.

During a 1990 fieldtrip to Guangxi Province, Edmondson collected data on Pa-hng Red Yao, who speak a kind of Bunu Miao (Edmondson 1990); it is the same language as Chang's YYT by another name.[6] The main differences between the data collected in Sanjiang and Rongshui Counties and YYT are that the Pa-hng has only four level tones. Moreover, tone 2 has a pitch value of 22 in Pa-hng but 33 in YYT.[7] Historically speaking, Chang's YYT has achieved its fifth level tone by manifesting historical tone 3 and tone 4 as different pitches, whereas historical tone categories 3 and 4 are identical in Pa-hng, because either the proto tone *c never split or because its two reflexes after splitting collapsed to form a single pitch again.

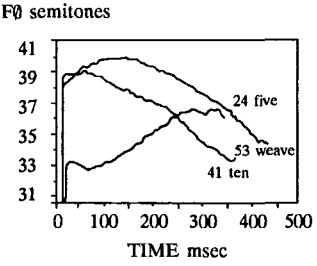
Figures (12) and (13) plot the pitch values of the seven distinctive tone categories derived from computer processing of multiple repetitions of the following examples: tone 1 *pja*^{24} 'tree, five', tone 2 *pə*^{22} 'flower', tone 3 *tə*$^{(2)11}$ 'fire', tone 4 *mɔ̃ĩ*$^{(2)11}$ 'horse', tone 5 *qo*^{55} 'egg', tone 6 *təi*^{44} 'die', tone 7 *na*^{53} 'weave', and tone 8 *ku*^{41} 'ten'. The speaker's tone space extends from 33 to 41 semitones, with the highest tone (55) appearing at 41 semitones, the lowest (11) at 33 semitones. Mid-low (22) appears at 35 semitones, mid-high (44) at 39 semitones. The historical correspondence between Pa-hng and YYT requires that Pa-hng tones 3 and 4 bifurcate and become 22 and 11, respectively, thereby forcing tone 2 to elevate from 22 to 33. No other changes are necessary to achieve the YYT situation. Note also that the higher of the four level tones of Pa-hng rise before leveling off and the lower of the tones drop before leveling.[8] The change between a four-level and a five-level tone system, in this instance, only requires the addition of a new contrast at the nearest higher level.

[6]The Pa-hng Red Yao number about 10,000 and are found in Sanjiang Kam Autonomous County, Longsheng County, Rongshui Miao Autonomous County, all in Guangxi Province, Liping County and Congjiang County both in Guizhou Province as well as 2,000 in Northern Vietnam. Chang 1947 refers to this language as Yung-ts'ung, Hsishanchieh, and Tahua Yao. Shi, Shi, and Liao 1988 and personal correspondence with Dr. David Strecker indicate that YYT is a form of Pa-hng Red Yao, which is a Hmongic (Miao) language whose speakers are grouped for cultural and historical reasons with the Yao (Red Yao or Eight Name Yao).

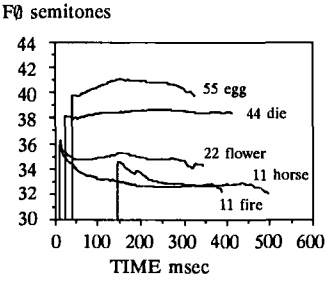
[7]These data and those on Kam were recorded on high-quality recording tape with a Sony TCM5000 professional quality cassette tape recorder using an Atus ATR20 low impedance unidirectional dynamic microphone placed close to the mouth but sufficiently outside the airstream to avoid microphone blast. The speaker repeated each elicited item five or more times. At a later time the tapes were played into the CECIL hardware unit (Computerised Extraction of Components of Intonation in Language, SIL, Jaars, Waxhaw, NC), which contains bandpass filters, an amplifier, and an 8-bit parallel interface to an AT-286 DOS computer. The digitized data were saved on floppy disk medium.

[8]Cf. similar phenomena in Trique (§1) and Kam (§5).

