44. The Iambic—Trochaic Law

Brett Hyde

Sections

1 Introduction

In the development of metrical stress theory, several influential approaches (**Hayes 1985, 1987, 1995**; **McCarthy and Prince 1986**; **Prince 1990**) have employed the Iambic—Trochaic Law (ITL) to provide extralinguistic grounding for an account of the differences between iambic and trochaic stress systems (see also CHAPTER 39: STRESS: PHONOTACTIC AND PHONETIC EVIDENCE; CHAPTER 40: THE FOOT; CHAPTER 41: THE REPRESENTATION OF WORD STRESS). The ITL, given in (1), is a statement about the naturalness of two types of rhythmic groupings in two different contexts. According to the ITL, sequences of elements that contrast in intensity most naturally divide into groups with trochaic prominence, and sequences of elements that contrast in duration most naturally divide into groups with iambic prominence.

(1)   *The Iambic—Trochaic Law* (**Hayes 1985, 1987**)

      a.   Elements contrasting in intensity naturally form groupings with initial prominence.

      b.   Elements contrasting in duration naturally form groupings with final prominence.

For approaches to metrical stress based on the ITL, this difference in naturalness is responsible for the duration-related differences found in iambic and trochaic stress patterns.

The ITL is based on a long tradition of experimental investigation into the perception of rhythmic grouping (**Bolton 1894**; **Woodrow 1909**). In the typical experiment, participants are asked to group a sequence of artificially created alternating sounds. The sounds alternate either in intensity, as in (2a), or in duration, as in (2b).

(2) a. ... o O o O o O o O o O o O o O o O o O o O o ...
     b. ... – — – — – · — · — · — · — · — · — · — · — – · ...

The outcome, under certain circumstances, is that participants tend to divide intensity alternations into groups where the more intense element appears first, as in (3a), and they tend to divide duration alternations into groups where the longer element appears second, as in (3b).[1] The ITL is essentially a statement of these results.

(3) a. *Intensity contrasts: Left-prominent groupings*
         ... [O o][O o][O o][O o][O o][O o][O o][O o][O o] ...

     b. *Duration contrasts: Right-prominent groupings*
         ... [– —][– —][– —][– —][– —][– —][– —][– —] ...

Though the ITL is an extralinguistic principle, it seems to be reflected in the stress patterns of numerous languages, suggesting, at least initially, that it plays an important role in shaping them. For example, many trochaic languages are like Cahuilla (**Seiler 1965, 1967, 1977**; **Seiler and Hioki 1979**). They exclude heavy syllables from disyllabic feet, ensuring that durational contrasts never arise in a foot with trochaic prominence. In Cahuilla, heavy syllables are CVV and CVʔ.

(4) *Exclusion of H from disyllabic feet in Cahuilla*

('LL)(ˌL)	('taxmu)(ˌʔat)	'song'
('LL)(ˌLL)	('taka)(ˌlitʃem)	'one-eyed ones'
('H)(ˌL)	('paʔ)(ˌli)	'the water (OBJ)'
('H)(ˌLL)	('qa:)(ˌnitʃem)	'palo verde (PL)'
('L)(ˌH)(ˌL)	('su)(ˌkaʔ)(ˌti)	'the deer (OBJ)'
('L)(ˌH)(ˌLL)	(ˌnesun) ('ka)(ˌvi:)(ˌtʃi-wen)	'I was surprised'

Many iambic languages are like Hixkaryana (**Derbyshire 1985**). They lengthen the vowel of stressed syllables, if necessary, to ensure that feet with iambic prominence always contain durational contrasts. In Hixkaryana, heavy syllables are CVV and CVC.

(5) *Iambic lengthening in Hixkaryana*

a. (LˈL)('H)L   →   (LˈH)('H)L
    (khæˈnæ)('nuh)nɔ   →   (khæˈnæ:)('nuh)nɔ   'I taught you'
b. (LˈL)(LˈH)L   →   (LˈH)(LˈH)L
    (muˈhæ)(næˈnuh)nɔ →   (muˈhæ:)(næˈnuh)nɔ   'you taught him'
c. ('H)(LˈL)L   →   ('H)(LˈH)L
    ('ɔw)(tɔˈhɔ)næ   →   ('ɔw)(tɔˈhɔ:)næ   'to the village'
d. ('H)(LˈL)LL   →   ('H)(LˈH)LL
    ('tɔh)(kuˈri̇)hɔnæ →   ('tɔh)(kuˈri̇:)hɔnæ   'to Tohkurye'

This chapter reviews the strengths and weaknesses of ITL approaches to metrical stress, and examines some of the most promising alternatives. We shall see that the ITL does not actually offer an adequate foundation for an account of stress systems in general, but it may provide an adequate foundation for an account of quantity–sensitive stress systems in particular (see CHAPTER 57: QUANTITY–SENSITIVITY). This is not to say that it provides the best foundation. There is a clear sense in which the superficial and descriptive ITL is itself an observation in need of an explanation, much like the stress patterns found in natural language. Part of the appeal of the most promising alternatives is that they have the potential to account not only for the stress patterns of natural language, but also for the ITL itself.

Before reviewing the various proposals, we should note the results of more recent investigations into the perception of rhythmic grouping. In some cases, more recent studies have confirmed the grouping preferences found in the earlier studies on which the ITL was based. In other cases, they have challenged their universality. The studies of **Rice (1992)**, **Vos (1977)**, and **Hay and Diehl (2007)**, for example, found grouping preferences among English, French, and Dutch speakers similar to those found in the earlier studies of **Bolton (1894)** and **Woodrow (1909)**.[2] The studies of **Kusumoto and Moreton (1997)** and **Iversen et al. (2008)**, however, found significant differences between speakers of English and Japanese. Iversen *et al.*, for example, found that English speakers had a fairly strong preference (68 percent) for dividing

sequences of amplitude contrasts into trochaic (loud—soft) groups, but Japanese speakers had a much stronger preference (91 percent) for trochaic grouping. English speakers showed a very strong preference (89 percent) to divide duration contrasts into iambic (short—long) groups, but Japanese speakers showed no preference. While the challenge to universality may be troubling to those particularly concerned with extralinguistic grounding, and it certainly presents an interesting problem in this connection, it does not necessarily tell us anything about the ITL's ability to predict differences between iambic and trochaic stress patterns in language. Having noted the problem with respect to extralinguistic grounding, then, I will not address the issue further.

2 Interpretations of the ITL

The most recent ITL accounts (**McCarthy and Prince 1986**; **Hayes 1987, 1995**; **Prince 1990**) reflect two distinct interpretations. The stronger of the two, given in (6), takes the ITL to be concerned with the actual presence or absence of durational contrasts within rhythmic groupings.

(6)   *Strong interpretation of the ITL*

      a.   If a foot contains a durational contrast, it is iambic.

      b.   If a foot lacks a durational contrast, it is trochaic.

The weaker interpretation, given in (7), takes the ITL to be concerned with sensitivity to the positions of the heavy syllables that might help to create durational contrasts.

(7)   *Weak interpretation of the ITL* (**Hayes 1985**)

      a.   If parsing is sensitive to the position of heavy syllables, it is iambic.

      b.   If parsing is insensitive to the position of heavy syllables, it is trochaic.

Even at the point at which the ITL was introduced to metrical stress theory, it was clear that the strong interpretation in (6) was unsustainable, at least when applied to stress systems generally. Under the strong interpretation, iambic footing and the presence of durational contrasts are intimately connected: only iambs contain durational contrasts; durational contrasts arise only in iambic feet; and only iambic systems employ rules that create durational contrasts. Similarly, trochaic footing and the absence of durational contrasts are intimately connected: only trochees lack durational contrasts; durational contrasts are absent only in trochaic feet; and only trochaic systems employ rules that destroy durational contrasts.

Even a cursory look at the general typology of attested stress patterns reveals that the strong interpretation misses the mark by a wide margin. As mentioned above, many iambic languages are like Hixkaryana, lengthening the vowel of stressed syllables, if necessary, to ensure that surface iambs contain durational contrasts. Many other iambic languages are like Araucanian (**Echeverría and Contreras 1965**), however. They tolerate surface iambs that have no durational contrasts.

(8) *Even iambs in Araucanian*

(L'L)	(wu'le)	'tomorrow'
(L'L)L	(ti'pan)to	'year'
(L'L)(L‚L)	(e'lu)(mu‚ju)	'give us'
(L'L)(L‚L)L	(e'lu)(a‚e)new	'he will give me'

A similar situation obtains with trochaic languages. As mentioned above, several are like Cahuilla in prohibiting foot-internal durational contrasts. Several others, however, are like Chimalapa Zoque (**Knudson 1975**). They tolerate foot-internal durational contrasts and even have rules that create them. In Chimalapa Zoque, heavy syllables are CVV and CVC.

