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The Complex Tones of East/Southeast Asian Languages: Current Challenges for Typology and Modelling

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Abstract
In some of the tone systems of East and Southeast Asian languages, linguistic tone cannot simply be equated with pitch; some tones have phonation-type characteristics as part of their phonological definition; and there is no compelling evidence for analyzing tonal contours into sequences of levels. Salient findings are reviewed, first from a synchronic perspective, then from a diachronic one, to bring out facts that are relevant for tonal typology and for evolutionary approaches to phonology.

Index Terms: tonal typology, Asian tones, phonation-type characteristics, tonogenesis, registrogenesis, diachrony of tone systems, level tones, complex tones

1. Introduction
Since the early 20th century, considerable progress has been made in the study of tonal systems of East and Southeast Asia. An increasing number of languages have come under academic scrutiny; together with synchronic descriptions, historical studies have attained an increasing degree of precision, and the diachronic origin of tones in many of the languages of the area is now well-understood. As far as tonal typology and the phonological modelling of tones are concerned, however, there remain some incomprehensions between researchers. The present paper reviews evidence on the complex tone systems of Asia, first from a synchronic perspective, then from a diachronic one, to bring out facts that are relevant for tonal typology and for evolutionary approaches to phonology.

2. A brief review of synchronic studies of complex tones
Chao Yuen-ren’s work on Mandarin Chinese in the early 20th century [1], [2] brought to the attention of linguists the complexities of its tone system [see also 3]. It is clear to linguists grappling with the tone systems of Chinese dialects (“Sinitic languages”) that “Chinese tones are complex suprasegmental events distinguishing (otherwise) homophonous syllables” [4]. Following sustained exchanges between Chao Yuen-ren and Kenneth Pike, Chao’s findings were taken up in Pike’s typological divide between registertone* and contour-tone*, which recognized that “the glides of a contour system must be treated as unitary tonemes and cannot be broken down into end points which constitute lexically significant contrastive pitches” [5]. Later studies [6–10] have brought out the importance, in some languages of Asia, of phonation-type characteristics that are part and parcel of the definition of tones. In these systems, phonation types are not a distinctive feature orthogonal to tone, unlike in the Oto-Manguean language Trique, for instance [11]. Pike’s two-way typology, while it emphasizes important properties of the languages which he was able to take into consideration, has some limitations in this respect: characterization as “contour tone” may not be an adequate label for tones such as those of Vietnamese, which contrast with the other tones of the system through a set of characteristics that include specific phonation types* in addition to the time course of fundamental frequency (“height modulation”, “melodic contour”).

Languages with phonetically complex tone systems constitute a challenge for tonal typology and phonological modelling. There clearly remains some progress to make in this area. Given the complexity of linguistic tone, tonal typology is a formidable task, which requires taking into account considerable amounts of data. Specialists typically focus primarily on one area or language group, with the unwanted result that they sometimes tend to grant universal status to the characteristics that they repeatedly observe. Eugénie Henderson makes her choice clear: “My preference, derived both from professional training and experience, would be to present only material of which I have first-hand personal knowledge, since, though this may be fallible, one may at least suppose the same bias to run through the whole of it” [12]. This can lead one to consider with some suspicion the work of colleagues who, starting out from different languages, come to different conclusions. Eugénie Henderson, who is familiar with complex tones, warns that “… ‘tone’ is seldom, if ever, a matter of pitch alone” [12]; this “if ever” amounts to casting doubt on the validity of tonal descriptions that do not mention phonation type* and other potential phonetic correlates of tone [see also 13]. One of the conclusions of Martine Mazaudon’s study of the complex tones of the Tamang-Gurung-Thakali-Manangke group (Sino-Tibetan, Nepal) is that “The pitch-only tones which are reported especially from African languages might be a special case rather than the prototype, as they are commonly presented” [14]. Conversely, generative phonology adopted the “autosegmental” representations initially developed for the level tones* of African languages [15–17] and raised it to the status of universal representation of tone. Adherents of generative phonology therefore tend to assume that analyses into level tones* apply to all tone systems, in East Asia as elsewhere, even in the absence of compelling language-internal evidence.

I am fortunate to be familiar with a few strikingly different tone systems of Asia: Yongning Na (Sino-Tibetan), which has many properties that will be familiar to Bantuists; tonal spreading, tonal reassociation, and tonal morphology [18], [19]; the closely related language Naxi, which likewise has H(igh), M(id) and L(ow) levels as basic units, but has

1 Terms in italics followed by an asterisk are defined in the Appendix (§5).
much fewer tonal alternations [20–22]; Vietnamese; and Mandarin Chinese. To me, it is equally clear (i) that Yongning Na is to be described as having a level-tone* system, and (ii) that “there are no objective reasons to decompose Vietnamese tone contours into level tones or to reify phonetic properties like high and low pitch into phonological units such as H and L. In Vietnamese, tone features would only duplicate perceptual properties that have to exist independently in the phonetic grammar of listeners” [23; see also 24, 25].

