Metrical Phonology

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Metrical Phonology

- A generative framework drawing on the insights of autosegmental theory and accounting for lexical stress and other rhythmic phenomena.

- See Liberman and Prince 1977; van der Hulst and Smith 1982; Giegerich 1985; Hogg and McCully 1987; Goldsmith 1990; Hayes 1995 (and references therein).


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On Stress and Linguistic Rhythm (1977)

Mark Liberman and Alan Prince

0 Prospectus

In this essay a new theory of stress and linguistic rhythm will be elaborated, based on the proposals of Liberman (1975).[1] It will be argued that certain features of prosodic systems like that of English, in particular the phenomenon of "stress subordination," are not to be referred primarily to the properties of individual segments (or syllables), but rather reflect a hierarchical rhythmic structuring that organizes the syllables, words, and syntactic phrases of a sentence. The character of this structuring, properly understood, will give fresh insight into phenomena that have been apprehended in terms of the phonological cycle, the stress-subordination convention, the theory of disjunctive ordering, and the use of crucial variables in phonological rules.

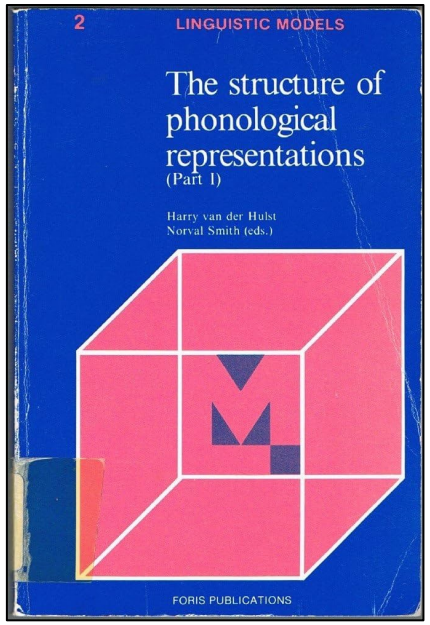
Our theory will employ two basic ideas about the representation of traditional prosodic concepts: first, we represent the notion *relative prominence* in terms of a relation defined on constituent structure; and second, we represent certain aspects of the notion *linguistic rhythm* in terms of the alignment of linguistic material with a "metrical grid."

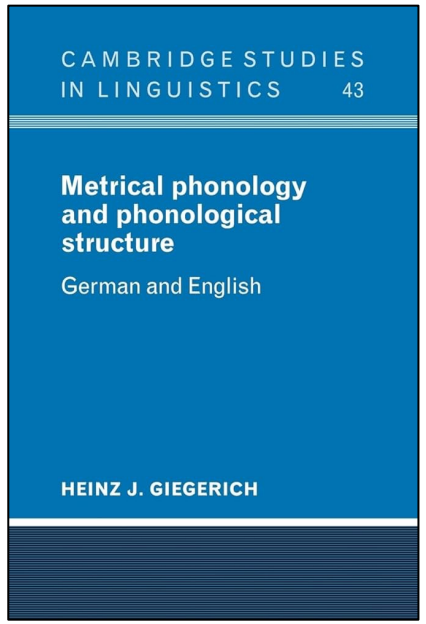
The perceived "stressing" of an utterance, we think, reflects the combined influence of a constituent-structure pattern and its grid alignment. This pattern–grid combination is reminiscent of the traditional picture of verse scansion, so that the theory as a whole deserves the name "metrical." We will also use the expression "metrical theory" as a convenient term for that portion of the theory which deals with the assignment of relative prominence in terms of a relation defined on constituent structure.

