

10 Stress Assignment in Tiberian Hebrew

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10.1 Introduction

The metrical structure of Tiberian Hebrew, as seen through the assignment of main stress and related processes that lengthen and reduce vowels, has long been problematic for theories of metrical structure. The main problem has been that different processes have required apparently incompatible metrical structures. Thus, Tiberian Hebrew has appeared to lack *metrical coherence* (Dresher and Lahiri 1991): incompatible metrical constituents interfere with each other in ways that go beyond what is characteristic of metrical structure in other languages.

The simplified bracketed grid (SBG) theory developed by Idsardi (1992, this volume) and Halle and Idsardi (1995) offers a more elegant alternative to previous analyses of Tiberian Hebrew metrical structure. I will argue that the evidence previously taken as supporting inconsistent metrical constituents does not in fact require the construction of entire constituents; the same evidence can be accounted for by the construction of more minimal single brackets. The marks required by the different processes do not contradict each other; rather, metrical structure is constructed progressively without destroying previous marks.

One characteristic of earlier analyses that is retained in the current proposal is the derivational nature of the construction of Tiberian Hebrew metrical structure. The assignment of aspects of metrical structure interacts with phonological processes in intricate ways that create surface opacity. While these results follow straightforwardly from a derivation, they pose a challenge to nonderivational theories.

10.2 Earlier Approaches: Metrical Overwriting

Tiberian Hebrew is what van der Hulst (1996) has called a “main stress first” language, in that main stress is assigned very early, prior to other metrical structure (Blake 1951, Prince 1975, Malone 1993, Balcaen 1995). For reasons to be made

clear below, this early stress is assigned to a word-final syllable if and only if it is closed, and otherwise to the penult. McCarthy (1979) and Hayes (1980) construct a quantity-sensitive left-headed foot (trochee) at the right edge of the word (1); sample forms are shown in (2).

(1) *Main Stress Rule (MSR)*

Build a quantity-sensitive trochee on the right side.

(2) *Main Stress Rule: Sample forms*

	a. 'slew'	b. 'slew + 3pl.'	c. 'word'	d. 'your m.sg. word'
Line 2	x	x	x	x
Line 1	(x)	(x)	(x)	(x)
Line 0	x (x)	x (x x)	x (x)	x x (x x)
MSR	ha rag	ha ra guu	da bar	da ba re kaa

The words in (2a) and (2c) end in closed syllables, which count as heavy. Hence, the final trochee consists only of this syllable. In (2b) and (2d), the final syllable is open, allowing a binary foot to be constructed.

The quantity distinctions implied by this patterning classify closed syllables as heavy and open syllables as light. However, word-final vowels in open syllables tend to be long, as in the above examples. It is typologically unusual to count long vowels as light. Moreover, such a classification contradicts that required by vowel reduction, discussed immediately below, as well as by secondary stress and the phrasing indicated by the system of accents (Dresher 1981a,b, 1994).

The earlier accounts of Tiberian Hebrew stress viewed the anomalous definition of quantity required by the MSR as simply one of a number of unusual aspects of the rule. Later analyses have attempted to reconcile the treatment of final long vowels with more usual systems of syllable quantity. In place of (1), Rappaport (1984) constructs a quantity-insensitive left-dominant binary foot at the right edge of each word. To force stress onto final closed syllables, her analysis first assigns them an accent, thereby achieving the same result as a quantity-sensitive foot: stress a final closed syllable, otherwise stress the penult. There is little other motivation, however, for assigning lexical accents in Tiberian Hebrew; moreover, accents here are assigned precisely to syllables that are treated as heavy in the rest of the grammar.

Rather than treat final closed syllables in a special way, Balcaen (1995) proposes to reconsider the underlying quantity of final vowels. Final vowels are predictably long in Tiberian Hebrew, suggesting that a rule of final lengthening applies to underlying short vowels.¹ On this analysis, which I adopt here, long vowels can be considered as heavy syllables throughout the grammar, while allowing the MSR to treat final short vowels as light (3).