(12) Pa-hng Red Yao rising and falling tones



(13) Pa-hng Red Yao level tones

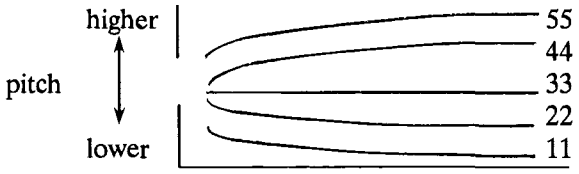


5. Gaoba Kam

In their study of Gaoba Kam (Jinzhan County, Guizhou Province, China), Shi, Shi, and Liao (1988) describe the following values for the nine tones that occur on cv syllables: *ma*^{45} 'vegetable', *ma*^{11} 'come', *ma*^{22} 'tongue', *ma*^{33} 'light in weight', *ma*^{13} 'ink', *ma*^{31} 'horse', *ma*^{55} 'cut down', *ta*^{24} 'nail', and *pa*^{44} 'husk'.

They found that, of the nine tones occurring in cv syllables, five were level and defined five distinct heights. Phonetically, these level tones all begin at mid height and are described as diverging like "rays of the sun," the lower tones falling before they become horizontal in the latter part of their course, the higher tones rising before sustaining a level trajectory. Shi, Shi, and Liao support their claim with fundamental frequency data derived by calculation from sound spectrograms and plot the results basically as in (14).

(14)



They attribute this pitch pattern to the natural tendency of the glottis to initiate phonation at a mid-pitch level. This assumption basically amounts to claiming that there is a natural center of gravity for pitch around which speakers initiate a syllable. In this regard, recall Longacre's similar and independent proposal for Trique (§1).

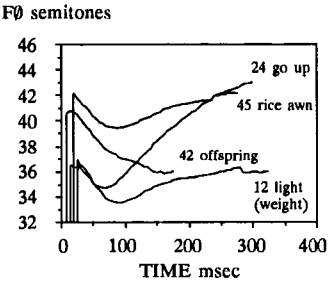
6. Shidong Kam

Haudricourt (1961) and others since have pointed out that Kam is a language of extraordinary tonal complexity. We are also beginning to understand how this complexity arose. Simply stated, these tones evolved from a proto language that had three contrasts of pitch in open syllables, called *A, *B, and *C (Li 1977). There were also closed syllables that at first had no tonal contrast but took over the pitch shapes of some open syllables; these were called *D. At a later time, the vowel length contrast of D-type syllables was transformed into a pitch contrast; in the terms of investigators of this field, the *D split into *DS (D-short) and *DL (D-long) to give five tonal categories. Later still came the Great Tone Split (Haudricourt 1961, Brown 1975), in which a voiced-voiceless contrast on initial consonants was replaced by low-high pitch heights; from five, a total of ten tones appeared (§4). This heritage can be seen in the numbering system used above and in the study of China's minority Kadai languages (cf. Wang 1984). A → 1, 2; B → 5, 6; C → 3, 4; DS → 7, 8 (or sometimes 7s, 8s); and DL → 9, 10 (or sometimes 7L, 8L). These developments were widely shared by languages across the Asian mainland, including Kam, Bouyei, Chinese, Miao-Yao, and many others, which is why it has been called the Great Tone Split.

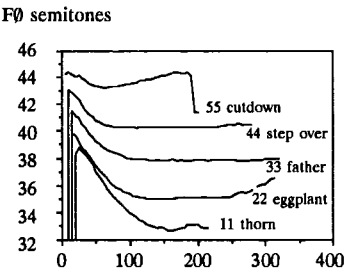
Unlike most languages of the area, Kam was not satisfied with ten tones. It carried the process of turning initial-consonant contrasts into pitch contrasts one step further by using an old theme with a new variation. Vocabulary items with aspirated initial consonants were depressed at the onset of the syllable to create a new set of rising tones. Thus, after all these changes, there resulted a low set from items with original voiced initials, a high set from items with original voiceless initials, and a rising set from items with original aspirated initials, a total of fifteen tones in all.

New field research on Shidong Kam[9] was subjected to instrumental study. As in Gaoba, we found nine tones in cv syllables, which can be divided into contour and level types. The contour tones are exemplified by *áa*^{13} 'light in weight', *ɬa*^{25} 'ascend', *ɬa*^{45} 'riceawn', and *ɬa*^{42} 'offspring'. The set of minimal contrasts involving level tones is exemplified by *ɬa*^{11} 'thorn', *ɬa*^{22} 'eggplant', *ɬa*^{33} 'father', *ɬa*^{64} 'step over', and *ɬa*^{55} 'cut down'. A display of the pitch values for these forms is presented in (15) and (16).