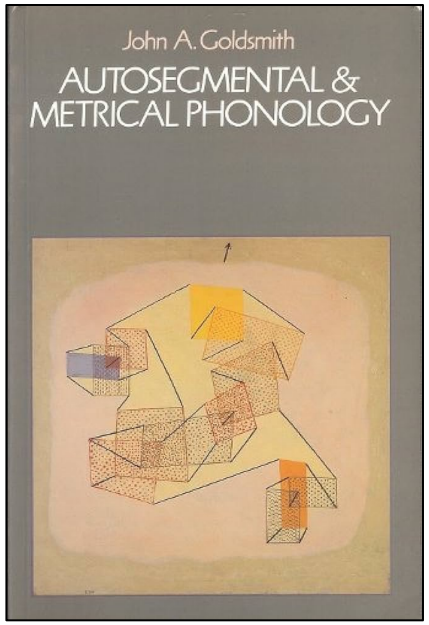
Section 1 [not repr. here] will apply the metrical theory of stress-pattern assignment to the system of English phrasal stress, arguing this theory's value in rationalizing otherwise arbitrary characteristics of stress features and stress rules. Section 2 [not all repr. here] will extend this treatment to the domain of English word stress, adopting a somewhat traditional view of the assignment of the feature [+stress], but explaining the generation of word-level patterns of stress in terms of the metrical theory developed to treat the phrasal domain. Section 3 [not repr. here] will introduce the concept of alignment with a *metrical grid* – fundamentally a formalization of the traditional idea of "stress-timing." We will argue that this concept is central to a satisfactory account of the so-called rhythm rule, and also gives a realistic picture of relative stress at the syllabic level.

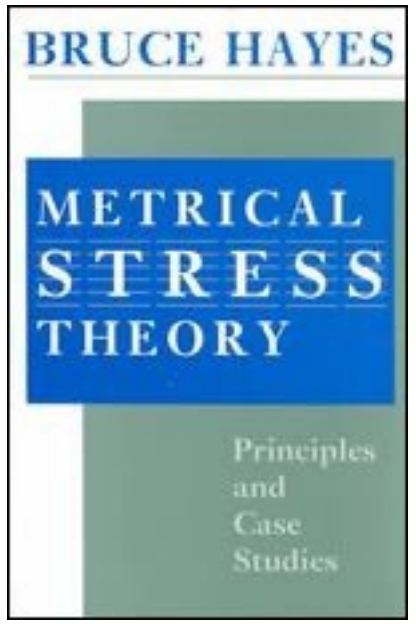
0.1 A note on the data

For the most part, this article will advance its case in terms of a reanalysis of old observations, rather than a flourish of new ones. The body of descriptive data we propose to









The Sound Pattern of English

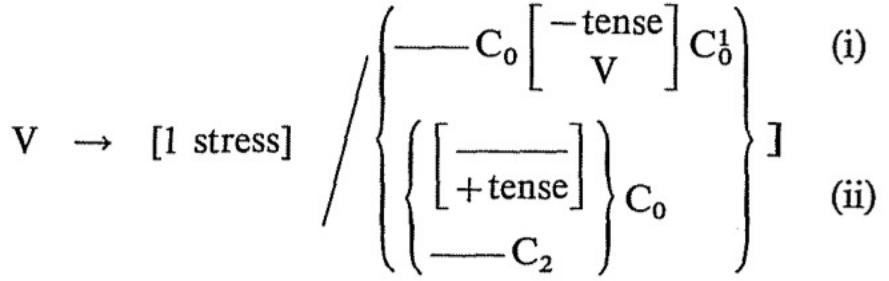
SPE:

- Phonological representations are linear, concatenated strings of segments (with no overarching hierarchical structure or organisation)
- Stress is an *n*-ary feature of vowel segments
  - e.g. primary stress is determined by a generative rule assigning the segmental feature [1 stress] to a given vowel, based purely on its segmental environment

Assign main stress to

(i) the penultimate vowel if the last vowel in the string under consideration is non-tense and is followed by no more than a single consonant;

(ii) the last vowel in the string under consideration if this vowel is tense or if it is followed by more than one consonant.[15]



Chomsky and Halle (1968, 69ff.).

