11 Brackets and Grid Marks, or Theories of Primary Accent and Rhythm

Harry van der Hulst

11.1 Introduction

In this chapter, I present the outlines of a formal theory of word accent.[1] The theory is nonmetrical in that the account of primary accent location is not based on iterative foot structure. The theory separates the representations of primary and rhythmic accents, the idea being that the latter are accounted for "with reference to" the primary accent location. This means that rhythmic structure is either assigned later (in a derivational sense) or governed by constraints that are subordinate to the constraints that govern primary accent (as is possible in the approach presented in Prince and Smolensky 2004). This approach has been called a "primary-accent-first theory" (see van der Hulst 1984, 1990, 1992, 1996, 1997, 1999, 2000a, 2002, in preparation, van der Hulst and Lahiri 1988, van der Hulst and Kooij 1994 for earlier statements). The theory (presented in sections 11.2 through 11.6) is offered here as an alternative to the approach in Idsardi 1992, this volume. However, it was not developed as an alternative to this theory. Rather, like Idsardi's theory, it was developed as an alternative to standard metrical phonology (Liberman and Prince 1977, Vergnaud and Halle 1978, Hayes 1980, Halle and Vergnaud 1987). In section 11.7, I will point to some parallels and differences between Idsardi's theory and the one presented here.

11.2 Word Accentuation

11.2.1 Standard Metrical Theory

The key insight of standard metrical theory is that syllables (or perhaps subsyllabic constituents such as skeletal positions, rhymes, or moras) of words are organized into a layer of foot structure, each foot having a head. Primary accent is then derived by organizing the feet into a word structure in which one foot is the head. The head of the head foot, being a head at both levels, expresses primary accent. In this view, rhythmic accents are assigned first, while primary accent is regarded as the promotion of one of these rhythmic accents; rhythmic accents form a subset of the secondary accents, the latter notion comprising also so-called cyclic accents (“traces” of primary accents that occur in embedded constituents of complex words).

Here and in the rest of this chapter, I will assume that structures like those delivered by formal algorithms in standard metrical phonology, my own model, and Idsardi’s model characterize properties of mental representation of words, but have no intrinsic phonetic content. However, aspects of these structures (in particular, edges and heads) may be cued by various phenomena such as salient phonetic properties (causing the perceptual impression of prominence, i.e., primary “stress” and rhythmic alternation), phonotactics (certain positions allow greater complexity), anchoring of tones (lexical or postlexical), and allophonic processes (such as aspiration in English). There is no necessity for all aspects of these abstract structures to be somehow “audible” in all words in all languages. The fundamental raison d’être of these structures may ultimately be cognitive in that sets of elements can be mentally represented only in certain ways. All the phenomena that signal these structures in one way or another may then simply be parasitic on structures that exist for independent, cognitive reasons (see van der Hulst, in preparation).

11.2.2 Reversing the Order of Things, and Why

In van der Hulst 1984, and subsequently in a number of other works (see above), I proposed that we reverse the order of things by first deriving the primary accent location, making the assignment of rhythmic accent a truly secondary matter.[2] The initial (and, in retrospect, perhaps not the crucial) motivation for this proposal was that in most systems, primary accent seems to fall on the foot that is assigned first in the classical metrical account. Formally, this means that in systems that assign feet from left to right, the word tree would in almost all languages be left-headed, while in right-to-left systems it would almost always be right-headed. I suggested initially that this pattern would be the only possible one if indeed primary accent is universally assigned first, with rhythm echoing (or rippling away); note Garde’s (1968) apt term *echo accent* for rhythmic accent. However, problematic for this view is the fact that in a class of accent systems the location of primary word accent depends on the number of syllables that make up the whole word. In classical terms, in such systems the direction of foot assignment would not correlate with the headedness of the word tree in the above manner. Thus, for example, primary accent would be initial in even-numbered words and would fall on the second syllable in odd-numbered words. I termed such systems “count systems,” which is perhaps an infelicitous term in that we need not literally count the syllables. Rather, syllables are grouped in binary feet throughout the word, and the last-assigned foot is promoted to head word status. Systems of this sort obviously present a challenge to the strong claim that all primary accents can be derived nonmetrically (i.e., without prior exhaustive foot assignment).

Once the primary-accent-first approach had been proposed, additional (and perhaps better) motivation for it emerged. Six additional lines of support can be distinguished. On the one hand, it now made sense that the weight criteria for primary and rhythmic accents can differ (see (1a)). After all, the primary-accent-first theory has available two distinct algorithms, one for primary accent, the other for rhythmic accent. Nothing, then, prevents a situation where one is quantity-sensitive while the other isn't, or where both are quantity-sensitive in different ways. Clearly, if such discrepancies exist, they are unexpected from the viewpoint of the standard metrical account, which then needs to be amended by allowing two different phases of foot assignment, the one that accounts for primary accent either being noniterative or seeing most of its feet erased.

A second motivation involves the right- or leftheadedness of the foot structure that is necessary for primary and secondary accent. Cases have been attested in which different foot types appear to be necessary (see (1b)). From the viewpoint of classical metrical theory, such systems again form an anomaly.

A third motivation comes from the fact that the edge-orientation of primary and secondary accent can differ in that, for example, primary accent is on the right edge (let us say the penultimate syllable), while the wave of rhythm seems to come from the left (see (1c)). Such a situation also presents a problem for the standard theory. At the same time, these cases show that rhythmic accents are not always echoing away from the primary accent, but rather can display a "polarizing" (i.e., "opposite edge") effect of some sort. Primary-accent-first theory can deal with this phenomenon, but the standard account cannot, at least not straightforwardly. In this case, too, it is of course possible to have two phases of foot assignment: a first foot layer (right to left) of which we erase all but the rightmost foot and then a second assignment of foot structure, now from left to right.[3] Or one might suggest that a foot is assigned noniteratively on the right edge, followed by an iterative application from left to right. The point is that such derivations are not expected given the core design of standard metrical theory.