(15) Shidong Kam rising and falling tones



(16) Shidong Kam level tones



The graphs in (15) and (16) demonstrate that the pitch curves for the five level tones of Shidong Kam are, in fact, not level—also a finding of Shi, Shi, and Liao. Unlike in their study, however, it appears that the pitch of all tone categories dropped over the course of the first 50–100 msec before becoming level and not just the lower ones; there was no center of gravity out of which lower tones descended and higher tones rose. The drop-before-level-pitch phenomenon was also found in syllables with initial

[9]Tianzhu County Shidong Village of Guizhou Province, which is located only 15–20 km to the northeast of Gaoba and is, as far as can be determined, virtually identical with it.

m as well as with initial *p*. Notice that, just like the level tones, Shidong Kam's nonlevel tones also exploit the full range of a five-height tone space with what are quite delicate pitch differences. Moreover, there is a similar drop in fundamental frequency at the onset of these syllables in rising tones before the rise begins.

With so many tone contrasts, it is not surprising that Kam might possess more examples of five-level tone systems than elsewhere. Indeed, the *Dongyu Diaocha Baogao* (1957) reports two additional noncontiguous locations with five levels. These are represented in (17) and (18).[10] Note again, however, that each of the three types of Kam with five-level tones differs as to what category has a level tone and what pitch value is found in that category.

(17) Damiaoshan Kam, Guangxi Province

I	II	III	IV	V	VI	VII	VIII	IX	X
44	22	33	11	55	53	55	33	22	11

(18) Jianhe Xiaoguang Kam, Guizhou Province

I	II	III	IV	V	VI	VII	VIII	IX	X
35/11	22	33/23	31	55/25	44	55/25	33	23	31

7. Bouyei

One of the languages cited by Wang (1967:97) as having five level tones is Shuicheng Fa'er Bouyei (Guizhou Province, China). Examples of the phonetic values of these tones (Buyi Diaocha Baogao 1959) are *na*^{44} 'thick', *na*^{11} 'rice paddy', *na*^{33} 'face', *na*^{22} 'maternal uncle', *kwa*^{55} 'to cross', *a*^{13} 'river', *zap*^{55} 'carrying pole', *zap*^{55} 'cage for piglets', *kap*^{13} 'pinch', and *kap*^{13} 'grasp'.[11] These are represented in (19).

(19)

I	II	III	IV	V	VI	VII	VIII
mid-high level	low level	mid level	mid-low level	high level	low-mid rising	high level	low-mid rising
44	11	33	22	55	13	55	13

[10]Tone I, III, V, VI, and IX are each divided into two in this latter variety of Kam.

[11]In the system for describing tones in Bouyei, the tone categories 7 and 8 designate the checked syllable tones, i.e., those with syllable structure CVC. 7S and 7L (7short and 7long) refer to the vowel length of these closed syllables. In many locations, but not in Shuicheng Fa'er Bouyei, the vowel length conditions a difference in pitch.

There is no obvious parallel between level categories in Bouei and those in Kam or Miao-Yao. Tones I-V are level in Bouyei, for example, whereas I', II, III, V, and VI are level in Shidong Kam. Tones I and V have the highest pitch level in Bouyei; in Kam, it is categories V and VI. Five-level tones exist at only one of the forty locations from which we have Bouyei data.

8. Ngamambo

Turning briefly now to Africa, Asongwed and Hyman (1976) have noted that the Ngamambo variety of Moghamo possesses an extraordinarily complex system of tonal patterns even by Grassfields Bantu standards.[12] The authors discuss, among other things, how a two-tone system of Proto-Grassfields developed into a system of five phonetic pitch levels. They describe these five as surface manifestations of tonal combinations found primarily on nouns. Stated simply, in this language nouns have a prefix and a tone concord that combines with the lexical tones of the root. The five resulting forms are described by Asongwed and Hyman as (1) low [L], (2) unreleased low [L°], (3) lower-mid ['M], (4) mid [M], and (5) high [H]. Only two of these are found on monosyllables—[L] and [H]—plus the nonlevel tone HL. Bisyllabic nouns have more complex tonal patterns, most involving some kind of prefixing. Examples with tones L, M (one example of 'M), and H are attested. The combinations L-L, L-L°, L-'M, and L-LH occur, with low tone in the first syllable. The combinations M-HL, 'M-'M, and M-H occur, with mid tone in the first syllable. Finally, the combinations: H-HL, H-L, and H-H occur, when the first syllable has a high tone. Five different phonetic levels are thus seen to occur on the second syllables of bisyllabic nouns.

