2003

Metrical phonology

John J. McCarthy
University of Massachusetts, Amherst, jmccarthy@linguist.umass.edu

Bruce Hayes

INTERNATIONAL ENCYCLOPEDIA OF LINGUISTICS

SECOND EDITION

WILLIAM J. FRAWLEY
Editor in Chief

Volume 3
Mande Languages–Selection

OXFORD
UNIVERSITY PRESS
2003

image onto the internal structure of another image. Image-metaphors thus tend to provide the basis for single linguistic expressions (e.g. *dunk*), while conceptual metaphors provide the basis for whole semantic fields of expressions (e.g., *Prices* ROSE, FELL, HIT BOTTOM, LEVELED OFF, etc.)

Conventional metaphors, on the whole, have a rather detailed structure. They have specified source and target domains (e.g. VERTICALITY and QUANTITY), and specific correspondences between source domain elements and target domain elements (e.g., UP corresponds to MORE, and DOWN to LESS). There are, however, conventional metaphors that do not have such specific constraints. They are referred to as "generic-level metaphors." An example is the EVENTS ARE ACTIONS metaphor, which construes events that occur as actions performed by some metaphorical agent. This metaphor is responsible for a large range of personifications. For example, in the adage *Time cures all ills,* the event of healing is understood as the action of curing performed by the metaphorical agent, Time. The EVENTS ARE ACTIONS metaphor can apply to any domain at all, so long as the source is an action and the target is an event. But it is also very tightly constrained; it does not allow an event to be understood in terms of just any action. For example, though paying is an action, *Patients pay for all illnesses* is not a metaphorical way of understanding healing. Paying is not an appropriate action for metaphorically characterizing healing. There are general principles that explain why. In general, the permissible actions must be taken from the same domain of experience as the event (e.g., curing is in the same domain as healing). In addition, the action must preserve certain aspects of semantic structure, called "generic-level" structure, in that domain. Such structure includes causal structure, temporal structure, number of entities, and modalities (like *must* and *can*). Time is permitted as an agent because *Time cures all ills* expresses the idea that time, like an agent that cures, plays the principal causal role in healing. All generic-level metaphors are constrained so as to preserve generic-level semantic structure in this manner.

The generic-level metaphor with the widest applicability is the GENERIC IS SPECIFIC metaphor. It enables one to understand any of a category of situations in terms of the generic-level structure of a single specific situation. For example, our knowledge about rain has the following generic-level structure: It is an externally produced effect that is beneficial in moderate, but not excessive, amounts. *When it rains, it pours* says literally that, whenever it rains at all, the rain occurs only in the excessive, non-beneficial quantity. Metaphorically, *When it rains, it pours* can be said of any situation with that generic-level structure, where an externally produced effect that is beneficial only in normal quantities is occurring in excessive quantities. Here the GENERIC IS SPECIFIC metaphor applies to the specific case of rain, and maps it onto any of a class of situations with the same generic-level structure.

In general, metaphor is a cognitive mechanism that permits one to take highly structured knowledge of concrete situations and to use it to comprehend other situations which are more abstract. It is thus central to the human capacity for abstract reason (see Lakoff and Nunez 2000, Turner 1996).

[*See also* Semantics; Cognitive Grammar; *and* Linguistics and Literature.]

BIBLIOGRAPHY

Johnson, Mark. 1987. *The body in mind: The bodily basis of meaning, imagination and reason.* Chicago: University of Chicago Press.

Lakoff, George. 1987. *Women, fire, and dangerous things: What categories reveal about the mind.* Chicago: University of Chicago Press.

Lakoff, George. 1995. Reflections on metaphor and grammar. In *Essays in semantics and pragmatics in honor of Charles J. Fillmore*, edited by J. Fillmore et al., pp. 133–143. Amsterdam: John Benjamins.

Lakoff, George, and R. Nunez. 2000. *Where mathematics comes from.* New York: Basic Books.

Lakoff, George, and Mark Johnson. 1980. *Metaphors we live by.* Chicago: University of Chicago Press.

Lakoff, George, and Mark Turner. 1989. *More than cool reason: A field guide to poetic metaphor.* Chicago: University of Chicago Press.

Ortony, Andrew, ed. 1979. *Metaphor and thought.* Cambridge and New York: Cambridge University Press.

Sweetser, Eve. 1990. *From etymology to pragmatics: Metaphorical and cultural aspects of semantic structure.* Cambridge and New York: Cambridge University Press.