(9) *Trochaic lengthening in Chimalapa Zoque*

a.	('LH)	→	('HH)	
	('kosaʔ)	→	('koːsaʔ)	'scold (IMP)'
b.	(‚L)('LL)	→	(‚H)('HL)	
	(‚hu)('kuti)	→	(‚huː)('kuːti)	'fire'
c.	(‚LL)L('LL)	→	(‚HL)L('HL)	
	(‚witi) hu('kuti)	→	(‚wiːti) hu('kuːti)	'big fire'
d.	(‚LH)H('HL)	→	(‚HH)H('HL)	
	(‚wituʔ)paj('niksi)	→	(‚wiːtuʔ)paj('niksi)	'he is coming and going'

There appears to be no close connection between iambs and the presence of durational contrasts, then, or between trochees and the absence of durational contrasts, at least in the general case.

Given the shortcomings of the strong interpretation, **Hayes (1985)** introduced the ITL to metrical stress theory under the weak interpretation in (7). Under the weak interpretation, the crucial connections are between iambic footing and quantity-sensitivity and trochaic footing and quantity-insensitivity. While iambic feet and trochaic feet might both contain durational contrasts, parsing is iambic if and only if it is sensitive to the positions of heavy syllables. Parsing is trochaic if and only if it is insensitive to the positions of heavy syllables.

There are three problems with the weak interpretation. The first is conceptual. The ITL is plainly a generalization about the appropriateness of durational contrasts within two different types of feet. Since its requirements concerning durational contrasts affect both types, the ITL does not countenance situations where either type is quantity-insensitive (where either type simply ignores the differences in syllable weight that help to create durational contrasts). In viewing the primary concern of the ITL to be the appropriateness of quantity-sensitivity for different types of feet, the weak interpretation seems really to be a misinterpretation.

The second problem is a loss of empirical coverage. Since it only addresses quantity-sensitivity, the weak interpretation tells us nothing about the status of lengthening and shortening rules addressed by the strong interpretation.

The final problem is that the weak interpretation is false. A significant number of trochaic systems are quantity-sensitive, falsifying (7a), and a significant number of iambic systems are quantity-insensitive, falsifying (7b). In (4), for example, we saw that heavy syllables consistently perturb the basic stress pattern of the trochaic Cahuilla, indicating that it is quantity-sensitive. In (10), we see that heavy syllables consistently fail to perturb the basic pattern of the iambic Paumari (**Everett 2003**), indicating that it is quantity-insensitive. In the basic pattern, stress appears on every odd-numbered syllable from the right. CVV syllables are heavy.

(10) *Quantity-insensitive iambs in Paumari*

(‚L)(L'L)	(‚ma)(si'ko)	'moon'
(L‚L)(L'L)	(ka‚d͡ʒo)(wi'ɾi)	'island'
(‚H)(H'L)	(‚kai)(hai'hi)	'type of medicine'
(H‚L)(L'L)	(wai‚t͡ʃa)(na'wa)	'little ones'

Additional quantity-sensitive trochaic languages include Palestinian Arabic (**Brame 1973, 1974**; **Kenstowicz and Abdul-Karim 1980**; **Kenstowicz 1983**) and Fijian (**Schütz 1978, 1985**; **Dixon 1988**). Additional quantity-insensitive iambic languages include Araucanian, Osage (**Altshuler 2009**), Suruwaha (**Everett 1996**), and Weri (**Boxwell and Boxwell 1966**).

As we shall see in §3, parts of both interpretations, (6a) of the strong interpretation and (7b) of the weak interpretation, are brought together to form the basis for two subsequent ITL accounts, those of **Hayes (1987, 1995)** and of **McCarthy and Prince (1986)**. This marriage between the halves of two very different interpretations often makes the connection between

the ITL and the phenomena that these approaches attempt to account for less than clear. This is part of the reason, perhaps, that some have concluded that there is actually little of the ITL left in ITL-based approaches (see van der **Hulst 1999**, for example). A third ITL approach, that of **Prince (1990)**, employs only the strong interpretation, but seeks to avoid the problems discussed above by employing it only in the context of quantity-sensitive systems and only as a relative "preference" rather than an absolute "law."

Though I will point out the aspects of the more recent ITL accounts that derive from the weak interpretation, it should be clear at this point that the weak interpretation does not give us an accurate picture of the potential for quantity-sensitivity with different types of feet, so I will not address the issue in any detail. I will address in some detail, however, the support that aspects deriving from the strong interpretation find among quantity-sensitive systems. While both iambic and trochaic languages can be quantity-sensitive, differences in the way that they resume basic stress alternations after a heavy syllable is encountered indicate that they are quantity-sensitive in different ways. Iambic systems require that heavy syllables occupy the prominent position in a disyllabic foot, but trochaic systems exclude heavy syllables from disyllabic feet entirely. Since the strong interpretation predicts this difference, it might provide the foundation for an account, not of stress systems generally, but of quantity-sensitive systems in particular.

3 Quantity-sensitivity

In quantity-sensitive languages, heavy syllables are always stressed, and this often has the effect of perturbing basic stress alternations. The feature of quantity-sensitivity that is most significant to the discussion here is that there is sometimes a difference between trochaic systems and iambic systems in how they resume their basic alternations after encountering a heavy syllable. Under certain circumstances, the particular way in which a system resumes its basic alternation can indicate whether it prefers to parse heavy syllables into disyllabic feet or monosyllabic feet. Whether or not a difference in resumption actually emerges, however, depends on the combination of foot type and parsing directionality the system employs.

No difference emerges when the headedness of the foot and parsing directionality match. As illustrated in (5), for example, in left-to-right iambic languages like Hixkaryana, a heavy syllable is always followed by a stressless syllable. Similarly, in right-to-left trochaic languages like Fijian, as (11) illustrates, heavy syllables are always preceded by a stressless syllable. In Fijian, heavy syllables are CVV.

(11)   *Fijian loanwords* (Schütz 1978)[3]

‚LL'LL	‚ndiko'nesi	'deaconess'
L‚LL'LL	pe‚resi'tendi	'president'
‚LL‚H'LL	‚mbele‚mbo:'tomu	'bell-bottoms'
L‚LL'H	pa‚lasi'ta:	'plaster'
‚LL‚LL'H	‚mini‚siti'ri:	'ministry'
L‚HL'H	pa‚raima'ri:	'primary'
‚H‚LL'H	‚ndai‚reki'ta:	'director'

There is no difference, then, between left-to-right iambic systems and right-to-left trochaic systems in this context – both resume their basic alternations with a stressless syllable – so there is no evidence for a difference in their treatment of heavy syllables.

The reason is simply that the foot that is constructed immediately after the heavy syllable is parsed, rather than the foot that is constructed to parse the heavy syllable itself, determines how the basic alternation resumes. Whether heavy syllables are included in disyllabic feet or parsed as monosyllabic feet, the basic alternations of both iambic and trochaic systems would resume with an unstressed syllable (the underlined syllable in the examples below).

(12)   *Parsing directionality matches headedness*

   a.   *Left-to-right iambic*
      i.   Iamb   ii.   Monosyllable
         (x)(x)   (x)(x)
         ...L H $\underline{L}$ L...   ...H $\underline{L}$ L...

   b.   *Right-to-left trochaic*
      i.   Trochee   ii.   Monosyllable
         (x   )(x   )   (x   )(x)
         ...L $\underline{L}$ H L...   ...L $\underline{L}$ H...

In left-to-right iambic systems, the heavy syllable must occur at the right edge of a foot whether the foot is an iamb, as in

(12a.i), or a monosyllable, as in (12a.ii). Since the next foot constructed would be iambic in either case, the alternation resumes with an unstressed syllable. In right–to–left trochaic systems, the heavy syllable would be parsed at the left edge of a foot whether the foot is a trochee, as in (12b.i), or a monosyllable, as in (12b.ii). Since the next foot constructed would be trochaic in either case, the alternation again resumes with an unstressed syllable.

A difference in the resumption of basic alternations emerges only in situations where parsing directionality and the headedness of the foot do not match. In right–to–left iambic languages like Tübatulabal (**Voegelin 1935**), as (13) illustrates, heavy syllables are always preceded by stressless syllables. In Tübatulabal, heavy syllables are CVV(C).

(13)   *Resumption with a stressless syllable in Tübatulabal*

'LL'L	'tʃiɲi'jal	'the red thistle'
L'LL'H	ti'ɲija'laap	'on the red thistle'
L'LL'L	wi'taŋha'tal	'the Tejon Indians'
'LL'LL'HL'L	'witaŋ'hata'laaba'tsu	'away from the Tejon Indians'
'H'LL'L	'taa'hawi'la	'the summer'
'H'LL'H	'taa'hawi'laap	'in the summer'

In left–to–right trochaic languages like Cahuilla, however, as illustrated in (4), heavy syllables are always followed by stressed syllables. The difference between right–to–left iambic systems and left–to–right trochaic systems, then, is that the former resume their basic alternations with stressless syllables while the latter resume them with stressed syllables.

