Constraint-Based Metrics

Chris Golston, CSU Fresno State

(NLLT 16, 719-770)

This paper offers an analysis of Middle English Alliterative Verse in terms of Prosodic Metrics (Golston & Riad 1995, 1997ab) using the ranked and violable constraints of Optimality Theory (Prince & Smolensky 1993). The analysis uses purely phonological constraints without recourse to language specific or meter-specific constraints and without an abstract metrical template. I show that the number of tokens per metrical type correlates with phonological well-formedness in one of four areas: binarity, weight, rhythm and alignment. In addition I try to show that poems written in this meter have no perfectly metrical lines in them: every line violates some constraint because absolute metrical well-formedness is not possible given the constraints in this type of meter. Gradient well-formedness in meter (Youmans 1989) is shown to be both demonstrable and formalizable.

1. INTRODUCTION[*]

Some meters have relatively invariant properties: Chaucer's meter has a constant 10 syllables per line and a generally iambic rhythm; the Japanese Haiku consists of three lines with 5, 7 and 5 moras each; and so on. But there are also meters that seem to have no fixed length: lines in Tohono O'odham songs, for instance, seem to have no fixed syllable count or fixed number of stresses per line (Fitzgerald 1994a). Old English meter is usually analyzed as having no single type of line: traditional analyses range from 5 types of half-line (Sievers 1885, 1987, 1893), though proposals go as high as 130 (Bliss 1958, 1962) or 279 (Pope 1966). The problem that such meters pose is clear (if they are indeed meters): how can we characterize the meter and how can we relate this sort of meter to the stricter types with which we are more familiar?

Middle English alliterative verse, the subject of the present study, allows over one hundred possible variations on just a half line yet is clearly recognizable as a meter (Cable 1991; see also Hammond 1993). Line-length varies from ten syllables (1) to seventeen (2):

(1) Er that styngande storme stynt ne myght (225)
'before that venomous storm was allowed to cease.'

(2) Where so wonyed this ilke wygh that wendez with oure Lorde (675)
'Where this same man lived who goes with our Lord'

The number of stresses per line ranges from four (3) to seven (4)

(3) Thay téen unto his témmple and témen to hymsélven, (9)
'They go to His temple and attach themselves to Him.'

(4) For món-swórne, and mén-scláght and tóo múch drínk (182)
'for perjury and manslaughter and too much drink'

I will show that there is indeed a meter here and that it is based on mora and syllable count in much the same ways as the classical meters of Greek and Arabic. To account for the massive variability in the meter I use ranked and violable constraints (Prince & Smolensky 1993) to create a continuum of metrical well-formedness, from best-formed types to worst. To show the similarity with stricter meters, I embed the analysis in the theory of Prosodic Metrics, a quantitative theory of prosodic constituents in the meters of classical Greek, Arabic and Old English (Golston & Riad 1995, 1997ab).

The main goal of Prosodic Metrics is to stipulate as little as possible in metrics by deriving the major characteristics of a given meter from general properties of prosody and from the particular properties of the ambient language. To do this for Midddle English Alliterative Verse (MEAV) I develop an analysis based solely on three types of constraint: ones that regulate weight, ones that regulate alignment, and ones that regulate the binarity of prosodic constituents.

The paper is organized as follows. After a brief description of the prosody of Middle English (§2) I turn to the metrical patterns in *Cleanness* and give a constraint-based account of them based on the prosody of ME and the prosody of language in general (§3). I then show how the relative frequencies of each distinct type of half-line can be formally accounted for using ranked and violable constraints (§4); one surprising consequence of the analysis is that no line of meter can be perfectly metrical . The paper ends with a discussion of Cable's (1991) analysis of the same corpus (§5) and a short conclusion (§6).

2. MIDDLE ENGLISH PROSODY

Theories of poetic meter are increasingly based on the prosody of the ambient language, in the belief that a truly explanatory theory of meter must relate metrical patterns to linguistic ones (Russom 1987; Helsloot 1995; Golston & Riad 1995, 1997ab; Hanson & Kiparsky 1996). Middle English phonology has three major prosodic characteristics that are relevant to the meter: final extrametricality (2.1), right-edge prominence (2.2) and a close connection between stress and weight (2.3).

2.1 Final extrametricality

At the word level, the strict initial stress of Old English began in Middle English to give way to the Latin-like stress system found in modern English. A Latin-like stress system correctly assigns stress not only to French and Latin loans but also to native mono- and disyllables of Late Middle English (Lass 1992, Minkova 1996). Consider the words below, stressed as in Latin: final syllables are extrametrical, heavy penults are stressed, otherwise antepenults.

(5) ME footing and stress

	(x)	. (x)	(x .)
open	knē	a.prō<che>	ha.pe<nes>
	(x)	. (x)	(x) .
closed	kyng	by.hel<de>	par.try<kes>

As in modern English and Latin, correct stress placement relies on final syllable extrametricality: only that will allow a binary foot to reach back to the antepenult. Final extrametricality can be taken as a requirement that prosodic words not end in feet:

(6) NonFinal Prosodic words end in unfooted syllables.

Closely related to final extrametricality is the loss of word-final schwa. Final schwa was deleted throughout much of Old and Middle English. The exact dating of schwa loss is hotly debated and the evidence points to a gradual loss of final schwa conditioned by several factors including syllable structure, position, and rhythm. Textual evidence for schwa loss under hiatus is the clearest and can be found as early as the 10th century (Luick 1921-40§452):

(7) OE	sægdic	<	sagde ic	'said I'
	wen ic	<	wene ic	'when I'

The loss of final schwa is common throughout Early Middle English (Minkova 1984) and probably peaked around the close of the fourteenth century (Morsbach 1896; Wright & Wright 1928).

Not all final schwas were lost at the same rate, however, and recent research suggests that prosodic considerations played a role both in retention and loss (Minkova 1987ab, 1990). Schwa was often lost to avoid stress lapse (Smithers 1983) or retained to avoid stress clash (Minkova 1984). There is even evidence that schwa was sometimes added word-finally to avoid stress clash in the meter (Minkova 1991, 55ff.). Minkova claims that by 1400 final unstresssed schwa had most likely been lost throughout all of England (1991, 30), but Cable (1991) has argued that the dialect in which *Cleanness* and several other poems were composed preserves final schwa significantly later than other texts. I have taken a conservative position here and assume that orthographic final schwa is lost only under hiatus.

2.1 Right-edge prominence

Middle English developed a right-edge phrasal prominence quite distinct from the left-edge phrasal prominence of Old English. At the word level, stress gravitated from word-initial position in OE towards the end of the word in Middle English (Lass 1992); and at the phrasal level stress gravitated from the beginning of the phrase to the end (McCully & Hogg 1994). Following Selkirk (1984, 1986, 1995) and McCarthy & Prince (1993), we can see this as the alignment of prominence with morpho-syntactic constituents:[1]

(8) ALIGN-R (WD, PROM) The final syllable in a word is prominent.

(9) ALIGN-R (PH, PROM) The final syllable in a phrase is prominent.

Taken together with final extrametricality this results in the following types of representations, where V marks the edge of the lexical category verb and VP marks the edge of the verb phrase:

(10) Metrical prominence and constituency in ME

```
                                   x            Phonological Phrase
   .   .      x  )        .   .    x)  . Prosodic Words
  He watz schunt]V       to the schad]VP<ow>
```

Both lexical words (shunt, shadow) are stressed (one eks), but the phrase-final stress gets phrasal prominence in addition (two ekses). Stressless syllables are parsed into constituents with the following stressed syllable in order to respect ALIGN-R (WORD, PROM); phrase-final stressless syllables remain extrametrical in order to satisfy ALIGN-R (PHRASE, PROM).

2.2 Stress and weight

A number of factors conspired to make stressed syllables heavy in Middle English and to make stressless syllables light. This led to a situation in which there was a near one-to-one correspondence between weight and stress.

Middle English open syllable lengthening (OSL) lengthened short open penults when stressed, yielding *ba:k(e)* from *bake, no:s(e)* from *nose* and so on (Wright & Wright 1928; Mossé 1952; Jordan 1974; Minkova 1984, 1987, 1991; Ritt 1994). Since the bulk of the native vocabulary was disyllabic, this had major consequences on the language. Monosyllables were already bimoraic (CVV or CVC) and had been since OE times due to a bimoraic minimality requirement on words (Riad 1992). The stressed syllables of disyllabic words with closed penults (CVC.CV) were bimoraic because of the coda consonant in the first syllable. Once CVCV disyllables underwent OSL to CV:.CV, all mono- and disyllabic words had bimoraic stressed syllables. Lass goes so far as to treat OSL as part of a conspiracy that made stressed syllables heavy (1992, 75):

> If precluster shortenings get rid of superheavy strong syllables, foot-final lengthening and OSL get rid of superlight ones. The two tendencies converge in maximizing simple heavy rhymes in strong positions.

The only major class of monomoraic stressed syllables occurs in words with antepenultimate stress on a short open syllable, a class mostly limited to French borrowings (*enprysonment*) and certain morphologically complex words (*hapenes*). As the following indicates, stressed monosyllables and disyllables had heavy (bimoraic) stresses, as did trisyllables with initial syllables that were closed:

(11) Stress and weight

	$\mu\mu$	$\mu\mu$	μ
open	knē	a.prō<che>	ha.pe<nes>
	μ μ	μ μ	μ μ

closed	kyng	by.hel<de>	par.try<kes>

It is not unlikely that stressed syllables in words like *hapenes* were bimoraic as well. There is evidence from Dutch (Kager & Zonneveld 1986, Kager 1989; but see Van Oostendorp 1995) that schwa nuclei don't support onsets: if this is the case for Middle English then the stressed syllable in *hapenes* is again closed and heavy [hap.ən.əs]. A number of parallels obtain between Dutch and Middle English with respect to schwa which suggest that ME schwa did not support an onset. First, both languages prohibit [h] in the coda and neither language allows syllables of the shape [hə]—if schwa doesn't license an onset these facts can be reduced to prohibiting [h] in the coda. Second, both languages prohibit any vowel other than schwa from following [ŋ]: we find words like *amonge, lenge, brynge, yonge,* but no words like **amonga, *lengi, *bryngo, *yongu*—if schwa doesn't license an onset the velar nasal occurs in the coda in *amonge* but in the onset in **lengi*, explaining the grammaticality of the former. Third, both languages exclude CRə# (where R is a liquid) while allowing CRə#: we find plenty of words like *lorde, ferde, harde, erde*, but none like **lodre, *hadre, *edre*. Apparent counterexamples turn out to be merely orthographic: *peple* [pipəl], *symple* [sɪmpəl], *strenkle* [strɛŋkəl]. If schwa did not license an onset in Middle English, then the stressed syllables in words like *hapenes* were closed and heavy (*hap.en.es*), and the stress-to-weight correlation was exceptionless.[2]

We see then that Middle English had a (near?) perfect equivalence between weight and stress such that stressed syllables were heavy. Prokosch (1939) was the first to recognize such a connection in the diachrony of Germanic languages; it can be stated as

(12) PROKOSCH'S LAW Stressed syllables are heavy.

A related phenomenon in the history of English is the deweighting of stressless syllables. Contrastive vowel length was lost in stressless syllables by the earliest OE records. This is a response to what we might call Kager's Law, following his treatment of stress and destressing in English and Dutch (Kager 1989):

(13) KAGER'S LAW Stressless syllables are light.

By the end of the eleventh century weak vowels in English did not support vowel colour and were generally reduced to schwa (Lass 1992, 77ff). Taken together, Kager's Law and Prokosch's Law provide the incentive for the stress-system of Middle English: stressed syllables are heavy, stressless syllables are light. As noted by Lass (1992), the situation did not last for long and is not the situation found in Modern English; but at the time of the composition of *Cleanness* there was a near one-to-one relation between weight and stress. As Minkova & Stockwell put it (1994, 59),

> the elimination of the late Old English #CV.Cə# sequence through schwa deletion and MEOSL created an almost across-the-board overlap between stress and quantity... After schwa deletion and MEOSL stressed syllables in English have to be bimoric...

Before passing on to the meter proper, I should make clear an assumption I make with respect to (non-lexical) function words and (lexical) content words. The former are generally stressless in stress-based languages (Selkirk 1984, 1995) and may not meet minimal word-requirements that hold of lexical items (McCarthy & Prince 1986). For this reason, it has been proposed that only lexical words are prosodic words (Selkirk 1986): in terms of an OT constraint, this is LXWD ≈ PRWD (every lexical word is a prosodic word). I assume that this constraint is undominated in Middle English meter and that function words are not stressed *metri causa*, but only when the prosody of the language would stress them anyway.

Recall that function words are not prosodic words and are thus not stressed unless contrastive or phrase-final. In terms of the metrical parse, this means that Lex ≈ Wd is undominated.