(3) *Underlying forms and the main stress rule*

	a. 'slew'	b. 'slew + 3pl.'	c. 'word'	d. 'your m.sg. word'
Line 0	x x	x x x	x x	x x x x
UR	ha rag	ha ra gu	da bar	da ba re ka
Line 2	x	x	x	x
Line 1	(x)	(x)	(x)	(x)
Line 0	x (x)	x (x x)	x (x)	x x (x x)
MSR	ha rag	ha ra gu	da bar	da ba re kaa

While the MSR can now be seen as operating on the same quantity distinctions as the rest of the phonology, the placement of main stress in (3) is *opaque* in the sense of Kiparsky 1973, in that main stress does not always surface in the position assigned in (3). In forms (3a) and (3c), main stress surfaces as shown, but this is not the case for (3b) and (3d). In the latter two forms, main stress actually surfaces, in the typical case, on the final syllable, not on the penultimate.

Evidence that the penultimate syllables in these forms are actually stressed at some stage of the derivation comes from the rule of Pretonic Lengthening (PTL).² This rule causes a vowel in an open syllable to lengthen when it immediately precedes the main stress. In (5), PTL applies as shown, consistent with the placement of the main stress to this point.

(4) *Pretonic Lengthening*

Lengthen a vowel in an open syllable immediately to the left of main stress.

(5) *Pretonic Lengthening: Sample forms*

	a. 'slew'	b. 'slew + 3pl.'	c. 'word'	d. 'your m.sg. word'
Line 2	x	x	x	x
Line 1	(x)	(x)	(x)	(x)
Line 0	x (x)	x (x x)	x (x)	x x (x x)
PTL	haa rag	haa ra gu	daa bar	da baa re ka

There is more evidence supporting the above assignment of main stress. Words that are in prominent prosodic positions, usually marked by Masoretic accents that (imperfectly) indicate Intonational Phrases (Dresher 1994), are said to be in *pause* and are called *pausal* forms. Forms that are not in pause are *contextual* forms.

When a word occurs in pause, main stress surfaces on the vowel stressed by the above rules; in many cases, this vowel is also lengthened (6a–c). In (6), the extra grid line represents the main phrasal stress.³

(6) *Pausal Stress (PS): Sample forms*

	a. 'slew'	b. 'slew + 3pl.'	c. 'word'	d. 'your m.sg. word'
Line 3	x	x	x	x
Line 2	...x)	...x	...x)	...x)
Line 1	(x)	(x)	(x)	(x)
Line 0	x (x)	x (x x)	x (x)	x x (x x)
PS	haa raag	haa raa gu	daa baar	da baa re ka

In contextual forms, the original main stress (and the trochaic foot) appear to be overwritten by quantity-sensitive iambic feet built from right to left (7). These feet are known as reduction feet (R-feet) because they give rise to an alternating pattern of vowel reduction/deletion. R-feet are illustrated in (8).⁴

(7) *Iambic feet from right (R-feet)*

Build quantity-sensitive iambs from the right.

(8) *R-feet: Sample contextual forms*

	a. 'slew'	b. 'slew + 3pl.'	c. 'word'	d. 'your m.sg. word'
Line 2	x	x	x	x
Line 1	(x x)	(x x)	(x x)	(x x)
Line 0	(x) (x)	(x) (x x)	(x) (x)	(x x) (x x)
R-feet	haa rag	haa ra gu	daa bar	da baa re ka

Vowels in weak position in these iambic feet are reduced; depending on various conditions, some of these reduced vowels are deleted. Affected vowels are represented by *V* in (9).

(9) *Reduction/Deletion (R/D) of weak vowels*

	a. 'slew'	b. 'slew + 3pl.'	c. 'word'	d. 'your m.sg. word'
Line 2	x	x	x	x
Line 1	(x x)	(x x)	(x x)	(x x)
Line 0	(x) (x)	(x) (. x)	(x) (x)	(. x) (. x)
R/D	haa rag	haa rV gu	daa bar	dV baa rV ka

Additional rules result in the final surface forms of the selected words, shown in (11) and (12). Some of these rules (not necessarily in order) are given in (10).⁵

(10) *Additional rules relevant to sample forms*a. *Spirantization*

Spirantize a nongeminate stop /p, b, t, d, k, g/ following a vowel.

b. *Final Lengthening*

Lengthen a word-final vowel.

c. *Tone Lengthening*

Lengthen a vowel that bears main stress under certain conditions; in the examples presented here, stressed /a/ lengthens in nouns (e.g., *də:vó:r*) but not in verbs (e.g., *hə:ró:y*).

d. *Canaanite Rounding*

a: > ɔ:

(11) *Surface contextual forms*

- | | | | |
|-----------|------------------|-----------|----------------------|
| a. 'slew' | b. 'slew + 3pl.' | c. 'word' | d. 'your m.sg. word' |
| hə:ró:y | hə:ryú: | də:vó:r | dəvə:rxó: |

(12) *Surface pausal forms*

- | | | | |
|-----------|------------------|-----------|----------------------|
| a. 'slew' | b. 'slew + 3pl.' | c. 'word' | d. 'your m.sg. word' |
| hə:ró:y | hə:ró:yu: | də:vó:r | dəvə:rəxə: |

The main difficulty in this type of analysis has been the relation between the left-headed feet assigned by the MSR (1) and the right-headed R-feet (7) that govern vowel reduction and deletion. In sample contextual forms (11b) and (11d), the latter overrun the former, causing the previously stressed vowel to reduce and in some cases delete. This kind of interaction has been problematic, aside from the evident lack of metrical coherence in having two such opposed metrical constituents in the same domain.

Rappaport (1984) proposes that the R-feet are not in fact stress feet, but are constructed on a different plane from the stress feet in (1). Vowel reduction and deletion follow the R-foot plane, independent of constituency assigned by the stress feet. On this account, the R-feet do not have to overwrite the stress feet, but coexist with them.

This solution does not really solve the metrical coherence problem, however. It remains the case that two contradictory types of metrical constituents appear to be required in a single domain, whether we call them R-feet or stress feet. On an empirical level, the claim that R-feet are simply independent of the stress plane is incorrect. The crucial cases concern the pausal forms. We have seen that in pause, the R-feet do not reduce the vowel stressed by the MSR and hence do not cause a shift in stress to the right. In cases where the vowel lengthens under pause, one might suppose that this is due to the fact that the stressed syllable has become heavy, so that the normal construction of the R-feet would treat it like any other heavy syllable, which is immune to reduction. An example is (13b).

(13) *Pausal Stress: Two planes*

	a. 'slew'	b. 'slew + 3pl.'	c. 'word'	d. 'your m.sg. word'
Stress feet				
Line 3	x	x	x	x
Line 2	...x)	...x)	...x)	...x)
Line 1	(x)	(x)	(x)	(x)
Line 0	x (x)	x (x x)	x (x)	x x (x x)
	haa raag	haa raa gu	daa baar	da baa re ka
Line 0	(x) (x)	(x) (x) (x)	(x) (x)	(x x) (x x)
Line 1	x x	x x x	x x	x x
R-feet				

In (13b), the lengthened pausal vowel is treated as an R-foot and thus avoids reduction and loss of stress.

Such an account does not work for forms like (13d), where the stressed vowel does not undergo pausal lengthening. Nevertheless, it retains its stress and is not reduced. Prince (1975:199) stipulates that the rule of vowel reduction does not affect pausal forms. That is, the extra measure of stress carried by pausal forms is sufficient to make them immune from reduction. While this makes intuitive sense, it is necessary to integrate this explanation into a metrical account. In a biplanar analysis such as (13), construction of R-feet should not be influenced by marks on the stress plane. Evidently, stress does influence construction of the R-feet.

To my knowledge, none of the metrical analyses proposed for Tiberian Hebrew address the question of how pausal forms like (12d) are derived—that is, how the heightened phrasal stress prevents the construction of an iambic R-foot that would put the stressed vowel in a weak position. Rather than speculate about how this fact can be integrated into the above analysis, I will consider it in the context of the revised SBG analysis to be presented in the next section.

10.3 A Simplified Bracketed Grid Analysis

Using unpaired brackets allows for a more elegant derivation in which metrical structure is constructed progressively without destroying previous marks.

The key point concerns the early MSR. I propose that this rule does not assign a stress, or even a metrical constituent, but rather a left bracket. This bracket is assigned to the left of the last vowel of the word that is not absolutely word-final. If the final syllable is closed, the bracket will go to its left (15a,c); if open, it will go to the left of the penult (15b,d).

(14) *Left Bracket Insertion (LBI)*

Insert a left bracket to the left of the last vowel of the word that is not absolutely word-final.

(15) *Underlying representation (UR) and Left Bracket Insertion*

	a. 'slew'	b. 'slew + 3pl.'	c. 'word'	d. 'your m.sg. word'
	x x	x x x	x x	x x x x
UR	ha rag	ha ra gu	da bar	da ba re ka
	x (x	x (x x	x (x	x x (x x
LBI	ha rag	ha ra gu	da bar	da ba re ka

This rule is followed by PTL, reformulated now to be sensitive to the bracket assigned by LBI, not to a stress.⁶

(16) *Pretonic Lengthening*

Lengthen a vowel in an open syllable immediately to the left of a left bracket.