The reason that a difference emerges when headedness and parsing directionality do not match is that the resumption of basic alternations depends directly on how the heavy syllable itself is footed.

(14)   *Mismatch between parsing directionality and headedness*

   a. *Right-to-left iambic*

     i. Iamb

$$(\quad x)(\quad x)$$
$$...L\quad L\ \underline{L}\quad H...$$
$$\longleftarrow$$

     ii. Monosyllable

$$*(\quad x)(x)$$
$$...L\quad \underline{L}\ H...$$
$$\longleftarrow$$

   b. *Left-to-right trochaic*

     i. Trochee

$$*(x\quad)(x\quad)$$
$$...H\ \underline{L}\ L\ L...$$
$$\longrightarrow$$

     ii. Monosyllable

$$(x)(x\quad)$$
$$...H\ \underline{L}\ L...$$
$$\longrightarrow$$

In right–to–left iambic systems, parsing the heavy syllable into an iamb, as in (14a.i), would position an unstressed syllable between the heavy syllable and the next stress to the left. Parsing it into a monosyllabic foot, however, as in (14a.ii), would make the next stress adjacent. The fact that right–to–left iambic languages resume their basic alternation with a stressless syllable indicates that they prefer to accommodate heavy syllables with disyllabic feet. In left–to–right trochaic systems, parsing the heavy syllable into a trochee, as in (14b.i), would position a stressless syllable between the heavy syllable and the next stress to the right. Parsing it into a monosyllabic foot, as in (14b.ii), would not. The fact that left–to–right trochaic languages resume their basic alternation with a stressed syllable indicates that they prefer to accommodate heavy syllables with monosyllabic feet.

Though iambic and trochaic languages display no difference, then, in the resumption of basic stress alternations when parsing directionality and headedness match, they do show a difference when parsing directionality and headedness do not match. The difference indicates that iambic systems prefer to parse heavy syllables into disyllabic feet and trochaic systems prefer to parse heavy syllables as monosyllabic feet. As we shall see next, the foot inventories of ITL accounts capture these divergent preferences as directly as possible.

3.1 The asymmetric foot inventory

As mentioned above, some of the most recent ITL accounts fuse together parts of the strong interpretation and the weak interpretation. **Hayes (1987, 1995)**, for example, relies on the combination to motivate two disparities in the inventory of parsing feet.

(15) a. *Quantity-insensitive*
          Syllabic trochee   (σ σ)

      b. *Quantity-sensitive*
          i.   Moraic trochee   (L L) or (H)
          ii. Standard iamb   (L σ) or (H)

Clause (7b) of the weak interpretation, "if parsing is insensitive to the position of heavy syllables, it is trochaic," motivates a disparity in the types of feet that can be quantity–insensitive. As (15a) indicates, Hayes's account allows only trochaic feet to be quantity–insensitive. As discussed above, the approach is undermined by the existence of several quantity–insensitive iambic languages. While Hayes argues that the quantity–insensitivity of such systems is only apparent, as they do not actually contain heavy syllables to perturb the basic pattern, the argument is plausible only in the cases of Araucanian and Weri. It is not plausible in the cases of Osage, Paumari, and Suruwaha, each of which has long vowels, diphthongs, or both.

Given that both iambic and trochaic systems can be quantity–sensitive, clause (6a) of the strong interpretation, "if a foot contains a durational contrast, it is iambic," motivates a disparity in precisely how the two types can be quantity–sensitive. As (15b) indicates, Hayes's account requires trochaic systems to deal with heavy syllables differently than iambic systems. Iambs allow heavy syllables in strong position in disyllabic feet, where they can create durational contrasts. They exclude them only from weak position. Trochees, however, exclude heavy syllables from disyllabic feet entirely. Trochaic systems must parse heavy syllables into monosyllabic feet, where no durational contrast is possible.

The disparity in how the two types of feet can be quantity–sensitive predicts the difference, discussed above, in how right-to–left iambic languages and left–to–right trochaic languages resume basic stress alternations after encountering a heavy syllable. The fact that iambic systems parse heavy syllables into disyllabic feet in Hayes's account correctly predicts that right–to–left iambic languages will resume their basic alternation with a stressless syllable, as in (14a.i). The fact that trochaic systems must parse heavy syllables into monosyllabic feet correctly predicts that left–to–right trochaic languages will resume their basic alternation with a stressed syllable, as in (14b.ii).

McCarthy and Prince (1986) arrive at a foot inventory similar to Hayes's, but they arrive at it through a slightly different route and in service of a different purpose. They posit one type of quantity–insensitive foot: the balanced [σ σ] template, and two types of quantity–sensitive feet: the balanced [μ μ] template and the unbalanced [σ_μ $\sigma_{\mu\mu}$] template.

(16) a. *Quantity-insensitive*
          Balanced   [σ σ]

      b. *Quantity-sensitive*
          i.   Balanced   [μ μ]
          ii. Unbalanced   [σ_μ $\sigma_{\mu\mu}$]

The ITL contributes to McCarthy and Prince's account in two ways. First, clause (6a) of the strong interpretation, "if a foot contains a durational contrast, it is iambic," motivates the iambic configuration of the quantitatively unbalanced foot. To guarantee that quantitatively iambic feet are also iambic with respect to stress, they posit the Quantity/Prominence Homology principle. It ensures that the heavier syllable in feet with a quantity contrast – in effect, the heavy syllable in a [σ_μ $\sigma_{\mu\mu}$] foot, given the limited possibilities in (16) – bears the stress.

(17)   *Quantity/Prominence Homology*

            For a, b ∈ F, if a > b quantitatively, then a > b stresswise.

Prominence in unbalanced feet is determined by the Trochaic Default principle, which ensures that [σ σ] and [μ μ] feet both stress their initial syllable.

(18)   *Trochaic Default*

            For a, b ∈ F, if a = b quantitatively, then F = [s w].

That the single quantity–insensitive foot template, [σ σ], always emerges as a trochee is a second contribution of the ITL. It derives from clause (7b) of the weak interpretation, "if parsing is insensitive to the position of heavy syllables, it is trochaic."

Although they provide some minimal discussion of the asymmetric foot inventory's role in creating stress patterns, McCarthy and Prince's primary concern is to derive the types of feet encountered in morphological templates. The fact that the types of feet that seem to be required for creating the appropriate stress patterns in Hayes's account are the same types that seem to be involved in morphological templates in McCarthy and Prince's account significantly strengthens the case for the asymmetric foot inventory and the ITL.

Prince's (1990) Harmonic Parsing account also involves crucial asymmetries but, in this case, the asymmetries emerge in the preference hierarchies of iambic and trochaic systems rather than in the foot inventory itself. For Prince, quantity–

sensitive systems are those that obey the Weight-to-Stress principle and quantity-insensitive systems are those that do not.

(19)   *Weight-to-Stress*

      If heavy, then stressed.

Focusing on the former, Prince provides three principles that can be used to determine the relative well-formedness of different types of iambic and trochaic feet in quantity-sensitive systems.

The first principle, Binarity, is given in (20). It requires that feet be either disyllabic or bimoraic.

(20)   *Binarity*

      Feet should be analyzable as binary.

The second and third principles, given in (21), are equivalent to the strong interpretation of the ITL in (6). |X| means "the size of X."

(21)   a.   *Iambic Quantity*

            In a rhythmic unit [W S], |S| > |W|, preferably.

        b.   *Trochaic Quantity*

            In a rhythmic unit [S W], |S| = |W|, preferably.

Iambic Quantity expresses the preference that iambic feet contain a durational contrast, and Trochaic Quantity expresses the preference that trochaic feet not contain a durational contrast.

As (22) indicates, the best-formed feet are those that respect both the relevant quantity principle and Binarity. The next best are those that respect Binarity only. The worst are those that respect neither.

(22)

	satisfy:	IQ/TQ, Binarity		Binarity only		neither
a.	Iambic	[L H]	>	[L L], [H]	>	[L]
b.	Trochaic	[L L], [H]	>	[H L]	>	[L]

The asymmetry in this case arises in how the iambic and trochaic hierarchies order balanced and unbalanced feet. Iambs prefer unbalanced [L H] to balanced [L L] and [H], but trochees prefer balanced [L L] and [H] to unbalanced [H L].

The main difference between the inventory of quantity-sensitive feet in Prince's and Hayes's accounts is the possibility of unbalanced [H L] trochees. As Prince notes, however, with their lesser status, there are limited situations in which unbalanced trochees might arise. First, consider the result of Harmonic Parsing in a left-to-right trochaic system. Since feet are constructed serially, and parsing the next syllable in line is the overriding concern, Harmonic Parsing would parse the H of an HL sequence as monosyllabic foot, just like Hayes's moraic trochees. If the following L could not combine with another L to form a disyllabic foot, giving [H][LL], it might be parsed as a monosyllable, giving [H][L], or left unparsed, giving [H]L, depending on whether or not degenerate feet are tolerated. These are the same options available under Hayes's moraic trochees. The results are rather different in right-to-left systems. Harmonic Parsing would always parse an HL sequence into an [HL] foot, but Hayes's moraic trochees would yield either [H][L] or [H]L, depending on whether or not degenerate feet are tolerated. The latter option results in the same stress pattern, but the former does not. I am not aware, however, of a right-to-left trochaic language that would allow us to distinguish between the two approaches.