3. MIDDLE ENGLISH ALLITERATIVE VERSE

The poem studied here, *Cleanness* (or *Purity*), is part of a large body of alliterative poetry composed in rural England during the fourteenth century generally known as the alliterative revival (see Oakden 1935 for a survey). *Cleanness* is a long religious poem (1812 lines) of unrhymed alliterative verse. The poem survives on a single manuscript (British Library MS. Cotton Nero A.x) from the end of the 14th century which also contains *Sir Gawain and the Green Knight*, *Pearl* and *Patience*. Judging both from stylistic (Menner 1920) and metrical (Oakden 1935) evidence, the four poems probably had the same author, though little can be known for sure in this area. As Cable (1991) has shown, the metrical patterns of *Cleanness* are typical for alliterative poems of the time and these are quite distinct from the metrical patterns one finds in Old English alliterative verse.

Cleanness consists of lines with three or more main-stressed syllables and a number of metrically subordinated syllables. Three or more of the prominent syllables generally alliterate, i.e. begin with a similar onset. The first four lines of the poem illustrate the general pattern, with alliterating sounds indicated phonetically:[3]

(14) [k]lánnesse who so [k]índly cowthe [k]ómende,
And [r]ékken up alle the [r]ésounz that ho by [r]íght áskez
[f]áyre [f]órmez myght he [f]índe in [f]órthering his spéche,
And in the [k]óntrare, [k]árk and [k]ómbraunce húge.

Whoever can praise cleanness as it deserves,
and count up all of the arguments that it claims by right,
Fair examples might he find in furthering his speech;
But in doing the opposite, difficulty and great trouble.

Note that prominent syllables occur only in lexical categories (nouns, verbs, adjectives, certain adverbs). Function words (auxiliaries, determiners, prepositions, pronouns, etc.) are not generally included in the alliterative scheme, presumably because they are not stressed.[4] A caesura breaks most lines into A (first) and B (second) half-lines, with the first longer than the second (Matonis 1984, 346). Note that alliteration ties together the two half-lines: the alliterated [k] in the first A half-line is picked up in the first B half-line as well; the final stressed word tends not to alliterate (*áskes, spéche, húge*).

The meter of *Cleanness* is fairly fluid and admits of a large number of patterns. Cable finds 167 distinct patterns of half-line in the first 900 lines of the poem, sharply divided into A and B types. The present analysis has somewhat less (27 B types, 80 A types), mostly because final stressless syllables are treated as extrametrical, but this is still a large number of metrical patterns for a single type of meter. Much of the difficulty in analyzing such a poem lies in finding some way of expressing the pattern loosely enough to encompass the diversity of patterns and tightly enough to exclude a line like *Had we but world enough and time* or *Shall I compare thee to a summer's day.*

To show the metrical patterns most clearly, I'll begin with the twelve most common types of A and B half-lines (cf. Cable 1991, 85ff.).[5] These twenty-four types of half-line account for 95% of the B half-lines and 67% of the more disparate A half-lines and thus provide a convenient cut off point. Having established an account of the basic patterns based on the best-attested types, I will then return to the entire corpus—all 27 B types and 80 A types—and show that the commonness of a given type correlates with its markedness in terms of a set of ranked constraints (§5). The goal, then, is to look at *all* of the lines in the corpus, determine the frequency of *each* type and account for the differences in frequency with ranked and violable constraints.

The twelve most common B half-line types are given below. Scansion will be discussed shortly. I use bracketed grid notation (Hayes 1995 and references therein) where eks (x) indicates a stressed syllable and dot (.) indicates a stressless syllable; angle brackets enclose extrametrical syllables.

(15) Twelve most common types of B half-line

#	type	Line
326	. (x)(. . x) that reden and syng<en>	(7)
124	(x) (. . x) cowthe comend<e>	(1)
114	(. . x). (x) wyth a bone cher<e>	(28)
96	. (x) . (. . x) in forthering his spech<e>	(3)
44	(. . x) (x) in a carp on<ez>	(23)
41	. (. . x) . (x) and hym to greme cach<en>	(16)
41	(x) . (. . x) helded to the tabl<e>	(39)
36	. (. . x) (x) that ho by right ask<ez>	(2)
10	. (x) . (x x) his worthy God knaw<e>	(231)
10	(. x) . (x) that fest to hav<e>	(22)
8	(. . x)(. . x) were closed to byd<e>	(449)
7	(x) (. x) stynt ne myght	(225)

Note that most B types have two stressed syllables and a single string of stressless syllables before or between them (Cable 1991, 91ff). In what follows I will assume that each stressed syllable occupies a metrical position and that each pair of stressless syllables occupies a metrical position as well. That is, I'll assume that metrical positions are defined quantitatively as containing two moras; this gives the common B half-line three metrical positions (cf. the top nine types above). Note also that the alliterating sound in a B half-line is hard to detect without the A half-line present: the latter has two of the three alliterating words, the former only one.

Only with the full line, *As renkes of relygioun that reden and syngen,* is it clear that *reden* alliterates.

Types such as these hardly every occur in the A half-line, where we find a very different set of types each of which has two stresses and two strings of stressless syllables:

(16) Twelve most common types of A half-line

#	type	Line
141	(. . x) (. . x) As so says, to that syght	(29)
128	. (. . x) (. . x) For he that flemus uch fylth<e>	(31)
91	(. . x) . (. . x) And his tabarde totorn<e>	(41)
45	. (. . x) . (. . x) And at thi banne we haf broght	(95)
41	(. x) . (. . x) The gome watz ungarn<yst>	(137)
29	. (. . x)(. x) Thenne the ludych lord<e>	(73)
25	(. x) (. . x) On stamyn ho stod	(486)
24	. (x) . (x) (. . x) For wonder wroth is the Wyy	(5)
22	(. x). . (. . x) Excuse me at the cort	(70)
20	(. . x) (. x) That my hous may holl<y>	(104)
19	. . (. . x) (. . x) And hade dedayn of that ded<e>	(74)
18	(. x) (. x). (. . x) the fowre frekez of the fold<e>	(540)

A half-line types usually have four bimoraic metrical positions, two stressed syllables (x) and two pairs of stressless syllables (..), as found in the top four types above.

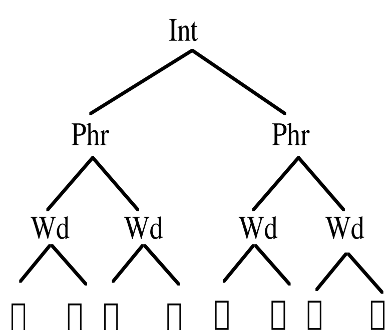
The line, then, breaks neatly in half, with the first (A) half longer than the second. The first half tends to have two full feet (..x), or four metrical positions, while the second half has one full foot (..x) and one curtailed foot (x), for a total of three metrical positions. Cable (1991, 91ff.) calls a string of stressless syllables a strong dip: using this terminology, an A half-line usually has two stresses and two strong dips while a B half-line usually has two stresses and one strong dip. This is not true of every half-line: the bottom four B-types in (15) have either no strong dip at all or two strong dips; and a number of the A-types in (16) lack one of the two strong dips. But the overall pattern is fairly clear: B half lines have a core of (..x) (x) or of (x) (..x) and A half-lines have a core of (..x) (..x). Deviations from this pattern are discussed in detail in §5.

As the tables make clear, some types of half-line occur much more often than others. In section §4 I will show that this is not random but correlates with how well-formed each type is with respect to a small number of prosodic constraints. Prerequisite to this, however, is a formal analysis of the meter, to which I now turn. The goal here is to define the metrical structure of MEAV in terms of independently needed constraints in phonology.

As a glance at (14) will confirm, a line of poetry in MEAV generally consists always of a clause, with naturally occurring pauses line-finally. This corresponds to an intonational phrase in the prosodic hierarchy (Selkirk 1978, Nespor & Vogel 1983, 1986; Hayes 1989). As we have seen, each line is broken into an A and a B half-line, which I take to be phonological phrases, the consituents immediately below the intonational phrase. The A half-line usually has two identical parts (..x) (..x) that I take to be prosodic words, descending down the hiearchy and lining up the eks with the main word-stress. The B half-line has different parts, (..x) and (x), which I take to be phonological words as well, the second one non-branching. Prosodic words consist of (bimoraic) feet in natural language and thus we may safely assume that the (..) and the (x) each constitute bimoraic feet. Whether any secondary stresses occur in the (..) foot is not known and probably not knowable from the text; in any case the (x) carries the primary stress of a word (the stress that is susceptible to Prokosch's Law) and it can be determined from the text.

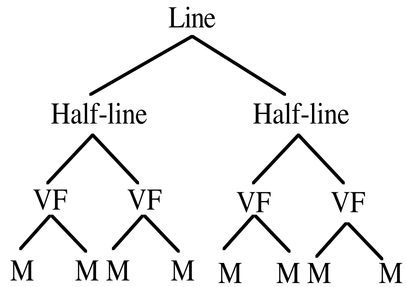
I assume that a line of meter is in the unmarked case binary and based on the prosodic hierarchy (Hayes 1988, 1989; Golston & Riad 1995; Helsloot 1995, 1997). The prosodic hierarchy includes the phonological foot (Σ), the prosodic word (Wd), the phonological phrase (Ph) and the Intonational phrase (Int).[6] With these four levels of structure we get a basic tetrameter with eight metrical positions:

(17) The prosodic hierarchy under binarity



In meter these prosodic constituents are called the line, the half-line or colon, the verse foot (VF) and the metrical position (M):

(18) Metrical equivalents of the prosodic hierarchy



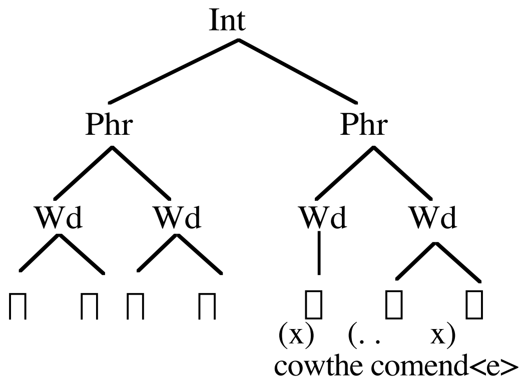
I will use the prosodic and metrical terms interchangeably, but the latter are always to be understood in terms of the former: meter is a species of phonology.

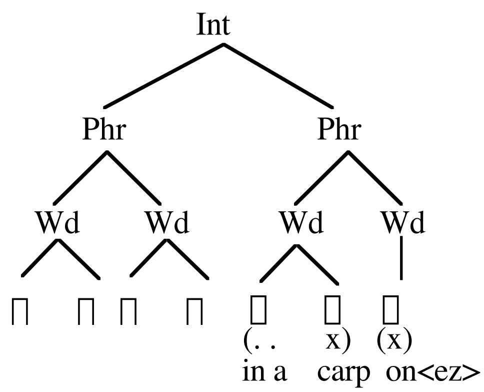
This completely binary type of line is very common: it has been proposed for Old English meter (Creed 1990, Stockwell & Minkova, in press; Golston & Riad 1997b), modern English (Hayes 1988, 1989), 18th and 19th century Russian poetry (Friedberg 1997) and in the nursery rhymes of a number of unrelated languages (Burling 1966). All things being equal, then, we would expect MEAV to employ a tetrameter with eight metrical positions, obeying the following constraints on the binarity of prosodic (and thus metrical) constituents:[7]

(19)	INTBIN	Intonational phrases (lines) branch once.
(20)	PHBIN	Phonological phrases (half-lines) branch once.
(21)	WDBIN	Phonological words (verse feet) branch once.