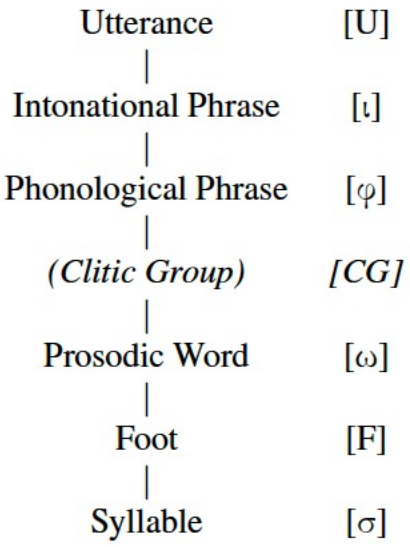
After SPE…

- Metrical phonology began with Liberman and Prince (1977), who challenged the approach to stress proposed in SPE.
- Metrical phonology rejects the idea of stress as a segmental feature (it's necessarily a suprasegmental property of multiple segments).
- Relies on the assumption that stress and other rhythmic phenomena involve phonological constituents above the level of the segment, i.e. the σ & F.
- Stress results from the relative prominence of prosodic constituents (hierarchically organised and determined by suprasegmental properties, e.g. quantity & weight).

For a thorough discussion of this topic, see Lahiri (2001).

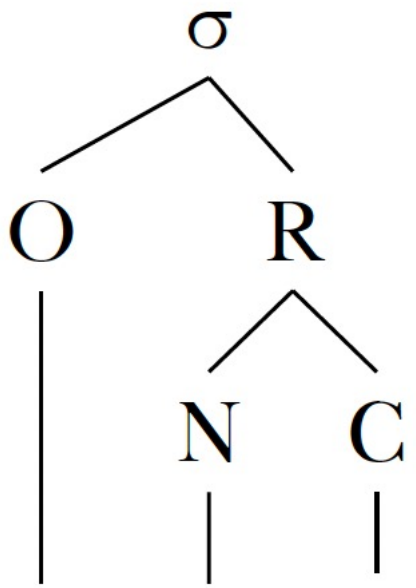
Metrical Stress

- A foot is an organizing unit of prosodic structure built on moras and syllables.
- Prominence falls on the heads of feet, and feet can be right- or left-headed (an iamb or a trochee).
- Feet may be sensitive to syllable weight, and definitions of σ weight can vary.
- Feet can be constructed from the right or the left edge and lexical stress falls on the head of the leftmost or rightmost foot.
- The metrical system of a language can thus be defined by:
  - weight sensitivity,
  - the nature of the foot (trochee/iamb),
  - the direction of parsing,
  - the foot that carries main stress.
- Certain ω-final units may also be considered 'extrametrical' and ignored.
- Each prosodic word minimally comprises a stressed foot.

