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METRICAL FORMS

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1. INTRODUCTION

The idea of temporal organization can be factored naturally into two components: (1) the metrical grid, a train of beats or pulses differentiated as to relative prominence, where greater prominence is represented as the locus of the fall of a higher-order beat, and (2) phrasing. An example of the metrical grid is the notion of $\frac{2}{4}$ time, an infinite sequence of beats of alternating strength and weakness. What is written as

$\frac{2}{4}$ ♩ ♩ | ♩ ♩ | ♩ ♩ | ...

is represented in grid form as

$$\begin{array}{ccccccc} x & & x & & x & & \\ x & x & x & x & x & x & \dots \end{array}$$

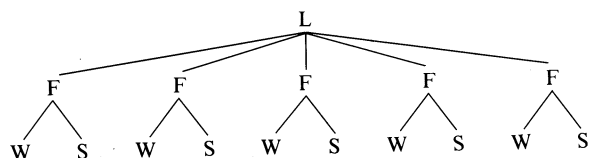
where each first-row entry stands for a basic beat and where the prominence of the measure-initial beat is indicated by the entries of the second row, superordinate beats that recur at half the basic rate. A variety of phrasings can be imposed on any such grid: among the simplest are

♩ ♩ | ♩ ♩ | ♩ ♩ | ... and ♩ ♩ ♩ ♩ | ♩ ♩ ♩ ♩ | ...

Such groupings of differentially prominent elements can be represented with relationally labeled tree structures: for the first, $\begin{array}{c} \diagup \quad \diagdown \\ S \quad W \end{array} \begin{array}{c} \diagup \quad \diagdown \\ S \quad W \end{array} \begin{array}{c} \diagup \quad \diagdown \\ S \quad W \end{array}$; for the second, $\begin{array}{c} \diagup \quad \diagdown \\ W \quad S \end{array} \begin{array}{c} \diagup \quad \diagdown \\ W \quad S \end{array} \begin{array}{c} \diagup \quad \diagdown \\ W \quad S \end{array}$. The label "W" means that the unit it dominates is weaker than its sister constituent; the label "S" means stronger (these notions and notations are taken from Liberman 1975; see also Lerdahl and Jackendoff 1983; Liberman and Prince 1977; Prince 1983; Cooper and Meyer 1960.) Clearly, any constituent structure imposed on a grid will (largely) determine a W/S-labeled tree; conversely, given suitable interpretive principles, a W/S-tree determines (or strongly limits) the grid it can be associated with.

Traditionally, much poetic meter has been viewed as a phenomenon of hierarchical constituent structure. The line (L) breaks down into a sequence of feet (F), the foot into a sequence of syllables or metrical positions, which are restricted in a way that correlates with the perceptual prominence of some linguistic entity (e.g., stress, quantity). Of iambic pentameter, we would say, using the notation of phrase structure rules, $L \rightarrow F^5$, $F \rightarrow W S$. The rules define a structure such as that in (1).

(1)



Some recent theorists have departed from this view of metrical organization. Halle and Keyser, as well as those who follow their lead, such as Magnuson and Ryder and Kiparsky (1975), espouse what might be called a SERIAL THEORY; they see a meter as a simple sequence of positions, some of which are designated strong, others weak. The iambic pentameter is specified by a rule such as (2).

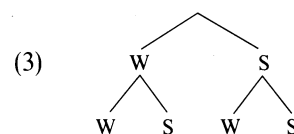
(2) $L \rightarrow W S W S W S W S W S$

Although the serial theory is appealing in its conceptual bareness, it cannot be right. Rules such as (2) portray a meter as a random sequence of weak and strong positions; but if the metrist has the ample combinatorial freedom of simply stringing together units drawn from the repertory {S,W}, it becomes a fantastic accident that a simple repetitive pattern emerges. If the strong-weak relation is defined within the foot, then lines composed of iterated feet can only display a limited number of highly periodic structures. Serial theorists have occasionally made use of the freedom available to them. Halle and Keyser (1977) analyze the Serbo-Croatian epic line as $S W S S W S W S$, which does not admit of a breakdown into recurrent feet. Their facts, however, show that the line is actually trochaic pentameter— $(S W)^5$ —as Jakobson (1966)

originally implied, with an obligatory caesura after the second foot. The serial theory, then, is at least incomplete; it needs to adjoin a set of constraints that enable it to match the foot theory's predictions about periodicity.

The phenomenon of dipodic meter, in which the recurrent unit consists of two feet rather than two positions, shows that no infusion of new hypotheses is going to save the serial theory. Familiar from ballads, dipodic meters do not play much of a role in the prosody of sophisticated verse in English; but they are central to the metrical systems of Classical Greek and Arabic, as we see below. In addition to distinguishing alternate syllables as strong and weak, such meters treat every other strong position as especially strong, and—perhaps as a consequence—every other weak position as especially weak. Increasing the serial vocabulary to include a third element—say Σ , for extra strong—only aggravates the distributional problems of the theory; clearly, the insight is that a second level of alternation has been imposed on the first, exactly the kind of situation that motivates hierarchical representation for rhythmic interactions in both language and music (notice that any tightening of the serial theory must be implicitly hierarchical; for example, Σ must be characterized as a variety of S). Any further differentiation among positions, such as has been posited by Kiparsky (1977), Chen (1979), Piera (1980), and others following them, can only add to the distress of serialism.

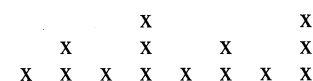
The approach advocated here represents metrical distinctions in terms of a single strength-weakness relation, uniform in meaning for all levels of the hierarchy of constituents. An iambic dipody or metron, for example, has the kind of relational structure illustrated in (3).



The second-level labeling [W S] in (3) could also be [S W], making the first foot stronger than the second. Choice between the two possibilities is an empirical matter which is addressed below; I in fact hypothesize that structure drawn in (3) is the one that is found.

It is worth noting that the metrical grid—a layered hierarchy of intersecting periodicities—also expresses the relevant notion of rhythmic differentiation in an appropriately uniform way. The iambic metron requires, as in (3), two levels structured identically with respect to the row immediately beneath (two successive metra are shown to clarify the row relationships; any relation between the metra would require a further level, left unspecified here):

(4)



The grid imposes no constituency; the regular recurrence of each of the varieties of strength and weakness is ensured by the periodicity of each level, which is measured against the level below it. Setting the ratio of recurrence at 1:2, as in (4), gives a strictly binary alternation, which is the maximal density of packing that the grid naturally tolerates. Other ratios are possible, even plausible; 1:3, for example, gives the sparsest packing that is not further susceptible to the introduction of separated beats. Mixtures too are attested; *dolniki*, for example, freely allows 1:2 or 1:3 at any given point. Observe that the notion of recurrence used here is an abstract one, defined in terms of the formal construct "grid" and not tied to any particular strategy of realization (e.g., isochrony). (Alignment with a grid or relational tree is not, then, an instance of "musical scansion," with its presupposition of metronomic rigidity as some sort of informing ideal.)