In fact, this is not exactly what we find: instead of eight positions to the line we find seven, with four in the A half-line and three in the B. This shortening of the second half-line comes about by having the third or fourth verse-foot non-branching:[8]

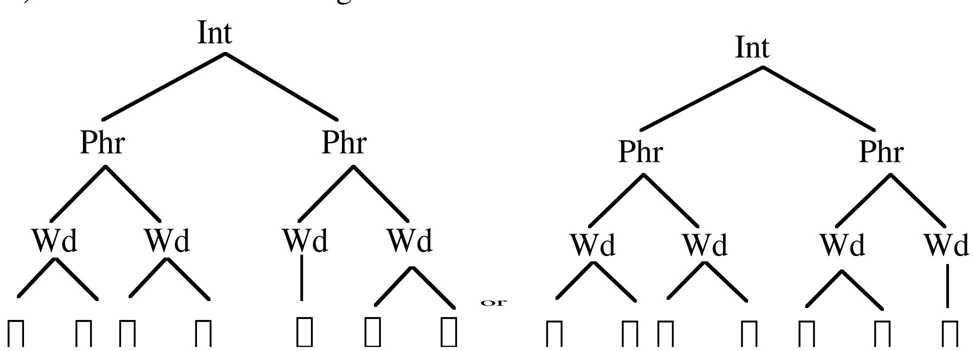
(22) Metrical structure of MEAV





The two types of line differ only in terms of the second half-line, which branches either on the right or on the left. Similar imbalanced lines are found in Chinese regulated verse (Chen 1979, 1980; Yip 1980, 1984):

(23) Metrical structure of regulated verse[9]

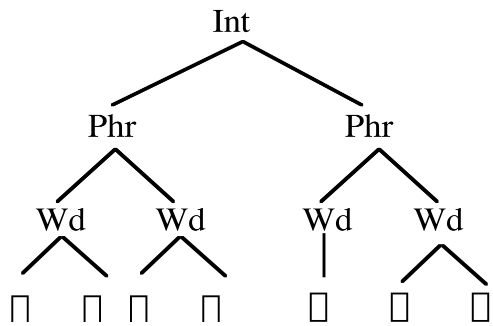


We can understand this type of imbalanced line in terms of catalexis, a traditional device in which a metrical position (□ in MEAV, □ in regulated verse) goes unfilled with text. Catalexis makes a line more salient through truncation (Hayes & MacEachern to appear)—the listener expects a certain count but doesn't always get it. Catalexis is the metrical analog to rest in music. How may this be cast in a constraint-based framework?

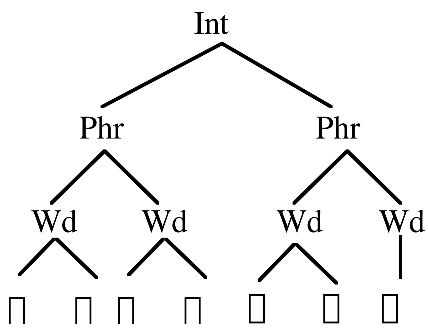
The surface result of catalexis is that one of the prosodic words does not branch (as seen in 23 above), in violation of the constraint WDBIN which demands that prosodic words (verse feet) branch once. Golston (1996) has proposed that language uses violation of constraints *distinctively*, to mark meaningful contrasts differentiating morphemes: zero affixes distinctively violate EXPONENCE, which requires morphemes to have audible surface reflexes; infixes distinctively violate CONTIGUITY, which prohibits discontinuous morphemes; and so on. Golston & Riad 1995 extend the notion to meter: the dactylic meter of Homer and Vergil uses feet HH (xx) and HLL (xx.), which distinctively violate CLASH; the iambic meter of Aeschylus and Sophocles uses feet which distinctively violate LAPSE; and cataleectic meters distinctively violate constraints on binarity at some level of the prosodic hierarchy. In this way we can understand the catalexis in (23) as distinctive violation of WDBIN: we expect only binary prosodic words but get one per line that does not branch. The salience of a catalectic line comes about through this distinctive violation of a prosodic constraint. Because violation is minimal, the forced catalexis occurs only once per line.

Catalexis does not of course decide between a left-heavy line (with a caesura dividing the line four/three) and a right-heavy line (with a late caesura dividing the line three/four):

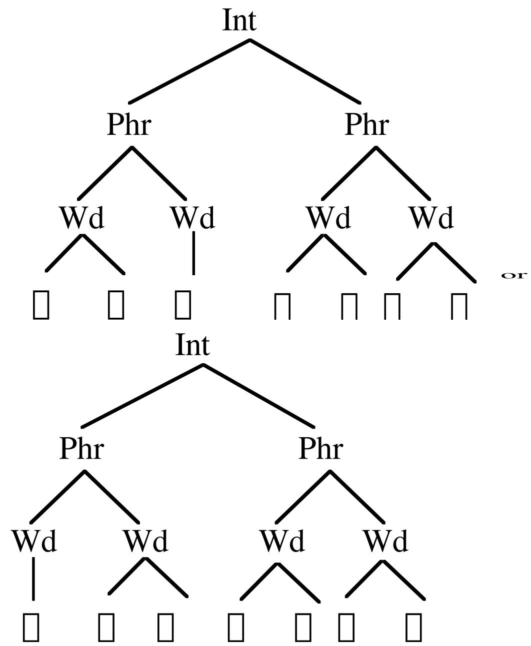
(24) Left-heavy lines



or



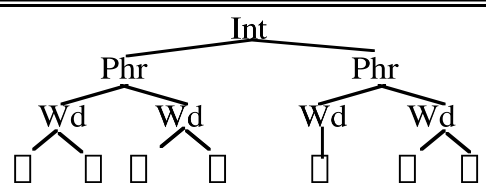
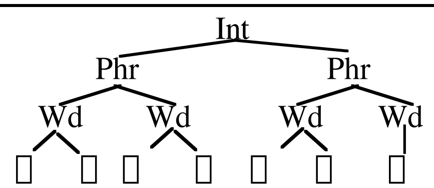
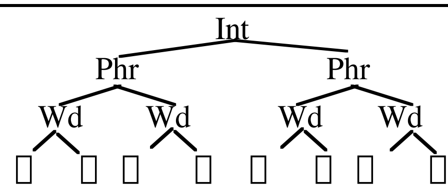
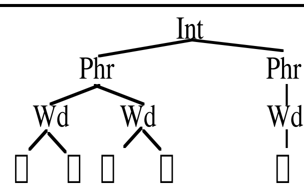
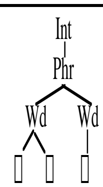
(25) Right-heavy lines



I have provided no explanation for what makes left-heavy lines better in MEAV (or in Chinese regulated verse); the issue is complicated somewhat by the fact that other metrical traditions prefer right-heavy lines (e.g., the 11 syllable lines of many Romance languages[10]). Michael Kenstowicz suggests that the directional asymmetry might stem from metrical well-formedness being weaker at the right edge of the line: half-lines that are too short (less than four metrical positions) would then gravitate towards the right in MEAV and Chinese regulated verse; half-lines that are too long (more than four metrical positions) would gravitate towards the right in Romance meters.

We are now in a position to derive the basic MEAV line solely from constraints. The first two candidates in the tableau below[11] are the types of line we find most commonly in MEAV, with seven metrical positions. No other line type can fare as well. Each has singly branching intonational phrases, phonological phrases and prosodic words, respecting the prosodic constraints on binarity. The catalectic position is shown with distinctive violation of WDBIN, using C for catalexis to show that one prosodic word does not non-branch:

(26) Constraining the MEAV line[12]

	INTBIN	PHBIN	WDBIN
			C
			C
			<C>
		*	C
	*		C

The third candidate does not have a catalectic position; it is *too* binary and lacks the distinctive violation of WDBIN required by this type of meter, shown by the bracketed <C> in the WDBIN column. The fourth candidate has the requisite violation of WDBIN but still fails because it has a phonological phrase that does not branch, in violation of PHBIN. The final candidate fails because its intonational phrase does not branch.

We have yet to discuss the terminal level of meter, the metrical position. Prosodic Metrics holds that metrical positions are phonological feet,[13] where feet are maximally bimoraic and disyllabic (Kager 1993). In quantity-sensitive systems like those of classical Greek, Latin and Arabic, this yields three types of phonological foot: LL (two light syllables), H (one heavy) and degenerate L (one light). These combine in pairs to yield nine possible verse feet in the theory:

(27) Possible verse feet in Prosodic Metrics (quantitative)

(H H)	(H L)	(H LL)
(L H)	(L L)	(L LL)
(LL H)	(LL L)	(LLLL)

Note that verse feet *contain* phonological feet: it takes two phonological feet to make a single verse foot. Limiting a metrical position to at most two moras has been proposed for Japanese meter (Kawakami 1974, Kozasa 1997), classical Greek meter (Prince 1989), the sprung rhythm of G.M. Hopkins (Kiparsky 1989), Iambic Pentameter (Hanson & Kiparsky 1996), Old English meter (Golston & Riad 1997a) and Classical Arabic meter (Golston & Riad 1997b).

Assuming that MEAV is stress-based rather than quantity-based, we need a way of translating the purely quantitative system above to one based on stress. Given the Middle English equivalence of weight and stress discussed above we can translate the quantitative feet above to the stress-based feet below by substituting ‘x’ (stressed) for H and ‘.’ for L:

(28) Possible verse feet in Prosodic Metrics (stress-based)

(x x)	(x .)	(x ..)
(. x)	(. .)	(. ..)
(.. x)	(.. .)	(.. ..)

The verse feet we should expect to find in MEAV are those that are stress-final (xx), (.x) and (..x)—all other verse feet fail to satisfy ALIGN-R (WD,). That is, if the phonology of the language prefers stress-final prosodic words, the meter should abjure the shaded cells below:

(29) Optimal verse feet in MEAV

(x x)	(x .)	(x ..)
(. x)	(. .)	(. ..)
(.. x)	(.. .)	(.. ..)

The remaining verse feet (prosodic words) are precisely those that are needed for *Cleanness*. As we will see below, these verse feet are not equally well attested: (..x) feet are far more common than either (xx) or (.x) verse feet. More on this later. For now it is enough to see that (xx) (.x) and (..x) emerge from two constraints: WDBIN, which gives us the nine-cell table to begin with, and ALIGN-R (WD,), which picks out the left-hand column of the nine-cell table.

Having motivated the analysis in terms of the phonology of Middle English and in terms of a general theory of meter let us turn to the most common types of A and B half-lines to see what type of analysis they receive. The most common types of B half-line include the following, where the right-most verse foot branches:

(30) Right-dominant B half-lines

```
 .   (x) (.   .     x)
and rent at the syd<ez>                    (144b)
'and torn at the sides'

 .  (x) .   (.      .     x)
ful pover and ful  gned<e>                 (146b)
'very poor and very meagre'

(x)(.   .      x)
laled and cry<ed>                          (153b)
'spoke and cried'

(x) . (.     .    x)
hapenez ful fayr<e>                         (27b)
'gains good fortune'
```

The four types form a set with a basic (x) (..x) core, with the first foot catalectic. Catalexis forces the first and second types to have an initial unfooted syllable: parsing 144b as (.x) (..x) with all syllables footed would give us two branching prosodic words in the B half-line, where our catalectic meter requires one one of the prosodic words to be non-branching (the distinctive violation of WDBIN). The second and fourth types have an unfooted syllable between the two prosodic words; this is the result of WDBIN in conjunction with FTBIN. Parsing the extra syllable into the (..x) foot would either yield a word with three feet ([.] [..] [x]) in violation of WDBIN or a foot with three moras ([...] [xx]) in violation of FTBIN—so the stray syllable is left unfooted.

Note that the branching prosodic word here is always (..x), never (.x) or (xx). We will see below that such prosodic words do occur in *Cleanness* but that no such half-line type occurs as often as the corresponding type with (..x)—i.e., (..x) is the optimal prosodic word (verse foot) in MEAV. Exactly the same obtains for the left-dominant types:

(31) Left-dominant B half-lines

(. . x) . (x)
of his brothe word<ez> (149b)
'at his angry words'

. (. . x) . (x)
and hym to greme cach<en> (16b)
'and drive Him to anger'

(. . x) (x)
of that man rych<e> (51b)
'of that rich man'

. (. . x) (x)
as thou me wyt lant<ez> (348b)
'as you lent me skill'

These types are built on a (..x) (x) core, seen unadorned in 51b. The first and second types have an additional unfooted syllable between the prosodic words to ensure that WDBIN is violated once. The second and fourth have an additional unfooted syllable before the branching prosodic word. Again, the branching verse foot is (..x) and similar types with (.x) are much less common, as will be seen shortly. Each of these eight common B types shares the same core: a catalectic verse foot (x), a full verse foot (..x) and at most one stray stressless syllable before, between or after the two prosodic words. Together these eight half-line types account for fully 91% (822) of the 900 B half-lines.

Turning now to the most common types of A half-line we find a similar state of affairs. But here the most common types have two branching feet, both of which are (..x):

(32) A half-lines

(. . x) (. . x)
He watz schunt to the schad<ow> (605a)
'he had retreated to the shade'

(. . x) . (. . x)
When the mete watz remu<ed> (646a)
'when the meat was removed'

. (. . x) (. . x)
And uche blod in that burn<e> (686a)
'and each nation through that man'

. (. . x) . (. . x)
Bot I schal kenne yow by kynd<e> (865a)
'but I shall show you by nature'

Catalectic feet are avoided in the A half-line and sought after in the B so that the line may be split into a longer then shorter half: (..x) (..x) // (x) (..x) or (..x) (..x) // (..x) (x). As in the B half-line, feet of the shape (.x) or (xx) are much less common than (..x). Let us see why.