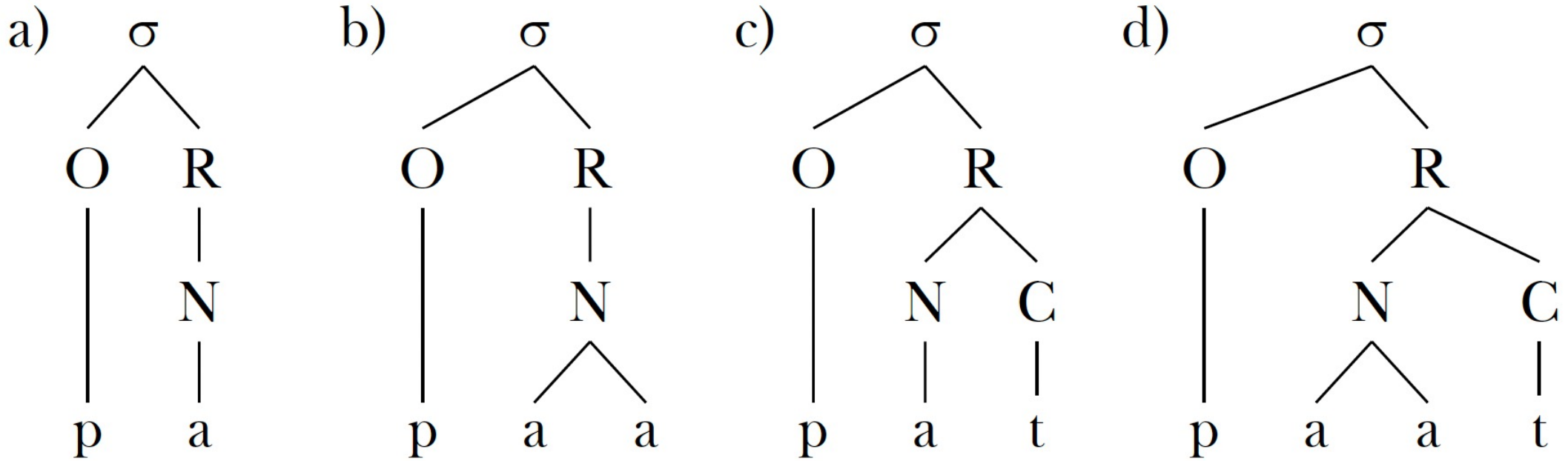


Syllable structure

- Syllables have their own internal structure, and the received view is that this structure is hierarchical.
- Not part of the underlying representation, but a predictable product of the phonological grammar (the syllabification algorithm).
- Usually assumed to apply cyclically throughout the derivation
- Syllable rhymes may be branching or non-branching.
  - For a general discussion, see Kenstowicz 1994, 250–309; Blevins 1995; Hayes 2009a, 250–70). The algorithm must be to an extent language specific.
- It is possible for a syllable to have both a branching rhyme *and* a branching nucleus / coda



Syllable structure



Syllable structure

Possible branching rhyme structures word-medially. Examples are taken from the dialect of Imst (Schatz 1897).

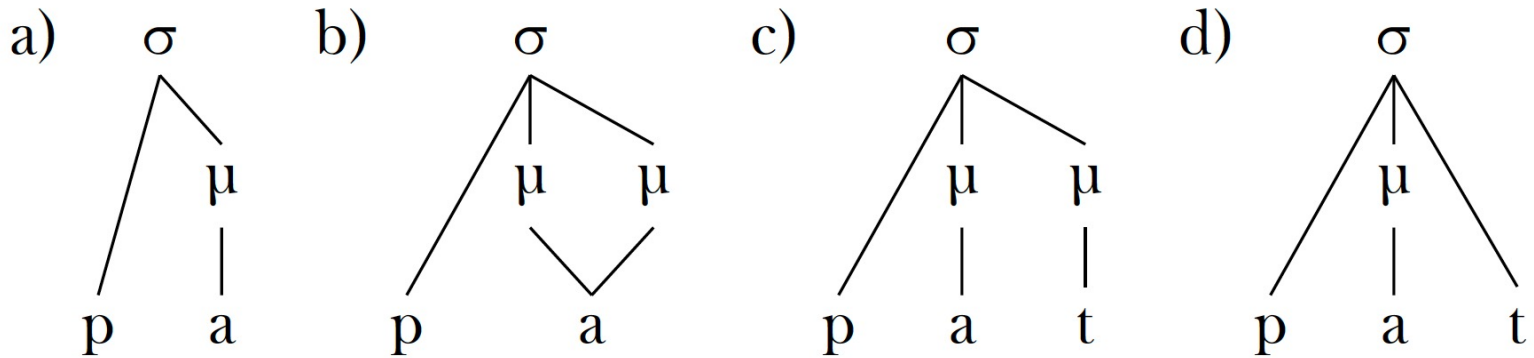
- Long vowel — [ʃɔː.də] ‘damage’
- Diphthong — [løɪ̯.sə] ‘read-INF’
- Closed by coda consonant — [ʃœl.fə] ‘fruit skin’
- Closed by geminate — [rɔp̣ːə] ‘raven-PL’
- Closed by affricate — [hup͡p̣fə] ‘hop-INF’

‘Branching’ structure

- Essential in accounting for metrical structure in quantity-sensitive languages, as it is this property which determines syllable weight:
  - σ̄ = branching
  - σ̆ = non-branching
  - σ̿ = doubly-branching (languages may make a distinction between σ̄ and σ̿)
- Weight distinctions are highly language specific:
  - Weight insensitive, e.g. Pintupi (Hayes, 1995, pp. 62–64)
  - Only branching nucleus heavy, e.g. Huasteco (Lahiri and Koreman 1988, 218)
  - ‘Weight-by-position’: CVV and CVC heavy, e.g. Cayapa (Lahiri and Koreman 1988, 219)

Moraic theory

- Unit of syllable weight is the mora (μ)
- Units contributing weight (in a given language) thus linked to 1+ μs, depending on quantity



- Vowels & geminates inherently moraic
- In quantity-sensitive languages with weight-by-position, a coda consonant may also be assigned a μ, otherwise they contribute none.
- Onsets do not contribute weight to a syllable

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  - Therefore, σ̄s = bimoraic & σ̆s = monomoraic.
  - Crosslinguistically, trimoraic σ̄̄s tend to be avoided (cf. Lahiri 2001), but they are found across Germanic.