A complete recapitulation of Asongwed and Hyman's treatment would be too lengthy to present in detail here. Nevertheless, some of their conclusions are of interest for our discussion of languages with five level-tone contrasts and how these may have developed. Basically, they argue that the prefix carries one of three prosodic tonal states: nasal carries L, vowel carries M (or 'M), and consonant-vowel carries H. Asongwed and Hyman choose the solution that L occurs underlyingly on nasal prefixes, H on both vowel prefixes and consonant-vowel prefixes, with a subsequent rule lowering H to M ('M) conditioned by whether the syllable begins with a consonant or vowel. They state, moreover, that Proto-Western-

[12]We were unable to obtain the references cited in Maddieson 1978 for the other five-level tone languages of Africa.

Grassfields had a word structure consisting of a monosyllabic prefix and a bisyllabic stem, in which the stem lost its final syllable, with the tone of the lost syllable continuing to exercise influence over tonal combinations, such that L-L-Ļ → L-L, L-L-Ḥ → L-L°, L-H-Ļ → L-'M, L-H-Ḥ → L-LH, where Ļ and Ḥ represent floating tones. The conclusion of this article is that the collapse of syllables with only two original tones can result in forms that distinguish five level pitches.

9. Some concluding observations

9.1. Limits on the dimensions of natural language phenomena. As our knowledge of natural language grows, so does our ability to characterize the possibilities within its various subsystems. From the point of view of gross acoustics, of course, the number of fundamental frequency levels produced (or producible) in human languages is undoubtedly myriad. The ultimate task of an empirical linguistics, however, is to characterize TONE LEVEL from an emic and systemic perspective. Doke's (1926) nine levels of tone for Zulu thus seem not to have survived scrutiny, nor did they even accord with his own description of three levels elsewhere (1921–23) when contrastive phonological function is taken into account (Pike 1948:6, fn. 8).

More recently, Duthie (1986) proposes, among other revisions of Ladefoged's inventory of phonetic features, a seven-level system of relative pitch levels under the general rubric of REGISTER, as in (20), with a neutral mid level accorded a value of 0, situated between three ascending (+) levels and three descending (–) levels.

(20)	−3 low	0 mid	+1 mid-high
	−2 low-mid		+2 high-mid
	−1 mid-low		+3 high

This system clearly commends itself for symmetry and a certain arithmetic logic. It is straightforwardly advertised as phonetic rather than phonemic. If the goal, however, is to provide a universal phonetic alphabet for tone from which languages (or analysts) select a set of gross (acoustic?) features, this system would appear to be too sparse. On the other hand, if these phonetic features are thought to predict the limits of specification of phonological contrast in any particular language, they seem by all evidence to be too numerous. The question from this angle is ARE THERE ANY SEVEN-LEVEL TONE LANGUAGES? This paper suggests that the magic number

limiting the significant levels of tone would seem to be five (Maddieson 1978:338) or, as Longacre originally put it:

> There must be somewhere a practical limit to the degree of complexity of a phonemic or tonemic system... and probably a symmetrical four-level or an asymmetrical five-level system approaches this extreme limit in tonemic complexity. (1952:73, fn. 1)

9.2. The nature of tones as linguistic objects. The conception of what tones are in Trique, as well as in Chinantec and Ticuna, is ultimately bound up with the goal of providing a parsimonious interpretation of the total repertoire of unique pitch sequences in each language.

In Trique, for example, in which eighteen unique, unconditioned tonal configurations present themselves, the analyst must decide whether to be a splitter or a lumper in positing the prosodic primes of the language. If, as a lumper, one opts to conceive tone as a complex object including some with pitch trajectories that are level (e.g., 3), others that have single change contours (e.g., 45), and still others that have double change contours (e.g., 354), the inventory of tone types becomes rather large, eighteen in the case of Trique. On the other hand, Longacre ends up, predictably enough, as a splitter of Trique tone, with fewer primitives but more combinations thereof.