(1)	*Primary accent*	*Rhythmic accent*		
a.	Weight	Weight-sensitive	Weight-insensitive	(English)
		Weight-insensitive	Weight-sensitive	(Finnish)
b.	Foot type	Left-headed	Right-headed	(BigNambas, Marind)
		Right-headed	Left-headed	(Taga, Dari, Uzbek)
c.	Word	Right-edge	Left-edge	(English)
		Left-edge	Right-edge	(Turkish)

A fourth motivation is that there are bounded, weight-sensitive systems that plainly cannot be accounted for by the standard theory, no matter what variant of foot theory one adopts (see (8) and discussion below).

A fifth motivation comes from the fact that, whereas primary accent location can easily be lexically governed to some extent, rhythmic accents never show any trace of being lexically determined. This difference in particular has prompted the suggestion that primary accent is, or at least can be, lexical, while rhythmic accents are postlexical (see Hurch 1995). All the usual criteria for distinguishing between lexical and postlexical rules seem to square with the differences between primary and secondary rhythmic accent locations.

Finally, a sixth motivation comes from the treatment of so-called unbounded systems. Various approaches to unbounded systems, employing both bounded and unbounded feet, have been proposed over the years (see van der Hulst 1999, 2000a,b, 2002, 2006 for overviews). Hayes (1995) states that such systems are nonmetrical. He remarks that since "the facts in this area are quite simple and fill out all the logical possibilities, it is hard to develop a theory that goes much beyond just describing the facts" (p. 33). He handles "opposite edge" systems (first/last, last/first; see below) by constructing unbounded weight-sensitive feet (as proposed in the standard theory). "Same edge" systems (first/first, last/last) are handled by "projecting prominence distinctions" (heavy syllables) and directly assigning primary accent to the left- or rightmost heavy or (in the absence of a heavy) left- or rightmost syllable. At this point, let me explain the "first/first, first/last, etc." terminology since I will continue to use it: a system is said to be, for example, first/first if primary accent is located in the first heavy syllable within the accentual domain, or, in the absence of heavy syllables, on the first syllable.

In summary, there are many reasons for exploring an alternative framework, that is, one in which primary accents are assigned nonmetrically. With these accents in place, a constituent structure can be erected (almost automatically; see section 11.5) that accommodates the full accentual structure of words.

11.2.3 Primary-Accent-First Theory: How Does It Work?

The key idea is that primary accent is always located on a left- or rightmost syllable within the accentual domain. Representations of primary accent involve the presence of a grid structure as in standard metrical phonology, or more specifically as in Prince 1983. Following Prince 1983, I refer to the relevant constraint as the End Rule. Heavy syllables are projected at level 1 of the grid if the system is weight-sensitive.[4] Syllables that are lexically marked are automatically present at level 1 (i.e., that is how they are marked). If there is no special (i.e., heavy or lexically marked) syllable, level 1 will be provided with a mark by a default rule. Hence, the general scheme for primary accentuation consists of three parameterized constraints (*parameters* for short), as in (2).

(2) a. *Projection*
    Project weight (*yes/no*) to level 1.
  b. *Default Rule*
    Assign a mark to the (*leftmost/rightmost*) syllable in case level 1 is empty.
  c. *End Rule*
    Assign primary accent to the (*leftmost/rightmost*) mark at level 1.

The End Rule can be set only in case the domain can contain more than one level 1 mark. This can easily happen in weight-sensitive systems (whenever more than one heavy syllable is present in the domain), but is probably rare in weight-insensitive systems where only multiple lexical marks can create the required situation. In bounded systems, that situation is much less likely to occur than in unbounded systems (such as Russian; see below). If, for some reason, it is important to represent word accent at level 2 in all cases, we might stipulate that the unspecified End Rule will simply "reinforce" the mark at level 1 by adding an extra grid mark at level 2.

To differentiate between bounded and unbounded systems, we need a domain parameter. The accentual schema in (2) may apply within a two-syllable domain on the left or right side of the word, modulo extrametricality, or within the word as a whole (also modulo extrametricality), as shown in (3).

(3) *Domain setting*
  a. The domain of accent assignment is *left/right/unspecified.*
  b. Extrametricality: *left/right/unspecified.*

In (3), both parameters can be left unspecified, which indicates in the case of (3a) that all syllables are within the accentual domain, and in the case of (3b) that there are no extrametrical elements. Alternatively, to avoid the unspecified "third value," one could adopt additional parameters on which the other parameters depend. For example, one could replace (3) by (4).

(4) *Domain setting (alternative)*
  a. The domain is *unbounded* (the whole word)/*bounded* (two edge syllables).
    a′. The bounded domain of accent assignment is *left/right.*
  b. Extrametricality: *yes/no.*
    b′. Extrametricality: *left/right.*

This alternative is perhaps preferred since we already have other parameters that require dependent subparameters—for example, the parameter in (2a). If weight is relevant, we need to specify which syllabic properties contribute to weight. In addition, we need a further parameter dependent on (4b′) that specifies what is extrametrical—

a syllable, a mora, a final consonant, or whatever options are required. An independent issue regarding extrametricality is whether it is an available option on the left side. The virtual absence of systems with accent on the third syllable suggests that extrametricality is (for whatever reason) limited to the right edge.

Let us now turn to a more detailed discussion of bounded and unbounded systems, respectively, still focusing on primary accent. I will deal with secondary rhythmic accent in section 11.5.