As discussed above, the evidence for a difference between iambic and trochaic quantity-sensitivity comes from systems

where parsing directionality is opposite the headedness of the foot. After left-to-right trochaic parsing encounters a heavy syllable, binary alternation resumes with a stressed syllable. In contrast, after right-to-left iambic parsing encounters a heavy syllable, binary alternation resumes with a stressless syllable. Where ITL approaches posit an asymmetric foot inventory to account for this difference, **Kager (1993)** proposes a symmetric foot inventory, arguing that the difference is best explained in terms of the metrical principles of clash and lapse avoidance.

Kager distinguishes between parsing feet and the surface feet that can be formed later through adjunction of unparsed syllables. The inventory of parsing feet is symmetric. The quantity–insensitive syllabic trochee corresponds to a mirror-image syllabic iamb. The quantity–sensitive moraic trochee corresponds to a mirror-image moraic iamb. Iambic quantity–sensitivity and trochaic quantity–sensitivity are identical, then, in that both exclude heavy syllables from disyllabic feet.

(23) *Parsing feet*

	trochaic	iambic
	(x)	(x)
Syllabic (quantity-insensitive)	σ σ	σ σ
	(x)	(x)
Moraic (quantity-sensitive)	μ μ	μ μ

Crucial to Kager's account is the claim that heavy syllables contain an internal prominence contrast corresponding to a decline in sonority between the first and second mora. According to Kager, the internal contrast is the characteristic of heavy syllables responsible for their attraction of stress (**Prince's 1990** Weight-to-Stress principle). The decline in sonority ensures that stress occurs over the first mora and that the second mora is stressless, as in (24).

(24) (x)
μ μ

H
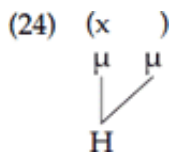
A heavy syllable's strong—weak contour translates into different results with respect to clash at the mora level. When a stressed heavy syllable immediately follows another stressed syllable, as in (25a), the result is a clash. When the order is reversed, as in (25b), there is no clash.

(25) a. *Clash*   b. *No clash*

x x   x   x
μ μ μ   μ μ μ
L H   H   L
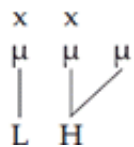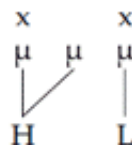
Assuming that clash is never tolerated at the point the basic alternation is resumed, the internal prominence contrast accounts for the different modes of resumption after a heavy syllable.[4] In left-to-right trochaic systems, a trochaic foot can immediately follow the heavy syllable without creating clash, so the pattern resumes with a stressed syllable.
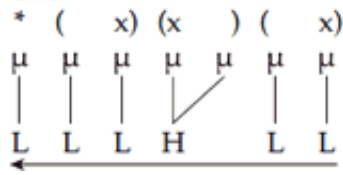
(26) *Left-to-right trochees: No clash*

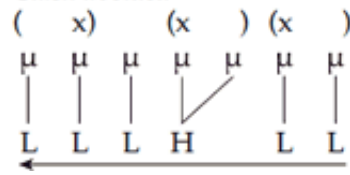(x) (x) (x)
μ μ μ μ μ μ
L L H   L L
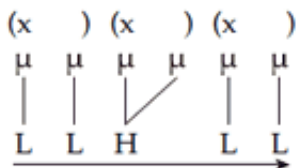
In right-to-left iambic systems, however, an iambic foot cannot immediately precede the heavy syllable without creating clash. This being the case, the parsing algorithm must skip a syllable before constructing an iambic foot, and the pattern resumes with an unstressed syllable.
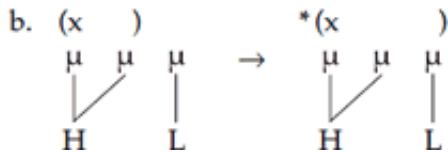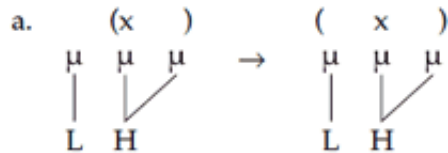
(27) *Right-to-left iambs*

a. *Clash*

```
  *  (    x) (x    ) (      x)
     μ  μ  μ  μ  μ  μ  μ
     |  |  | \|  |  |  |
     L  L  L  H     L  L
  ←─────────────────────
```

b. *Clash avoided*

```
     (    x)       (x    ) (x      )
     μ  μ  μ  μ  μ  μ  μ
     |  |  | \|  |  |  |
     L  L  L  H     L  L
  ←─────────────────────
```

An asymmetric inventory of parsing feet is not actually necessary, then, to account for the different ways in which alternating patterns resume after a heavy syllable. Kager shifts the asymmetry to the prominence contrast within heavy syllables, and the difference in pattern resumption falls out from the principle of clash avoidance.

Although the inventory of surface feet is still asymmetric in Kager's account, the assymetry falls out from the principle of foot-internal lapse avoidance. The unparsed syllable in L(H) sequences can adjoin to the following foot to form an (LH) iamb, as in (28a), because it does not create a foot-internal lapse. In contrast, the unparsed syllable in (H)L sequences cannot adjoin to the preceding foot to form an (HL) trochee, as in (28b), because it would create a foot-internal lapse.

(28) *Adjunction of stray syllables*

a.
```
     (x    )               (    x    )
     μ  μ  μ         →      μ  μ  μ
     |  | \|                |  | \|
     L  H                   L  H
```

b.
```
     (x    )               *(x          )
     μ  μ  μ         →      μ  μ  μ
     | \|  |                | \|  |
     H     L                H     L
```

Van de Vijver's (1998) "Incidental Iamb" approach is similar to Kager's Symmetrical Foot Inventory approach, in that it rejects a difference between iambic and trochaic quantity-sensitivity. Rather than accounting for the different behavior of iambic and trochaic systems in terms of rhythmic principles, however, van de Vijver claims that examples of the crucial iambic case, right-to-left iambs, simply do not exist.

Following an earlier idea from **Kager (1989)**, van de Vijver re-analyzes right-to-left iambic languages like Tübatulabal as right-to-left trochaic languages. He argues that diachronic processes have resulted in a lexical stress on word-final syllables in Tübatulabal and that trochaic feet are constructed from right to left away from the lexical stress, as in (29).

(29) σσσσ'σ → ('σσ)('σσ)('σ)
      σσσσσ'σ → σ('σσ)('σσ)('σ)

While such an analysis does have the virtue of producing the correct stress pattern, one undesirable feature is the necessity of representing an entirely predictable aspect of the pattern – the word-final stress – in the lexicon (**CHAPTER 1**: UNDERLYING REPRESENTATIONS).

To actually rule out the possibility of right-to-left iambic systems, and the necessity of accounting for the type of quantity-sensitivity that such systems would have to exhibit, the Incidental Iamb approach posits a constraint specifically promoting trochaic feet but not a constraint specifically promoting iambic feet. Iambic systems can only arise from the combined demands of two constraints. The first, ALIGN-L(PrWd, Ft), requires that every word begin with a foot. The second, *EDGEMOST, requires that peripheral syllables be stressless.

(30)   a.   ALIGN-L(PrWd, Ft)

                  The left edge of the prosodic word should be aligned with the left edge of a foot.

b. *Edgemost

Edge-adjacent elements may not be prominent.

Combined, the constraints essentially make two demands. They demand that final syllables be stressless, due to *Edgemost, and they demand that every word begin with a disyllabic iamb, due to both *Edgemost and Align-L(PrWd, Ft). (Each word must begin with a foot, but it must be a foot that leaves the initial syllable stressless.) While trochaic systems often meet the demand that final syllable be stressless, they do meet the demand that words begin with an iambic foot, creating an opening for an iambic system to emerge.

The type of iambic system that emerges, of course, must meet the combined demands of *Edgemost and Align-L(PrWd, Ft). While left-to-right iambic patterns like (31a.i) do begin with an iambic foot and leave final syllables stressless, left-to-right patterns like (31a.ii) ignore the latter requirement, and right-to-left patterns like those in (31b) ignore both.