Given that both grid and tree characterize and measure a hierarchy of relations, the question arises as to which is the appropriate formalism for verse patterns; or perhaps—more subtly—what role each plays in the theory of poetic meter. The grid provides a perspicuous representation of purely "metric" properties—formal distance between beats at various levels, between positions of various strengths; the tree asserts an abstract, iterable phrasing, with relations of strength circumscribed by constituency. In the meters we examine in the following section, a verse typically divides into an integral number of repeated sequences; the theory of trees characterizes this straightforwardly as an *n*-fold iteration of foot or dipody. Merely giving a metric strictu sensu for such verses—the distance between strong positions, the number of strong positions—is insufficient, for it does not entail that a metrical length consists of an integral number of cycles; it allows, for example,

$$\begin{array}{ccccc} & x & & x & \\ x & x & x & x & x, \end{array}$$

which is not properly segmentable, as a possible meter. In Section 2, then, we set out a theory of metrical constituents and explore its consequences for the analysis of several systems of versification. In later sections we return to the concept of the metrical grid, finding that its formal properties support a typology of meters, distinguishing among them in terms of the extent to which they use its potential for vertical and horizontal development.¹

¹ Are there verse patterns metered only by the grid? Meters that count only number of positions can be seen as degenerate varieties of either system. Germanic strong-stress meter may be an authentic example that essentially counts only strong (i.e., second level) grid positions and presupposes no subtler constituency than the obviously motivated half-line.

The grid theory can be descriptively improved if we adjoin to it a vocabulary sufficient to characterize rising and falling rhythms. Suppose, adapting Hayes (1983), that we define a rising

Footnote (Continued)

peak as a grid position immediately preceded by a weaker position; iambic pentameter, then, is said to (1) be binary (interpeak distance = 1) and (2) to have five rising peaks in a line's pattern. The foot disappears as an actual structural unit of the verse, its content reappearing as a kind of Structural Description in the definition of "rising" (and "falling"). This kind of move attempts to undermine the distributional argument given above for foot, and so on; its ultimate success can only be judged when it is fully articulated, a problem best left to the reader.

Arguments other than pattern distribution deserve scrutiny, whatever the outcome of grid improvement. Many authors have noted that trochaic meter in English seems to call forth trochaic phrasings to support it, for example, which is readily comprehensible if meter requires conformity not only to a certain pattern of prominences but also to an implicit phrasing given by the foot. One of the most interesting arguments of this type is central to Kiparsky (1977). He notes the extreme unmetricality of sequences like *absurd pomp* (in the given, modern pronunciation, of course) when aligned S W S in iambic verse, a fact also noted by various other authors (Kökeritz, Nabokov, Magnuson, Ryder); his explanation is that there is a double misalignment that makes the sequence especially bad—not only in prominence, but in phrasing as well, the iambic word [σ σ] crossing the foot boundary S] [W. This form of explanation implies that positioning a trochaic word against [W S] should be less bad; and sure enough, although such alignment is never freely allowed by any competent versifier, we do find it permitted under some circumstances in poets such as Milton and Hopkins, who absolutely disallow the double mismatch (and the claim would be that no good poet systematically uses the opposite rule). A further prediction, it seems to me, is that trochaic verse ought to sometimes show the opposite license: *absurd pomp* in [S W] [S, *bottomless pit* never in W] [S W] [S; a remarkable fact if true, since the iambic–trochaic contrast here is only in grouping.

There are (at least) three other points of iambic–trochaic difference plausibly attributable to constituency in the meter: (1) Phrase-initial inversion. W is free in all serious iambic verse after a major phrase break; if this is a matter of metrical positions alone, the same should be true of trochaic verse, where the "inversion" would cross the foot boundary, [S | W] [S. As far as I know, this is not possible, suggesting that iambic freedom is due in part to the fortuitous preservation of grouping structure under prominent inversion in ... [W S]. (2) Location of extrametrical syllables. English iambic verse commonly allows an extrametrical weakly stressed syllable at S | if S itself contains a stress peak (as Hayes 1983 reminds us); yet it appears that trochaic verse allows no such license, displaying if anything the mirror image property (but line-internally?), once again suggesting that it is the coincidence of syntactic break and foot-boundary that frees up the meter. (3) Trochaic lines are notoriously subject to catalexis, dropping of the last W position. Perhaps this is the real analogue of extrametricality in trochaic meter, but iambic verse shows no tendency to drop or leave empty W | (this comparison rests on the not implausible expectation that iambic verse could generalize the phenomenon to line-internal phrase boundary just as it has extrametricality. Here too the licensing factor is the structural parallel between meter and syntax. Iambic verse allows the mirror-image process (acephaly) to a limited extent in the early stages of its development; it is an interesting question why headlessness never went anywhere while catalexis is always common. Note that point (3) would be more compelling if the process at hand were already in trochaic verse generalized to line-internal position; otherwise one can point simply to the coincidence of line- and phrase-boundary as the determinant.

Finding convincing empirical support that gives weight to these three contrasts is rendered, alas, less than straightforward by the status of trochaic verse in the English tradition (language?). The fact that the standard length is the tetrameter sets narrow limits on possible fluidity of expression; the proper comparison is with iambic tetrameter, itself notably less various than the supple pentameter. But help may yet be forthcoming, perhaps from other traditions.

2. A HIERARCHICAL THEORY OF METER

2.1. Elements

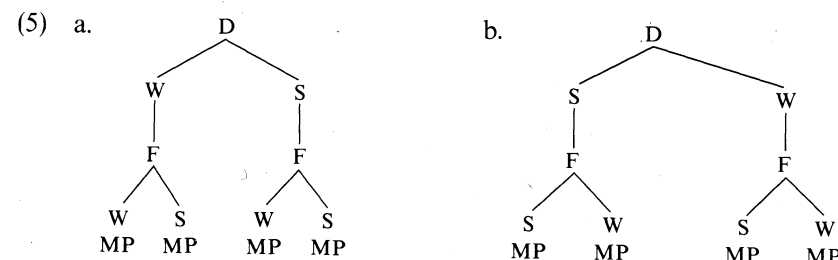
The basic notion of metrical theory since Halle and Keyser (1966) has been the METRICAL POSITION. There is a tendency in traditional metrics to take the syllable itself as the basic unit out of which feet are composed, leading to loss of generalization along two dimensions. First, variants within a single meter must be described as substitutions of different metrical feet for the basic one, for example, trochee for iamb. Not only does this lead—as Halle and Keyser note—to mere cataloging of instances, reducing one meter to an arbitrary family of meters, but it is also empirically inadequate. Consider the notion that iambic verse allows “trochaic substitution” line-initially. In the German and Russian verse traditions, such inversion is allowed only when the line’s first position is occupied by a monosyllable (see Bjorklund 1978 for some recent discussion); the first foot, then, is not simply a trochee—more must be said. Similarly, in English, aligning *the keen teeth* with S W S cannot be just a matter of replacing an iamb [*ō ō*] with a spondee [*ō ō*], because a stresswise identical sequence such as *unique teeth* is disallowed. Such cases demonstrate that the iambic character of the verse—the fact that the crucial position really is W—persists after substitution is supposed to have erased it. Halle and Keyser replace the syllable, in this use, with the appropriately abstract “metrical position,” which is subject to realization by rule in syllabic materials. Under this organization of metrical grammar, W correctly remains W; and significant, accurate generalization across “substitution” types has been achieved by the work of numerous scholars whose occasional contentiousness should not disguise conceptual affinity.