The iambic shape (.x) consists of two phonological feet, one of them (.) degenerate.[14] Degenerate feet violate binarity at the level of the phonological foot:

(33) FTBIN Phonological feet are bimoraic.

FTBIN has been proposed independently for Middle English (Prince 1990), modern English (Hayes 1982), Germanic generally (Riad 1992, 1995), quantity sensitive trochaic systems generally (Hayes 1995) and may hold of quantity sensitive iambic systems as well (Kager 1993). Spondaic verse feet (xx) respect FTBIN (stressed syllables are heavy in ME) but violate an alignment constraint: one of the stressed syllables does not occur at the end of a prosodic word. That is, ME prefers both stress-final words and word-final stress. The constraint responsible for stress-final words is ALIGN-R (WD, PROM) as we have already seen. The constraint responsible for word-final stress is

(34) ALIGN-R (PROM, WD) Prominent syllables are word-final.

(See McCarthy & Prince 1993 for other languages that use both argument orders in alignment constraints.) Since FTBIN and ALIGN-R (PROM, WD) jointly conspire to make (..x) the best of the three verse feet I will refer to them both under the rubric FOOTFORM in what follows.

One final observation: by far the most common type of half-line is the B type that runs . (x) (..x), *and rent at the syd<es>* (144b). Nothing seems to motivate the initial unfooted syllable and we might well expect B types like (x) (..x), *laled and cry<ed>* 153b, to be more common. The 144b type occurs 326 times, while the 153b type occurs only 124 times. For lack of a better solution I propose that phonological phrases are subject to a NONINITIAL constraint that parallels the NONFINAL constraint found with prosodic words:

(35) NONINITIAL Phonological phrases begin with unfooted syllables.

Let's now review the proposal. The claim is that the meter of *Cleanness* can be described in terms of constraints on weight, alignment and binarity. The constraints used are the following:

(36) Weight

PROKOSCH'S LAW	Stressed syllables are heavy.
KAGER'S LAW	Stressless syllables are light.

(37) Alignment

NONFINAL Prosodic words end in unfooted syllables.

NONINITIAL Phonological phrases begin with unfooted syllables.

ALIGN-R (WD, PROM) The final syllable in a word is prominent.

ALIGN-R (PH, PROM) The final syllable in a phrase is prominent.

ALIGN-L (WD, □) Prosodic words begin with bimoraic feet.

ALIGN-R (PROM, WD) Prominent syllables are word-final.

(38) Binarity

INTBIN Intonational phrases (lines) branch once.

PHBIN Phonological phrases (half-lines) branch once.

WDBIN Phonological words (verse feet) branch once.

FTBIN Phonological feet (metrical position) branch once.

The constraints on weight come from Middle English grammar, as do most of the constraints on alignment. NONINITIAL and ALIGN-L (WD, □) have no ME antecedents, though the latter is found elsewhere in the phonology-morphology interface. The constraints on binarity are taken to be universal both in prosody (Kager 1989, 1993; Prince 1991; Hayes 1995) and in meter (Hayes 1988, Prince 1989, Golston & Riad 1995, Helsloot 1995, 1997). Closer to home, Cable (1991) has shown that the basic metrical patterns of MEAV are very common in late ME prose as well.

The beauty of a constraint-based analysis of this sort is that it requires very little stipulation: the basic patterns of MEAV can be had by simply ranking these constraints very highly. Meter is for the most part just a reranking of prosodic constraints already operative in the ambient language (Fitzgerald 1995, Golston & Riad 1995, Rice 1997abc). Assuming that the normal (prose) state of affairs has syntactic constraints outranking prosodic ones (Golston 1995, Rice & Svenonius 1997; but see Fitzgerald 1994b), meter can be defined as the opposite:

(39) Meter as constraint reranking

Prose:	Syntax >> Prosody
Meter:	Prosody >> Syntax

According to this conception of meter, composing MEAV amounts to simply respecting all of the constraints in (36)-(38). Meter is thus partly natural (the constraints used) and partly artificial (the ranking of prosody over syntax).

Strikingly absent from the constraints mentioned so far are rhythmic constraints; the absence is surprising because most theories of meter define it in terms of rhythm. Rhythm does have a role to play in MEAV, but it is a slight one as we will see. The two rhythmic constraints are CLASH (*xx) and LAPSE (*...). These are purely rhythmic constraints whose status is well established independently of meter in a number of language families (Selkirk 1984, Nespor & Vogel 1979, 1989) including early Germanic (Riad 1992, 130ff.). In what follows I will lump these two constraints into a single constraint Rhythm, violated by any string that contains two adjacent stressed or three adjacent stressless syllables:

(40) RHYTHM

CLASH No sequences (xx) of stressed syllables.

LAPSE No sequences (...) of stressless syllables.

Violations of RHYTHM are very common in Middle English meter (as in Old English) but a close inspection of the data reveals that they play a role nonetheless.

4. GRADIENT WELL-FORMEDNESS

In this section I analyze all of the half-line types found in *Cleanness* with an eye towards explaining why some occur so much more frequently than others. The proposal is that metrical well-formedness is gradient (Youmans 1989) and explicable in terms of ranked and violable constraints, the core tenet of Optimality Theory (Prince & Smolensky 1993). There are almost four times as many A types as B, so it will be simpler to start with the latter, where the forest is less obscured by the trees.

4.1 B types

The present analysis distinguishes some 27 types of B half-line. The three most common of these are given below, with the number of half-lines given in the leftmost column. Each is perfectly well-formed in terms of the constraints we have discussed so far except that the second and third types do not begin with an unfooted syllable, in violation of NONINITIAL:

(41) Most common B types

#		NONIN
326	. (x)(. . x) that reden and syng<en>	
124	(x) (. . x) cowthe comend<e>	*
114	(. . x) . (x) wyth a bone cher<e>	*

This violation of NONINITIAL is what makes the bottom two types less common than the preceding type. Note that the first two types constitute a minimal pair: they differ only in the presence or absence of an initial stressless syllable. The slight difference between the second and third types (124 vs. 114) is taken to be insignificant and will not be accounted for here.

The next most common B types are also metrically impeccable except that they each violate RHYTHM. The first, second, fourth and fifth violate LAPSE (*...); the third and fifth violate CLASH (*xx):

(42) Next most common B types[15]

		RHY	NONIN
96	. (x) . (. . x) in forthering his spech<e>	*	
44	. (. . x) . (x) and hym to greme cach<en>	*	
41	(. . x) (x) in a carp on<ez>	*	*
41	(x) . (. . x) helded to the tabl<e>	*	*
36	. (. . x) (x) that ho by right ask<ez>	* *	

These eight B types account for 822 (91%) of the first 900 B half-lines in *Cleanness*. Note that every arhythmic type is less common than its rhythmic counterpart(s). This is made clear by the following pairwise comparisons:

(43) The role of RHYTHM

#		RHY	NONIN
326	. (x)(. . x) that reden and syng<en>		
96	. (x) . (. . x) in forthering his spech<e>	*	

#		RHY	NONIN
124	(x) (. . x) cowthe comend<e>		*
41	(x) . (. . x) helded to the tabl<e>	*	*

#		RHY	NONIN
114	(. . x) . (x) wyth a bone cher<e>		*
44	. (. . x) . (x) and hym to greme cach<en>	*	
41	(. . x) (x) in a carp on<ez>	*	*
36	. (. . x) (x) that ho by right ask<ez>	* *	

In each case we see clear minimal pairs that differ only in terms of LAPSE (326 vs. 96, 124 vs. 41, 114 vs. 44) or CLASH (114 vs. 41, 114 vs. 36)—the most common types of half-line violate no rhythmic constraints at all. Although rhythm does not play a defining role in the meter it does play a strong realizational role: *ceteris paribus*, rhythmic types are more common than arhythmic types. Similar quantitative claims have been made before for meters in Russian (Friedberg 1997), Classical Arabic (Golston & Riad 1997), and English (Hayes & McEachern to appear).

We still need to account for the rarity of the less well-attested types, of which there are 19. We will now see that they all violate constraints that the types discussed above respect. Eight of these rarer types contain (.x) or (xx) prosodic words instead of the (..x) found in the common types. As discussed above, these types violate either ALIGN-L (WD, □) or ALIGN-R (, WD), combined here as FOOTFORM:

(44) FTFORM offenders

		FTFM	RHY	NONIN
10	. (x) (. x) that fest to hav<e>	*		
7	(x) (. x) stynt ne my3t	*		*
10	. (x) . (x x) his worthy God knaw<e>	*	*	
5	. (x x). (x) that feght loved best	*	*	
1	(. x) (x) and ma kak<ez>	*	*	*
1	(x) . (x x) swete men tweyn<e>	*	*	*
3	. (x x) (x) to raw sylk lyk<e>	*	* *	
6	(x) (x x) mad god cher<e>	*	* *	*

Note that each bit of text has the best parse possible: specifically, one foot is left non-branching to satisfy catalexis. Again, the relative ill-formedness of these types is best seen by comparing otherwise identical types:

(45) The role of ALIGN-L (WD, □)

#		FTFM	RHY	NONIN
326	. (x)(. . x) that reden and syng<en>			
10	. (x) (. x) that fest to hav<e>	*		

124	(x) (. . x) cowthe comend<e>			*
7	(x) (. x) stynt ne my3t	*		*

(46) The role of ALIGN-R (, WD)

#		FTFM	RHY	NONIN
96	. (x) . (. . x) in forthering his spech<e>		*	
10	. (x) . (x x) his worthy God knaw<e>	*	*	

44	. (. . x) . (x) and hym to greme cach<en>		*	
5	. (x x). (x) that feght loved best	*	*	

Pairwise comparison shows the significance of the FTFORM constraints.

We come now to violations of WDBIN. Violations go in one of two directions. First, those half-lines that have ternary words, words with three bimoraic feet (....x); these types are very rare but do occur:

(47) WDBIN offenders (ternary)

#		WDBIN	FTFM	RHY	NONIN
5	. (x) (. . . . x) and harde theroute schowv<ed>	*	*	*	
2	(. . . . x) . (x) he schulde be halden utt<er>	*	*	*	*
2	(. . . . x) (x) that ever I mon mad<e>	*	*	*	*
3	(x) (. . . . x) nymmez efte the dov<e>	*	*	*	*

A violation is assessed for every extra pairs of moras. Pairwise comparison again makes the case for WDBIN very clearly:

(48) The role of WDBIN

#		WDBIN	FTFM	RHY	NONIN
326	. (x)(. . x) that reden and syng<en>				
5	. (x) (. . . . x) and harde theroute schowv<ed>	*	*	*	
41	(. . x) (x) in a carp on<ez>			*	*
2	(. . . . x) . (x) he schulde be halden utt<er>	*	*	*	*

The second way in which a B type can violate WDBIN is to be acatalectic, to lack the one distinctive violation of WDBIN (C) required by the meter. (Following Golston 1996, the *lack* of a distinctive violation is shown with bracketing, <C>) Acatalectic B half-lines with two branching feet account for only 1% of the corpus:

(49) WDBIN offenders (acatalectic)

#		WDBIN	FTFM	RHY	NONIN
8	(. . x)(. . x) were closed to byd<e>	<C>			*
1	(. . x) . (. . x) were founde in yonde toun<e>	<C>		*	*
2	(x x)(. . x) God kepez non oth<er>	<C>	*		

The rarity of these types we may safely ascribe to their lack of a distinctive WDBIN violation. Minimal pairs tell a now familiar tale:

(50) The role of catalexis

#		WDBIN	FTFM	RHY	NONIN
41	(. . x) (x) in a carp on<ez>			*	*
8	(. . x)(. . x) were closed to byd<e>	<C>			*
41	(x) . (. . x) helded to the tabl<e>			*	*
1	(. . x) . (. . x) were founde in yonde toun<e>	<C>		*	*

Four B types, all of them quite rare, violate PHBIN by having more than two prosodic words. This comes in the form of an extra stressed syllable that introduces a third prosodic word:

(51) PHBIN offenders

#		PHBIN	WDBIN	FTFM	RHY	NONIN
3	. (x) (. x)(. x) the falce fende wroght	*		*		
3	(x) (. x) (. x) bothe two his hand<ez>	*		* *		*
3	. (x)(. . x) (. x) and letegh my gestes on<e>	*		*		
3	(. x)(. . x) (x) on folde no flesch styr<yed>	*		*	*	*

Violations of PHBIN are recorded in terms of extra prosodic words: three prosodic words is one too many. Consider again a pairwise look at the above with the major types they most closely resemble:

(52) The role of PhBin

#		PhBin	WdBin	FtFm	Rhy	NonIn
326	. (x)(. . x) that reden and syng<en>					
3	. (x)(. . x) (. x) and letegh my gestes on<e>	*		*		

#		PhBin	WdBin	FtFm	Rhy	NonIn
41	(. . x) (x) in a carp on<ez>				*	*
3	(. x)(. . x) (x) on folde no flesch styr<yed>	*		*	*	*

The rarity of the lesser types is clearly due directly to the extra prosodic word, i.e. to the ternary branching of the phrase.