(31) a. *Left-to-right iambic systems*
  i. Predicted (attested)
     (σ'σ)(σ'σ)σσ
     (σ'σ)(σ'σ)(σ'σ)σ

  ii. Not predicted (attested)
     (σ'σ)(σ'σ)(σ'σ)
     (σ'σ)(σ'σ)(σ'σ)σ

b. *Right-to-left iambic systems*
  i. Not predicted (attested, but re-analyzed as trochaic)
     (σ'σ)(σ'σ)(σ'σ)
     ('σ)(σ'σ)(σ'σ)(σ'σ)

  ii. Not predicted (unattested)
     (σ'σ)(σ'σ)(σ'σ)
     σ(σ'σ)(σ'σ)(σ'σ)

The results are mixed. The Incidental Iamb approach predicts the (31a.i) pattern, a pattern found in Carib (**Hoff 1968**), Hixkaryana, and Choctaw (**Nicklas 1972, 1975**; **Lombardi and McCarthy 1991**). It does not predict the (31a.ii) pattern, however, a pattern found in Araucanian. It also does not predict (31b.i), an attested pattern re-analyzed as trochaic, as discussed above, and it does not predict (31b.ii), an unattested pattern.

4 Rhythmic lengthening and rhythmic shortening

Rhythmic lengthening and rhythmic shortening are two processes where a syllable's duration is altered because it occupies a particular position in an alternating pattern. Rhythmic lengthening appears to be based solely on the alternation of strong and weak positions, affecting only the former. In contrast, rhythmic shortening can affect both strong and weak positions and seems in many cases to be motivated, at least partially, by a preference for exhaustive parsing.

Rhythmic lengthening increases the duration of stressed syllables either through vowel lengthening (CHAPTER 20: THE REPRESENTATION OF VOWEL LENGTH) or gemination of an adjacent consonant (CHAPTER 37: GEMINATES), the former method being more common than the latter. It can be found in both iambic and trochaic languages. In (5), for example, we saw that the stressed vowels of underlyingly light syllables lengthen in the iambic Hixkaryana, making them heavy on the surface. Other iambic lengthening languages include Carib, Choctaw, and several varieties of Yupik (**Woodbury 1981, 1987**; **Jacobson 1984, 1985**; **Krauss 1985a**; **Leer 1985**; among others). In (9), we saw that the stressed vowels of underlyingly light syllables lengthen in the trochaic Chimalapa Zoque. Other trochaic lengthening languages include Chamorro (**Topping and Dungca 1973**; **Chung 1983**), Icelandic (**Á;rnason 1980, 1985**), Mohawk (**Michelson 1988**), and Selayarese (**Mithun and Basri 1986**).

An interesting difference between iambic and trochaic lengthening is that lengthening occurs in iambic systems only when they are quantity-sensitive, and in trochaic systems only when they are quantity-insensitive.[5] When it is seen as shaping the possibilities of stress patterns generally, then, the existence of trochaic lengthening in quantity-insensitive systems clearly undermines the ITL. If we restrict the ITL's scope to quantity-sensitive systems, however, the distribution of lengthening gives it considerable support. The presence of lengthening in iambic languages, where durational contrasts are encouraged, is consistent with the ITL, as is the absence of lengthening in trochaic languages, where durational contrasts are prohibited.

Another important generalization concerning rhythmic lengthening is the correlation between what I will refer to as *regular lengthening* and certain types of minimal words. *Regular lengthening* is the exceptionless lengthening in non-minimal forms characteristic of many lengthening languages: vowels lengthen in underlyingly light syllables whenever they receive the appropriate degree of stress.[6] As (32) indicates, languages with regular lengthening allow only three types of minimal word:

H, LL, and HL.

(32) *Minimal words associated with regular lengthening*

   a. *Monosyllabic*
      L   *unattested*
      H   Chimalapa Zoque (trochaic)
           Choctaw nouns (iambic)
           Icelandic (trochaic)
           Yupik varieties (iambic)

   b. *Disyllabic*
      LL Choctaw verbs (iambic)
      HL Carib (iambic)
           Hixkaryana (iambic)
           Selayarese (trochaic)

      LH *unattested*

Iambic lengthening languages and trochaic lengthening languages can both insist on H or HL minimal words, but only iambic lengthening languages can insist on an LL minimal word. There appear to be no regular lengthening languages with L minimal words, and none with LH minimal words.

If we exclude alternations better described as vowel reduction (see below), rhythmic shortening is a marginal phenomenon. It occurs in only a few trochaic systems, and, as **Mellander (2003)** points out, each of these few is quantity–sensitive. Trochaic shortening can affect either a stressed syllable or an unstressed syllable. In Fijian, for example, stressed syllables shorten, converting HL sequences into LL sequences.

(33) *Trochaic shortening in Fijian*

ŋbuː-nŋu	→ 'mbu-nŋu	'my grandmother'
θaː-j-a	→ 'ta-j-a	'chop-TRANS-3 SG OBJ'
nreː-ta	→ 'nre-ta	'pull-TRANS'

In Pre–Classical Latin (**Allen 1973**; **Mester 1994**), stressless syllables shorten, converting LH sequences into LL sequences.[7]

(34) *Trochaic shortening in Latin*

egoː	→ 'ego	'I'
maleː	→ 'male	'bad'
amiːkitiam	→ ˌamiˈkitiam	'friendship'

Rhythmic shortening, though marginally attested, is consistent with the ITL. Among quantity–sensitive languages, it occurs only in trochaic systems, destroying the durational contrasts that the ITL prohibits. It does not occur in iambic systems, where it would destroy durational contrasts that the ITL requires. Quantity–insensitive languages, of either type, apparently do not exhibit rhythmic shortening.

Before we proceed, it should be noted at this point that there are at least two languages with shortening phenomena that are potential counterexamples to the generalizations presented in the preceding paragraph: Central Slovak (**Dvonč 1955**; **Bethin 1998**; **Mellander 2003**) and Gidabal (**Geytenbeek and Geytenbeek 1971**; **Rice 1992**; **Mellander 2003**). The stress patterns of both languages are fairly complex, however, and their analyses are not at all straightforward. It is not clear whether they are examples of shortening in trochaic feet (resulting in unbalanced HL trochees), shortening in iambic feet, or both, or whether they are simply examples of shortening in non–head syllables generally. Since it is unclear exactly how such examples are relevant, I have set them aside here.

I have also set aside phenomena involving vowel strengthening in stressed syllables and vowel reduction and deletion in unstressed syllables. Some of the alternatives to an ITL approach draw to a significant extent on such phenomena as evidence that the difference between iambs and trochees with respect to rhythmic lengthening and shortening is not as great as previously thought (**Revithiadou and van de Vijver 1997**; **van de Vijver 1998**; **Revithiadou 2004**). Strengthening, reduction, and deletion phenomena are fairly common in both iambic and trochaic systems.

While **Hayes (1985)** introduced strengthening, reduction, and deletion into the discussion to support the ITL, claiming that the phenomena arose primarily in iambic systems and helped to create durational contrasts, he later observed that there were significant difficulties with this line of evidence (**Hayes 1995**). First, while they have some impact on phonetic duration, they are not primarily duration phenomena – as opposed to sonority or parsing phenomena. They do not involve phonological duration in the same way as the canonical examples of lengthening and shortening. The second reason, Hayes admits, is that they are not specifically iambic phenomena, which essentially grants the position of Revithiadou and van de Vijver.

Although the introduction of strengthening, reduction, and deletion into the debate was probably a misstep in terms of defending the ITL, the resulting discussion has helped to identify its most plausible areas of influence. Just as the case for the

ITL is much stronger in quantity-sensitive systems than in quantity-insensitive systems, the case is much stronger in the contexts of genuine lengthening and shortening than in the contexts of strengthening, reduction, and deletion. This being the case, I will not address the latter contexts further.

4.1 Lengthening and shortening rules

Just as **Hayes's (1987, 1995)** asymmetric foot inventory effectively captures the different types of quantity-sensitivity that arise in iambic and trochaic systems, his approach to rhythmic lengthening and shortening effectively captures their distribution in quantity-sensitive systems. In Hayes's account, rhythmic lengthening is only possible when it would create a durational contrast in iambs, a restriction motivated by the strong interpretation of the ITL.

(35) *Iambic lengthening*

$$
\begin{array}{cc}
(& x) \\
\sigma & \sigma \\
| & | \diagdown \\
\end{array}
$$
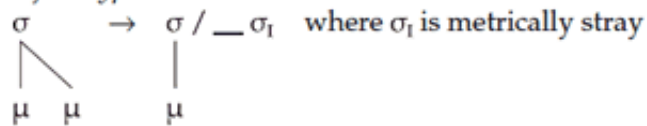$$\emptyset \rightarrow \mu \,/\, \mu \quad \mu \quad \underline{\ \ }$$
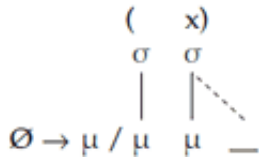
As (35) indicates, iambic lengthening only occurs in iambic feet where both the first and second syllable are light. The second syllable becomes heavy, creating a durational contrast.
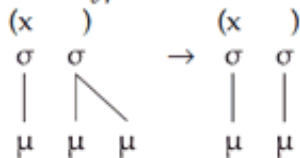
Rhythmic shortening is only possible when it would avoid a durational contrast in trochees. The effect of the Fijian-type shortening rule in (36a) is to convert an (H)L sequence to an (LL) sequence. It helps to minimize underparsing without resorting to an (HL) foot. Since the appropriate context can also arise in limited circumstances in iambic systems, Hayes stipulates that the rule can only apply in trochaic systems.