11.3 Bounded Systems

The first step in deriving bounded systems is to delimit on the right or left side of the word a domain for primary accentuation of two syllables (modulo extrametricality). The second step is to apply the Default Rule to provide this domain with a mark just in case no other special syllable (heavy or lexically marked) is present at level 1. If primary accent is weight-sensitive, this means that heavy syllables project a mark to level 1 in the two-syllable domain. The account is made complete by setting the value for the End Rule, (2c). I will first discuss weight-sensitive systems, which present a more interesting challenge than weight-insensitive systems.

11.3.1 Weight-Sensitive Bounded Systems

The primary-accent-first approach allows four types of bounded weight-sensitive systems at each edge of the word (modulo extrametricality).

(5) *Right-edge cases*

a. *Rotuman: Final in case of σh], otherwise penultimate*

x			x		x	x	
x			x	x	x	x	
(h	l)]	(l	h)]	(h	h)]	(l	l)]

"Rightmost heavy, otherwise leftmost (last/first)"
Domain: bounded, right
Project: heavy syllable
Default Rule: left
End Rule: right

b. *Yapese: Penultimate in case of hl], otherwise final*

x			x		x		x
x			x	x	x		x
(h	l)]	(l	h)]	(h	h)]	(l	l)]

"Rightmost heavy, otherwise rightmost (last/last)"
Domain: bounded, right

Project: heavy syllable
Default Rule: right
End Rule: right

c. *Aklan: Penultimate in case of hσ], otherwise final*

```
 x            x        x            x
 x            x        x x          x
(h l) ]    (l h) ]    (h h) ]    (l l) ]
```

"Leftmost heavy, otherwise rightmost (first/last)"
Domain: bounded, right
Project: heavy syllable
Default Rule: right
End Rule: left

d. *Awadhi: Penultimate except in case of lh]*

```
 x            x        x          x
 x            x        x x        x
(h l) ]    (l h) ]    (h h) ]    (l l) ]
```

"Leftmost heavy, otherwise leftmost (first/first)"
Domain: bounded, right
Project: heavy syllable
Default Rule: left
End Rule: left

(6) *Left-edge cases*

a. *Capanahua: Peninitial in case of [σh, otherwise initial*

```
   x            x          x        x
   x x          x        x x        x
[ (h l)    [ (l h)    [ (h h)    [ (l l)
```

"Rightmost heavy, otherwise leftmost (last/first)"
Domain: bounded, left
Project: heavy syllable
Default Rule: left
End Rule: right

b. *Archi: Initial in case of [hl, otherwise second*

```
   x            x          x          x
   x x          x        x x          x
[ (h l)    [ (l h)    [ (h h)    [ (l l)
```

"Rightmost heavy, otherwise rightmost (last/last)"
Domain: bounded, left

Project: heavy syllable
Default Rule: right
End Rule: right

c. *Ossetic: Initial in case of [hσ, otherwise postinitial*

```
  x         x     x         x
  x x       x     x x       x
[(h l)  [(l h)  [(h h)  [(l l)
```

"Leftmost heavy, otherwise rightmost (first/last)"
Domain: bounded, left
Project: heavy syllable
Default Rule: right
End Rule: left

d. *Malayalam: Postinitial in case of [lh], otherwise initial*

```
  x         x     x       x
  x       x x     x       x
[(h l)  [(l h)  [(h h)  [(l l)
```

"Leftmost heavy, otherwise leftmost (first/first)"
Domain: bounded, left
Project: heavy syllable
Default Rule: left
End Rule: left

The theory proposed here is completely instantiated for bounded weight-sensitive systems, although there are frequency differences.[5] Note that only those cases in which the domain contains two heavy syllables critically require a setting of the End Rule. Other cases that necessitate this rule would be ones that involve lexical marking.[6]

The four-way distinction that is found on each edge of the word cannot easily be replicated with foot structure, whatever variant one assumes. In the original metrical theory (Vergnaud and Halle 1978, Hayes 1980), two of these four systems require a retraction rule, as shown in (7).[7]

(7) Rotuman: quantity-sensitive trochee
Yapese: quantity-sensitive iamb
Aklan: quantity-sensitive iamb, plus retraction rule in the hh] case
Awadhi: quantity-sensitive trochee, plus retraction rule in the hh] case

A similar situation exists for the left-edge systems. The newer foot theory proposed in Hayes 1995 or Kager 1993 cannot do without retraction rules in some cases. The present account makes no appeal to retraction rules and is thus more restrictive. It allows structure-building rules only, and it is thus compatible with a constraint-based approach. It is not obvious how the retraction analysis (involving structure-changing operations) could be translated into a purely constraint-based grammar formalism.

Additional cases that need attention are so-called broken window cases, in which an accent can "jump outside" through the binary accent window to an antepenultimate position just in case the antepenultimate syllable is heavier than the penultimate syllable. At first sight, extrametricality cannot be invoked easily in those cases since it would be unacceptable (for reasons of locality) to make extrametricality dependent on a relative weight-relationship between σ_3 σ_2, as in (8). A retraction rule is always possible, but it is unattractive given the above criticism of the standard approach to cases like Aklan and Awadhi.

Broken window systems are not unbounded, since no syllable outside the three-syllable window is ever relevant. An example of such a system is Maithili (Hayes 1995:149–162). Primary accent is on the final syllable if this is heavy; otherwise, it is penultimate. However, as shown in (8), if both final and penultimate syllables are light and the antepenultimate is heavy, primary accent goes to the antepenultimate.

(8) *Maithili*

x	x	x	x	x
x	x	x x	x	x
(h l)]	(l h)]	(h h)]	(l l)]	h (l l)]

A possible analysis of this case within the present approach is to analyze the final syllable as extrametrical if and only if it is light. We then set both the Default Rule and the End Rule to the value "right," as in (9).