The second weakness of the concrete descriptive style is that it blocks cross-linguistic comparison, if taken with ungenerous literalness. One system depends on stress, a second on quantity, a third on some mixture of the two, a fourth on pitch; the concrete units are incommensurable. The common use of such terms as “iamb,” “trochee,” and “dactyl” to describe quite different objects does imply an appreciation of fundamental similarities; but a fully explicit theory of universal metrics requires the abstract, language-independent notions of metrical position and relative strength, pretty much as Halle and Keyser conceived them.

What then is the universal vocabulary from which complex metrical patterns can be constructed? Beyond the metrical position (MP) and the line, we recognize two categories of superordinate structure: the FOOT (F) and the METRON or dipody (D). (Here we hark back to the ur-tradition of Western metrical description, that of the Alexandrians, though the term “metron” is being used in a slightly distorted way.) The essential metrical pattern of a line is

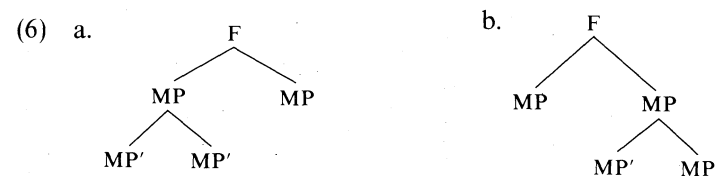
specified as the iteration of a given type of foot or metron. We also assume, as is usual since Liberman (1975), that the constituency of metrical structure is maximally articulated—that branching is binary. A foot, then, consists of just two metrical positions; a metron, of two feet. The hypothesis of binarity entails higher-order structure as well, but we will not find cases where it has direct effects on metrical realization.

If feet are binary, then there can be only two basic rhythmic shapes: [_F W S] and [_F S W]. Similarly, there are only two types of D units: [_D W S] and [_D S W]. On the basis of evidence presented below, we can see that the W,S-labeling of D and F is not independent. We can also hypothesize cross-level uniformity, a single rule of this form: in the configuration [A,B], A = S (or conversely B = S). On this view, there can be only two types of metra (5):



(In what follows, we often leave out the labels F, D, and MP when the status of the nodes is clear.)

It is well known that there are common meters that canonically demand three syllables per foot, rather than the two suggested by our notion of foot; for example, dactylic (— ~ ~) and anapestic (~ ~ —). How are these to be accommodated? The natural proposal is to allow one MP of a binary foot to split into two further positions, giving rise to structures like those in (6).



Such representations differ from the more obvious ternary structures [MP MP MP] in two important respects: (1) they claim greater articulation of constituency, and (2) they necessitate a metrical strength distinction between the two subpositions. When either of these features comes into play as a determinant of metrical properties, we look for evidence favoring the structures of (6) over the ternary possibility, and, more generally, favoring a thoroughgoing binarist perspective over its conceptual alternatives.

What metrical strength relations ought to obtain between the constituents of a subdivided MP? If the MP is analogous to the beat of musical rhythm, then dividing it should produce a trochaic [S W] sequence. When quarter notes, for example, are split into eighth notes, the natural accent falls on the first of each eighth-note pair:



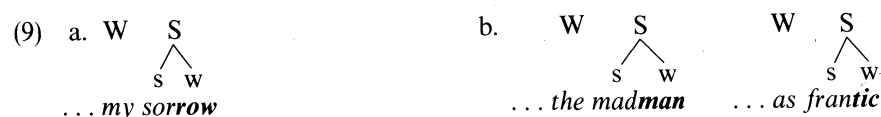
Placing the accent elsewhere results in syncopation. Notice too that any further subdivision always places the natural (or unmarked) accent on the first unit of the subdividing pair. With the MP as the fundamental rhythmic unit, beat or tactus, the MP-dividing feet of (6) by the principle of trochaic subdivision are limited to the structures in (7).



Here it may be useful to bring forth some evidence that clearly supports the proposed interpretation of the MP as a beatlike unit. In Kiparsky (1977), several rules of English meter which have the effect of letting extra syllables into the pentameter line are discussed. Chief among these is his rule (115), which allows for an extrametrical syllable to appear after an S position that precedes a major syntactic break (p. 231). Some examples, in increasing order of daring, are given in (8).

- (8) a. $\text{W S W S W S W S W S}$ (W.T. 2.3.24)
 Laugh at me, make their pasttime at my sorrow
- b. WS WS WSWS WS (MND 5.1.10)
 That is the madman. The lover, all as frantic.
- c. W S W SWS W S W S
 You needn't be afraid he'll leave you this time.
 (Frost, "Death of the Hired Man")

For Kiparsky, the emphasized syllables are truly extrametrical, in the sense that they are not associated with any metrical position. Their necessary linguistic property—lack of relative prominence—must be stipulated. In the present context, it is plausible to regard extrametricality as a phenomenon of beatsplitting; an extrametrical syllable thus belongs to an S-position, rather than merely accompanying it. From this, it follows that the extrametrical syllable must (minimally) be metrically weak. Scansions like those in (9) result:

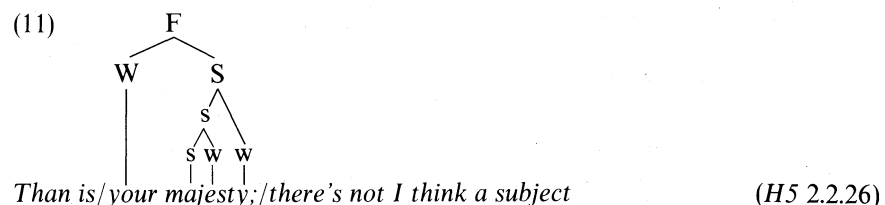


A second rule that allows overstuffing of S-positions is RESOLUTION: the bisyllabic sequence C₀ V C V can count as functionally monosyllabic:

- (10) a. $\text{W S W S W S W S W S}$ (LLL 5.2.64)
 And spends his prodigal wits in bootless rhyme
- b. WS WS W S W S S (Cym. 3.3.69)
 Followed my banishment, and this twenty years

Here again the beat-splitting theory correctly predicts the [S W] prominence relation that holds between the two resolving syllables (in fact, Kiparsky does not place a stress constraint on resolution, but all his examples conform to the [+stress] [−stress] requirement). The notion of MP as beat thus entails a necessary condition for mapping more than one syllable into a metrical position. There is, of course, still more to be said in each case about what constitutes a sufficient condition.