(36) *Trochaic shortening*

    a. *Fijian-type*

$$
\begin{array}{ccc}
\sigma & \rightarrow & \sigma \,/\, \underline{\ \ }\, \sigma_{I} \quad \text{where } \sigma_{I} \text{ is metrically stray} \\
\diagdown & & | \\
\mu \quad \mu & & \mu \\
\end{array}
$$

    b. *Latin-type*

$$
\begin{array}{ccccc}
(x &) & & (x &) \\
\sigma & \sigma & \rightarrow & \sigma & \sigma \\
| & \diagdown & & | & | \\
\mu & \mu \quad \mu & & \mu & \mu \\
\end{array}
$$

The effect of the Latin-type shortening rule in (36b) is to convert an ill-formed (LH) trochee to a well-formed (LL) trochee. An ill-formed (LH) trochee might be created inadvertently, for example, when an extrametrical H syllable is adjoined to a degenerate (L) foot, and (36b) repairs the defect.

Though the ITL account captures the distribution of rhythmic lengthening and shortening in quantity-sensitive systems, it falls short in two ways. First, it fails to allow for trochaic lengthening in quantity-insensitive systems (a phenomenon whose existence Hayes denies). Second, it does not account for the correlation between regular lengthening and the group of minimal words in (32). Based on the ITL, lengthening rules might be employed to create durational contrasts in iambic feet (or, possibly, to destroy them in trochaic feet), but there is nothing in the law entailing that lengthening languages should prefer H, HL, and LL minimal words above L and LH minimal words. If the ITL is actually the motivation for lengthening, then the correlation of regular lengthening with these particular minimal words is a mystery.

## 4.2 Lapse avoidance and non-finality

Kager's (1993) approach to the asymmetries in rhythmic lengthening and shortening is based on the same principles that governed his approach to quantity-sensitivity (see §3.2). In conjunction with a prohibition against foot-internal lapse, the internal prominence contrast in heavy syllables restricts the occurrence of lengthening. Kager views lengthening of stressed syllables in general as phonetically motivated, but the restriction against foot-internal lapse ensures that such lengthening is more common in iambs than in trochees. As (37) illustrates, the grammar tolerates lengthening that creates (LH) iambs, because they contain no foot-internal lapse, but it does not tolerate lengthening that creates (HL) trochees, because they do contain a foot-internal lapse.

(37) *Lengthening asymmetry through lapse avoidance*

    a. *No lapse after iambic lengthening*

```
(    x)        (    x    )
 μ  μ    →    μ   μ  μ
 |  |         |    \/
 L  L         L    H
```
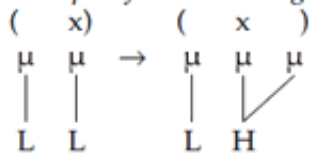
    b. *Lapse after trochaic lengthening*

```
(x    )      * (x          )
 μ  μ    →     μ   μ  μ
 |  |          \/     |
 L  L          H      L
```
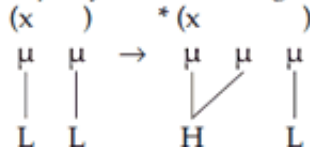
The prohibition against foot−internal lapse also accounts for the shortening asymmetry, but in this case it acts as a trigger. In Kager's view, the purpose of trochaic shortening is to eliminate foot−internal lapses like those found in (HL) trochees. Since there is no foot−internal lapse in (LH) iambs, the motivation for shortening never arises in iambic systems.

(38) *Lapse avoidance predicts shortening asymmetry*

    a. *No lapse in iambs to trigger shortening*

```
(    x     )      * (     x)
 μ  μ  μ    →      μ   μ
 |   \/            |    |
 L   H             L    L
```
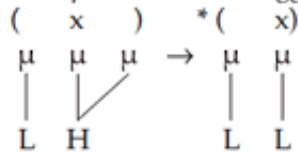
    b. *Lapse in trochees triggers shortening*

```
(x         )      (x     )
 μ  μ  μ    →     μ   μ
 \/    |          |    |
 H     L          L    L
```
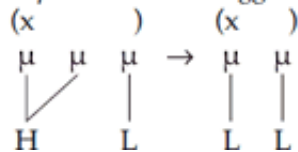
Although foot−internal lapse avoidance effectively addresses the lesser frequency of lengthening in trochaic systems, it does not address the actual phonological triggers for lengthening. **Hyde's (2007)** non−finality approach addresses the lesser frequency of lengthening in trochaic systems, but it also provides phonological triggers for rhythmic lengthening and addresses its correlation with certain types of minimal words (CHAPTER 43: EXTRAMETRICALITY AND NON−FINALITY).

Under the non−finality approach, rhythmic lengthening is a special case of the type of weight−sensitivity where stress avoids light syllables. To avoid stressing a light syllable, the syllable is lengthened to make it heavy. Non−finality produces this type of weight−sensitivity by prohibiting stress on domain−final moras. Following **Kager (1995)**, Hyde applies non−finality to the foot domain to promote iambic lengthening. Going a step further, he also applies non−finality to the syllable domain. This gives the approach a second mechanism for promoting iambic lengthening but it also gives it a mechanism for promoting trochaic lengthening.

(39)   a.   NON−FINALITY(Ft)

                  No stress occurs over the final mora of a foot.

      b.   NON−FINALITY(σ)

No stress occurs over the final mora of a syllable.

NON–FINALITY(Ft) effectively prohibits stress on light foot-final syllables. Since it bans foot-level gridmarks from foot-final moras, foot-final syllables must be at least bimoraic to support stress. NON–FINALITY(σ) effectively prohibits stress on light syllables generally. Since it bans foot-level gridmarks from syllable-final moras, syllables generally must be at least bimoraic to support stress.

To produce lengthening, one of the non-finality constraints must dominate DEP-μ, the faithfulness constraint that prevents mora insertion. Under such rankings, when stress would otherwise occupy a light syllable, a mora can be added to make the syllable heavy on the surface. The two non-finality constraints do not, however, have equal ability to promote lengthening in every type of foot. Since NON–FINALITY(Ft) prohibits stress over light foot-final syllables in particular, it can lengthen the stressed syllable of an iamb but not the stressed syllable of a trochee. In contrast, since NON–FINALITY(σ) prohibits stress over light syllables in general, it can lengthen the stressed syllables of both.

Consider first the situation where the stressed syllable occurs in an iamb. When NON–FINALITY(Ft) dominates DEP-μ, a second mora is added to underlyingly light syllables to avoid stress on foot-final moras.

(40) LLLL	NON-FIN(Ft)	DEP-μ
☞ a. [grid/mora/syllable structure]		**
b. [grid/mora/syllable structure]	*!*	

The result is similar when NON–FINALITY(σ) dominates DEP-μ: a second mora is added to the underlyingly light syllables to avoid stress on syllable-final moras.

(41) LLLL	NON-FIN(σ)	DEP-μ
☞ a. [grid/mora/syllable structure]		**
b. [grid/mora/syllable structure]	*!*	

Now consider the situation where the stressed syllable occurs in a trochee. When NON–FINALITY(Ft) dominates DEP-μ, as in (42), there is no lengthening. Because stress does not occupy the foot-final syllables in either candidate, there is no danger that it will occupy the foot-final moras, and NON–FINALITY(Ft) cannot distinguish between them. The lower ranked DEP-μ settles on the

faithful (42b) candidate.

(42)

LLLL	NON-FIN(Ft)	DEP-μ
a. (metrical structure)		*!*
☞ b. (metrical structure)		

When NON-FINALITY(σ) dominates DEP-μ, however, as in (43), the lengthening candidate emerges as the winner. The stressed syllables become heavy, to allow stress to avoid syllable-final moras.

(43)

LLLL	NON-FIN(σ)	DEP-μ
☞ a. (metrical structure)		**
b. (metrical structure)	*!*	

One advantage of the non-finality approach is that it has a built-in explanation for the lesser frequency of lengthening among trochaic systems. Non-finality in the syllable and non-finality in the foot both produce iambic lengthening, but only non-finality in the syllable produces trochaic lengthening. Every ranking that produces trochaic lengthening, then, also produces iambic lengthening, but some rankings that produce iambic lengthening do not produce trochaic lengthening. Since the percentage of possible rankings that produce iambic lengthening is greater than the percentage of possible rankings that produce trochaic lengthening, we would expect lengthening to occur with greater frequency in iambic systems than it does in trochaic systems, all else being equal.