There are other consequences as well. On the positive side, one may argue that by decomposing all pitch phenomena into discrete units of level, the use of level specifications needed in any given case is maximized while at the same time automatically accounting for rising and falling features without having to accord them any status as primitives in the system. This is convincing, of course, to the extent that those latter features play no role in stating any tone generalizations. There is, however, a price to pay for splitting. To be specific, levels 3 and 4 occur independently in Trique. They also occur in combinations of 34, 43, or even 343 on a single syllable, and similarly with the other independently needed pitch levels. But the sequences 12, 21, and in one case 51 also occur in Trique, in which levels 2 and 5 occur independently but level 1 does not. The latter turns up only in these combinations with other pitch levels. At this point, the decision to be a splitter argues in favor of being a thoroughgoing one. But that, unfortunately, involves the recognition of a nonindependently occurring level 1 pitch as a prime in the system as the highest pitch level from which to specify the glide sequences above on the model of the other sequences in the language.

Wang (1967) argues against the splitter (register) approach, commenting that Trique may simply be considered a four-level system if one recognizes as contour tones all those involving level 1. The problem with that solution is that it provides no principled basis for not collapsing all the other sequences into units. Longacre (1952:69, fn. 1) did, in fact, consider this

option, but rejected it for precisely that reason. For example, should the 343 and the 354 sequences be viewed as contour units because they are the only double change sequences and are restricted to occurrence on the ultimate syllable? In this regard, however, while recognizing the rationale for Longacre's analysis of Chicahuaxtla Trique, Hollenbach (1977:60) is able to propose just such a contour approach for the Copala Trique dialect. The reason she can do so, however, is that Copala Trique is devoid of a number of the historical morphophonemic tonal accretions that complicate the situation for contemporary Chicahuaxtla Trique.

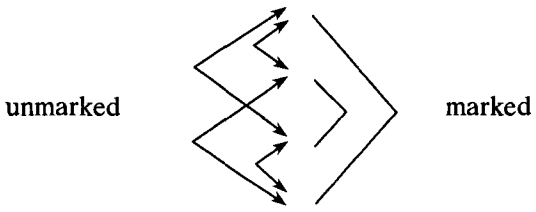
Thus again, in the case of Trique, the answer to the question "What is a tone?" seems to be THAT CONFIGURATION OF FEATURES WHICH COMBINES SIMPLICITY WITH ELEGANCE TO REPRESENT ALL THE PATTERNS OF THE TONE SYSTEM. In the final analysis, however, one must inevitably observe that *de gustibus non disputandum est.*

9.3. The representation of five level tones. The existence of five level tones has figured significantly in the discussion of how to represent tonal phenomena in a phonological theory of language. Since five level tones pose a maximum, an adequate feature system for representing tones should predict this fact. Moreover, the system of representation should also be capable of expressing a natural class of tones whose members—just as with classes of segments—tend to undergo phonological processes together, whether historical sound change, tone sandhi, or other change in context. Wang (1967) suggested three features [high], [mid], and [central]. Woo (1969) proposed three features as well, called [high], [low], and [modify]; and Maddieson (1970) has [high], [low], and [extreme]. All of these proposals have been questioned because of redundancy, e.g., [+mid] is needed only if there is a fifth level.

Woo (1969) uses [+modify] to indicate lower than the highest for 44 tones or higher than the lowest for 22 tones. However, both of these feature systems are less successful than that proposed in Yip (1980, in press), where it is suggested that tone space is divided into high and low registers, distinguished by the feature [upper], each register being further divided by the feature [high]. While only being capable of describing four pitch heights, this scheme makes accurate predictions about natural classes that correspond very well to the bifurcation of one pitch into high and low reflexes in the familiar Asian environment of initial consonants with the respective features [−voice] and [+voice]. To remonstrations that five levels of pitch are not encompassed by [±upper, ±high], Yip counters that five-level tone systems may really involve a contour tone mistaken as a fifth level (à la Wang on Trique) or that the fifth level tone might be some kind of conditioned variant. For cases of bona fide five-level tone systems, then a

feature [modify] à la Woo could be invoked.[13] Yip's proposal (4 = [+upper, +high], 3 = [+upper, –high], 2 = [−upper, + high], and 1 = [−upper, −high]) also predicts tone alternation correspondences which may be diagrammed as in the markedness scheme of (21), where unmarked alternations of tone level are indicated with arrowheads and differ by only one value of either [upper] or [high], while marked alternations of levels are indicated with unheaded lines and differ by more than one value.