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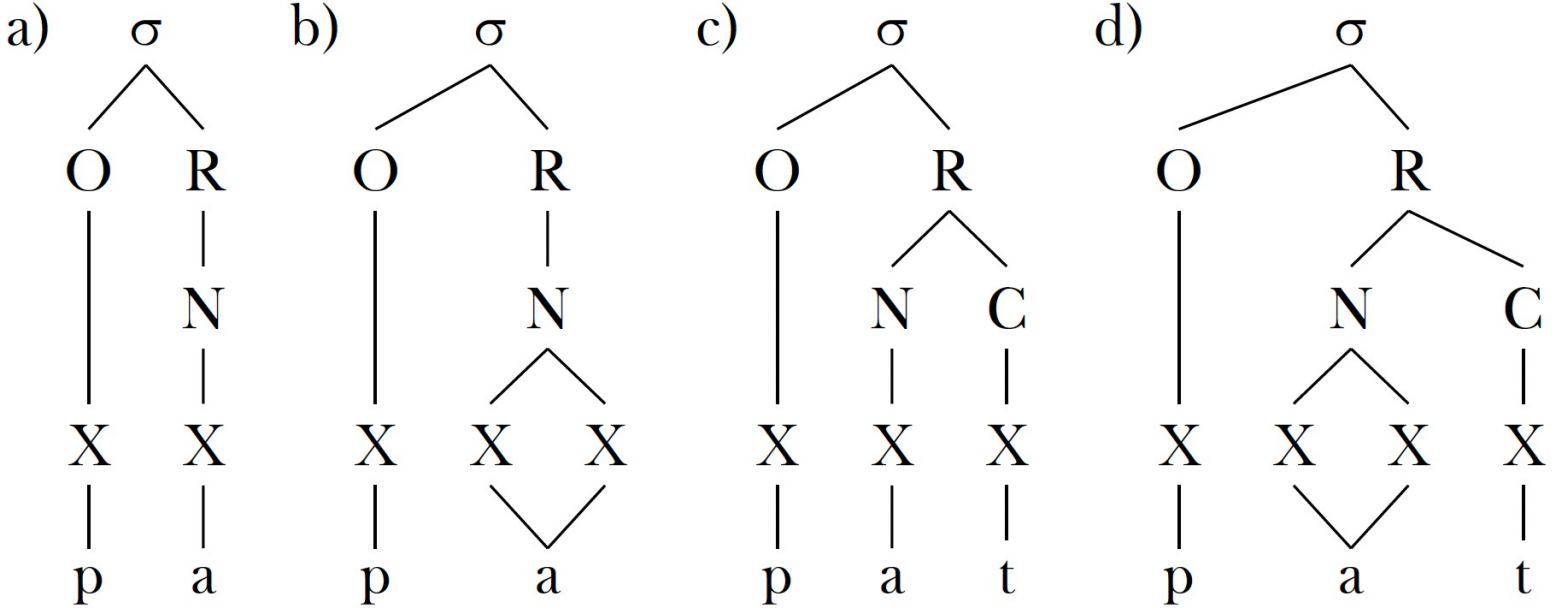
Skeletal approach

- Moraic approaches link segmental tier to σ via μs
  - Weight product of moras
- Skeletal approaches assume segments (ROOT nodes) attach to σ via separate timing tier
  - Weight product of branching structure (rhyme / nucleus)



Skeletal approach

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- Earlier models featured C(onsonantal) and V(ocalic) slots on the melodic tier (e.g. Clements and Keyser 1983)
- Later models (e.g. Levin 1985) propose undifferentiated X-slots, due to the redundancy of specifying C or V status (i.e. syllabic information) on the melodic tier.
- For a thorough discussion of the advantages and limitations of both approaches, see Broselow (1995) and Kraehenmann (2003, 16–27).