No other B types occur in the corpus. What the tableaux above show us is that metrical well-formedness is gradient (Youmans 1989): metrical types are better or worse attested depending on the ranking of the prosodic constraints they violate. The best attested type violates none of the constraints; the next best types violate only NonInitial; the next best only Rhythm; and so on.

A large corpus like this one allows us to check the relative strengths of the constraints in another way. We can simply count up all of the violations for each constraint in the entire corpus. Assuming that the strength of a constraint is inversely proportinal to the number of violations it suffers, we can graph the strength of each constraint as in figure 1.

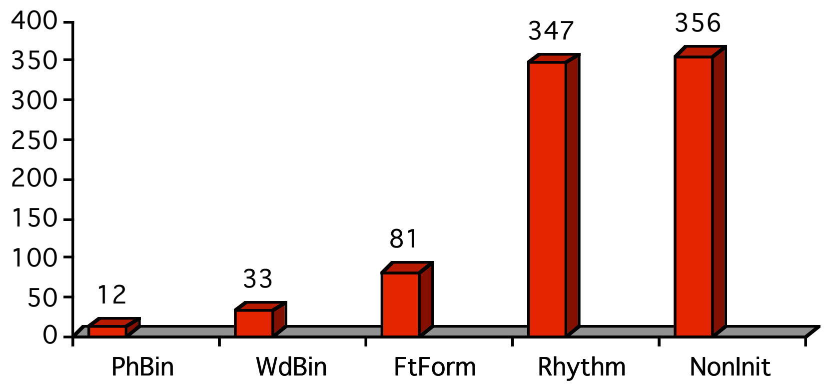


Figure 1. Number of violations per constraint, B half-lines.

Significantly, the constraint ranking arrived at here by simply counting the raw number of violations of each constraint in the corpus is compatible with the the constraint ranking needed to sort each type of line from best to least well-attested—the only difference being that the former shows more differences than the latter (the differences between PHBIN, WDBIN and FTFORM). The convergence is suprising and lends considerable support to the basic analysis. Note that when we use standard grammatical data to test Optimality Theory, there is only a single way to determine what the constraint ranking must be (the one winner vs. the many losers). Metrical data includes more than one winner, a ranked set of candidate outputs, and thus allows us to double check the analysis.

The same constraints and rankings can be used to explain the overall frequency of A half-lines. The best attested type violates only NONINITIAL, the next best types only RHYTHM and NONINITIAL. Consider the following tableau, sorted in descending order from best to worse types of A half-line:

(53) NONINITIAL offenders

#		RHY	NONIN
141	(. . x)(. . x) As be honest utwyth		*
128	. (. . x) (. . x) then ar thay synful hemself	*	
91	(. . x) . (. . x) And his tabarde totorn<e>	*	*
45	. (. . x) . (. . x) And at thi banne we haf broght	* *	

Together these four best A types account for 45% (405) of the A half-lines. They are the best types for good reason. There are only four ways to realize the basic A pattern (..x) (..x) without violating highly ranked constraints: with no extra syllables (141 cases), with one at the beginning of the half-line (128 cases), with one between the two verse feet (90 cases) and with one at the beginning and one between the two verse feet (45 cases). Any additional syllables, stressed or stressless, anywhere else in the line forces violation of a higher ranked constraint, as we will see shortly.

The frequency facts above are compelling and follow directly from the constraint violations and rankings established earlier through analysis of the B types. The first type (141) violates the lowest ranked constraint; the second type violates the next lowest; the third violates it as well but violates NONINITIAL in addition, accounting for the disparity between 128 (arhythmic) and 91 (arhythmic and misaligned); the fourth candidate violates RHYTHM twice (once per stress lapse) and comes in last.

An interesting result of all of this is that a perfect A half-line is not possible: because the first verse foot runs (..x), the half-line incurs a violation of RHYTHM if it begins with a footless syllable (128 , 45) and it incurs a violation of NONINITIAL if it does not (141, 91). Either way the half-line is metrically flawed. This accords well with Optimality Theory, however, in which candidates are never perfect, only better or worse. The case for gradient well-formedness is now made: no type of line is perfect and some are less perfect than others.

The rest of the A half-line types violate one or more of the binarity constraints. The first set of these violate FOOTFORM, as inspection of the next best attested types makes clear. (Recall that schwa in hiatus is assumed to be deleted; such schwas are underlined below.)

(54) FootForm offenders

#		FtFm	Rhy	NonIn
25	(. x) (. . x) For thefte and for thre<pyng>	*		*
20	(. . x) (. x) In the drede of Drygh<tyn>	*		*
29	. (. . x) (. x) that he ne wyst on word<e>	*	*	
7	. (x x)(. . x) that hert honest and hol	*	*	
41	(. x) . (. . x) the gome watz ungar<nyst>	*	*	*
18	(x x) (. . x) Bry3t blykked the bem	*	*	*
3	(. . x) . (x x) As a scowte-wach scarred	*	*	*
7	(x x) . (. . x) Bryng bodworde to bot	*	*	*
5	. (x x) . (. . x) Bot non nuyez hym, on na3t	*	* *	
4	. (. . x) . (x x) And as to God the good mon	*	* *	
2	(. x)(. x) And sythen soberly	* *		*
2	. (x x)(. x) His two dere do3tere3	* *	*	
1	(x x) (. x) Now God in nwy	* *	*	*
1	(. x) . (x x) Now fyfty fyn frendez	* *	*	*
1	. (x x) . (x x) For mon-sworne, and men-sclaght	* *	* *	

(54) is sorted according to the analysis argued for here; note that as the numerical differences among types drop the empirical predictions made by the analysis are less well borne out: e.g., the types that occur 7 and 41 times have frequencies that do not fit well with the constraint ranking. If the model were more accurate, sorting the tableau by the constraint violations would put the type with 41 tokens at the top of the tableau, followed by the types with 29, 25, 20, 18 and so on.

Still, pairwise comparison of each type with its counterpart shows as well as ever the strength of FOOTFORM.

(55) The role of FOOTFORM

#		FTFM	RHY	NONIN
141	(. . x)(. . x) As be honest utwyth			*
25	(. x) (. . x) For thefte and for thre<pyng>	*		*

128	. (. . x) (. . x) then ar thay synful hemself		*	
29	. (. . x) (. x) that he ne wyst on word<e>	*	*	

91	(. . x) . (. . x) And his tabarde totorne		*	*
41	(. x) . (. . x) the gome watz ungar<nyst>	*	*	*

The analysis does not account for all the variation in the text, but it accounts for the major tendencies.

A large number of A types violate WDBIN. Here we can distinguish those that violate it because they have ternary branching (....x) prosodic words (57) from those that have unary (x) prosodic words (58).

(56) WDBIN offenders (too many moras)

		WDBIN	FTFM	RHY	NONIN
3	. (....x) (..x)	*		*	
19	(....x) (..x)	*		*	*
17	(..x) (....x)	*		*	*
1	(..x) . (....x)	*		*	*
9	. (..x) (....x)	*		* *	
2	. (....x) . (..x)	*		* *	
1	. (..x) . (....x)	*		* *	
9	(....x) . (..x)	*		* *	*
22	(.x) (....x)	*	*	*	*
13	(....x) (.x)	*	*	*	*
9	(.x) . (....x)	*	*	*	*
1	(xx) (....x)	*	*	*	*
1	. (xx) (....x)	*	*	* *	
1	(....x) (xx)	*	*	* *	*
3	(....x) (....x)	* *		* *	*
3	(.x) (......x)	* *	*	*	*
1	(......x) (.x)	* *	*	* *	*

(57) WDBIN offenders (too few moras)

		WDBIN	FTFM	RHY	NONIN
5	(x) (..x)	*			*
1	(..x) (x)	*		*	*
11	(x) . (..x)	*		*	*
1	. (..x) (x)	*		* *	
1	(....x) (x)	* *		* *	*

A small number of A types violate the constraint in both ways, containing both too-small and too-big words:

(58) WdBin offenders (too many and too few moras)

		WDBIN	FTFM	RHY	NONIN
10	(x) (....x)	* *		*	*
1	(x) (......x)	* * *		*	*

We come finally to A types that violate PHBIN: these are the traditional expanded half-lines. (I've left out examples of each type to conserve space here and in what follows.)

(59) PHBIN offenders

		PHBIN	WDBIN	FTFM	RHY	NONIN
1	(..x) . (..x) (..x)	*			*	*
6	(.x) (..x) (..x)	*		*		*
3	(..x) (.x) (..x)	*		*		*
2	(..x) (..x) (.x)	*		*		*
1	. (..x) (..x) (.x)	*		*	*	
1	(.x) (..x) . (..x)	*		*	*	*
1	(.x) . (..x) (..x)	*		*	*	*
24	(.x) (.x) (..x)	*		* *		*
10	(.x) (..x) (.x)	*		* *		*
6	(..x) (.x) (.x)	*		* *		*
4	. (..x) (.x) (.x)	*		* *	*	
18	(.x) (.x) . (..x)	*		* *	*	*
13	(.x) . (..x) (.x)	*		* *	*	*
2	(.x) (..x) . (xx)	*		* *	*	*
6	(.x) (.x) (.x)	*		* * *		*

At these low frequencies the differences are not perfectly captured by the constraint violations, but this is probably to be expected. The general trend is still clear: violators of PHBIN tend to be less common than respecters of it.

A surprisingly large number of A types violate both WDBIN and PHBIN but none of them is a commonly occurring type:

(60) WDBIN, PHBIN offenders

		PHBIN	WDBIN	FTFM	RHY	NONIN
5	(x) (..x) (..x)	*	*			*
1	(x) (..x) . (..x)	*	*		*	*
1	(x) . (..x) (..x)	*	*		*	*
6	(x) . (....x)	*	*		*	*
2	. (..x) (..x) (x)	*	*		* *	
14	(x) (.x) (..x)	*	*	*		*
2	(x) (..x) (.x)	*	*	*		*
11	(x) (.x) . (..x)	*	*	*	*	*
11	(x) . (..x) (.x)	*	*	*	*	*
3	(.x) (..x) (x)	*	*	*	*	*
2	(..x) (x) (.x)	*	*	*	*	*
4	(.x) . (..x) (x)	*	*	*	* *	*
5	(x) (.x) (.x)	*	*	* *		*
4	(.x) (.x) (....x)	*	*	* *	*	*
1	(.x) . (....x) (.x)	*	*	* *	*	*
5	(.x) (....x) (.x)	*	*	* * * *	*	*
3	(x) . (..x) (x)	*	* *		* *	*
1	(.x) (....x) (x)	*	* *	*	* *	*
1	(....x) (x) (.x)	*	* *	*	* *	*
1	(x) (..x) . (....x)	*	* *	*	* *	*
2	(x) (....x) (x)	*	* * *	* *	*	*
1	(..x) (x) (..x) (x)	* *	* *		* *	*

(Note that the last type, with four prosodic words, could equally well be treated as a violation of INTBIN if it consists of two phonological phrases. This would make it the only violation of INTBIN in the corpus.)

As should now be clear, the patterns for A half-lines mirror those of B half-lines almost exactly. As before we can confirm the overall constraint ranking by looking at raw numbers of constraint violations, as shown in figure 2:

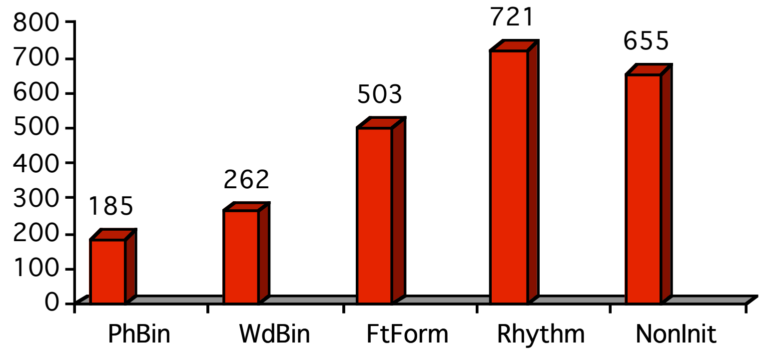


Figure 2. Number of violations per constraint, A half-lines.

With the exception of the slightly low figure for NONINITIAL[16], we see that the frequency with which a type occurs varies proportionately with its well-formedness in terms of constraints on binarity, rhythm and alignment; the ranking is the same one found among B half-lines.