I hope that this diversified experience will to some extent alleviate suspicions of a bias towards a given theoretical approach. Level-tone* representations have proved useful way beyond the Subsaharan domain, for which they were initially developed: in the Americas [26–29], Asia [30–33, 20, 34, 35], New Guinea [36, 37] and elsewhere. They do not meaningfully apply to all systems, however. It is of course possible to propose ad hoc amendments to autosegmental representations to describe unitary contours. One such proposal [38] consists in describing the contours of Mandarin by sequences of level tones (e.g. Low+High for a rising tone) all of which are linked to a single tonal node, as in (1a) below, instead of one tonal node for each level in ‘true’ level-tone* systems, as in (1b) below:

(1)

a. contour tone b. tone cluster

\[ V \quad V \quad (\text{tone-bearing unit}) \]
\[
\text{L} \quad \text{H} \quad \text{L} \quad \text{H} \\
\text{o} \quad \text{o} \quad \text{o} \quad (\text{tonal node})
\]

Diachrony can shed some light on this difficult topic. Section 3 reviews facts and hypotheses.

### 3. Diachronic insights into Asian tones

The present section briefly recapitulates salient facts about the evolutions leading up to the creation of complex tones. Some hypotheses are put forward about a possible relationship between the historical phasing of the various stages of tonogenesis and the properties of the resulting lexical tones.

#### 3.1. Tonogenesis and registrogenesis

Tonogenesis can result from the loss of various phonemic oppositions, through a mechanism of compensation (transphonologization): lexical contrasts are preserved (at least in part) by means of a new opposition. These processes are now well understood [see 44 for a worldwide survey]. Taking the textbook case of Vietnamese [45, 46], Table 1 recapitulates the evolution from a stage when the language did not have tone (Table 1a) up to the present-day system (1c) via a stage where there were three tonal categories (with stop-final syllables as a distinct, fourth set).

One can reasonably hope that these arguments will gradually lead to a general recognition of the existence of more than just one possible structure for lexical tones. “[In a number of languages] contour tones were clearly shown to be composed of a sequence of level tones. The phenomena that
A hypothesis proposed by Michel Ferlus (p.c.) is that tones comprising phonation-type characteristics are created in cases where the tones resulting from the first stage of tonogenesis (see Table 1b above) are still in a state where they preserve phonation-type characteristics associated with earlier final consonants, such as glottalization or breathy voice, at the time when the second stage of tonogenesis begins (Table 1c).

The following paragraph sets out a hypothesis concerning the link between the diachronic origin of tones and their synchronic properties.

### 3.2. The origin of complex tones: a hypothesis

As for level-tone* systems, their wide geographical distribution makes sense in light of the fact that they can have various diachronic origins: they can result from the transphonologization of contrasts on initial consonants, as in Oceanic languages [52–54], or on final consonants, as in Athabaskan [26].

After they come into existence, tones involving phonation-type characteristics may change, and their specific phonation type disappear: for instance, Hanoi Vietnamese still has glottalization in two of its tones, whereas Southern Vietnamese does not retain any phonation-type characteristics [23, 25]. It seems that no hard-and-fast boundary can be drawn between tones with and without phonation-type characteristics. In the vast domain of Sinitic languages (Chinese dialects), the tones of some varieties clearly have specific phonation [e.g. 7, 9] whereas for others (e.g. Mandarin dialects) it can be debated to what extent the nonmodal phonation which is occasionally present for some tones is part of their phonological definition.

The final section of this paper sets out reflections on possible differences between tone systems in terms of diachronic evolution.

### 3.3. Differences in evolutionary potential between level tones and complex tones

There appear to be salient differences in evolutionary potential between different tone systems. While Pike’s two-way distinction between “register tones” (level tones*) and “contour tones” is certainly not the last word in prosodic typology, the differences that it aims to capture are reflected in diachronic evolution. Non-decomposable tones such as those of Vietnamese, Thai and Mandarin undergo a gradual phonetic evolution – apart from tone mergers, which are categorical and irreversible. The evolution of level tones*, on the other hand, is punctuated by categorical changes. Under given circumstances, noncontrastive details in the realization of tone (i.e. conditioned allotonic variation) can be reinterpreted as differences between tonal categories; as a result, the phonological system is modified. For instance, a slight phonetic raising of a H tone preceding a L tone has been noted in various tone languages: taking the Gulmancema data in Table 2 as an example, the syllable /LMo Hkan/ will be realised higher than in /LMo Hkant/. This phonetic phenomenon does not affect the phonological nature of the tones. In the closely related language Moba, on the other hand, the super-high phonetic variant of the high tone has gained contrastive status – i.e. a lexical extra-high tone has emerged – following the loss of word-final vowels.