‘Branching’ structure

- It seems necessary to separate weight and length and represent each independently, as languages exist where only V: syllables or only VC syllables count as heavy, as well as languages where both count as heavy (or even where both are heavy, but one seems somehow heavier than the other)

  → The level within the syllable’s internal structure at which the branching occurs seems to be relevant in defining syllable weight.

- Moraic accounts struggle to account for systems which count both V and V: as light, but VC as heavy (e.g. Seneca, Lahiri and Koreman 1988, 218).
- X-slots alone struggle to account for languages which do not have weight-by-position.
- Kraehenmann (2003, 28) assumes X-slots, with automatic syllabification rules determining the internal syllabic structure. Weight tier is then projected from the rhyme structure (the product of branching): V syllables are always light, but languages may count only syllables with branching N nodes or branching R nodes (or both) as heavy.

Parametrical accounts

- Assigning word stress is not merely a question of identifying which syllable carries maximum prominence, but is rather determined by metrical structure, the product of a number of separate but interrelated parameters
- Word stress is assigned on the basis of feet (weight-sensitive or insensitive)
- Left-headed feet are referred to as trochees, and right-headed feet as iambs
- Trochees can be weight-insensitive or weight-sensitive:
  - (σ́σ) | (σ̆́σ̆) or (σ́)
- Iambs are the reverse of trochees, but are always weight-sensitive and may be asymmetric:
  - (σ̆σ́), (σ̆σ̆́) or (σ́)

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  - (σ̆σ́), (σ̄σ́) or (σ̄́)
- The possibility of asymmetric trochees (σ́̆σ̆) has also been proposed
  - For Germanic, cf. Dresher & Lahiri 1991; Lahiri and Dresher 1999; Lahiri et al. 1999; Lahiri 2001, 2015; Fikkert 2000; Fikkert et al. 2006; Dresher and Lahiri 2022; Booth and Lahiri 2023; Booth 2023
  - See also Bethin 1998 for Slavic; Jacobs 2000, 2021 for Latin; Torres-Tamarit 2021 for Italo-Romance dialects

Syllabic trochee

```
   X
(  x  .  )
   σ  σ
```

Moraic trochee (two options)

```
   X          X
(  x  )    (  x  .  )
   μμ         μ  μ
   σ̄          σ̆  σ̆
```

Uneven trochee (a bimoraic head with an optional σ̆ dependent)

```
    X            X
(  |x|  )    (  |x   |  )
    μμ           μ  μ
    H            L  L
    σ̄            σ̆  σ̆
```

```
    X              X
(  |x|  .  )   (  |x   |  .  )
    μμ  μ          μ  μ  μ
    H   L          L  L  L
    σ̄   σ̆          σ̆  σ̆  σ̆
```

Parametrical accounts

- Feet can be constructed from the right or the left edge of the word and main stress is placed on the strong branch of either the rightmost or leftmost foot of the word (‘End Rule left/right’).
- In certain stress systems, an element at the right word edge (e.g. C, σ, F) is ignored in stress assignment, referred to as *extrametricality*.
  - Differences in stress placement in English nouns (SEM) and verbs (CEM)

    /ˈtɔːˌmɜnt›/$_{N}$ *tórment* vs. /tɔːˈmɜn‹t›/$_{V}$ *tormént*
- The four parameters for assigning words stress are:
  - Foot type,
  - Direction of parsing,
  - End rule,
  - Extrametricality

a. Moraic trochee, left-to-right, End Rule right, No extrametricality

(X	)	**(X**	)	(	**X**	)	(	**X**	)	(	**X**	)		
(x)		(x	.)		(x)		(x)	(x	.)	(x)	(x)			
H	L	**L**	L	L	L	**H**	L	H	**L**	L	H	**H**	L	

b. **Iamb**, left-to-right, End Rule right, No extrametricality

(X	)	(	**X**	)	(	X	)	(		**X**)	(	X	)	
(x)		(.	x)		(.	x)		(x)	(.	x)	(x)	(x)		
H	L	L	**L**	L	L	H	L	H	L	**L**	H	H	L	

c. Moraic trochee, **right-to-left**, End Rule right, No extrametricality

(X	)	(	**X**	)	(	X	)	(	X	)	(	X	)	
(x)		(x	.)		(x)		(x)	(x	.)	(x)	(x)			
H	L	L	**L**	L	L	H	L	H	L	L	H	H	L	

d. Moraic trochee, left-to-right, **End Rule left**, No extrametricality

(X	)	(X	)	(	X	)	**(X**	)	**(X**	)				
(x)		(x	.)		(x)		(x)	(x	.)	(x)	(x)			
H	L	L	L	L	L	H	L	**H**	L	L	**H**	H	L	