A more surprising point about figure 2 is how ill-formed A types are, compared to their B counterparts. The comparison is made in figure 3.

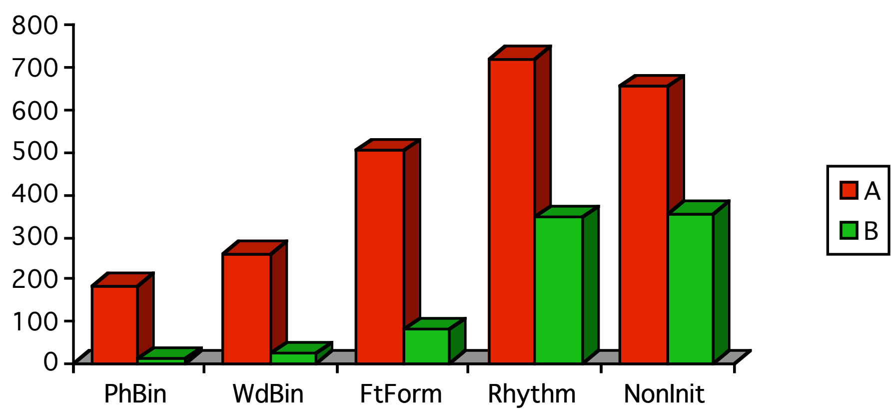


Figure 3. Raw number of violations per constraint, A and B half-lines.

This is fairly common in meter (Hayes 1988): metrical patterns are often loosest towards the beginning of the line and strictest towards the end. What is remarkable about figure 3 is how clearly it shows this and that it shows it for five independent constraints.

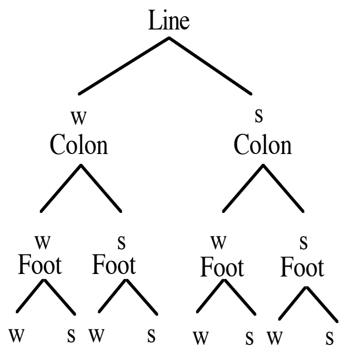
This looseness in the A half-line is responsible for the larger number of A types (n=87) than B (n=20). It also explains why the most common A types are so much less frequent than the most common B types: looseness breeds more types, more types make for less tokens per type in a given corpus.

5. CONSTRAINT-BASED METRICS

I'd like to sketch out some of differences between the current proposal of how meter works and proposals elsewhere in Generative Metrics. (Halle & Keyser 1969, 1971; Keyser 1969; Kiparsky 1975, 1977; Hayes 1983, 1988, 1989; Prince 1989; Hanson & Kiparsky 1996; and many others). Excellent reviews of this literature can be found in Hayes 1988 and Rice 1997c.

The genaral approach to meter in generative metrics has been to set up an abstract pattern such as the one below for iambic pentameter and then relate that pattern to a concrete text in terms a small number of metrical principles or correspondence rules. Hayes (1988) provides the following overview:

(60) Abstract pattern for Iambic Pentameter



(61) Correspondence rules

Syllable count: Syllables correspond one-to-one with terminal nodes of the metrical pattern.

Phrasing: Line boundaries must coincide with phonological phrase boundaries.

Rules governing stress

a. The *'Monosyllable Rule'*

A stressed syllable must occupy s position unless:

(i) it consists of a single, monosyllabic word; or

(ii) it immediately follows a phonological phrase boundary.

b. At the right edge of a phonological phrase, the sequence stressless-stressed must occupy ws position.

Metrical lines are those that do not violate any of the correspondence rules; unmetrical lines are those that do. Generally, unmetrical lines are supposed to be absent from the works of a given author, so that one may test the theory by looking for counterexamples to each of the correspondence rules.

In reality, however, each of these correspondence rules is broken, even in as metrically tight an author as Shakespeare. Let's briefly go through each case; the problematic result is that many lines of Shakespeare are not metrical.

Syllable count. Violations of the syllable count correspondence rule occur in lines that are too long and in lines that are too short.

Alexandrines are too-long lines with six verse feet (12 or 13 syllables). They straightforwardly violate any correspondence rules regulating syllable count. Though not common in the earlier Shakespeare, they are the hallmark of the poet's later work. According to Chambers (1903, 29):

> Until *Twelfth Night,* the dramatist seems to have contented himself with a dozen or half-dozen Alexandrines in each play; with *Measure for Measure* the number takes a sudden leap (revealing in this case, as in so many others, the poet's growing impatience of metrical rules), and the frequency of Alexandrines becomes a rought test for plays of the Third and Fourth periods.

A couple of the twenty-five examples Chamber cites from *Macbeth* make the problem clear (foot-boundaries supplied by Chambers)[17]:

(62) That trace | him in | his line. || No boas | ting like | a fool (*Macbeth* 4.1.153)

In an | imper | ial charge. || But I | shall crave | your pardon. (*Macbeth* 4.3.20)

Too-short lines occur when a line has less than five feet. Chambers finds 104 such lines in *MacBeth* (1903, 30) of which the following are typical:

(63) As this which now I draw. (*Macbeth* 2.1.41)

This is a sorry light. (*Macbeth* 2.2.21)

Too-short lines also occur when one of the feet does not branch. Chambers mentions five such lines in *MacBeth* including the following (1903, 39):

(64) Who | comes here? | The wor || thy thane | of Ross. (*Macbeth* 1.2.45)

This is not a common type of line, to be sure—Chambers finds only nine instances in *Macbeth*. Such lines must be classified as unmetrical if we take the syllable count correspondence rule seriously.

Phrasing. Lines whose boundaries do not coincide with phonological phrase boundaries are traditionally known as cases of *enjambment*. Again, they are rare in Shakespeare's earlier work but quite common later on:

(65) I put myself to thy direction, and
Unspeak mine own detraction, here abjure
the taints and blames I laid upon myself (*Macbeth* 4.3.22-24)

If no phrase boundary separates *and* from *unspeak mine own detraction*, the line must count as unmetrical, given a strict reading of the phrasing correspondence rule.

The monosyllable rule. This is the best studied of the correspondence rules and it is therefore very instructive that it, too, is frequently violated in Shakespeare, despite claims to the contrary.

The monosyllable rule makes lines like the following constructs unmetrical:

(66) *Pluck imménse teeth from enráged tigers' jaws
w s *w s w s *w s w s
*Unlock this casket, if áfter three nights (Kiparsky 1977, 221)
*Then beshréw it, it provókes groans dáily (Hayes 1988, 222)
*Pluck refíned sugar from the tiger's teeth (Prince 1989, 54)

But such lines do occur in Shakespeare (Bridges 1921, 67-69, Golston & Riad 1998):

(67) In pursúit of the thing she would have stay (Son 143.4)
w s *w s w s w s w s

Thy advérse party is thy advocate (Son 35.10)
w s *w s w s w s w s

Supposed as forfeit to a confíned doom (Son 107.4]
w s w s w s w s *w s

Harmless Ríchard was murdered traitorously (2H6 2.2.27)
w s *w s w s w s w s

There’s matter in these sighs, these profóund heaves (Ham, 4.1.1)
w s w s w s w s *w s

Upon my secúre hour thy uncle stole (Ham, 1.5.61)
w s w s *w s w s w s

Sir, in good sooth, in sincére verity (Lear 2.2.111)
w s w s w s *w s w s

Again, such lines must be treated as occurring but unmetrical if we treat the monosyllable rule as categorical.

The second half of the monosyllable rule is also violated, as the following make clear (Golston & Riad 1998):

(68) Therefore in fierce témpest is he cóming (H5 2.4.99]
w s w s *w s w s *w s

My cousin Warwick? No, my fair cóusin. [H5 4.3.19]
w s w s w s w s *w s

Young, valiant, wise, and no doubt right róyal [R3 1.2.231]
w s w s w s w s *w s

In the cathedral church of Westmínster [2 H 6, 1.2.37]
w s w s w s w s *w s

With walking once about the quadrángle [2 H 6, 1.3.156]
w s w s w s w s *w s

Despite frequent claims to the contrary, then, even the strictest of the correspondence rules proposed for iambic pentameter are not free of exceptions. The apparent difference between traditional generative metrics and constraint-based metrics, that the former makes categorical distinctions between metrical and unmetrical lines, is not real.

Recent OT analyses of meter divide constraints into more and less central types, using higher ranked constraints to define the basic meter and lower ranked (violable) constraints to capture tendencies among occurring types of line (Golston & Riad 1995, 1997; Hayes & McEachern 1996; Friedberg 1997).

A hallmark of Generative Metrics is that meter involves the interplay of an abstract pattern (WS WS WS WS WS) and a concrete text (Shall I compare thee to a summer's day?) that mirrors it. Constraint-based metrics obviates the need for two levels of analysis like this. Let us see why and see what the consequences of such a move are.

On the positive side, the analysis is simpler because it involves only the surface. Consider the lines in (52) above, which contain three prosodic words: e.g., *the falce fende wroght*. If we posit an abstract meter consisting of a set number of feet (seven presumably), the extra foot in lines such as these must be treeated as extrametrical, as anacrustic, etc., all highly questionable.

On the negative side, the existence of a unifying rhythmic model is lost. In G&R (1998), for instance, the iambic nature of pentameter is claimed to be epiphenomenal, contra most everyone's understanding of the meter as fundamentally going DiDum. G&R claim that the meter of Shakespeare is fundamentally trochaic (10 moraic trochees per line).

5.3 Catalexis

I've added a longish paragraph between (23) and (24) fleshing out the proposal. The analysis is based on my 1996 article in *Language* (guess you didn't read it, huh? huh?). I'm hoping the sketch in the text is enough to clarify things. The point of this is to avoid having an ad hoc metrical constraint CATALEXIS.

I come back to the issue in §5, where I discuss it in terms of having an abstract template (Generative Metrics) or not (C-B metrics).

6. CONCLUSION

I've tried to show that the metrical patterns in *Cleanness* can be described in quite some detail by using nothing more than the very constraints we need to describe languages in general and Middle English in particular—constraints on weight and stress, alignment, rhythm and binarity. Despite the looseness of the metrical pattern of *Cleanness*, there *is* a pattern and it can be described without recourse to meter-specific concepts.

A second goal has been to offer a precise analysis of the relative frequency of half-line types, of which there are a great many in *Cleanness*. This is done using linguistic constraints, but it crucially involves constraints that are violable, as developed in Optimality Theory. The well-formedness of a half-line type (as evidenced by its frequency in the text) is measured in a gradient manner against prosodic constraints.

More generally I hope to have shown that the phonological foundation of meter can be neatly expressed in a constraint-based framework. The theoretical gain here is appreciable insofar as it allows us to reduce most of meter to phonology. A residue remains, of course, but the element of artifice in meter seems to boil down to little more than valuing prosodic constraints more highly than one does in prose or in natural speech.

NOTES

* A great debt of thanks goes ..... Mistakes and inconsistencies are my own.

[1] I follow Parks (1997) in formulating all alignment constraints as ALIGN-L/R (X, Y), a significant simplification from McCarthy & Prince's cumbersome ALIGN (X, L/R, Y, L/R). Parks' formulation prohibits cross-alignment of the form ALIGN (X, L, Y, R) or ALIGN (X, R, Y, L), something she argues is not needed in natural language.

[2] Similar considerations lead Hammond (1996, 1997) to propose that stressed syllables are closed (and thus heavy) in Modern English, where there seems to be a conspiracy against stressless lights. Lass (1992) suggests that stressed open syllables were closed in ME by an ambisyllabic consonant: *hap.pe.nes*. This has the same effect of reducing the number of stressed light syllables in the language to none.

[3] Word-initial [h] counts as vowel-initial for the purposes of elision: *unclannesse̱ hatz* has schwa in hiatus despite the initial [h] of *hatz*. This is the pattern found elsewhere in ME versification (Minkova 1991) and is probably related to deletion of [h] in the onsets of stressless syllables (Jordan 1974, §195).

[4] Following Selkirk (1984, 341ff), I assume that function words are footed but lack word-level stress except under special circumstances (when contrastive or phrase-final). Polysyllabic function words are therefore footed but stressless at the level of the phonological word. This is the general assumption for MEAV in any case: 'Articles, prepositions, conjunctions, auxiliary verbs, linking verbs, the verb *have*, pronominal adjectives, and pronouns (personal, demonstrative, indefinite, relative, and interrogative) do not receive metrical stress unless they occur at the end of the half-line' (Cable 1991, 80). For discussion of the relation between alliterating function words and stress see Borroff (1962: 170-171) and Matonis (1984: 343, 347-51).

[5] I have rescanned the entire text (*Cleanness* 1-900) and all figures are based on that scansion, not on the scansion in Cable. Cable's scansion is based on etymological vowels that are not found in the manuscript and that cannot be assumed to have been around in Middle English, including the original vowels of loans from Old Norse and Old French (1991, §3). Surprisingly, the commonness of each type relative to all other types remains pretty much the same, regardless of which way the scansion is done.