(21)



Clements' (1983) hierarchical system of tone features may or may not involve splitting. A three-level tone system thus might be described as H (M L), in which the more closely related M and L are simply the high and low T of a lower register and the H is an unsplit high of the upper register. In any case, the system allows for asymmetrical phenomena in a straightforward fashion.

Hyman (1986) proposes to use the notion of underspecification of a tone, having H and L be interpreted as "effect a pitch height change of +1" or "effect a pitch height change of −1," respectively, and by having primary and secondary tiers to allow pitch height changes as spreading between the two.

The description of some of the languages in the sources we consulted is often rather meager. At least for some, however, some of the historical rules are known. The Trique data from Longacre (1952, 1957) indicate, for example, that the 55 tone (his 1) is probably a conditioned reflex of 44 (his 2), originally sharing a natural class feature of height (H).

The East Asian languages discussed here, both Miao-Yao and Kadai, underwent developments similar to each other, wherein each proto tone split into two in the context of the feature [voice] of the preceding initial

[13]Note that the tone system of Shidong Kam must be accounted the status of a bona fide five-level tone system. Duanmu San has suggested (personal communication) that Yip might also represent the 33 tone by using three features [upper], [high], and [low], which, with ±values, would yield six distinctive values.

consonants.[14] Thus reflexes after split share a common feature of a natural class. Consider the tones in (22), where, for example, two proto tones split in parallel fashion in Bouyei into 44 and 33 in old voiced-initial environments and into 11 and 22 in voiceless ones (and so on for the other tones above).

(22)	44, 11	33, 22	Bouyei
	44, 22	33, 11	Damiaoshan Kam
	55, 44		Shidong and Gaoba Kam, Trique, Pa-hng
	55, 22		Black Miao

9.4. Reflections on five-level tone systems. What empirical generalizations may then be found in five-level tone systems? There is at least one generalization of note in data from such systems. Level tones seem to occur as one member of a correspondence set involving as the other member another level tone. This feature seems to be true by a margin of about two-to-one. In other words, level tones develop more often from level tones than from nonlevel tones. That would suggest that the processes of UNIT TONE CHANGE—the elevation or depression of a tone shape (rise, fall, or level) to a new pitch height—are more prominent in the history of five-level tone systems than EDGE EFFECTS, which raise or lower the pitch height of the leading or trailing edge of a syllable tone, thus altering the configuration of the pitch contour (Yip 1989). The Asian type of tone bifurcation, however, is commonly conceived of as unit change; and Asian languages are prominent among those having five level tones.

Furthermore, data from tone sandhi and historical change indicate that a tone with true 33 (mid) pitch may belong phonologically to the upper or lower subset of pitch heights. For instance, Snyder and Lu (1990:4) show that 33 tones in Wuming Zhuang, a Kadai language of northern Guangxi closely related to Bouyei, belong with the upper register. Behavior of this type speaks in favor of six values in the phonological system even if these collapse to five phonetic values. For instance, in a phonological system with three features [upper], [high], and [low], the values [+upper, −high, +low] and [−upper, +high, −low] might be interpreted to have the identical phonetic interpretation, namely 33. If we assume that natural classes involving the change of only one feature are least marked—that two features are more marked and that all three features are the most marked—this would predict correspondences of the types indicated in a markedness matrix displaying markedness in terms of the number of feature changes

[14]As we explained above, the prime tone category and the high tone category in Kam do not seem to constitute two members of a class of level tones.

required to relate a pitch in the H set with a pitch in the L set, as in (23), where 1 is the lowest and 3 the highest.[15]

(23)	**55**	**44**	**33**	**33**	**22**	**11**
55		1	2	1	2	3
44			1	2	1	2
33				3	2	1
33					1	2
22						1
11						

For the correspondences listed in (22), four of them (33:22, 44:22, 33:11, 55:44) have a markedness value of 1 and only 44:11 and 55:22 have a markedness value of 2.[16] None have markedness value of 3. So far, so good; but it remains to be seen if a more adequate feature calculus can be envisaged that would predict other traits of a five-level tone system and explain why in tones, as in acts of a drama, five are good measure.

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[15]Empty cells in (23) represent meaningless or redundant correspondences; e.g., 55:55 is meaningless and 11:22 is the same as 22:11.

[16]The weight of changes requires some interpretation about which of the two 33 values is involved.

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