Both the rule allowing an extrametrical syllable and the rule of resolution apply only to S.² Consequently there can be a certain limited interaction between the two rules, if we let submetrical S divide by resolution just as metrical S does. Kiparsky cites a number of cases, of which (11) is typical:



These observations pertain rather to matters of realization than to the structure of patterns per se and may therefore be somewhat contaminated with facts that are really linguistic—how the speech beat (rather than the metrical position) divides. Let us then admit into our preliminary discussion an interesting property of ternary meters that is displayed by the disparate and unrelated systems of English and Russian. These share with German a general constraint on text-meter alignment that can be summarized: no "lexical s" (roughly, stressed syllable adjacent to an unstressed syllable within the word) may be mapped into a metrical W-position (in English, this constraint does not apply—in iambic verse—when s and S begin a major phonological phrase). The effect of the constraint is to ensure that the stress contour of polysyllabic

²This interpretation of extrametricality does not generalize to trochaic verse, which commonly allows a weak upbeat at the beginning of the line. Further study is needed to determine if the trochaic phenomenon is truly distinct, as we predict. Does trochaic extrametricality generalize to line-medial position? and so on.

words closely respects the metrical strength–weakness contrast (for English, see Kiparsky; for German and Russian, see Bjorklund, Halle, Zhirmunskij). Example (12) gives lines constructed to show the constraint by breaching it:

- W S
- (12) a. **Pluck re/fined sug/ar from/ the ti/ger's teeth*
- W S
- b. **Burning/in the/ bottom/less dank/ spittoon*

This descriptive generalization, as long as it is to be formalized as a constraint or constraints on occupancy of metrical W, gives us a tool to probe the ternary meters. If the anapest, for example, is no more than [W W S], then “lexical s” ought to be banned everywhere outside the culminative position of the foot; but if it is derived by dividing the first metrical position of a basic foot [W S], a subsidiary S is unavoidable, giving [[S W] S], which ought to supply an additional occasion for “lexical s.” Kiparsky (1975) notes exactly this phenomenon for English, and Kiparsky (1977) proposes a binary-branching foot structure as the appropriate description. The following are typical examples:

- (13) a. *O say/ can you see/ by the dawn's/ **early** light*
(F.S. Key, “Star-Spangled Banner”)
- b. *And against/ him the cat/le stood black/ **every** one*
(Browning, “How They . . .”)
- c. *And the thick/ **heavy** spume-/ flakes which aye/ and anon*
- d. *When the blue/ wave rolls night/ly on deep /**Galilee***
(Byron, “Destruction of S.”)
- e. *And cold/ as the spray/ of the rock-/**beating** surf*

The position-splitting theory offers a parallel analysis of the dactyl as [S [S W]]. English is particularly ill-suited, it seems, to sustain dactylic verse, but the following example, from George Canning (kindly provided by S. J. Keyser), suggests that the predicted option is in fact available:

- (14) *Nice **pretty**/ words by Tom/ Paine the phil/anthropist*

Russian verse strictly prohibits “lexical s” in W, even at the beginning of the iambic line, where inversion can only be accomplished by a stressed monosyllable; but, as noted by Zhirmunskij and discussed by Halle (1968), anapestic verse does permit “lexical s” in foot-initial position—a puzzle to them, for us an expectation:

- (15) a. *okruzús'/ jà togdá/ **gór'koj** slá/dost' ju róz*
b. *snóva ptí/cy letját/ izdaléka* (Fet)

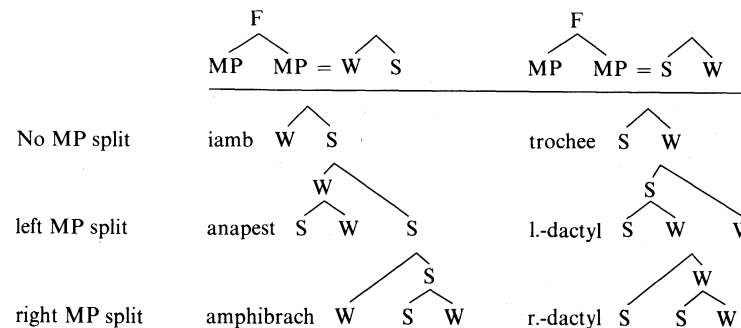
We also predict that the second weak position in dactyl and anapest should be irremediably W and unavailable for “lexical s”: the absence of sequences such as *by the dawn's/ maroon light* and *Nice effete/words . . .* is confirmatory.

We have seen that the hypothesis equating MP with the musical beat, or “tactus,” to use a term revived in Lerdahl and Jackendoff (1983), receives a promising variety of initial support. Before proceeding to the richer systems that more profoundly test our approach, let us lay out the theory of metrical organization we have introduced. It rests on three essential, independent theses:

- (16) a. MAXIMAL ARTICULATION. All metrical structure is binary.
b. UNIFORMITY. Foot (F = MP MP) and Metron (D = F F) are uniformly labeled for the S/W relation; either [W S] at both levels, or [S W].
c. TACTUS LEVEL. The MP has the rhythmic status of the musical beat.

If just one MP per foot, at most, is subdivided, the theory projects the following limited array of foot types:

(17) Permissible Feet



A binary-branching theory without the tactus-level hypothesis—one that allowed free assignment of W/S within Foot—would generate four additional ternary structures: two more anapests ([[W S] S] and [W [W S]]), one more dactyl ([S [W S]]), and an extra amphibrach ([[W S] W]). The present theory resolves the ambiguity completely in the case of anapest and amphibrach and reduces it for the dactyl to a two-way choice. The theory is strong enough, then, to dictate analyses in this area; and when those analyses are shown to be correct, we can claim to have truly explained aspects of metrical patterning in the system at hand.

The categorial vocabulary of the theory has the following structure: the true primitive is metrical position (MP); the other elements are defined in terms

of it. Foot (F) = MP MP. Metron (D) = F F. We also recognize as part of the metrical pattern the category METRICAL SUBPOSITION (mp), which is obtained by dividing MP (binarily, of course). A(n alternating) meter (that is, a Line in an alternating meter) is an n -fold iteration of F or D, along with one of the two S/W relations, and a specification of which if any MPs are divided (only one per foot, please). The reason for the prominence of these categories is that they—by hypothesis—give us (exactly) the vocabulary we need to specify the environment of the essential realizational constraints. Higher-order structure ought to exist between Line and D or F, by the principle of Maximal Articulation (binarity); our hypothesis is that its effects are felt more subtly and elsewhere than in the arena of gross metricality.

Vocat aestus in umbram. A theory of realization is called for, too, but this is left implicit.

Let us turn to the empirical richnesses of Greek and Arabic versification.

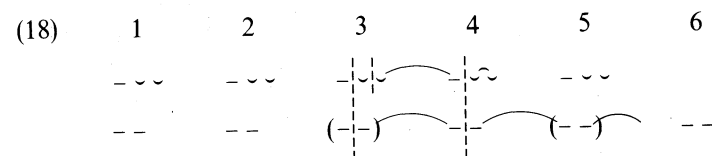
3. ASPECTS OF CLASSICAL GREEK METER

3.1. The Argument

In developing a single law for placement of necessary caesura in the salient spoken meters of Ancient Greek verse, we illustrate and gain evidence for the theory just outlined. (Dactylic hexameter, iambic trimeter, trochaic tetrameter, iambic tetrameter). The close relation with Alexandrian metrical analysis should be clear.