(17) *Pretonic Lengthening: Sample forms*

	a. 'slew'	b. 'slew + 3pl.'	c. 'word'	d. 'your m.sg. word'
	x (x	x (x x	x (x	x x (x x
PTL	haa rag	haa ra gu	daa bar	da baa re ka

In earlier analyses, vowel lengthening on an unstressed syllable due to PTL was taken as evidence for positing a stress on the immediately following syllable. This evidence does not necessarily point to a stress; all it shows is that it is necessary to distinguish the syllable preceding the lengthened one in some way. The left bracket accomplishes this in a minimal way.

As in the earlier analyses, at this point the derivation can take two different paths, depending on the prosodic position of the word. Let us first consider the pausal forms. Recall that the surfacing of stress in pausal forms was taken as a second type of evidence pointing to the existence of an early main stress on the syllable in question. Unlike the evidence of PTL, pausal evidence does directly indicate an actual stress. Therefore, it is reasonable to suppose that the effect of being the head of a phrase is to cause the assignment of higher-level grid marks to the right of the bracket assigned by LBI. To harmonize with the rest of the analysis, in which heads of constituents are on the right, I will suppose in addition that pausal stress induces a right bracket to the right of the syllable bearing phrasal stress at every level of the grid.

(18) *Pausal Stress (PS)*

Assign a right bracket and a grid mark at every prosodic level up to the Intonational Phrase on a vowel to the right of a left bracket.

On this account, Pausal Lengthening (PL) is a distinct process that applies to certain vowels that have pausal stress.

(19) *Pausal Lengthening*

Lengthen a stressed vowel (with certain exclusions, as in *daba:réka*) in the head of an Intonational Phrase.

(20) *Pausal Stress: Sample forms*

	a. 'slew'	b. 'slew + 3pl.'	c. 'word'	d. 'your m.sg. word'
Line 3	x)	x)	x)	x)
Line 2	x)	x)	x)	x)
Line 1	x)	x)	x)	x)
Line 0	x (x)	x (x) x	x (x)	x x (x) x
PS	haa rag	haa ra gu	daa bar	da baa re ka

(21) *Pausal Lengthening: Sample forms*

	a. 'slew'	b. 'slew + 3pl.'	c. 'word'	d. 'your m.sg. word'
Line 3	x)	x)	x)	x)
Line 2	x)	x)	x)	x)
Line 1	x)	x)	x)	x)
Line 0	x (x)	x (x) x	x (x)	x x (x) x
PL	haa raag	haa raa gu	daa baar	da baa re ka

If we choose the contextual path, the process of assigning the R-feet that control vowel reduction and deletion can be decomposed into steps that assign a right bracket to the right of a heavy syllable (22), operating on the output of LBI; insert a right bracket every two syllables, starting from the right (23); and project the rightmost element of each constituent onto line 1 (24).

(22) *Project heavy syllables*

Assign) to heavy syllables.

(23) *Iterative brackets from the right (R-feet)*

Insert) every two syllables from the right.

(24) *Iambic feet*

Project the rightmost element of each line 0 constituent on line 1.

(25) *R-feet: Sample contextual forms*

	a. 'slew'	b. 'slew + 3pl.'	c. 'word'	d. 'your m.sg. word'
Project H	x) (x)	x) (x x)	x) (x)	x x) (x x)
	haa rag	haa ra gu	daa bar	da baa re ka
Project R	x x	x x	x x	x x
Insert)	x) (x)	x) (x x)	x) (x)	x x) (x x)
	haa rag	haa ra gu	daa bar	da baa re ka

As before, vowels in the weak position of a foot are reduced or deleted (26).

(26) *Reduction and deletion of weak vowels: Contextual forms*

	a. 'slew'	b. 'slew + 3pl.'	c. 'word'	d. 'your m.sg. word'
Line 1	x x	x x	x x	x x
Line 0	x) (x)	x) (. x)	x) (x)	. x) (. x)
	haa rag	haa rV gu	daa bar	dV baa rV ka

The head of the rightmost foot is assigned main stress (27), (28).⁷

(27) *Main Stress Rule*

- Insert) at the right edge of line 1.
- Project the rightmost element of line 1 onto line 2.