A second advantage of the non-finality approach is that it helps to account for the particular group of minimal words associated with regular lengthening. As discussed above, languages that automatically lengthen appropriately stressed vowels only allow three types of minimal word: H, LL, and HL. They never allow L or LH minimal words. Using the same non-finality constraints to produce rhythmic lengthening and the minimal word restrictions predicts this situation.

L minimal words are absent, because the lengthening constraints themselves both establish H minimal words. NON-FINALITY(σ) has the same effect in monosyllabic feet that it has in disyllabic feet, and NON-FINALITY(Ft) has the same effect that it has in iambs. They both force the stressed syllable to lengthen. As (44) indicates, if either of the lengthening constraints ranks highly enough to produce lengthening in the disyllabic feet of longer forms, then it also ranks highly enough to produce lengthening in the monosyllabic feet of monosyllabic forms.

(44)   a.   Non-finality(σ) >> Dep-μ

Iambic or trochaic lengthening + H minimal word

         b.   Non-finality(Ft) >> Dep-μ

Iambic lengthening + H minimal word

Two desirable predictions result from this situation: regular lengthening is always accompanied by a minimal word that is at least bimoraic, and iambic lengthening languages and trochaic lengthening languages can both have H minimal words.

Although the lengthening constraints cannot produce disyllabic minimal words on their own, they do help to determine which type of disyllable emerges. Assuming that disyllabic minimal words have a trochaic strong—weak stress contour, we can explain the two-syllable requirement with an additional non-finality constraint, Non-finality(ω), which bans stress from the final syllable of a prosodic word.[8] Once the strong—weak contour is established, lengthening constraints determine the weight of the initial syllable. Non-finality(σ), which produces lengthening in both iambic feet and trochaic feet, requires that the initial syllable be heavy. Non-finality(Ft), which produces lengthening only in iambic feet, tolerates a light initial syllable.

(45)   a.   Non-finality(ω), Non-finality(σ) >> Dep-μ

Iambic or trochaic lengthening + HL minimal word

         b.   Non-finality(ω), Non-finality(Ft) >> Dep-μ

Iambic lengthening + LL minimal word

This correctly predicts that either iambic or trochaic lengthening can be accompanied by an HL minimal word, but only iambic lengthening can be accompanied by an LL minimal word.

Van de Vijver (1998) and Revithiadou (2004) propose an approach to rhythmic lengthening that is similar in some respects to the non-finality approach. Although it does not rely on the non-finality formulation, it does posit two lengthening mechanisms. One lengthens stressed syllables generally, which produces both iambic lengthening and trochaic lengthening, and the other lengthens foot-final syllables in particular, which produces only iambic lengthening.

(46)　　　　　　*Lengthening constraints* (**van de Vijver 1998**)

　　a.　　STRESSED SYLLABLE LENGTH
　　　　　A stressed syllable is long and an unstressed syllable is short.

　　b.　　FOOTFINAL
　　　　　Foot-final elements are lengthened.

Since there are two sources for iambic lengthening and only one for trochaic lengthening, Revithiadou's and van de Vijver's proposals, like the non-finality approach, provide an account of the different frequencies with which the two types of lengthening occur. The advantage of the non-finality approach is that it incorporates the lengthening mechanisms into the much more general non-finality formulation, a formulation independently motivated by its ability to account for a surprisingly broad range of phenomena at different prosodic levels. (See **CHAPTER 43**: EXTRAMETRICALITY AND NON-FINALITY.)

5 Summary

The most interesting interpretation of the Iambic—Trochaic Law is a strong interpretation that focuses on the presence or absence of durational contrasts in disyllabic feet. Since the general typology of attested stress systems offers very little support for the strong interpretation, **Hayes (1985)** introduced the ITL to metrical theory under a weaker interpretation that focused on quantity-sensitivity. This also turned out to be inadequate, however, as it was soon recognized that both iambic languages and trochaic languages could be either quantity-sensitive or quantity-insensitive. Two subsequent accounts – **McCarthy and Prince (1986)** and **Hayes (1987, 1995)** – pursued a hybrid approach, combining aspects of the weak interpretation and the strong interpretation. Another, **Prince (1990)**, returned to a strong interpretation of the ITL, but applied it, in effect, only to quantity-sensitive systems and as a preference rather than an absolute requirement.

Since the ITL is inherently quantity-sensitive, it seems more natural to employ it as a foundation for an account of quantity-sensitive systems in particular than as the foundation for an account of stress systems generally. There is, in fact, considerable support for the ITL among quantity-sensitive systems. Iambic quantity-sensitivity differs from trochaic quantity-sensitivity, as indicated by the different ways in which alternating patterns resume after encountering a heavy syllable, and the asymmetric foot inventory of ITL accounts very effectively for this difference. Standard iambs exclude heavy syllables from weak position in disyllabic feet; moraic trochees exclude them from disyllabic feet entirely. The result, that (disyllabic) iambic feet can contain durational contrasts but (disyllabic) trochaic feet cannot, is consistent with a strong interpretation of the ITL. Lengthening and shortening asymmetries also support a strong interpretation. Among quantity-sensitive systems, lengthening only occurs in iambic systems, and shortening only occurs in trochaic systems.

When we restrict our attention to quantity-sensitive systems, then, the ITL does capture important differences between iambs and trochees with respect to the particular type of quantity-sensitivity exhibited and the employment of lengthening and shortening rules. This does not necessarily mean, of course, that the ITL is the best explanation for these differences. Rather than being an explanation, the descriptive and superficial ITL actually seems to be an observation in need of an explanation, much like the attested stress patterns themselves.

Particularly important to alternative accounts is an assumed prominence asymmetry that arises within heavy syllables (**Kager 1993**). When a heavy syllable is stressed, the stress occupies its first mora and its second mora is stressless. This allows **Kager (1993)** to account for differences in quantity-sensitivity in terms of the rhythmic principle of clash avoidance and to account for lengthening and shortening asymmetries in terms of the rhythmic principle of lapse avoidance. **Hyde (2007)** exploits the same syllable-internal prominence asymmetry to provide a non-finality-based account of lengthening asymmetries and minimal words. An important advantage of these alternatives is that they offer the potential to account not only for many of the asymmetries found in the typologies of attested stress patterns, but also for the Iambic—Trochaic Law itself.

Notes

1　　The effect emerges in the range of one half to five beats per second. (The syllable rate of "ordinary conversational speech" is typically toward the upper limits of this range; **Bell 1977**.) **Hayes (1995)** states that the right-prominent effect illustrated in (3b) requires a durational contrast where the longer elements are 1.5 to 2 times as long as the shorter elements, noting that **Woodrow (1909)** found that smaller durational contrasts actually result in left-prominent groupings.

2　　Rice's study also found a preference for iambic grouping when elements contrasted in pitch, a result not found in previous studies.

3   Loanwords are typically employed to illustrate the Fijian stress pattern, since long native stems are uncommon and morphology can influence the position of stress.

4   More precisely, Kager assumes that the construction of a foot cannot introduce clash within the parsing window. The parsing window consists of the syllables being parsed in the current iteration plus the string of syllables encountered by the parsing algorithm in previous iterations. It does not include syllables that the algorithm has not yet encountered.

5   The clearest cases of quantity–insensitive iambs – Osage, Paumari, and Suruwaha – do not exhibit lengthening. The less clear cases – Weri and Araucanian – also do not exhibit lengthening.

6   Lengthening is not "regular" when it is prohibited in various positions in non–minimal forms, especially in final position. Syllables with primary stress in Italian, for example, lengthen if they are penultimate but not if they are antepenultimate or final. Languages like Unami and Munsee Delaware (**Goddard 1979**), which make stressed syllables heavy through consonant gemination, also fall outside the generalization.

7   The Latin–type shortening is often referred to as *iambic shortening*, because it affects the second syllable in a two–syllable sequence rather than the first.

8   Plausible cases of iambic minimal words appear to be extremely rare.

REFERENCES

Allen, W. Sidney. 1973. *Accent and rhythm*. Cambridge: Cambridge. University Press.

Altshuler, Daniel. 2009. Quantity–insensitive iambs in Osage. *International Journal of American Linguistics* (75) . 365–398.

Árnason, Kristján. 1980. *Quantity in historical phonology: Icelandic and related cases*. Cambridge: Cambridge University Press.

Árnason, Kristján. 1985. Icelandic word stress and metrical phonology. *Studia Linguistica* (39) . 93–129.

Bell, Alan. 1977. Accent placement and perception of prominence in rhythmic structures. In Larry, Hyman (ed.) *Studies in stress and accent*, 1–13. Los Angeles: Department of Linguistics, University of Southern California.

Bethin, Christina Y. 1998. *Slavic prosody: Language change and phonological theory*. Cambridge: Cambridge University Press.

Bolton, Thaddeus L. 1894. Rhythm. *American Journal of Psychology* (6) . 145–238.

Boxwell, Helen & Maurice Boxwell. 1966. Weri phonemes. In S. A. Wurm (ed.) *Papers in New Guinea Linguistics No. 5*, 77–93. (*Pacific Linguistics* A37.) Canberra: Australian National University.