[6] For discussion of the prosodic hierarchy see Selkirk 1986, Hayes 1989, Nespor & Vogel 1986 and the collection of papers in Inkelas & Zec 1989; Hayes 1989 provides the first evidence for the prosodic hierarchy in meter. Stockwell & Minkova (1997) propose two distinct constraints for Old English meter:

*5Pos A verse (half-line) may not have five positions.

*3Pos A verse (half-line) may not have three positions.

Assuming a few other constraints (*1Pos, *2Pos, *6Pos...), this gets binarity as well.

[7] For constraints on Prosodic Domination (Layeredness, Headedness, Exhaustivity, Nonrecursivity), see Selkirk 1995, 442 ff. I leave these out of the discussion for simplicity as they play no role in discussing the meter.

[8] See Cable (1991) for the insight that the A half-line is longer than the B and that the B half-lines contains only one stretch of stressless syllables between stress peaks where the A contains two. An anonymous reviewer suggests that the caesura might supply the missing metrical position in the B half-line. This is very plausible for lines in which the first verse foot of the B half-line is non-branching, somewhat less so for lines in which the second verse foot is non-branching; in the latter case the caesura is not contiguous with the non-branching foot.

[9] Duanmu (1993, 1994) demonstrates that many Chinese languages including Mandarin distinguish between bimoraic and monomoraic syllables, with a strong preference for the fomer. If Middle Chinese had syllables of this type, the parallels between this meter and MEAV are even closer: the terminal metrical positions in both cases are bimoraic feet in the unmarked case and monomoraic feet in the marked case.

[10] Helsloot (1997) derives the right-headedness of phonological phrases in Italian meter from the Iambo-Trochaic Law (Hayes 1995): uneven constituents are right headed. Applying the same principle to MEAV or to regulated verse yields the wrong results, since the first half-line is longer than the second.

[11] The constraints are not ranked, as shown by the dotted line separating them in the tableau. Evidence for ranking these constraints with respect to one another is weak; see figures 1 and 2 below.

[12] The tableau is read as follows (Prince & Smolensky 1993): a number of possible outputs occur in the left-most column and are evaluated by the set of ranked constraints arrayed in the top row, with the highest ranking constraint left-most. The winner is marked with a pointing hand (+), asterisks indicate violation of a constraint, exclamation marks indicate fatal violation.

[13] This is a proper subset of what can constitute a metrical position according to Hanson & Kiparsky (1996), who allow metrical positions to consist of a mora, a syllable, a foot or a prosodic word (p. 292). Hanson herself allows any constituents of the prosodic hierarchy to define a metrical position (1995, 62).

[14] Iambic feet of this sort are avoided in Japanese words as well; see Itô 1990.

[15] The present anaysis does not account for why the first type in (43) is almost twice as common (96 tokens) as the rest. An anonymous reviewer suggests that the difference may be related to the fact that the rhythmic counterpart to the first type is itself much more common (326 tokens) than the other lines types (124, 114 tokens). One possibility is that stresses like to align left-wards in the phrase: ALIGN-L (X, PH). If we assign a single violation to every syllable that stands between a stress and the left edge of a phrase we get the following tableau:

		RHY	NONIN	ALIGN
326	. (x)(. . x)			*****
124	(x) (. . x)		*	***
114	(. . x) . (x)		*	******
96	. (x) . (. . x)	*		******
44	. (. . x) . (x)	*		********
41	(. . x) (x)	*	*	***
41	(x) . (. . x)	*	*	****
36	. (. . x) (x)	**		****

This accounts for the difference between 96 and 44, as well as the slight difference between 124 and 114, but does not draw the desired connection with the commonness of the best-attested type (326 tokens).

[16] This is probably due to the fact that NONINITIAL can only be violated once per half-line; all other constraints can and are violated more than once per half-line. This is true for the binarity constraints as well as RHYTHM: we can easily imagine too-long lines that contain multiply branching phrases with prosodic words and feet that all branch once (violating PHBIN but respecting WDBIN and FTBIN), or too-short lines that contain only non-branching phrases with prosodic words and feet that all brance once. The fact that violations lower down on the prosodic hierarchy are felt less strongly than violations higher up is surprising and I have no explanation for it; I would have expected the opposite to be true and leave the solution to this puzzle to future research.

[17] Alexandrines occur with extrametrical syllables as well (Chambers 1903, 47):

Like syl | lable | of do(lour). || What I | believe, | I'll wail (*Macbeth* 4.3.8)

REFERENCES

Bliss, A. J. 1958. *The Metre of Beowulf*. Oxford: Blackwell.

Bliss, A. J. 1962. *An Introduction to Old English Metre*. Oxford: Blackwell.

Borroff, Marie. 1962. *Sir Gawain and the Green Knight: a stylistic and metrical study*. New Haven, Conn.: Yale University Press.

Burling, R. 1966. The metrics of children's verse: a cross-linguistic study. *American Anthropologist* 68, 1418-41.

Cable, Thomas. 1991. *The English alliterative tradition*. Philadelphia: University of Pennsylvania Press.

Chen, Matthew. 1979. Metrical structure: evidence from Chinese poetry. *LI* 10.3, 371-420.

Chen, Matthew. 1980. The primacy of rhythm in verse. *Journal of Chinese Linguistics* 8, 15-41.

Connor, Jack. 1974. *English prosody from Chaucer to Wyatt*. The Hague and Paris: Mouton.

Creed, Robert Payson. 1990. *Reconstructing the Rhythm of Beowulf*. Columbia and London: University of Missouri Press.

Duanmu, San. 1993. Rime length, stress and association domains. *Journal of East Asian Linguistics* 2. 1-44.

Duanmu, San. 1994. Syllabic weight and syllabic duration. *Phonology* 11. 1-24.

Fitzgerald, Colleen M. 1994a. The Meter of Tohono O'odham Songs. Ms, University of Arizona.

Fitzgerald, Colleen M. 1994b. Prosody drives the syntax. Proceedings of the Berkeley Linguistics Society, 20.

Fitzgerald, Colleen M. 1995. Poetic Meter >> Morphology in Tohono O'odham. Paper presented at the 1995 annual meeting of the Linguistic Society of America.

Friedberg, Nila. 1997. Optimal meter and Russian verse. Ms. University of Toronto.

Golston, Chris. 1995. Syntax outranks phonology. *Phonology* 12.3.

Golston, Chris. 1996. Direct Optimality Theory: representation as pure markedness. *Language* 72.4. 713-748.

Golston, Chris and Tomas Riad. 1995. Direct metrics. Paper presented at LSA, San Diego. Ms, California State University Fresno and Stockholm University.

Golston, Chris and Tomas Riad. 1997a. The phonology of Classical Arabic meter. *Linguistics*. 111-132.

Golston, Chris and Tomas Riad. 1997b. The phonology of Old English meter. Paper presented at the *Third Germanic Linguistics Annual Conference*. UCLA. Ms, California State University Fresno and Stockholm University.

Hammond, Mike. 1993. Review of *The English alliterative tradition* by Thomas Cable. *Language* 69, 400-404.

Hammond, Mike. 1996. Binarity in English nouns. *Nordlyd* 24. Tromsø Working Papers on Language and Linguistics. 97-110.

Hammond, Mike. 1997. Vowel quantity and syllabification in English. LANGUAGE.

Hanson, Kristin. 1995. Prosodic constituents in poetic meter. *West Coast Conference on Formal Linguistics* 13.62-67.

Hanson, Kristin and Paul Kiparsky. 1996. A parametric theory of poetic meter. *Language* 72.2, 287-335.
Hayes, Bruce. 1982. Extrametricality and English stress. *Linguistic Inquiry* 13.227-76.
Hayes, Bruce. 1983. A grid-based theory of English meter. *Linguistic Inquiry* 14.357-93.
Hayes, Bruce. 1988. Metrics and phonological theory. In Frederick Newmeyer (ed.) *Linguistics: The Cambridge Survey, Vol. 2, Linguistic Theory: Extensions and Implication*. Cambridge: Cambridge University Press. 220-49.
Hayes, Bruce. 1989. The prosodic hierarchy in meter. In Paul Kiparsky and Gilbert Youmans (eds.), *Rhythm and Meter*, 201-260. San Diego, Cal.: Academic Press.
Hayes, Bruce. 1994. An optimality-theoretic approach to textsetting in folk songs and its consequences for prosodic domain theory. Ms, UCLA and Rutgers Optimality Archive.
Hayes, Bruce. 1995. *Metrical stress theory*. Chicago: University of Chicago Press.
Hayes, Bruce and M. MacEachern. to appear. Folk verse form in English. *Language*.
Helsloot, Karijn. 1995. *Metrical Prosody: a template-and-constraint approach to phonological phrasing in Italian*. Doctoral dissertation, Universiteit van Amsterdam.
Helsloot, Karijn. 1997.
Itô, Junko. 1990. Prosodic minimality in Japanese. In M. Ziolkowski, M. Noske and K. Deaton (eds.), *Papers from the 26th regional meeting of the Chicago Linguistic Society*, vol. 2, 213-239.
Jordan, Richard. 1974. *Handbook of Middle English Grammar: Phonology*. Translated and revised by Eugene J. Crook. The Hague: Mouton.
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 & Linguistic Theory* 11:381-432.
Kager, René and Wim Zonneveld. 1986. Schwa, syllables, and extrametricality in Dutch. *The Linguistic Review* 5, 197-221.
Kawakami, Shin. 1974. Nihongo onsuuritu no saikentoo [Reexamination of the rhythm of Japanese verse. Onishi hakuhi kiju kinen onseigaku deikai ronbonshu [Worldwide anthology of papers in phonetics in honor of Dr. Onishi's seventy-seventh birthday]. Tokyo: Phonetic Society of Japan. 665-671.
Kozasa, Tomoko. 1997. Meter or rhythm: moraic tetrameter in Japanese poetry. Ms, California State University Fresno.
Lass, Roger. 1992. Phonology and morphology. In Norman Blake (ed.), *The Cambridge History of the English Language, Vol. II*. Cambridge: Cambridge University Press. 23-155
Menner, Robert J. (ed.) 1920. *Purity*. New Haven: Yale University Press.
Matonis, A. T. E. 1984. A reexamination of the Middle English alliterative long line. *Modern Philology*, 81. 339-360.
McCarthy, John J. and Alan S. Prince. 1993. Generalized alignment. *Yearbook of Morphology*, 79-153.

McCully, Christopher B. and Richard M. Hogg. 1994. Dialect variation and historical metrics. *Diachronica* 11.1, 13-34.
Minkova, Donka. 1984. Early Middle English metric elision and schwa deletion. In N. F. Blake & C. Jones (eds.), *English Historical Linguistics: Studies in Development*. Sheffield: Centre for English Cultural Tradition and Language (Sheffield University). 56-66.
Minkova, Donka. 1987. The prosodic character of early schwa deletion in English. In Anna Giacalone Ramat et al. (ed.), *Papers from the Seventh International Conference on Historical Linguistics*. Amsterdam/Philadelphia: Benjamins. 445-57.
Minkova, Donka. 1990. Adjectival inflexion relics and speech rhythm in Late Middle and Early Modern English. In Sylvia Adamson et al. (ed.), *Papers from the Fifth International Conference on Historical Linguistics*. Amsterdam/Philadelphia: Benjamins. 313-37.
Minkova, Donka. 1991. *The history of final vowels in English*. Berlin: Mouton de Gruyter.
Minkova, Donka. 1995. Non-primary stress in Early Middle English accentual-syllabic verse. In Christopher B. McCully (ed.), *Papers from the First G. L. Brook Symposium on English Historical Metrics*.
Minkova, Donka. 1996. Middle English stress: an optimality theoretic account. Ms, UCLA.
Minkova, Donka and Robert P. Stockwell. 1994. Syllable weight, prosody and meter in Old English. *Diachronica* XI.1.35-64.
Morsbach, Lorenz. 1896. *Mittelenglische Grammatik, Erste hälfte*. Halle.
Mossé, Fernand. 1952. *A handbook of Middle English*. Translated by James A. Walker. Baltimore: the Johns Hopkins Press.
Nespor, Marin and Irene Vogel. 1983. Prosodic structure above the word. In A. Cutler and D.R. Ladd (eds.), *Prosody: Models and Measurements*. Berlin: Springer Verlag.
Nespor, Marina and Irene Vogel. 1986. Prosodic Phonology. Dordrecht: Foris.
Nespor, Marina and Irene Vogel. 1979. Clash avoidance in Italian. *Linguistic Inquiry* 10:467-482.
Nespor, Marina and Irene Vogel. 1989. On clashes and lapses. *Phonology* 6, 69-116.
Oakden, J. P. 1935. *Alliterative poetry in Middle English: a survey of the traditions*. Manchester: the University Press.
Oostendorp, Marc van. 1995. *Vowel quality and syllable projection*. Doctoral dissertation, Tilburg University.
Parks, Mary Constance. 1997. Align-Left and Align-Right. Ms, California State University Fresno.
Piera, C. 1980. *Spanish Meter and the Theory of Verse*. Doctoral dissertation, UCLA.
Pope, J. C. 1966. *The Rhythm of Beowulf*. Revised edition. New Haven: Yale University Press.
Prince, Alan and Paul Smolensky. 1993. *Optimality theory: Constraint interaction in generative grammar*. Ms, Rutgers University and University of Colorado, Boulder.

