Toneme as the basic unit of tonology and criteria for its identification[1]

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Typological study of tonal languages of the world is currently complicated by the lack of clarity concerning the basic tonological unit. It is indicative that the term "tone" is widely used in tonological literature indiscriminately for both a pitch-based phonological contrast and any pitch contour. This hampers both the understanding of organization and functioning of tonal systems and the cross-linguistic quantitative and qualitative comparison of tonal systems.

What most tonologists would probably agree on is that for any tonal language one can always postulate some minimal discrete units with a potential to distinguish lexical and/or grammatical meanings through pitch contrast. In fact, the term for such a unit existed for quite some time, a **toneme**. It was first introduced by D.M. Beach in the first half of 20th century (Beach 1938), and later used by Pike (1948). We suggest to use toneme as the basic unit of a tonal system.

What is required for comparative tonological studies to proceed is a stricter operationalization that would allow to consistently identify functionally comparable units (tonemes) in unrelated languages. In many languages, surface realization of phonological tonal contrasts is highly context-dependent, so that researchers rely on various distributional criteria to recover contrasting units. To ensure that such units (tonemes) are indeed comparable across languages one needs to standardize the set of criteria and procedures for their identification.

We take an axiomatic approach to standardization. We formulate general toneme properties and principles for the tonal processes that define surface realization of tonemes taking into account arguments advanced earlier in the tonological literature. The aim is a set of properties and principles that is concise and self-consistent. The operational criteria for the assignment of tonemic status to a particular pitch contour would logically follow from these properties and principles.

In our axiomatic system, a toneme is a unit with the following properties:

- **Sequentiality**: tonemes follow each other, but do not overlap.
- **Continuity**: a toneme is realized on an uninterrupted sequence of tone bearing units (hereafter, TBU).
- **Scalability**: a toneme can be realized on one or more than one TBU.

Principles for tonal processes:

- The **One Toneme Per TBU Principle**: One TBU cannot bear more than one toneme if no tonal process is involved. In other words, on the underlying level only one toneme can be linked to a TBU. If more than one toneme is realized on the same TBU on the surface level, it is always the result of some tonal process.
- The **TBU Occupancy Principle**: If a TBU is involved in a tonemic contrast, it is involved in it completely. In other words, a TBU cannot be shared between a toneme and a zero. A TBU can bear Ø, T, T+T, but not *T+Ø.
- The **Toneme Deletion Principle**: A toneme deletion can be conditioned either by another toneme, or by the configuration of a segmental chain, or by a subtractive tonal morpheme, but not by a zero tone.

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- The **Conformity of the tonal span and prosodic unit:** If a language has a basic prosodic unit higher than TBU (a syllable, for moraic languages; a foot; a word) to which refer the rules of tonemic distribution, and if such a unit contains a sequence of TBUs carrying identical tonal levels, this sequence represents one tonal span.

There is one **general criterion** for identification of tonemes:

- The **Persistence Criterion**: If a tone is contrastive and it persists in all contexts (i.e., it is not affected by tonal processes which could be regarded as criteria of tonemic status), such tone is considered to be a toneme. This criterion may be sufficient for "simple" tonal systems where tones are stable and no (or very few) tonal processes are attested.

There are three **criteria for a contour toneme** (i.e., indicating that a tonal contour is a toneme, rather than a combination of two or more level tonemes):

- The **Non-Compositionality Criterion**: If a language has a tonal contour realized on one TBU composed of levels which are not available in this language as tonemes, this contour is a toneme.
- The **Single TBU Criterion**: If a tonal contour can appear on one TBU as an element of an exponent of a single morpheme, and the contour is not a result of a tonal process (such as tonal spread, etc.), this contour is a toneme. This criterion follows from *The One Toneme Per TBU Principle*.
- The **Extensibility Criterion**: If a tonal melody can be realized on a segmental unit (most often, a word) represented by a single TBU, but can also be hosted by a longer unit, this melody is a toneme. This criterion is based on the *Scalability Property* and *One Toneme per TBU Principle*. It is meant to answer a question: if a language has steady tonal melodies, what is their status? Are they tonemes or combinations of tonemes? According to the Extensibility Criterion, the answer depends on the ability of the melody to be mapped onto one TBU.

There are four criteria aimed specifically to distinguish between a privative (zero tone) and equipollent tonal oppositions:

- The **Floating Criterion**: If a tone can float, it is a toneme (first formulated by Hyman (2000)).
- The **Tonal Morpheme Criterion**: An additive or replacive tonal (non-segmental) morpheme contains at least one toneme.
- The **Shared TBU Criterion**: If two level tones can be assigned to one TBU, both tones are tonemes (unless this contour is a toneme, see criteria for the contour tonemes above), and neither is Ø. This criterion is based on the *TBU Occupancy Principle*. It was first suggested by Hyman (2000).
- The **Activity Criterion**: If a tone appears as a part of the condition in a tonal rule, it is a toneme. Cf. Hyman's (2000) formulation: "If the opposition is /H, Ø/, tone rules should refer only to H's."
- The **Constraints Criterion**: If there are positional constraints for a tone relative to some segmental unit, this tone is a toneme. Cf. Hyman's (2000) formulation: There are constraints on the marked tone occurring, and there are no constraints on Ø occurring.

The use of the standardized criteria for toneme identification opens up the possibilities for quantitative comparative studies of tonal systems in the languages of the world, including toneme inventory composition, tonal density in text, and functional load of tonemes.