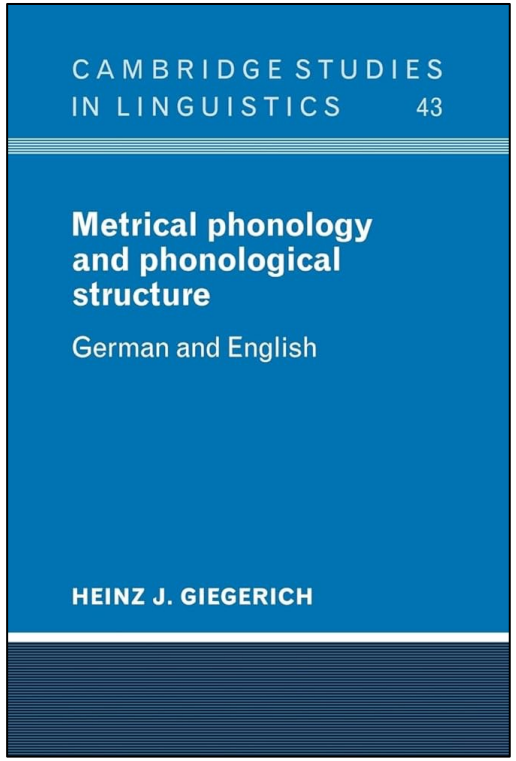
e. Moraic trochee, left-to-right, End Rule right, **extrametrical syllable**

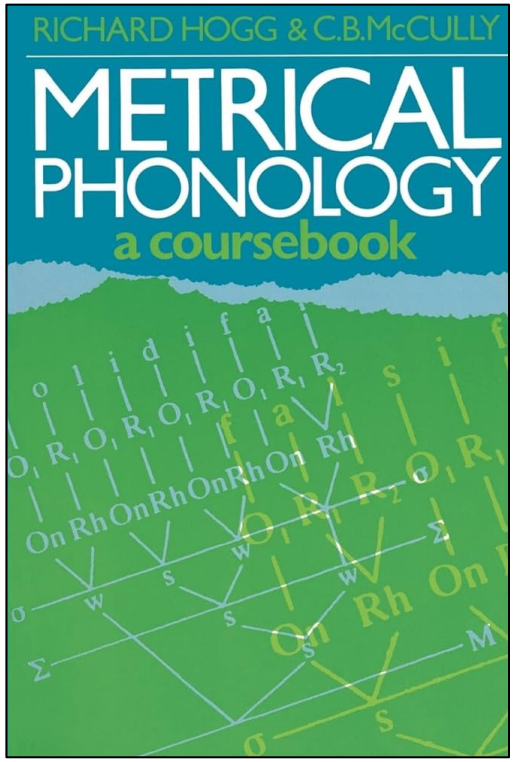
(X	)	(X	)	(	X	)	**(X**	)	(	X	)			
(x)		(x	.)		(x)		(x)			(x)	(x)			
H	‹L›	L	L	‹L›	L	H	‹L›	**H**	L	‹L›	H	H	‹L›	

Trees or Grids?

- Are metrical grids:
  - An augmentation of trees?
  - A replacement of trees?
  - Inadequate?

- For a discussion, see Giegerich (1985) and Hogg & McCully (1987)





OT?

WSP (Weight-to-Stress Principle) (Prince and Smolensky 1993)
A heavy syllable is stressed.

FOOT-BINARITY (Prince and Smolensky 1993)
Feet consist of either two syllables or of one heavy syllable.

ALIGN-FOOT-RIGHT (McCarthy and Prince 1993b)
Align (Prosodic Word, Right; Foot, Right)
Every Prosodic Word ends with a foot.