(9)

x	x	x	x	x
x	x	x x	x	x
(σ h) ⟨l⟩]	(l h)]	(h h)]	(l l) ⟨l⟩]	(h l) ⟨l⟩]

The system of constraints for Maithili is given in (10). It remains to be seen whether all broken window systems can be dealt with in this manner.

(10) *Maithili primary accent*
  a. Domain: bounded, right
  b. Extrametricality: yes, light syllable
  c. Project: heavy syllable
  d. Default Rule: right
  e. End Rule: right

11.3.2 Weight-Insensitive Bounded Systems

Let us now briefly turn our attention to weight-insensitive bounded systems. Weight-insensitive systems differ from the systems in (5) and (6) in that no special syllables are designated for projection to level 1. Initial, second syllable, antepenultimate,

penultimate, and final accent all depend on the choice of domain edge, extrametricality, and the default rules. Many systems of this type have exceptions, however. Exceptions can be marked in lexical representations in two ways, the choice depending on the type of exception: either words are marked for extrametricality, or syllables are marked with what I have elsewhere called "diacritic weight" (van der Hulst 1999). Lexically marked syllables behave just like heavy syllables and, in a diachronic sense, often are remnants of a weight system (as in various Romance languages; see Roca 1999). Other sources for lexical marking are unadapted loanwords with accent patterns that deviate from the pattern of the receiving language.

The algorithm for Polish, a weight-insensitive penultimate system allowing words to have exceptional penultimate or final accent, is depicted in (11) and exemplified in (12).

(11) *Polish primary accent*
  a. Domain: bounded and right
  b. Extrametricality: no
  c. Project weight: no
  d. Default Rule: left
  e. End Rule: (not set)

(12)	a.	x	b.	x	c.	x	Rule (11e)
		x		x		x	Rules (11c), (11d)
		(σ σ)]		(σ **σ**)]		(σ σ) ⟨σ⟩]	Rules (11a), (11b)
		Penultimate		Final		Antepenultimate	

(12a) represents the regular case. In (12b), there is a lexical mark on the final syllable, shown in boldface, whereas (12c) requires the final syllable to be lexically marked as extrametrical. If there is no lexically marked syllable, (11d) inserts a level 1 mark on the leftmost syllable as in (12c). It stands to reason that no accentual domain will contain more than one lexically marked syllable, unless the domain would include (parts of) more than one morpheme, in which case, in principle, two lexical marks could be present. Unless this is the case, the End Rule cannot be set. It was suggested earlier that we might assume that in such a case the End Rule reinforces the grid mark of level 1, as was done in (12).

11.4 Unbounded Systems

A uniform characterization of bounded and unbounded systems is possible in the present approach. In unbounded systems, accent locations are not restricted to a syllable near the left or right edge of the word. Rather, primary accent is assigned to the left- or rightmost special syllable, taking into account the whole word (modulo extrametricality). Syllables can be special by virtue of being heavy and/or being diacritically marked. In the present approach, the four types of unbounded systems quite simply arise from cross-classifying the options of the Primary Accent Rule and the Default Rule; see (13).

(13) a. *Classical Arabic, Huasteco, Eastern Cheremis*

```
               x         x
       x       x         x
(l l l h l l l h l l)   (l l l l l)
```

“Rightmost heavy, otherwise leftmost (last/first)”
Domain: unbounded
Project: heavy syllable
Default Rule: left
End Rule: right

b. *Komi, Kwak’wala, Golin*

```
               x                 x
       x       x                 x
(l l l h l l l h l l)   (l l l l l)
```

“Rightmost heavy, otherwise rightmost (last/last)”
Domain: unbounded
Project: heavy syllable
Default Rule: right
End Rule: right

c. *Aguacatec, Western Cheremis*

```
       x                         x
       x       x                 x
(l l l h l l l h l l)   (l l l l l)
```

“Leftmost heavy, otherwise rightmost (first/last)”
Domain: unbounded
Project: heavy syllable
Default Rule: right
End Rule: left

d. *Indo-European, Murik*

```
       x                 x
       x       x         x
(l l l h l l l h l l)   (l l l l l)
```

“Leftmost heavy, otherwise leftmost (first/first)”
Domain: unbounded

Project: heavy syllable
Default Rule: left
End Rule: left

Thus, unbounded systems assign primary accent to the rightmost or leftmost heavy syllable, assuming furthermore that the Default Rule is independent and may select the same or the opposite edge of the word. Goldsmith (1990:180ff.) proposes an approach of this type, which in the present theory is applied to bounded and unbounded systems alike. In both types of systems, primary accent is located in terms of the same parameters except for the parameter that determines the size of the accentual domain.

In most of the examples in (13), special syllables are heavy. There are also so-called unbounded lexical accent systems (like Russian) in which morphemes may contain lexically marked syllables. If morphemes are put together to form words, primary accent is placed in accordance with the schemes shown in (14). For further discussion, see van der Hulst 1999, in preparation.

(14) a. Last/First: (vacancy)
b. Last/Last: Modern Hebrew
c. First/Last: Turkish
d. First/First: Russian

The unbounded nature of Turkish (which in most cases has final accent) is revealed by the fact that a lexical accent on any morpheme followed by any number of other morphemes will emerge as bearing the primary accent (see van der Hulst 1999:60–64). In both examples in (15), a suffix is added to a stem carrying a lexical accent. This marked syllable rather than the (regular) final syllable carries primary accent.