3.2. The Dactylic Hexameter

Dactylic hexameter is the meter of Homer and Hesiod, used for the epic, and used by the sibyl for mystic pronouncements and ethical maxims. From the remarks of Raven (1962) and West (1982), we can deduce the following schematic representation of the line's possible realizations (this diagram is a slightly annotated version of Raven's, p. 44):



A few interpretive remarks. The six numbers count off the constituent feet; to arrive at a metrical line, freely select an option from each column. Parentheses enclose options that are infrequently taken; for example, the lower, spondaic realization of 5 appears in only about 2% of Homer's lines (5% if vowel contraction, a historically later change, is not undone; see West 1982). The broken vertical lines mark the possible locations of the caesura, "caesura" meaning word-juncture, with "word" meaning lexical item plus surrounding pro- and enclitics. Every line must have a caesura. The ligatures indicate positions where caesura may NOT lie or is more-or-less highly disfavored; these are often called "bridges" (Allen 1973; Devine and Stephens 1984).

The macron (¯) and breve (˘) refer to the two-way classification of syllables that Greek meter, and indeed Arabic meter, is based on. The breve always denotes a light syllable $C_0 V$ (V short, C_0 = any string of consonants). The macron denotes a heavy syllable, one that contains a long vowel or diphthong or is closed by a consonant; if long vowels are simply diphthongs with identical elements (VV), as indeed the phonology of the language demands, then the appropriate formula for the heavy syllable is $[C_0 V X \dots]$, where $X = C$ or V . A useful way of talking about this quantity distinction has it that a light syllable contains one mora, a heavy syllable two moras; some recent linguistic work equates the first mora with the first (or only) vowel—recall that long vowels are VV—and the second mora with everything (anything) that follows it in the syllable. The macron has a second interpretation: at the end of a line of stichic verse, the kind we are concerned with, any syllable at all is deemed heavy for purposes of meter (here I follow Halle's interpretation of the so-called final anceps phenomenon). It is interesting to note that the genetically unrelated system of Arabic has the same convention. The chief consequence is that no stichic meter can require a light syllable in line-final position; in the case at hand, the dactyl must always contract to spondee in the sixth foot because there is simply no such thing as a line-final light syllable.³

³ A couple of facts about Greek syllable structure ought to be noted: (1) a word-final consonant is syllabified with a following word-initial V or hV , so we find, for example, *polemon te* ([mon]) but *meeni* [n a]eide and *polutropo* [n hos] mala; (2) sequences of consonant + sonorant may either be divided between syllables (typically so in Homer, as in *po* [lut] [ro]pon), or count as syllable initial, giving either, for example, [ak] [mee] or [a] [kmee], dependent upon dialect, period, morphology, genre, and, perhaps, convenience. See Raven (1962:23) for a concise discussion; more detail may be found in West (1982) and Allen (1973); for a thorough account, see Steriade (1982).

The syllabic patterns listed in the hexameter schema (18) are amenable a priori to three structural interpretations:

- (19) a. ternary
- ```

 F
 /|\
 S W W

```
- b. left-branching
- ```

      F
     / \
    S   W
   / \
  s   w
  
```
- c. right-branching
- ```

 F
 / \
 S W
 / \
 s w

```

The spondaic option may be arrived at variously: by erasing one W from the ternary pattern (a), by contracting a divided MP in (b,c), or by mapping two metrical nodes onto a single syllable. Evaluating these approaches—looking at the rules each one requires—gives a basic clue that (c), the right-branching dactyl [S [s w]], is correct.

What rules realize the right-branching dactyl? We need only say that (1) |MP| = two moras, that is, the content of any MP is one heavy syllable or two lights, and that (2) |S| =  $\sigma$ , the content of the strong MP is a single syllable.

The left-branching dactyl [[s w] W] and the three-branched [S W W] essentially fall together in realizational possibilities. Achieving the spondee by eliminating a W (position or subposition) is unattractive; it forces us to place environmental conditions on the realization of W—|W| = one mora if there is another W in the foot, otherwise |W| = two moras in one syllable—a statement that completely misses the equivalence of the two modes of realization. Letting two nodes go to one syllable allows a more straightforward statement: |S| = a two-mora syllable, |W| = one mora (here S and W refer to both positions and subpositions).

Although this gives a simple enough strategy of realizing positions and subpositions, the resulting constituency claims (20) are strikingly odd:

- (20) a. ternary
- ```

      F
     /|\
    S W W
   / \ / \
  σ  σ σ  σ
  
```
- b. left-dactyl
- ```

 F
 / \
 S W
 / \ / \
 s σ w σ

```

In neither case does the linguistic unit syllable correspond to a metrical constituent. Worse perhaps is the left-dactyl, where the internal grouping of the foot's elements baldly contradicts the linguistic organization. Notice that

the right-dactyl's structure comports exactly with the syllabic breakdown of the text. These constituency facts I take to be highly suggestive. They are of course compelling only in the presence of a principle disallowing the alignment of a single syllable with a metrical nonconstituent string; plausible enough, particularly within a binarist theory, it ought to be taken as an initial hypothesis.

Clearer evidence emerges as we turn to examine the location of (metrically required) caesura in the hexameter line. A glance at (18) shows that caesura must occur in the third or fourth foot and must not occur between them. There is an interesting additional wrinkle: although caesura falls anywhere in Foot-3, it may not lie in Foot-4 except after the first macron (—|~). How this relates to the structure of left- and right-branching dactyls is shown in (21):

- (21) a. left-dactyl
- Feet:
- ```

      F-3      F-4
     /|\      /|\
    S W | W   S W | W
   / \ |     / \ |
  s  w |     s  w |
  
```
- MP:
- ```

 F-3 F-4
 /|\ /|\
 S W | W S W | W
 / \ | / \ |
 s w | s w |

```
- b. right-dactyl
- Feet:
- ```

      F-3      F-4
     / \      / \
    S   W   S   W
   / \ / \ / \
  s  σ w  σ s  σ w  σ
  
```
- MP:
- ```

 F-3 F-4
 / \ / \
 S W S W
 / \ / \ / \
 s σ w σ s σ w σ

```
- ↑  
line  
center

Figure (21b) suggests the following formulation: caesura may not fall at the center of the line (i.e., between Foot-3 and Foot-4) and must fall NO MORE THAN ONE METRICAL POSITION FROM THE CENTER. In (21b) the outer caesura slots are exactly one MP from the center; the inner slot is less than one MP away. The middle of the W-MP in Foot-4 is not fit for caesura because it is farther than one MP from the center.

Under the left-dactyl—or ternary brancher [<sub>F</sub> S W W]—the statement of caesural locus must contain a disjunction of terms: caesura falls no more than two Ws (positions or subpositions) or one S from the line center. The metrical equivalence that lies behind the placement of caesura cannot be directly expressed.