Brame, Michael K. 1973. On stress assignment in two Arabic dialects. In Stephen R. Anderson & Paul Kiparsky (eds.) *A Festschrift for Morris Halle*, 14–25. New York: Holt, Rinehart & Brame.

Michael, K. 1974. The cycle in phonology: Stress in Palestinian, Maltese and Spanish. *Linguistic Inquiry* (5) . 39–60.

Chung, Sandra. 1983. Transderivational relationships in Chamorro phonology. *Language* (59) . 35–66.

Derbyshire, Desmond C. 1985. *Hixkaryana and linguistic typology*. Dallas: Summer Institute of Linguistics & University of Texas at Arlington.

Dixon, R. M. W. 1988. *A grammar of Boumaa Fijian*. Chicago: University of Chicago Press.

Dvonč, Ladislav. 1955. *Rytmický zákon v spisovnej slovenčine*. Bratislava: Vydavateľstvo Slovenskej Akadémie Vied.

Echeverría, Max S. & Heles Contreras. 1965. Araucanian phonemics. *International Journal of American Linguistics* (31) . 132–135.

Everett, Daniel L. 1996. *Prosodic levels and constraints in Banawá and Suruwaha*. Unpublished ms., University of Pittsburgh (ROA–121).

Everett, Daniel L. 2003. Iambic feet in Paumari and the theory of foot structure. *Linguistic Discovery* (2) (1). 22–44.

Geytenbeek, Brian B. & Helen Geytenbeek. 1971. *Gidabal grammar and dictionary*. Canberra: Australian Institute of Aboriginal Studies.

Goddard, Ives. 1979. *Delaware verbal morphology: A descriptive and comparative study*. New York: Garland.

Hay, Jessica S. F. & Randy L. Diehl. 2007. Perception of rhythmic grouping: Testing the iambic/trochaic law. *Perception and Psychophysics* (69) . 113–122.

Hayes, Bruce. 1985. Iambic and trochaic rhythm in stress rules. *Proceedings of the Annual Meeting, Berkeley Linguistics Society* (11) . 429–446.

Hayes, Bruce. 1987. A revised parametric metrical theory. *Papers from the Annual Meeting of the North East Linguistic Society* (17) . 274–289.

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

Hoff, Berend J. 1968. *The Carib language: Phonology, morphonology, morphology, texts and word index*. The Hague: Martinus Nijhoff.

Hulst, Harry van der. 1999. Issues in foot typology. In S. J. Hannahs & Mike Davenport (eds.) *Issues in phonological structure: Papers from an international workshop*, 95–127. Amsterdam & Philadelphia: John Benjamins.

Hyde, Brett. 2007. Non–finality and weight–sensitivity. *Phonology* (24) . 287–334.

Iversen, John R., Aniruddh D. Patel & Kengo Ohgushi. 2008. Perception of rhythmic grouping depends on auditory experience. *Journal of the Acoustical Society of America* (124) . 2263–2271.

Jacobson, Steven A. 1984. The stress conspiracy and stress–repelling bases in the Central Yup'ik and Siberian Yupik Eskimo languages. *International Journal of American Linguistics* (50) . 312–324.

Jacobson, Steven A. 1985. *Siberian Yupik and Central Yupik prosody*. In Krauss (1985b), 25–45.

Kager, René. 1989. *A metrical theory of stress and destressing in English and Dutch*. Dordrecht: Foris.

Kager, René. 1993. Alternatives to the iambic–trochaic law. *Natural Language and Linguistic Theory* (11) . 381–432.

Kager, René. 1995. Review article of Hayes (1995). *Phonology* (12) . 437–464.

Kenstowicz, Michael. 1983. Parametric variation and accent in the Arabic dialects. *Papers from the Annual Regional Meeting, Chicago Linguistic Society* (19) . 205–213.

Kenstowicz, Michael & Kamal Abdul–Karim. 1980. Cyclic stress in Levantine Arabic. *Studies in the Linguistic Sciences* (10) (2). 55–76.

Knudson, Lyle M. 1975. A natural phonology and morphophonemics of Chimalapa Zoque. *Papers in Linguistics* (8) . 283–346.

Krauss, Michael. 1985a. *Supplementary notes on Central Siberian Yupik prosody*. In Krauss (1985b), 47–50.

Krauss, Michael (ed.) 1985b. *Yupik Eskimo prosodic systems: Descriptive and comparative studies*. Fairbanks: Alaska Native Language Center.

Kusumoto, Kiyomi & Elliott Moreton. 1997. Native language determines parsing of non–linguistic rhythmic stimuli. *Journal of the Acoustical Society of America* (102) . 3204.

Leer, Jeff. 1985. *Toward a metrical interpretation of Yupik prosody*. In Krauss (1985b), 159–172.

Lombardi, Linda & John J. McCarthy. 1991. Prosodic circumscription in Choctaw morphology. *Phonology* (8) . 37–71.

McCarthy, John J. & Alan Prince. 1986. Prosodic morphology. Unpublished ms., University of Massachusetts, Amherst & Brandeis University. Mellander, Evan W. 2003. (HL)–creating processes in a theory of foot structure. *The Linguistic Review* (20) . 243–280.

Mester, Armin. 1994. The quantitative trochee in Latin. *Natural Language and Linguistic Theory* (12) . 1–61.

Michelson, Karin. 1988. *A comparative study of Lake–Iroquoian accent*. Dordrecht: Kluwer.

Mithun, Marianne & Hasan Basri. 1986. The phonology of Selayarese. *Oceanic Linguistics* (25) . 210–254.

Nicklas, Thurston Dale. 1972. *The elements of Choctaw*. Ph.D. dissertation, University of Michigan, Ann Arbor.

Nicklas, Thurston Dale. 1975. Choctaw morphophonemics. In James M. Crawford (ed.) *Studies in Southeastern Indian languages*, 237–250. Athens: University of Georgia Press.

Prince, Alan. 1990. Quantitative consequences of rhythmic organization. *Papers from the Annual Regional Meeting, Chicago Linguistic Society* (26) (2). 355–398.

Revithiadou, Anthi. 2004. The Iambic/Trochaic Law revisited: Lengthening and shortening in trochaic systems. *Leiden Papers in Linguistics* (1) . 37–62.

Revithiadou, Anthi & Ruben van de Vijver. 1997. Durational contrasts and the iambic/trochaic law. *Proceedings of Western*

Conference on Linguistics (9) . 229–242.

Rice, Curt. 1992. *Binarity and ternarity in metrical theory: Parametric extensions*. Ph.D. dissertation, University of Texas, Austin.

Schütz, Albert J. 1978. English loanwords in Fijian. In Albert J. Schütz (ed.) *Fijian language studies: Borrowing and pidginization*, 1–50. Suva: Fiji Museum.

Schütz, Albert J. 1985. *The Fijian language*. Honolulu: University of Hawaii Press.

Seiler, Hansjakob. 1965. Accent and morphophonemics in Cahuilla and in Uto-Aztecan. *International Journal of American Linguistics* (31) . 50–59.

Seiler, Hansjakob. 1967. Structure and reconstruction in some Uto-Aztecan languages. *International Journal of American Linguistics* (33) . 135–147.

Seiler, Hansjakob. 1977. *Cahuilla grammar*. Banning, CA: Malki Museum Press.

Seiler, Hansjakob & Kojiro Hioki. 1979. *Cahuilla dictionary*. Banning, CA: Malki Museum Press.

Topping, Donald M. & Bernadita C. Dungca. 1973. *Chamorro reference grammar*. Honolulu: University Press of Hawaii.

Vijver, Ruben van de. 1998. *The iambic issue: Iambs as a result of constraint interaction*. Ph.D. dissertation, University of Leiden.

Voegelin, Charles F. 1935. Tübatulabal grammar. *University of California Publications in American Archaeology and Ethnology* (34) . 55–189.

Vos, P. 1977. Temporal duration factors in the perception of auditory rhythmic patterns. *Scientific Aesthetics* (1) . 183–199.

Woodbury, Anthony. 1981. *Study of the Chevak dialect of Central Alaskan Yupik*. Ph.D. dissertation, University of California, Berkeley.

Woodbury, Anthony. 1987. Meaningful phonological processes: A consideration of Central Alaskan Yupik Eskimo prosody. *Language* (63) . 685–740.

Woodrow, Herbert. 1909. A quantitative study of rhythm. *Archives of Psychology (New York)* (14) . 1–66.

Cite this article

Hyde, Brett. "The Iambic—Trochaic Law." *The Blackwell Companion to Phonology*. van Oostendorp, Marc, Colin J. Ewen, Elizabeth Hume and Keren Rice (eds). Blackwell Publishing, 2011. Blackwell Reference Online. 16 January 2012 <http://www.companiontophonology.com/subscriber/tocnode?id=g9781405184236_chunk_g978140518423646>