Tonal density and its correlation with the types of tonal systems: Diachronic aspects

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Tonal systems are usually compared by the number of tones, by the character of tones (level or modulated), and by their function (lexical or grammatical). Following Gussenhoven (2004: 34), we suggest to compare these systems also by the criterion of tonal density, and introduce a Tonal Density Index (TDI), which equals the number of tonemes per 100 syllables. In order to make the calculation of the tonal density possible, it is necessary to define some key notions: toneme, tonal domain, marked tone and default tone, tonal and toneless syllables.

Toneme as a meaningful tone, i.e. a tone (or tonal contour, in a larger sense) which can distinguish lexical and/or grammatical meanings. With some reserves, toneme can be compared with what is phoneme in the segmental phonology. For certain types of languages, distinction between tone and toneme is marginal, but for some others, it is of a primary importance. This term was introduced by Pike (1948), it reappears sporadically (Welmers 1959; Hyman & Leben 2021), however, we are unaware of any serious attempt to elaborate this notion and make it work.

The **tonal domain** is a segmental chain on which a toneme is realized. It may vary from zero (for floating tones) to a long sequence of syllables; its length is language-specific. In some languages, a segmental chain is entirely subdivided into tonal domains; in some others, certain segments can remain outside tonal domains.

With respect to the **marked and default tones**, it is important to distinguish between unmarked tones which can be still regarded as tonemes and those which should be interpreted as absence of tones (or zero tones).

Toneless is a syllable (or mora) to which no toneme is assigned at the underlying level. Toneless syllables are found even in some languages with very high tonal density.

When this approach is applied to tonal languages, it turns out that tonal systems can be roughly subdivided into three major types, and these types correlate with the tonal density: **omnisyllabic** type (the TDI close to 100); **tonemic** type (the TDI between 50 and 90); **privative** type, i.e. languages with marked and zero tones (the TDI is below 50); **pitch-accent** type (the TDI is below 30).

Distribution of tonal languages by these types follows a clusterization model, and existence of some intermediate (hybrid) types can be envisaged.

With respect to the tonal types, diachronic evolution of tonal systems can follow various patterns.

1) Emergence of tones in an originally toneless language (or loss of tones). This case can be illustrated by Tibetic languages going back to the atonal Old Tibetan which has split around 9-10 century. An atonal modern language Amdo (TDI = 0) retains voiced consonants as well as certain onset consonant clusters (Makley et al. 1999). In Utsang (Lhasa Tibetan), the tonogenesis resulted from the devoicing of originally voiced consonants and the simplification of the onset consonant clusters (Huang Bufan 1995). According to Jäschke (2018) and Tournadre & Dorje

(2003), Utsang has two meaningful tones (i.e. tonemes): high (H) and low (L). Their superficial realizations depend on the segmental structure of a syllable, the main factors being the syllable weight, and on the extension of the tonal domain which can be equal to one or two syllables. TDI for the Lhasa Tibetan is 51.

2) Mobility between the tonal types. For example, in the Baltic group (Daugavet 2012; Kushnir 2018), the Lithuaninan Aukštaitian is a typical pith-accent language. It has two tonemes (falling and rising) and a mobile stress (an accentuated syllable can occupy any position in a word-form). Only accentuated heavy syllables (i.e., containing long vowels, or diphthongs, or diphthongoids) carry meaningful tones. Light syllables (stressed or unstressed) and unstressed heavy syllables cannot carry meaningful tones. The TDI of this variety is 30.

The Old Latvian had a system close to the Lithuanian, but the situation in the modern literary Latvian is different. It has a word-initial stress and three tonemes: rising/high, falling and rising-falling, the latter also includes an interrupting phonation. Every heavy syllable (both stressed or unstressed) carries a meaningful tone, and light syllables are toneless. Because of the historical loss of short vowels and the subsequent syllabic contraction, two or more heavy (and, subsequently, tonal) syllables can appear in one wordform. As a result, the Latvian language has evolved from the pitch-accent type toward the omnisyllabic type, and its TDI equals 43; it can be regarded as a hybrid type.

3) Change of tonal density within the limits of one tonal type. For example, both Bambara (Manding < Western Mande, TDI = 66-67.5) and Kakabe (Mokole < Western Mande, TDI = 62.5) are tonemic languages with similar tonal systems. The decrease of TDI in Kakabe can be explained by a couple of innovations, such as: definitive loss of tones by light postpositions (in Bambara, this rule is facultative); reinforcement of the rule of the phrase-final high tone lowering if preceded by a low tone (in Bambara, this rule is also facultative); partial loss of tones by personal pronouns (Vydrina 2017).

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