An alternative formulation of the law of caesura might be contemplated which measures the critical distance from the center not metrically, in MPs, but linguistically, in moras: caesura occurs within two moras of the line's center. Observationally equivalent, this formulation must nonetheless be faulted on descriptive grounds. Why two moras? Why not one or three? Why not one syllable? The answer must surely be that moras, more than syllables, play an especially salient role in the meter; and that the number two, involved





natural interpretation in hierarchical terms as an extension of the S/W relation from the MP to the Foot level; assuming the principle of Uniform Labeling, as in line schema (23), we find that the strong feet are especially constrained, requiring maximal polarization of S and W positions; the weak feet are freer; and the initial weak position—perhaps the weakest of all—is quite unrestricted (see, e.g., English iambic verse for trochaic inversion of first foot, actually freeing of initial W; also, classical Chinese Lü Shih, Chen 1979; and many others—see Hayes 1983 for a catalogue).

The realization of the trimeter can be factored into a few rules. A basic principle is (24):

- (24) A terminal node of the metrical pattern preferably corresponds to a single syllable.

This principle is most likely part of universal metrics. General to all Greek meters—for example, both hexameter and iambic trimeter—are the following:

- (25) a.  $|MP| \leq 2 \mu$  (moras)  
b.  $|MP/S| = 2 \mu$

Rule (25a) embodies the claim that no metrical position in Greek verse can correspond to more than one heavy syllable or two light syllables; rule (25b) fixes the realization for the strong position at the maximum value. The tragic trimeter requires two additional rules (26) beyond the general background assumptions of (24) and (25):

- (26) Tragic Trimeter  
a.  $|MP/W| = \sigma$ , except in absolute line-initial position, where it is free  
b.  $|MP/W| = \mu$  in F/S

According to rule (26a), W positions must be unitary, must have the simplest form of meter-text correspondence, as determined by (24). According to rule (26b), in strong feet, W-positions have their minimal realization. In weak (odd) feet, then, W is free up to the general limit of two moras, though constrained by (26a) to be monosyllabic except line-initially. Realization of S-position follows from the general conditions, except perhaps that the lack of bisyllabic S in D/III ought to be specifically noted (though it does fall under the oft-noted tendency of meter to stiffen toward line's end).

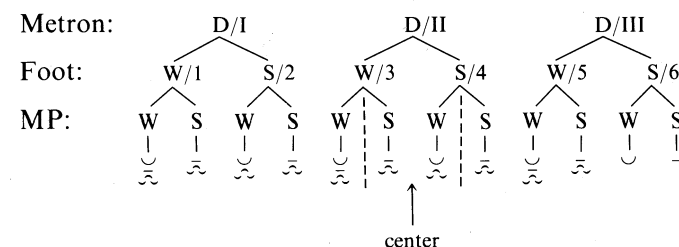
Note that we are assigning to double occupancy of MP in the trimeter a status notably distinct from that of the apparently similar phenomenon of MP-splitting in the hexameter. In this we formalize the feelings of virtually all modern describers (e.g., Raven, Allen, West), who would point to (at least) the following three arguments. (1) Double-light syllable realization is limited to

S-position in the iamb (or trochee, for that matter), and to W-position in the dactyl. (2) It is “fairly rare” in the tragic meters, “except in the later plays of Euripides” (Raven 1962:28). In dactylic verse it is the true dactyl that is the comparatively unmarked choice, though of course the spondee is common and very much intrinsic to the texture of the meter (notice that this property follows, in gross, from the principle of preferred 1:1 matching (24) and the representations of each abstract pattern). (3) Two syllables occupying a single undivided MP, as in iambic verse, cannot belong to different (lexical) words; the natural phrasing of the language, in its tightest form, must bind them together, reinforcing the perceptual unity of the MP. No such condition restricts the alignment of the metrically divided W-position in the dactyl (see example 22), and indeed a favored caesura point is right in the middle of the W-MP in the third foot. Our analysis, in sum, is empirically justified, as is the usual restriction of the term “resolution” to mean “variant realization (of S).”

Like the hexameter, the tragic line requires a caesura which may fall either in Foot-3 or Foot-4. A glance at schema (23) confirms that this accords exactly with the law developed above for the hexameter: not at the center of the line, but within one MP of it. (Caesura cannot divide the S-position immediately preceding the center because of the general restriction on the lexical integrity of resolutions.) What we have, then, is the makings of a general law that embraces the chief meters of spoken verse.

The comic trimeter has a slightly wider range of syllabic options, but the caesura is found just where we expect it:

- (24) Iambic Trimeter: Comedy



Realization is significantly liberalized, but in ways that respect the full hierarchy of foot and metron. (1) Resolution of S is allowed everywhere; tragedy bans it from last metron (note: The last S cannot be resolved because there are by definition no line-final light syllables). (2) Totally free realization of W is generalized from line-initial to metron-initial position (MP/W of F/W). (3) The most sensitive Ws (MP/W of F/S) are no longer limited to single mora (light syllable) realization; instead, they are only prohibited from containing a heavy syllable, the archetypical member of S (no sequences of

four light syllables; double occupancy of one position precludes it for both neighbors; this is true also in tragedy—F/1 only involved). These observations lead to two rules parallel to those for the tragic trimeter:

(25) Comic Trimeter

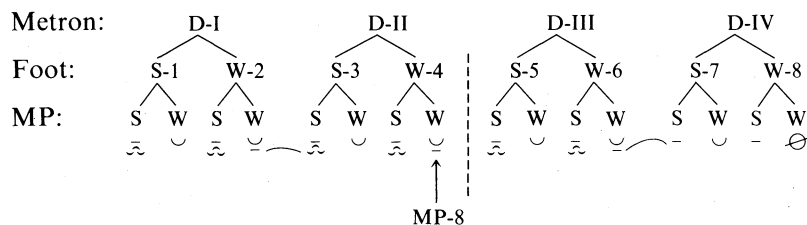
- a.  $|MP/W| \neq [\sigma \mu \mu]$  in F/S
- b.  $|MP/W| = \mu$  in last F

Resolution is traditionally conceived of as the replacement of a heavy syllable with two lights. Our overall rule system does not recognize this operation; bisyllabic realization is treated simply as one of the options, always available when not ruled out directly or by implication. The facts of the comic trimeter, its pattern of liberation, support our approach and reveal a weakness in the standard conception: the sensitive strong-foot Ws permit bisyllabic occupancy, can be “resolved,” yet they absolutely disallow the heavy syllable to which the light pair is supposed to be related. If metrical realization is restricted to rules of correspondence and does not have access to the heavy firepower of generative phonology (underlying forms, multistep derivations, etc.), then our generalized sense of “resolution” is empirically the correct one.

It is worth noting that comic versification is “loose” as well as liberalized: resolution is frequent and may even cross word boundaries under certain conditions (West 1982:89–90); the caesura is occasionally omitted. Despite these licenses, the basic doubly alternating pattern remains clear.