(15) a. akşám - leyin 'at evening'
b. şévrole - la 'with Chevrolet'

There is no formal reason why unbounded systems should be weight-sensitive or use lexical accents. The present theory allows unbounded, weight-insensitive systems as well. Such a system would have initial or final accent, or—with extrametricality—second syllable or penultimate accent. This implies that, strictly speaking, only antepenultimate weight-insensitive systems (like Macedonian) are outside the reach of the unbounded-domain treatment. However, as soon as a system has lexical exceptions, we learn from their locations whether a system is bounded or unbounded. To see this clearly, let us consider how Polish, for example, could at first sight be analyzed as an unbounded system with the rules in (16), yielding the metrical structures in (17).

(16) *Polish primary accent*
a. Domain: unbounded
b. Extrametricality: yes
c. Project weight: no
d. Default Rule: right
e. End Rule: (not set)

(17)	a. x	b. x	c. x	Rule (16e)
	x	x	x	Rules (16c), (16d)
	(σ) ⟨σ⟩]	(σ **σ**)]	(σ σ) ⟨σ⟩]	Rules (16a), (16b)
	Penultimate	Final	Antepenultimate	

Exceptional final and penultimate accent location would have to be marked with diacritic weight. Such a treatment is possible, but it would not account for the fact that no lexical marks lead to unbounded accent effects in Polish (as does happen in Turkish, for example). It would appear, then, that the types of exceptions that occur in a system reveal the nature of the system.

11.5 Constituent Structure

In the proposed model, primary accent selection is determined by a procedure that attributes minimal internal structure to words. In bounded systems, a binary domain is postulated adjacent to one edge of the word or, in case of extrametricality, removed from the edge by one syllable or an even smaller unit. In unbounded systems, we postulate no word-internal structure at all, except when excluding a peripheral extrametrical unit. In both cases, whatever word-internal structure is postulated could merely exist for the purpose of computing the location of primary accent and nothing else. What kind of additional word-internal structure is needed, if any, and for what reason? Taking issue with the idea of needing exhaustive binary foot structure to account for rhythmic structure, Prince (1983) showed that the relevant patterns could be generated in terms of procedures that place alternating marks in the grid (perhaps with strength differentiation among these to account, for example, for the strongest rhythmic initial beat in languages such as English). The model presented here is compatible with this proposal and therefore it offers a refinement on Prince's grid-only approach in the sense that it adds a special procedure for selecting the head of the word. Others writers, however, have argued that word-internal constituency is necessary, at least in bounded systems, in part to account for phenomena of accent shift; see Vergnaud and Halle 1987. For reasons of space, I will remain neutral with respect to this issue. My proposal for primary accent location can also be combined with a procedure for erecting a word-internal prosodic constituent structure. Constituent structure, if indeed needed, would have to respect the heads that are assigned by primary accent placement. It is reasonable to expect that algorithms for additional structure (whether grid-only or involving feet) can be fairly simple given that the apparent complexities of such procedures in the traditional metrical approach were largely caused by the intricacies of primary accent location, which we have factored out from the account of rhythmic accents. As stated at the beginning of this chapter, procedures for rhythmic organization not only follow primary accent assignment, but in most cases are lexical postcyclic, postlexical, or part and parcel of phonetic implementation.