Prince, Alan. 1989. Metrical forms. In Paul Kiparsky and Gilbert Youmans (eds.), *Rhythm and Meter*, 45-80. San Diego, Cal.: Academic Press.
Prince, Alan. 1990. Quantitative consequences of rhythmic organization. *Parasession on the syllable in phonetics and phonology. Chicago Linguistics Society*. 355-98.
Prince, Alan. 1991. Quantitative consequences of rhythmic organization. In Deaton, K., R. Noske and M. Ziolkowski (eds.), *Proceedings of the Chicago Linguistics Society* 26, vol. 2.
Prokosch, Eduard. 1939. *A comparative Germanic grammar*. Linguistic society of America. Philadelphia: University of Pennsylvania Press.
Riad, Tomas. 1992. *Structures in Germanic prosody*. Doctoral dissertation, Stockholm University.
Riad, Tomas. 1995. The Germanic quantity shift: a typology. Amsterdamer Beiträge zur älteren Germanistik 42. (Greifswalder symposium zu fragen der Germanischen Quantitätsverschiebung und Metrik in der Mittelalter.)
Rice, Curt. 1997a. Phonology outranks morphology: Chaucerian past participles and the grammar of poetry. HILP 3, Amsterdam.
Rice, Curt. 1997b. Ranking components: the grammar of poetry. Ms, University of Tromsø.
Rice, Curt. 1997c. Generative Metrics. GLOT International.
Rice, Curt and P. Svenonius. 1997. Prosodic V2 in Northern Norwegian. Talk presented at the Hopkins Optimality Theory Workshop and Maryland Mayfest, Baltimore. Ms, University of Tromsø.
Ritt, Nikolaus. 1994. *Quantity adjustment: vowel lengthening and shortening in early Middle English.* Cambridge: Cambridge University Press.
Russom, Geoffrey. 1987. *Old English meter and linguistic theory*. Cambridge: Cambridge University Press.
Selkirk, Elizabeth O. 1978. On prosodic structure and its relation to syntactic structure. In T. Fretheim (ed.), *Nordic Prosody II*. Trondheim: TAPIR.
Selkirk, Elizabeth O. 1984. *Phonology and Syntax*. Cambridge: MIT Press.
Selkirk, Elizabeth O. 1986. On derived domains in sentence phonology. *Phonology Yearbook* 3. 371-405.
Selkirk, Elizabeth O. 1995. The prosodic structure of function words. In Jill N. Beckman, Laura Walsh Dickey and Suzanne Urbanczyk (eds.), *Papers in Optimality Theory*. University of Massachusetts Occasional Papers 18. Amherst: GLSA. 439-470.
Sievers, Eduard. 1885. Zur Rhythmik des germanischen Alliterationsverses, I-II. *Beiträge zur Geschichte der deutschen Sprache und Literatur,* 10, 209-314, 451-545.
Sievers, Eduard. 1887. Zur Rhythmik des germanischen Alliterationsverses, III. *Beiträge zur Geschichte der deutschen Sprache und Literature,* 12. 454-482.
Sievers, Eduard. 1893. *Altgermanische Metrik.* Halle: Niemeyer.
Smithers, G. V. 1983. The scansion of *Havelok* and the use of ME *-en* and *-e* in *Havelok* and by Chaucer." In Donald Gray and Eric G. Stanley (eds.), *Middle English Studies presented to Norman Davis in Honour of his Seventieth Birthday*. Oxford: Clarendon Press. 195-234.
Stockwell, Robert and Donka Minkova. 1997. Old English metrics and the phonology of resolution. Ms, UCLA.

Stockwell, Robert P. & Donka Minkova. (in press) The Prosody of Beowulf. In John Niles & Robert Bjork (eds.), *A Beowulf Handbook*. Univ. of Nebraska Press.

Tarlinskaja, Marina. 1976. *English verse. Theory and history*. The Hague: Mouton.

Wright, Joseph and E. M. Wright. 1928. *An elementary Middle English Grammar*. 2nd ed. London.

Yip, Moira. 1980. The metrical structure of regulated verse. *Journal of Chinese Linguistics 8*, 107-125.

Yip, Moira. 1984. The development of Chinese verse: a metrical analysis. In Mark Aronoff & Richard T. Oehrle (eds.), *Language Sound Structure: Studies in Phonology presented to Morris Halle by his teacher and students*. Cambridge, Mass.: MIT Press, 346-372.

Youmans, Gilbert. 1989. Milton's Meter. In Paul Kiparsky and Gilbert Youmans (eds.), *Rhythm and Meter*, 341-379. San Diego, Cal.: Academic Press.

Appendix

Following are all of the B types, given in descending order of frequency. Each of the top eight types respects all of the top three constraints; none of the other types do. Note that the accuracy of the predictions falls off as the frequency of a half-line type drops below 10.

tokens	27 B types	WdBin	PhBin	FtForm	Rhythm	NonInit
326	. (x)(. . x) that reden and syng<en>					
124	(x) (. . x) cowthe comend<e>					*
114	(. . x) . (x) wyth a bone cher<e>					*
96	. (x) . (. . x) in forthering his spech<e>				*	
44	. (. . x) . (x) and hym to greme cach<en>				*	
41	(. . x) (x) in a carp on<ez>				*	*
41	(x) . (. . x) helded to the tabl<e>				*	*
36	. (. . x) (x) that ho by right ask<ez>				* *	
10	. (x) (. x) that fest to hav<e>			*		
10	. (x) . (x x) his worthy God knaw<e>			*	*	
8	(. . x)(. . x) were closed to byd<e>	<C>	*	*		*
7	(x) (. x) stynt ne my3t			*		*
6	(x x) (x) mad god cher<e>			*	* *	*
5	. (x x). (x) that feght loved best			*	*	
5	. (x) (. . . . x) and harde theroute schowv<ed>	*		*	*	
3	. (x x) (x) to raw sylk lyk<e>			*	* *	

3	. (x)(. . x) (. x) and letegh my gestes on<e>		*	*		
3	. (x) (. x)(. x) the falce fende wroght		*	*		
3	. (x)(. . x) (x) on folde no flesch styr<yed>		*	*	*	
3	(x) (. x) (. x) bothe two his hand<ez>		*	* *		*
3	(x) (. . . . x) nymmez efte the dov<e>	*		*	*	*
2	(x) (x)(. . x) God kepez non oth<er>		*	*	*	*
2	(. . . . x) . (x) he schulde be halden utt<er>	*		*	*	*
2	(. . . . x) (x) that ever I mon mad<e>	*		*	*	*
1	(. x) (x) and ma kak<ez>			*	*	*
1	(x) . (x x) swete men tweyn<e>			*	*	*
1	(. . x) . (. . x) were founde in yonde toun<e>	<C>	*	*	*	*

Following are all of the A types (n=80), given in descending order of frequency. Each of the top four types respects all of the top three constraints; none of the other types do. Note that the accuracy of the predictions falls off as the commonness of a half-line type drops below 25 or so.

tokens	80 A types	WDBIN	PHBIN	FTFORM	RHYTHM	NONINIT
141	(. . x)(. . x) As be honest utwyth					*
128	. (. . x) (. . x) then ar thay synful hemself				*	
91	(. . x) . (. . x) And his tabarde totorne				*	*
45	. (. . x) . (. . x) And at thi banne we haf broght				* *	
41	(. x) . (. . x) the gome watz ungar<nyst>			*	*	*
29	. (. . x) (. x) that he ne wyst on word<e>			*	*	

25	(. x) (. . x) For thefte and for thre<pyng>			*		*
24	(.x) (.x) (..x)		*	* *		*
22	(.x) (....x)	*		*	*	*
20	(..x) (.x)			*		*
19	(....x) (..x)	*			*	*
18	(xx) (..x)			*	*	*
18	(.x) (.x) . (..x)		*	* *	*	*
17	(..x) (....x)	*			*	*
14	(x) (.x) (..x)	*	*	*		*
13	(.x) . (..x) (.x)		*	* *	*	*
13	(....x) (.x)	*		*	*	*
11	(x) . (..x)	*			*	*
11	(x) (.x) . (..x)	*	*	*	*	*
11	(x) . (..x) (.x)	*	*	*	*	*
10	(.x) (..x) (.x)		*	* *		*
10	(x) (....x)	* *			*	*
9	. (..x) (....x)	*			* *	
9	(....x) . (..x)	*			* *	*
9	(.x) . (....x)	*		*	*	*
7	. (xx) (..x)			*	*	
7	(xx) . (..x)			*	*	*
6	(.x) (..x) (..x)		*	*		*
6	(..x) (.x) (.x)		*	* *		*
6	(.x) (.x) (.x)		*	* * *		*
6	(x) . (....x)	* *			*	*
5	. (xx) . (..x)			*	* *	
5	(x) (..x)	*				*
5	(x) (..x) (..x)	*	*			*
5	(x) (.x) (.x)	*	*	* *		*
5	(.x) (....x) (.x)	*	*	* * * *	*	*
4	. (..x) . (xx)			*	* *	
4	. (..x) (.x) (.x)		*	* *	*	
4	(.x) . (..x) (x)	*	*	*	* *	*
4	(.x) (.x) (....x)	*	*	* *	*	*
3	(..x) . (xx)			*	*	*
3	(..x) (.x) (..x)		*	*		*
3	. (....x) (..x)	*			*	

3	(.x) (..x) (x)	*	*	*	*	*
3	(....x) (....x)	* *			* *	*
3	(.x) (......x)	* *		*	*	*
3	(x) . (..x) (x)	* *	*		* *	*
2	(. x)(. x)			* *		*
2	. (xx) (.x)			* *	*	
2	(..x) (..x) (.x)		*	*		*
2	(.x) (..x) . (xx)		*	* *	*	*
2	. (....x) . (..x)	*			* *	
2	. (..x) (..x) (x)	*	*		* *	
2	(x) (..x) (.x)	*	*	*		*
2	(..x) (x) (.x)	*	*	*	*	*
2	(x) (....x) (x)	* *	* *	* *	*	*
1	(xx) (.x)			* *	*	*
1	(.x) . (xx)			* *	*	*
1	. (xx) . (xx)			* *	* *	
1	(..x) . (..x) (..x)		*		*	*
1	. (..x) (..x) (.x)		*	*	*	
1	(.x) (..x) . (..x)		*	*	*	*
1	(.x) . (..x) (..x)		*	*	*	*
1	(..x) . (....x)	*			*	*
1	(..x) (x)	*			*	*
1	. (..x) . (....x)	*			* *	
1	. (..x) (x)	*			* *	
1	(....x) (x)	*			* *	*
1	(xx) (....x)	*		*	*	*
1	. (xx) (....x)	*		*	* *	
1	(....x) (xx)	*		*	* *	*
1	(x) (..x) . (..x)	*	*		*	*
1	(x) . (..x) (..x)	*	*		*	*
1	(.x) . (....x) (.x)	*	*	* *	*	*
1	(......x) (.x)	* *		*	* *	*
1	(x) (..x) . (....x)	* *	*	*	* *	*
1	(.x) (....x) (x)	* *	*	*	* *	*
1	(....x) (x) (.x)	* *	*	*	* *	*

1	(..x) (x) (..x) (x)	* *	* *		* *	*
1	(x) (......x)	* * *			*	*

CONSTRAINT-BASED METRICS
Chris Golston
Department of Linguistics
California State University, Fresno
Fresno CA 93740-0092

chrisg@csufresno.edu

Home: (209) 292-7049
Office: (209) 278-4895

to Tom Cable for generously sharing his data and expertise in this area. I'd also like to thank Cheryl Chan, Mike Hammond, Kristen Hanson, Bruce Hayes, Karijn Helsloot, Micheal Kenstowicz, Paul Kiparsky, Donka Minkova, Dick Oehrle, Tomas Riad, Donca Steriade, Bob Stockwell, Cheryl Zoll and three anonymous NLLT reviewers for considerable input. Stupid things, of course, are solely my responsibility, not theirs.