Turner, Mark. 1987. *Death is the mother of beauty: Mind, metaphor, criticism.* Chicago: University of Chicago Press.

Turner, Mark. 1996. *The literary mind.* Oxford: Oxford University Press.

GEORGE LAKOFF

METATHESIS. *See* Phonological Processes.

METRICAL PHONOLOGY. This is a family of subtheories of generative phonology that are intended to

characterize insightfully the properties of *stress* and stress rules. Metrical theory holds that, unlike other phonological properties, stress is not a feature; rather, it is the hierarchical rhythmic organization of utterances.

Different versions of metrical theory use different formalisms. This article will employ formalisms from Prince 1983, Halle and Vergnaud 1987, and Hayes 1995, but will focus on general properties shared by other metrical theories.

1. Typological properties. Stress differs from other phonological properties, such as nasality or voicing, both in its phonetics and in its phonological organization. Phonetically, stress is unusual in that it has no invariant physical correlates; rather, it is an abstract property that is instantiated physically by a variety of mechanisms (such as length and pitch), which differ across languages.

Stress also has a number of distinctive phonological characteristics:

(a) It is usually *culminative*: each word or phrase has a single strongest syllable.
(b) Stress is *rhythmically distributed*: syllables bearing equal levels of stress tend to occur at roughly equal intervals. Thus, in many languages, six-syllable words are regularly assigned the stress pattern x́ x x́ x x́ x; but there appear to be no languages in which six-syllable words receive the pattern x x x x́ x́ x́. Rhythmic distribution of phonological properties other than stress is rare.
(c) Stress is *hierarchical*: in most languages that have stress, it occurs in an indeterminate number of degrees—primary, secondary, tertiary, etc. In contrast, ordinary features have a limited, predetermined number of contrasting phonological values (only two, according to some scholars).
(d) Stress does not *assimilate*: while features like [round] and [back] often extend their domains through spreading, this is totally unattested for stress.

2. Metrical theory (Liberman and Prince 1977) posits that these phonetic and phonological differences between stress and ordinary features can be best accounted for if stress is represented by a hierarchically organized rhythmic structure. One representation for this structure is a metrical grid; e.g.

```
                    x
x         x         x
x   x     x   x     x   x
x x x x   x x x x x x x x
```

(1) *twenty-seven Mississippi legislators*

In the grid, the height of each column indicates the stress level of the syllable at its base. (Stress levels are established by various phonological diagnostics.) The rows of the grid are also phonologically significant, in that they represent sequences of rhythmic beats. Successively longer rhythmic intervals occur at successively higher levels—in this utterance, at one, two, and four syllables.

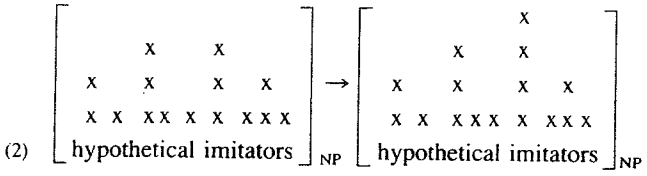
Metrical representation allows the special properties of stress to be stated perspicuously:

(a) Culminativity reflects a principle of maximal organization: if at every grid level a relation of relative prominence must be defined on competing grid marks, then it follows that every domain must have a single highest column.
(b) Rhythmic distribution can be stated as a tendency toward even spacing of grid marks at all levels. This is illustrated by ex. (1), in which a rule of English has altered the normal stressings of *twenty-séven* and *Mississíppi* to create even spacing on the third row.
(c) The existence of multiple levels of stress reflects the hierarchical nature of rhythmic structure.
(d) The absence of stress assimilation follows from the absence of a feature [stress] which can be assimilated. The general picture is that a metrical representation captures the typological properties of stress more accurately than would a feature [stress].

3. Predictability of stress. In many languages, stress is predictable by rules, constraints, or other principles. In Polish, for example, words of more than one syllable have penultimate stress. Other languages have different, sometimes far more complex regularities. Stress relations among words at the phrasal level are also predictable.

Rules or constraints affecting stress are often non-local. For instance, phrasal stress in English is assigned roughly as follows: locate the main stress of the rightmost word in a syntactic phrase, and promote it to the strongest stress of the phrase. In order to locate the target, it is necessary to scan several syllables, as in the phrase *hypothètical ímitators,* where the target syllable *ím* is four syllables from the end of the phrase.