11.6 Count Systems

The proposed domain-based theory covers all discussed cases of primary accent location in a maximally simple fashion. Once assigned, primary accents form the controlling force behind the construction of word-internal rhythmic structure. The present theory, then, is "backward" in two ways: first, it derives primary accent before secondary rhythmic accent; and second, it derives heads (of words) before erecting word-internal constituent structure if such structure turns out to be needed. Before concluding that all matters of primary accent location are nonmetrical, we have to deal with cases in which the location of primary accent has been claimed to depend on the number of syllables in the whole word (modulo extrametricality). For example, in some languages, in words with an even number of syllables primary accent is penultimate, while in words with an odd number of syllables it is final. See (18).

```
(18) Right-headed             x                    x
     Left-to-right     (x     x)      (x     x     x)
                       (x  x) (x  x)  (x  x) (x  x) (x)
                        1  2   3  4    1  2   3  4   5
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Such systems do not seem compatible with the view that the location of primary accent takes priority over the creation of rhythmic (foot) structure. How can we treat systems of this type? In count systems, it would seem that primary accent is crucially based on an exhaustive "perfect gridding" (or foot parsing) of the whole word. If this is indeed so, count systems make it impossible to claim that all primary word accents are nonmetrical. In van der Hulst 1997, I have discussed in some detail that it is probably too early to give up on this strong claim and therefore premature to conclude that count systems represent a real "metrical residue" of primary accent systems. Much is at stake here, because if we were to accept a standard metrical account of count systems, we would have to accept that noncount bounded systems (except the most complicated cases where primary accent must precede secondary accent assignment for a variety of reasons; Hayes (1995:116–117) calls these "top-down systems") are ambiguous, since these then could be derived as in the present model ("primary accent first"), or in the standard way as in the classical metrical theory ("secondary rhythmic accent first"). The strong claim that all primary accent is nonmetrical can be maintained if we can demonstrate that the metrification in count systems, applied without guidance of the primary accent routine that takes precedence over it, simply fails to deliver primary accents. This would be the case if we can show that words in such systems have word-internal rhythmic structure but no word-level primary accent. This is, in essence, what I have tried to argue in van der Hulst 1997, on which the remainder of this section draws.

First let us note that some languages have indeed been reported to lack the notion of primary word accent. Hayes (1995) refers to a number of languages in which words have several equally strong accents. Whatever the appropriate treatment of such systems may turn out to be, they do not refute the claim that all primary accentuation is nonmetrical, simply because they lack "primary accent." However, I strongly suspect that the claim that words in some languages lack primary accent refers to cases in which the choice of a word head depends on phrasal matters. In such cases, there would be no lexical rule for primary word accentuation. Here I refer to a parallel situation in English, where many adjectival or attributive words have two different patterns depending on whether they are used phrase-finally (*thirTEEN*) or before a noun with initial stress (*THIRteen men*). Traditionally, such cases have been dealt with in terms of rules that change the primary word accent location, but it seems equally feasible (and preferred within the present approach) to say that such words lack a primary accent at the lexical level. The location of primary stress is then fully taken care of by the phrasal accentuation rules. This approach is supported by the fact that in traditional analyses, the so-called Rhythm Rule seems to duplicate the effect of independently needed phrasal rhythm rules.

In this section, I will try to show that there is some plausibility to the conjecture that count systems fall in the class of systems that lack primary word accent, and that the "primary word accent" mentioned in the descriptions of such languages is really a phrasal accent, possibly signaled in terms of an intonational tone. If this conjecture can be maintained, count systems cease to be counterexamples to the nonmetrical approach to primary accent.

In van der Hulst 1997, I suggest that "lacking primary accent" may have two sources. First, a situation of this type may indicate a historical accentual change involving a shift of primary accent from one side of the word to the other. In such cases, the location of a "primary accent" is perhaps entirely dependent on the position of words in the phrase. I show why, in this stage of development, a system may come across as a word-level count system.

To illustrate this point, in van der Hulst 1997 I refer to an account of the development from "early" Latin (with initial accent) to Classical Latin (with (ante)penultimate accent), and to accentual variation in Arabic languages that include initial accent, (ante)penultimate accent, and (trochaic and iambic) count systems. I also apply this line of reasoning to Australian count systems, although in these cases the lack of word accent may also be the result of a second source for the absence of primary accent. For reasons of space, I refer the reader to van der Hulst 1997 for details.

The second source for "lacking word accent" can lie in the morphosyntactic structure of a language. In languages with a richly developed polysynthetic morphology, and therefore with words of considerable length, it is not uncommon to avoid a unique word-level primary accent. One reason for this may be that very long words do not "fit" a single prosodic word template and behave prosodically more like phrases, with the result that phrasal accentuation is responsible for what might be described as "primary word accent." A second, more fundamental reason may be that such languages, with their dependence on highly productive morphology (often at the "expense" of a rich syntactic system) rely much less on the notion of word as a lexical entity and thus have much less opportunity to establish a lexical accent pattern.

As with systems that are in historical transition, such morphology-dependent systems may create the impression of a count system if, for example, the word-level rhythm is left to right, while phrasal accent occurs on the right edge of the phrase. With respect to this class of count systems, there is another noteworthy tendency, which also points to the relevance of phrasal accentuation: several descriptions explicitly mention that the location described as having "primary word accent" is identified by a "tonal accent," which is sometimes explicitly referred to as part of the intonational system. In this case, the identification of count systems with systems that are explicitly reported as lacking primary word accent is further supported by the observation that both types of systems are reported for languages that occur within the same language families. Hayes (1995:sec. 6.3) offers several examples of these types of cases, which are more fully discussed in van der Hulst 1997. If deeper investigation of the relevant cases supports my conjectures, it may turn out that "count" systems do not exist as word-level primary accent types, simply because these systems do not involve the notion of primary word-level accent. This would mean that there is no metrical residue with respect to primary accent location.