(28) *Main Stress Rule: Contextual forms*

	a. 'slew'	b. 'slew + 3pl.'	c. 'word'	d. 'your m.sg. word'
Line 2	x	x	x	x
Line 1	x x)	x x)	x x)	x x)
Line 0	x) (x)	x) (. x)	x) (x)	. x) (. x)
	haa rag	haa rV gu	daa bar	dV baa rV ka

In the pausal forms, the medial vowel is protected from reduction by the early PS rule (18).

(29) *R-feet: Sample pausal forms*

	a. 'slew'	b. 'slew + 3pl.'	c. 'word'	d. 'your m.sg. word'
Line 3	x)	x)	x)	x)
Line 2	x)	x)	x)	x)
Line 1	x)	x)	x)	x)
Line 0 <i>Proj. H</i>	x) (x)	x) (x) x	x) (x)	x x) (x) x
	haa rag	haa raa gu	daa baar	da baa re ka
Line 3	x)	x)	x)	x)
Line 2	x)	x)	x)	x)
Line 1 <i>Proj. R</i>	x x)	x x) x	x x)	x x) x
Line 0 <i>Ins.)</i>	x) (x)	x) (x) x)	x) (x)	x x) (x) x)
	haa rag	haa raa gu	daa baar	da baa re ka

Applying the other rules in (10) as before, we arrive at the surface forms in (11) and (12).

10.4 The Opacity of Metrical Structure Assignment in Tiberian Hebrew

We have derived two surface forms for our sample verb: [hɔ:ró:yu:] in pause and [hɔ:ryú:] in context. In the case of pause, there is no possibility of this stress clashing with a following one, since pausal forms by definition are final in their Intonational Phrase. However, a contextual form may be followed in the same Phonological

Phrase by a word with initial stress, and this situation can trigger Stress Retraction. Retraction moves the main stress back to the next full vowel in an open syllable, yielding [hó:ryu:] in our example.

(30) *Stress Retraction*

In clash, retract stress to the next full open syllable.

(31) *Stress Retraction: Sample form*

Line 3	x	x	→	x	x	
Line 2	x	x) x)		x	x) x)	
Line 1	x)	(. x) (x)		x)	(. x) (x)	
Line 0	haa	rVguu	ʔiiš	haa	rVguu	ʔiiš
	‘slew’		‘man’	‘(they) slew a man’		(Gen. 49:6)

The challenge, for a constraint-based theory that selects optimal candidates in a single pass (Prince and Smolensky 2004), is to devise a grammar that obtains all three surface forms—pausal [hó:ró:yu:], unretracted contextual [hó:ryú:], and retracted contextual [hó:ryu:]—from the single underlying form /harag + u/. Revell (1987:111) interprets the facts diachronically and argues that stress retraction must have developed following vowel reduction; if it did not, retraction would have pulled stress back to the medial vowel, and the retracted form should have been the same as the pausal form.

This argument is actually a synchronic argument about the grammar of Tiberian Hebrew. Since the pausal form shows that the medial vowel is stressable, why is the same form not optimal when a form with nonfinal stress is required? Any nonderivational solution would have to overcome the considerable amount of opacity involved in the derivational approach sketched above.⁸

Notes

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1. Some final vowels surface as short, but these can be shown to derive from vowel-consonant sequences.
2. There are certain restrictions on the rule; see Prince 1975:62–66, Malone 1993:85–87.
3. Notice that we must assume that words are already in place in phrases at this point in the derivation. This presupposes that some phrasing has already taken place before the phonological derivation is complete (Dresher 1983).

4. Generative analyses of vowel reduction originate with Prince (1975). Various metrical interpretations are proposed by McCarthy (1979), Hayes (1980), and Rappaport (1984).
5. Khan (1987) argues that Hebrew vowels at the time of completion of the Tiberian notation system were no longer distinguished by quantity. Thus, the transcriptions and grammar presented here refer to an earlier stage of the language.
6. This formulation is inspired by Balcaen 2000. As before, there are restrictions on the rule that I do not discuss here.
7. The Main Stress Rule (27) does not apply in pausal forms, or applies to no effect, as these forms already have the main phrasal stress assigned.
8. On the particular problems caused by the opacity of spirantization, see Idsardi 1997, 1998.

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