ALIGN-FOOT-LEFT (McCarthy and Prince 1993b)
Align (Prosodic Word, Left; Foot, Left)
Every Prosodic Word begins with a foot.

FOOT-FORM(TROCHAIC) (Prince and Smolensky 1993)
Align (Foot, Left; Head of the foot, Left)
Feet are left-headed.

NoClash
Adjacent heads of feet are prohibited.

FINAL-HEAD
Align (Prosodic Word, Right; Head of the Prosodic Word, Right)
The head of a Prosodic Word is right-bounded.

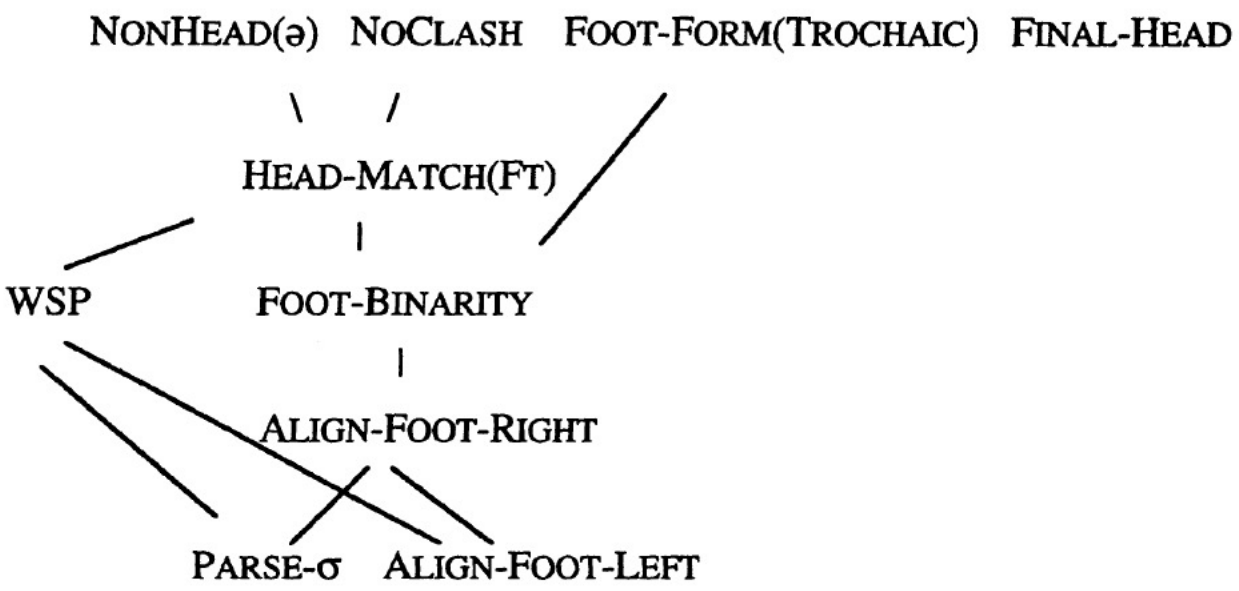
NonHead(ə)
Schwa syllables cannot be heads of feet.

PARSE-SYLLABLE
Syllables are parsed into feet.

HEAD-MATCH(FT)[10]
If α is the prosodic head of a foot and $\alpha \mathcal{R} \beta$, then β is the prosodic head of a foot.

Féry (1998)

OT?


NONHEAD(ə)
NOCLASH
FOOT-FORM(TROCHAIC)
FINAL-HEAD
HEAD-MATCH(FT)
WSP
FOOT-BINARITY
ALIGN-FOOT-RIGHT
PARSE-σ
ALIGN-FOOT-LEFT

Féry (1998)

OT?

x /papχika /	FINAL-HEAD	NO CLASH	HEAD-MATCH (FT)	FOOT-BIN	ALIGN-FOOT - RIGHT	ALIGN-FOOT - LEFT
a. x (x .) ☞ Papri ka					*	
b. x (x)(x .) Pa prika		*!		*		
c. x (x .) Pa prika			*!			*
d. x (x .)(x) Papri ka				*!		

Féry (1998)

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