11.7 Simplified Bracketed Grid Theory

Standard metrical theory has evolved, via Halle and Vergnaud's (1987) bracketed grid theory, into the theory of metrical structure assignment that was developed in

Idsardi 1992; see Halle and Idsardi 1995. The most recent presentation of this model can be found in Idsardi, this volume. In this section, I will make some comments on this theory, which I have characterized elsewhere (van der Hulst 2000b:319) as being preoccupied with the notational system (in terms of the manipulation of brackets) without consideration of the "semantics" of this notation. In my understanding of the bracketed grid notation, brackets are supposed to be notational devices that represent constituent structure, that is, a purely graphic variant of tree structure graphs. As such (as in syntactic representations that use brackets), a left bracket or a right bracket by itself doesn't "mean" anything. Hence, the idea of formulating algorithms that insert left or right brackets (forming "open constituents") struck me as incoherent and only possible by assigning a different sort of "meaning" to these symbols. Note that the "open constituents" are present not only in intermediate representations; final representations still have them. I understand that so-called open constituents can do some work (e.g., in the case of incorporating "clitic material"), but I fail to grasp what kind of constituent an open constituent is. This caused and causes my concern that perhaps brackets in Idsardi's model are not graphic devices for constituent structure at all. Rather than characterizing constituent structure (in the traditional sense), Idsardi's brackets function more like boundary (or juncture) symbols of some sort. In fact, this possible "meaning" of these symbols is brought out in the open in Reiss's discussion of the model in this volume. Reiss proposes to further develop (i.e., simplify) Idsardi's model by replacing the left and right brackets by a single symmetrical divider symbol ("|"). I believe that Reiss's proposal is a logical step, given the way in which Idsardi uses the left and right brackets, which is indeed more like divider (boundary, juncture) symbols than as notational devices for constituent structure.

Taking the model that Idsardi proposes in this spirit, and leaving aside the question of what kind of constituent structure is being assigned (if any), it is easy to see that a laudable attempt is being made to develop fully explicit algorithms that deliver representations for all possible word accent systems, making use of the smallest number of rule types. This goal is, of course, what all models ought to strive for, but—and here I agree with Idsardi—this appears to be nonobvious to those who have been working on accent systems within the framework of Optimality Theory. It does seem to be the case that there has been reduced concern with articulating the representations that are employed.

Naturally, I believe that my own enterprise is very much concerned with the same goals that drive Idsardi's. To the extent that Idsardi's model is closer to standard metrical phonology (particularly in adopting a rigid bottom-up approach), it may very well be that some of my criticism of the standard metrical approach applies to his model as well. Thus, Dresher (this volume) points out that the arguments for giving priority to assigning primary accent (at least in some critical cases like Tiberian

Hebrew) are valid. It would seem to me that a consistent bottom-up approach cannot account for this phenomenon in a straightforward way. Thus, the major thing that may be "wrong" (from my perspective) with Idsardi's model is its inability to deal with the primary-accent-first syndrome that is the essential phenomenon motivating my own model. But I could be wrong about that aspect of Idsardi's model. Perhaps it can deal with primary accent first. In fact, I have no doubt that it can—but I have not seen a full demonstration of all the relevant cases. And this is a very relevant point: both models need to be applied to a wide(r) variety of cases before we can embark on a detailed comparative study. So far, we both have provided some hints of how our systems will cover the array of word accent systems, leaving aside numerous details and complications that might force either model to add machinery. True, Idsardi has provided several analyses in his earlier work (Idsardi 1992) and several others (including revisions) in his contribution to this volume. My own approach has formed the basis for analyzing over 500 accent systems within the context of the StressTyp database (Goedemans, van der Hulst, and Visch, 1996a,b, Goedemans and van der Hulst 2005a–d). It seems to me that both models need to be exemplified in a longer work (comparable, let us say, to Hayes 1995) in which there will be ample opportunity to cover a wide variety of systems, including all their "dirty details" (see van der Hulst, in preparation). Whereas systems in which primary accent cannot or need not be based on prior assignment of rhythmic structure form a challenge for Idsardi's model, count systems are potentially problematic for my model if they truly exist (recall section 11.6).

Another factor that prevents detailed comparison at this point is that Idsardi's model accounts for both primary accents and secondary rhythmic accents, whereas I have so far accounted only for primary accents.

I do not believe that Idsardi's proposed formalization in terms of finite state automata presents an advantage as such. There are no inherent restrictions on accentual structure that follow from this formalization, as far as I can see. For example, given the possibility of building in two "skip states" to derive ternary systems, there are no formal objections to designing automata that have more than two skip states. Abstracting away from the finite state formalization, it would seem that both models appeal to somewhat similar formal devices such as projecting grid marks to a higher level and forming constituents by inserting brackets. The theories are similar in another respect as well; they both aspire to be monotonic, that is, to make use of structure-building operations only, banning rules that change structure by deleting or moving elements. However, it is not clear to me how Idsardi's model can handle systems like those of Aklan and Awadhi that rely on retraction rules in traditional metrical approaches.

Rather than spending much time on tedious out-of-context, isolated comparisons, it seems to me that both models need to be further developed and applied to a wide range of cases. We will thus gain useful insight into the nature of accent systems and into the workings (and possible shortcomings) of these models. It may well be that a fuller development will show that the models are less different than they initially appear to be. So much the better.

11.8 Conclusions

The main goal of this chapter has been to outline an approach to word accent systems that deviates from the standard metrical account (including descendants like Idsardi's model) in separating the treatment of primary accent from the assignment of rhythmic accents and, if necessary, the construction of word-internal constituency. I supplied an array of reasons for this deviation. I then considered a treatment of so-called count systems (elsewhere called "the metrical residue") that is consistent with the model. Finally, I briefly compared my model with Idsardi's, concluding that both models are viable approaches to the phenomenon in question, albeit that Idsardi's model faces some of the same problems that motivated me to develop an alternative to standard metrical phonology.