The non-locality of phrasal stress can be explicated by metrical representation, because the higher levels of the grid are phonologically relevant. English phrasal stress assignment amplifies the highest grid mark that is string-adjacent to the right phrase boundary:



(2)

For purposes of locality, it is only necessary to identify the rightmost element on the highest level of the input grid. On that level, the process is strictly local. Long-distance segmental phenomena have been analyzed analogously.

Another property of stress rules is a tendency to exaggerate pre-existing contrasts, by making strong syllables stronger and weak ones weaker. For example, the process just described amplifies only the main stress of the target word. By contrast, *destressing* processes, found in many languages (Hammond 1984), apply only to syllables with subordinated stress, and never to primary stressed syllables. It is likely that such patterns can be deduced from the basic postulates of metrical theory (Prince 1983, Hayes 1995).

4. Grouping. Traditional notions of rhythmic structure often impute more to *rhythm* than just a hierarchy of beats: rhythm is also held to involve the grouping of consecutive beats into phrases. Over the past two decades, a body of evidence has been developed that supports including grouping structure in metrical theory.

One source of evidence for grouping is the insight which it can provide into word-stress assignment. The sequence of syllables in a word is parsed into groupings called *feet*. Each foot has a single prominent syllable, which is marked on the grid. For example, in a variety of Hungarian (Hammond 1987), stress is placed on the odd-numbered syllables of every word. Hammond's analysis divides each word at the lowest metrical level into disyllabic feet, with each foot given prominence on its initial syllable. In the diagram below, parentheses indicate foot bracketings:

(3)
x x x x
(megvesz)(teget)(hetet)(lenek)
'unbribable ones'

Positing feet as metrical constituents makes it possible to state several cross-linguistic generalizations:

(a) The types of licit feet, and hence the types of permissible stress systems, are severely limited (Hayes 1995). Binary feet are strongly favored; arguably, feet never contain more than two syllables, and feet containing just one syllable are restricted or prohibited entirely in many languages. There are also prominential differences in feet: languages with left-headed feet (3) are common, but the mirror image, with final prominence, is rare or unattested.

(b) Languages like Hungarian in (3) are *quantity-insensitive*: the internal contents of syllables do not affect foot assignment. Other languages, such as English, are *quantity-sensitive*: they distinguish between heavy syllables (with a long vowel or final consonant) and light syllables (with a short vowel and no final consonant). Quantity-sensitive languages provide even more striking evidence for feet. Arguably, there are two rather different types of feet found in different quantity-sensitive languages: a trochee (with initial prominence) consisting of two light syllables or a single heavy syllables; and an iamb (with final prominence) consisting ideally of a light-heavy sequence.

(c) Phonological processes are often observed to change syllable weight to bring it into better conformity with these norms. In trochaic languages, heavy-light trochees are subject to shortening of the first syllable, while in iambic languages, light-light trochees may show lengthening of the second syllable (Mester 1993, Hayes 1995, Prince 1990).

(d) Foot binarity, combined with the requirement that every word contain a foot (a natural consequence of hierarchical prosodic structure), explains *word minimality* effects (McCarthy and Prince 1995). In many languages, content words must contain at least two syllables or two moras, depending on whether the language is quantity-insensitive or quantity-sensitive. Phonological processes actively enforce this requirement; for example, Mohawk adds prothetic *i* to monosyllables: /k+tats+s/ → *íktats* 'I offer'.

(e) *Prosodic morphology* also refers to metrical feet (McCarthy and Prince 1995), as in Diyari, whose reduplicative morpheme consists of a single disyllabic foot: *ṭilpa-ṭilparku* 'bird species (plural)'.

(f) Research in Optimality Theory has identified a class of constraints aligning the edges of constituents (McCarthy and Prince 1993). It has been claimed that constraints aligning the edges of feet with the edges of words are the source directional foot-parsing.

There is, then, convergent evidence for feet as metrical constituents.

5. Current issues. Open questions greatly outnumber

settled ones in metrical theory. The following are three current issues.

5.1. ***Rules vs. constraints.*** The development of Optimality Theory (OT) has focused attention on the question of whether stress regularities are accounted for by transformational rules or by output constraints. Many aspects of metrical theory readily lend themselves to constraint-based treatment, especially the conditions on the licit forms of feet. OT's thesis that constraints are violable is also relevant to metrical concerns; for instance, it correctly predicts that languages can differ in how and whether they enforce foot binarity requirements. These matters are not uncontroversial, though, for example, the common metrical phenomenon of deletion of unstressed vowels presents new challenges in the OT context (Kager 1999).