The three six-foot meters we have examined are remarkably well behaved with respect to the law of caesura; they even share a preference for placing the break in the third foot rather than the fourth. The eight-foot meters require further comment. The trochaic tetrameter—said to be the original meter of tragic dialogue (texts not preserved)—is found in early tragedy, late tragedy, and comedy. The scheme of the tetrameter line is presented in (26), and it contains a surprise:

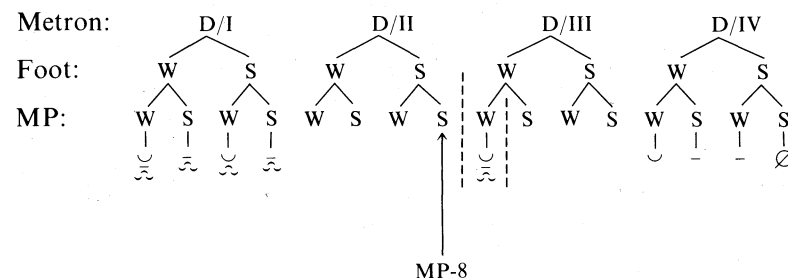
(26) Trochaic Tetrameter



Caesura sits in the middle of the line, splitting it into pairs of metra. But the line does not actually fall into the two equal halves so carefully avoided elsewhere, for there are only fifteen manifest positions in the tetrameter—the

last is always empty. The actual center of the line, counting by filled MPs, lies within MP-8 (arrow). Our rule, then, allows the 8/7 division that is found, but it fails to exclude the 7/8 division that is not found. Further illumination may be obtained by examining the other long line of the drama, the iambic tetrameter catalectic, “very common in Greek comedy” (Raven 1962:32), which has surprises of its own:

(27) Iambic Tetrameter Catalectic



(Realization of first three metra is identical; MP-9s contents are drawn in for clarity.) The iambic line shares with its trochaic counterpart both catalexis—final position empty—and caesural placement, here a preference between two choices, after D/II. The long meters, then, reject the early caesura that falls in the first half of the verse. The oddity of the iambic tetrameter is that it has an extra caesural point one position downstream, allowing a 9/6 line break. This is too far from the center, if it is reckoned by filled MPs to lie inside MP-8. Notice, however, that the late caesura is only one position away from the center as determined from hierarchical structure (feet, metra), suggesting the following reformulation of the general law:

(28) LAW OF CAESURA

- a. A caesura must occur within one MP of the hierarchical center of the line.
- b. The line may not be divided into two equal pieces, counting by filled MPs.

To this we must add a condition for the long meters:

(29) LONG METER LAW. There must be a caesura outside the first half of the line.

And finally a special tightening for the trochaic version of the long line:

(30) TROCHAIC TETRAMETER CLAUSE. Caesura must fall in the preferred position.

The preferred position is the earlier one, in all meters. Aeschylus and Sophocles use the later caesura, cutting the line 7/5, in just 20% of their iambic trimeters; Euripides, in only 14% (West 1982:82). The early caesura, after D/II, is used in approximately 75% of iambic tetrameters (West 1982:93). Grouping the two positions in F-3 of the hexameter together as “early” in contrast to the position in F-4, we find that the percentage of lines with only late caesura is remarkably slight: about 1.4% in the *Iliad*, 0.9% in the *Odyssey*, 2.2% in Hesiod (West 1982:36; presumably rather more have both early and late caesuras in the same line). Between the two early caesural points there is considerable fluctuation in favor over the centuries. Homer prefers the second over the first in about the ratio of 4:3 (West 1982:36), which looks like much of a muchness; the second is more often presupposed in formulaic phrases, suggesting a historical tendency in favor of the first, and indeed, by the fifth century, the first has (temporarily) won out. (Those whose craving for detail has not been slaked by this survey are referred to West 1982:153–177, for further listings; see also Lerdahl and Jackendoff 1983, for a general account of the role of preference in aesthetic and perceptual structuring.)

However the fine points of formulation are ultimately decided, the iambic and trochaic meters demonstrate unequivocally that the crucial notion of “center” cannot be determined from the linguistic representation alone, in terms of moras or syllables. The hexameter’s rigid correspondence  $|MP| = \mu \mu$  raises this possibility: every line is twenty-four moras long. The freedom of iambic and trochaic W-positions to range on occasion over the whole gamut of one- and two-mora sequences effectively rules out any reductively linguistic measurement of the line; access must be had to the abstract pattern. Only by reckoning in terms of MPs (and feet) can the law of caesura be given appropriately general statement.

The realization of the trochaic line provides striking evidence for the kind of hierarchical structure we are imposing on it. As with the iambic metron, there is differentiation not only between adjacent positions but also between the two Ws—one is strictly monomoraic, the other merely monosyllabic. The thesis of Uniformity, by which the trochaic metron is [S W] and the iambic [W S], makes an important prediction: whenever there is realization in terms of hierarchical S/W context, as there is here, then the serial order of strict W and free W should be opposite in the two meters. This is borne out: the first W of the trochaic metron is strict; the first W of the iambic metron is free. Since the rules for realizing MPs in iambic verse carry over exactly, given the kind of structure and labeling our theory imposes, the trochaic tetrameter has no rules of its own.

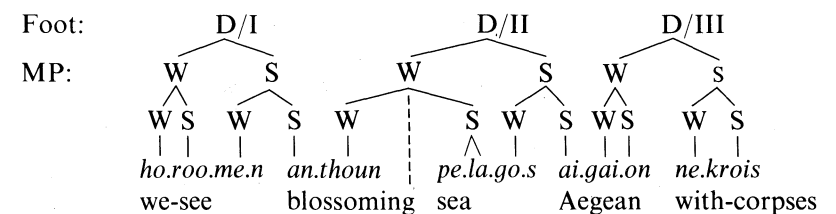
Notice that what the Greek facts REQUIRE is not precisely Uniformity but rather that iambic and trochaic metra be oppositely labeled. We could achieve this result by adopting instead of Uniformity a principle of (let us call it) Antithesis, by which iambic metra are [S W], trochaic [W S]; or indeed we

could admit both principles into the theory and allow any given system to choose just one of them. Under Antithesis, it is the weak feet that are sensitive; perhaps universal metrics has something to say about whether this is an expected outcome, thereby helping us to decide the general issue. It may be worth noting that the Alexandrians considered the first foot of the iambic metron to be its *thesis* (i.e., to be S), but the basis for this ascription remains to be determined, as does their evaluation of the trochaic metron. In sum, the Uniformity thesis is demonstrably a member of the right class of theories, which could use some narrowing. This issue arises again in the analysis of the Arabic system.