Notes

1. All languages mentioned in this chapter are analyzed in StressTyp, a database system that provides information (extracted from the literature) about more than 500 languages. This database, which provides parametric analyses of all systems and references to sources that have been used, has been developed by the author and various other scholars, in particular Rob Goedemans (see Goedemans, van der Hulst, and Visch 1996a–c, Goedemans and van der Hulst 2005a–d for details and online availability).

2. A similar claim has been made in other studies, usually with reference to specific systems; see Harms 1981, Roca 1986, Hayes 1995, Hurch 1995. In his book, Hayes refers to primary-accent-first systems as "top-down systems," suggesting that the word tree is built first while foot structure is "tucked in" later. How this works formally has never been clear to me. Apparent top-down systems were used in the early Optimality Theory literature (Prince and Smolensky 2004) as an argument against the possibility of accounting for all accent systems derivationally.

3. This comes close to Halle and Vergnaud's (1987) account of English, a language displaying polar rhythm in that the initial syllable is typically rhythmically strong (as long as primary accent is not on the second syllable).

4. To deal with more than two degrees of weight, if such a situation exists, the projection rules must be applied more than once.

5. Supporting information for these claims comes from StressTyp.

6. This approach predicts that a lexical mark could overwrite weight in causing an hl domain to have second syllable accent in a system like Archi or final accent in a system like Rotuman by providing a lexical mark to the light syllable. At this point, I do not have data that either confirm or disconfirm this prediction.

7. An alternative for Yapese (as found in Hayes 1980) in this case would be to invoke a so-called quantity-determined foot type, a trochee in this case. This would leave the sequence ll] unfooted, and the final syllable would be stressed by the word tree.

References

Garde, Paul. 1968. *L'Accent*. Paris: Presses Universitaires de France.

Goedemans, Rob, and Harry van der Hulst. 2005a. Fixed stress locations. In *The world atlas of linguistic structures*, ed. by Martin Haspelmath, Matthew Dryer, David Gil, and Bernard Comrie, 62–65. New York: Oxford University Press.

Goedemans, Rob, and Harry van der Hulst. 2005b. Weight-sensitive stress. In *The world atlas of linguistic structures*, ed. by Martin Haspelmath, Matthew Dryer, David Gil, and Bernard Comrie, 66–69. New York: Oxford University Press.

Goedemans, Rob, and Harry van der Hulst. 2005c. Weight factors in weight-sensitive stress systems. In *The world atlas of linguistic structures*, ed. by Martin Haspelmath, Matthew Dryer, David Gil, and Bernard Comrie, 70–73. New York: Oxford University Press.

Goedemans, Rob, and Harry van der Hulst. 2005d. Rhythm types. In *The world atlas of linguistic structures*, ed. by Martin Haspelmath, Matthew Dryer, David Gil, and Bernard Comrie, 74–77. New York: Oxford University Press.

Goedemans, Rob, Harry van der Hulst, and Ellis Visch. 1996a. *The organization of StressTyp*. In *Stress patterns of the world*, ed. by Rob Goedemans, Harry van der Hulst, and Ellis Visch, 27–68. The Hague: Holland Academic Graphics.

Goedemans, Rob, Harry van der Hulst, and Ellis Visch. 1996b. *StressTyp manual*. Leiden: Holland Institute of Generative Linguistics (HIL).

Goedemans, Rob, Harry van der Hulst, and Ellis Visch. 1996c. StressTyp: A database for prosodic systems in the world's languages. *Glot International* 2 (1/2): 21–23.

Goldsmith, John. 1990. *Autosegmental and metrical phonology*. Oxford: Blackwell.

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

Halle, Morris, and Jean-Roger Vergnaud. 1987. *An essay on stress*. Cambridge, Mass.: MIT Press.

Harms, Robert T. 1981. A backwards metrical approach to Cairo Arabic stress. *Linguistic Analysis* 7:429–451.

Hayes, Bruce. 1980. A metrical theory of stress. Doctoral dissertation, MIT.

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

Hulst, Harry van der. 1984. The diminutive suffix and the structure of Dutch syllables. In Hans Bennis and W. U. S. van Lessen Kloeke, eds., *Linguistics in the Netherlands 1984*, 73–83. Dordrecht: Foris.

Hulst, Harry van der. 1990. The book of stress. Ms., Department of General Linguistics, Leiden University.

Hulst, Harry van der. 1992. The independence of main stress and rhythm. Paper presented at the Krems Phonology Workshop.

Hulst, Harry van der. 1996. Separating primary accent and secondary accent. In *Stress patterns of the world*, ed. by Harry van der Hulst, Rob Goedemans, and Ellis Visch, 1–26. The Hague: Holland Academic Graphics.

Hulst, Harry van der. 1997. Primary accent is non-metrical. *Rivista di Linguistica* 9:99–127.

Hulst, Harry van der. 1999. Word accent. In *Word prosodic systems in the languages of Europe*, ed. by Harry van der Hulst, 3–116. Berlin: Mouton de Gruyter.

Hulst, Harry van der. 2000a. Issues in foot typology. In *Issues in phonological structure*, ed. by S. J. Hannahs and Mike Davenport, 95–127. Amsterdam: John Benjamins. Originally published in *Toronto working papers in linguistics* 16, 77–102. Toronto: University of Toronto, Toronto Working Papers in Linguistics.

Hulst, Harry van der. 2000b. Metrical phonology. In *The first Glot International state-of-the-article book*, ed. by Lisa Cheng and Rint Sybesma, 307–326. Berlin: Mouton de Gruyter. Originally published in *Glot International* 1 (1): 3–6.

Hulst, Harry van der. 2002. Stress and accent. In *Encyclopedia of cognitive science*, *vol.* 4, ed. by Lynn Nadel, 246–254. London: Nature Publishing Group.

Hulst, Harry van der. 2006. Word stress. In *Encyclopedia of language and linguistics*, ed. by Keith Brown, 3:451–458. 2nd ed. Oxford: Elsevier.

Hulst, Harry van der. In preparation. Word accentual systems. Ms., University of Connecticut.

Hulst, Harry van der, and Jan Kooij. 1994. Two modes of stress assignment. In *Phonologica*, ed. by Wolfgang Dressler and John Rennison, 107–114. Turin: Rosenberg and Sellier.

Hulst, Harry van der, and Aditi Lahiri. 1988. On foot typology. In *Proceedings of North East Linguistic Society (NELS) 18*, ed. by James Blevins and Juli Carter, 286–309. Amherst: University of Massachusetts, Graduate Linguistic Student Association.

Hurch, Bernhard. 1995. Accentuations. In *Natural Phonology: The state of the art on Natural Phonology*, ed. by Bernhard Hurch and Richard A. Rhodes, 73–96. Berlin: Mouton de Gruyter.

Idsardi, William J. 1992. The computation of prosody. Doctoral dissertation, MIT.

Kager, René. 1993. Alternatives to the Iambic-Trochaic Law. *Natural Language and Linguistic Theory* 11:381–432.

Liberman, Mark, and Alan Prince. 1977. On stress and linguistic rhythm. *Linguistic Inquiry* 8:249–336.

Prince, Alan S. 1983. Relating to the grid. *Linguistic Inquiry* 14:19–100.

Prince, Alan S., and Paul Smolensky. 2004. *Optimality Theory: Constraint interaction in generative grammar.* Malden, Mass.: Blackwell.

Roca, Iggy M. 1986. Secondary stress and metrical rhythm. *Phonology Yearbook* 3:330–341.

Roca, Iggy M. 1999. Stress in the Romance languages. In *Word prosodic systems in the languages of Europe*, ed. by Harry van der Hulst, 659–812. Berlin: Mouton de Gruyter.

Vergnaud, Jean-Roger, and Morris Halle. 1978. Metrical structures in phonology. Ms., MIT.