5.2. ***Prominence-driven stress.*** Early research in metrical theory allowed syllable-internal structure to have only a limited role in stress assignment: in quantity-sensitive languages, heavy syllables attract stress. This binary, structurally based dichotomy now appears to be insufficient. In some languages, stress is assigned according to preference scales with three, four, or more steps. Non-structural factors, such as vowel height, differentiate the steps on these scales. Current research seeks to determine the range of these factors and how they affect stress and other metrical phenomena (Gordon 1999, de Lacy 2002).

5.3. ***Ternary rhythm.*** A small number of languages have ternary rather than binary alternating stress. In Cayuvava, for example, stress is assigned to the antepenult and every third syllable preceding it: *ikitàparerépeha* 'the water is clean'. The problem is how to accommodate these languages within a theory that basically favors binary alternation, see Elenbaas and Kager 1999 for a recent proposal and reviews of earlier work.

[*See also* Autosegmental Phonology; Generative Phonology; Optimality Theory; Phonological Features; Phonological Processes, *articles on* Assimilation *and* Long-distance Processes; *and* Syllables.]

BIBLIOGRAPHY

de Lacy, Paul. 2002. *The formal expression of scales*. Amherst, Mass.: University of Massachusetts dissertation.

Elenbaas, Nine, and René Kager 1999. Ternary rhythm and the lapse constraint. *Phonology* 16.273–330.

Gordon, Matthew. 1999. Syllable weight: Phonetics, phonology, and typology. Los Angeles: University of California dissertation.

Halle, Morris, and William Idsardi. 1995. General properties of stress and metrical structure. In *The handbook of phonological theory*, edited by John A. Goldsmith, pp. 403–443. Cambridge, Mass., and Oxford: Blackwell.

Halle, Morris, and Jean-Roger Vergnaud. 1987. *An essay on stress*. (Current studies in linguistics, 15.) Cambridge, Mass.: MIT Press.

Hammond, Michael. 1984. Constraining metrical theory: A modular theory of rhythm and destressing. Los Angeles: UCLA dissertation. Published, New York: Garland, 1984.

Hammond, Michael. 1987. Hungarian cola. *Phonology Yearbook* 4.267–269.

Hayes, Bruce. 1980. A metrical theory of stress rules. Cambridge, Mass.: MIT dissertation. Revised version, New York: Garland, 1985.

Hayes, Bruce. 1984. The phonology of rhythm in English. *Linguistic Inquiry* 15.33–74.

Hayes, Bruce. 1995. *Metrical stress theory: Principles and case studies*. Chicago: University of Chicago Press.

Kager, René. 1995. The metrical theory of word stress. In *The handbook of phonological theory*, edited by John A. Goldsmith, pp. 367–402. Cambridge, Mass., and Oxford: Blackwell.

Kager, René. 1999. Surface opacity of metrical structure in Optimality Theory. In *The derivational residue in phonological Optimality Theory*, edited by Ben Hermans and Marc van Oostendorp, pp. 207–245. Amsterdam: Benjamins.

Liberman, Mark, and Alan S. Prince. 1977. On stress and linguistic rhythm. *Linguistic Inquiry* 8.249–336.

McCarthy, John J., and Alan Prince 1993. Generalized alignment. In *Yearbook of morphology*, edited by Geert Booij and Jaap van Marle, pp. 79–53. Dordrecht: Kluwer.

McCarthy, John J., and Alan Prince 1995. Prosodic morphology. In *The handbook of phonological theory*, edited by John A. Goldsmith, pp. 318–366. Cambridge, Mass., and Oxford: Blackwell.

Mester, Armin. 1994. The quantitative trochee in Latin. *Natural Language and Linguistic Theory* 12.1–61.

Prince, Alan S. 1983. Relating to the grid. *Linguistic Inquiry* 14.19–101.

Prince, Alan. 1990. Quantitative consequences of rhythmic organization. In *Parasession on the syllable in phonetics and phonology*, edited by M. Ziolkowski et al., pp. 355–398. Chicago: Chicago Linguistic Society.

BRUCE HAYES AND JOHN J. MCCARTHY

MICRONESIAN LANGUAGES.

A group spoken on the Micronesian islands in the South Pacific. They constitute a branch of REMOTE OCEANIC.

LANGUAGE LIST

Carolinian: also called Saipan Carolinian, Southern Carolinian. 3,000 speakers in Northern Mariana Islands. Saipan,