### Table 2. A comparison showing the origin of the extra-high tone of Moba. Data and analysis from [35].

<table>
<thead>
<tr>
<th>meaning</th>
<th>Gulmancema</th>
<th>Moba</th>
</tr>
</thead>
<tbody>
<tr>
<td>he stepped over</td>
<td>1LMo ’łkan ’di (ō kândl)</td>
<td>1LMo ’łkant (ū kánt)</td>
</tr>
<tr>
<td>he steps over</td>
<td>1LMo ’łkan ’di (ō kândl)</td>
<td>1LMo ’łkant (ū kánt)</td>
</tr>
</tbody>
</table>

This is a classical case of transphonologisation (transfer of distinctiveness): from the tone of the word-final vowel to the one that precedes. The allotonic variation paves the way for the diachronic change, but the change itself (the modification of the tone system) is triggered by the loss of final vowels.
4. Conclusion

The above review aimed to recapitulate salient synchronic and diachronic properties of some of the tone systems of Asia. The considerable progress made in the study of the synchronic properties and diachronic evolution of these systems warrants a (cautiously) optimistic conclusion: it does not seem unreasonable to hope that refined models of tone will be developed in the next few years, taking into account the diversity of the fascinating complex-tone systems of Asia.

Beyond the typology and modelling of lexical tone systems, this issue has a bearing on intonation studies. “Autosegmental-metrical” models of intonation borrow extensively from studies of Subsaharan tone systems [66]. A significant number of researchers, some of whom initially argued against the modelling of intonation into discrete levels [67], now advocate models whose basic tenets are familiar concepts of autosegmental tonology, such as level tones*, downstep and tones spreading [witness the following textbooks: 68, 69]. Supposing, as the evidence reviewed here suggests, that there are lexical tone systems for which autosegmental models of tone do not tell the full story, new developments in the study of these tones could provide models and concepts for non-autosegmental approaches to intonation. The latter, which include the Kiel Intonation Model and its developments [70–73], superpositional approaches [74–81], and other approaches that have pre-generative roots [82–86], are currently outside the mainstream of intonation studies, in the same way as non-autosegmental analyses of tone systems fall outside mainstream (generative) phonology [87, 88]. Exchanges between researchers working within different frameworks is made difficult by differences in research goals, reflected in a different understanding of basic concepts. The present paper has achieved its goal if it has successfully conveyed some of the reasons why the generalization of representations based on level tones* is problematic.

5. Appendix. Definition of terms

This Appendix provides explanations about a few central concepts that receive widely different definitions in different frameworks. “After all, the goal is to typologize linguistic properties, not linguists” [89].

Contour tone. This term refers to two distinct things. (i) In the autosegmental framework, it refers to a tone* composed of two level tones* (or more). For instance, a L+H sequence realized over a single syllable is referred to as a contour. (ii) In Pike’s two-way distinction between “register tones” (=level tones) and “contour tones”, it refers to a tone* defined by a certain time course of pitch over the syllable [5].

Level tone. A tone* defined by a discrete level of relative pitch. In a language distinguishing two levels, the following

—
tones may be observed: H(high), L(ow), H=L, and L+H. Level-tone systems have two to five levels. Systems with more than three levels are uncommon [Bariba: 90; Bench, a.k.a. Gimira: 91, 92]. One single case of six-level system has been reported: Chori [93], for which a reanalysis is possible [94]. Five may seem a low figure, in view of the number of musical notes that the ear can distinguish. However, in speech, where attention is not exclusively focused on the recognition of successive pitches, four- or five-level systems present a high degree of complexity.

Phonation type. Mode of vibration of the vocal folds during phonation. This is commonly referred to as voice quality: see the entry on phonation-type registers.

Phonation-type register. See Register; phonation-type register.

Register; phonation-type register. In languages with a phonation-type register system, phonation type has a lexically distinctive role. Thus, the Mon language has a ‘clear’ voice (also called ‘modal’ voice) register contrasting with a breathy/whispery voice register; this was still the case of Khmer less than a century ago [49]. Even more than other linguistic features, registers tend to have multiple correlates: mode of vibration of the vocal folds, but also greater duration of syllables carrying nonsyllable phonation, differences in vowel articulation, and differences in fundamental frequency.

Instrumental studies of register systems include [95–104]. The term ‘phonation-type register’ is preferred over ‘voice quality’, as the latter is more general: “In a forthcoming book on general phonetics Professor David Abercrombie of Edinburgh accepts ‘register’ as an appropriate phonological term but suggests that ‘phonation-type’ is a more suitable term for its phonetic realization, thus reserving the expression ‘voice quality’ for more general use” [12].

Tone; toneme. The terms ‘toneme’ and ‘tone’ as used here are strictly equivalent. The word ‘toneme’ brings out the parallel with phoneme: like phonemes, tones are units that contrast with others within a system; they are defined as part of a paradigm. In this respect, tone is of a different nature from lexical stress, which has a specified position, i.e. a syntagmatic specification. It may be useful to add, in order to distinguish lexical tone from lexical phonation type registers, that fundamental frequency has a great importance in the phonetic realization of tone, unlike in the realization of phonation-type registers. It is unlikely, however, that a hard-and-fast line can be drawn between phonation-type register systems and tone systems.

6. Acknowledgments

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7. References