One way of voiding the crucial evidence would be to give the strict-W/free-W rules in terms of position instead of S/W structure. The free W is the one adjacent to the metron boundary; the strict W, internal to the metron. Although hardly implausible, this formulation should be faulted for introducing a new range of descriptive vocabulary, opening up options, loosening the theory. Much of the work done by the S/W distinction for MPs could be taken over in principle by this descriptive style; for example, the S-position in iambic verse is the MP that immediately precedes a foot boundary. This is of course the wrong way to delimit S, as it does not allow us to generalize across meters. Since reference to S/W in realization is independently necessary, and reference to foot structure alone independently unwanted, I am willing to suggest that the correct generalization to dipodic meter involves S/W relations rather than serial position (the dipodic meters of Arabic provide direct empirical support for this stance; see p. 74 below).<sup>5</sup>

Let us close with an unsettling line from Aeschylus (*Ag.* 659):

(31) Metron:



‘We behold the Aegean blossoming with dead’

<sup>5</sup>The trochaic tetrameter, always catalectic (last position empty), invites a counteranalysis as a headless iambic tetrameter—first position empty. But this makes it more not less difficult to compare its caesural facts with those of the iambic tetrameter, so I am not going to pursue the option. If correct, it would eliminate trochaic verse from the Greek repertory, removing—alas—the possibility of iambic–trochaic contrast, which is an important testing ground of hierarchical theories.

### 3.4. Summary

The Alexandrian analysis of Greek spoken meters, involving MP, F, and D, is well supported by the distributional facts. Our notion of metrical subposition distinguishes dactyl from trochee appropriately. Generalization of the S/W relation to hold between feet as well as MPs imposes an empirically significant second layer of alternation in trochaic and iambic verse, not only making the correct distinctions within each meter but also allowing a single set of hierarchically conditioned rules to realize the MPs in both rhythms. Going beyond the Alexandrian perspective, we find a general law of caesural placement for all spoken verse that makes crucial reference to the notion of abstract metrical position. The principle of Maximal Articulation (binarity of branching) correctly eliminates the ternary-branching structure for the dactyl and allows just those forms of F and D that the meters are built from. The principle of Uniformity of Labeling correctly predicts the opposite serial order of strict and free W-positions in iambic and trochaic verse.

## 4. CLASSICAL ARABIC METERS

### 4.1. Introduction

The meters of pre-Islamic Arabic poetry provide a particularly rich field of analytical challenges. The number of distinct meters is large, the rules relating abstract pattern to actual text are quite different from those of Greek, and the possibilities of ternary meter—three terminal nodes per foot—are fully exploited. Although the Arabic system has been well studied in many respects (see Weil 1960; Halle 1966; Maling 1973; Halle and Keyser 1977), it has never been treated in terms of general principles of S/W patterning.

The classical theory of al-Xalil (d. 791) recognizes sixteen different meters. Of these one (sariṣ) is plausibly a variant of another (rajaz) (Maling 1973), and four are demonstrably non-ancient and rarely used (Wright 1898). The table in (32) sets out the entire system, along with various anticipatory and informative annotations. The table lists the metrical lengths of the half-line. The symbols P and K are mnemonic for the classical metrists' 'peg' and 'cord' (i.e., tent-peg, tent-cord, the verse itself being called *bayt*<sup>um</sup> 'tent'). They represent the abstract positions of al-Xalil's theory. P is realized as  $\bar{\sigma}$   $\bar{\sigma}$  except at the end of the line, where it may correspond to mere  $\bar{\sigma}$ , a form of catalexis. K can be realized as either  $\bar{\sigma}$  or  $\bar{\sigma}$ , that is, as any single syllable; the choice between heavy and light is restricted by various conditions, some quite general over the whole system, a few specific to individual meters. Q corresponds to  $\bar{\sigma}$   $\bar{\sigma}$ , P reversed; L is  $\bar{\sigma}$   $\bar{\sigma}$ , K resolved. With Halle (1966), we regard Q and L as realizational variants of P and K.

### (32) Arabic Verse Patterns

|                     |                 | Basic Foot Type | Line Type                        |
|---------------------|-----------------|-----------------|----------------------------------|
| I. <i>ṭawīl</i>     | PK PKK PK PKK   | [S W]           | D <sup>2</sup>                   |
| <i>basīṭ</i>        | KKP KP KKP (KP) | [W S]           |                                  |
| <i>madīd</i>        | KPK KP KPK (KP) | [W S]           |                                  |
| II. <i>wāfir</i>    | PLK PLK PLK     | [S W]           | F <sup>3</sup>                   |
| <i>kāmil</i>        | LKP LKP (LKP)   | [W S]           |                                  |
| III. <i>hazaj</i>   | PKK PKK         | [S W]           | F <sup>3</sup>                   |
| <i>rajaz/sariṣ</i>  | KKP KKP (KKP)   | [W S]           |                                  |
| <i>ramal</i>        | KPK KPK (KPK)   | [W S]           |                                  |
| IV. <i>munsariḥ</i> | KKP KKQ KKP     | [W S]           | F <sup>3</sup> , F <sup>2</sup>  |
| <i>xafīf</i>        | KPK KQK (KPK)   | [W S]           |                                  |
| * <i>muqtadab</i>   | KKQ KKP         | [W S]           |                                  |
| * <i>mujtaṭṭ</i>    | KQK KPK         | [W S]           |                                  |
| * <i>muḍāriṣ</i>    | PKK QKK         | [S W]           |                                  |
| ( <i>sariṣ</i> )    | KKP KKP KKQ     | [W S]           |                                  |
| V. <i>mutaqārib</i> | PK PK PK PK     | [S W]           | D <sup>2</sup> or F <sup>4</sup> |
| * <i>mutadārik</i>  | KP KP KP (KP)   | [W S]           |                                  |

P = ~ ~    Q = - ~    K = ~ or -    L = ~ ~

\*Non-ancient and rare

Q1: Why are PKP, KKK, etc., not possible feet?

Q2: Why are circle 1 meters so limited?

a. sequencing of binary and ternary feet.

b. choice of binary feet with ternary foot: why not \*KPK PK?

#### Glosses

|                   |             |                     |                                |
|-------------------|-------------|---------------------|--------------------------------|
| I. <i>ṭawīl</i>   | 'long'      | IV. <i>munsariḥ</i> | 'flowing'                      |
| <i>basīṭ</i>      | 'outspread' | <i>xafīf</i>        | 'nimble'                       |
| <i>madīd</i>      | 'extended'  | <i>sariṣ</i>        | 'swift'                        |
| II. <i>wāfir</i>  | 'exuberant' | <i>muqtadab</i>     | 'lopped'                       |
| <i>kāmil</i>      | 'perfect'   | <i>mujtaṭṭ</i>      | 'amputated'                    |
| III. <i>hazaj</i> | 'trilling'  | <i>muḍāriṣ</i>      | 'similar' (to <i>mujtaṭṭ</i> ) |
| <i>rajaz</i>      | 'trembling' | V. <i>mutaqārib</i> | 'tripping'                     |
| <i>ramal</i>      | 'running'   | <i>mutadārik</i>    | 'continuous'                   |

Once the P/Q and K/L distinctions are abstracted away from, it becomes clear that the thirteen patterns of II–V in table (32) actually represent just five meters: (PKK)<sup>n</sup>, (KPK)<sup>n</sup>, (KPP)<sup>n</sup>, (PK)<sup>n</sup>, (KP)<sup>n</sup>. The complex meters of I are constructed from this repertory by alternating binary and ternary sequences.

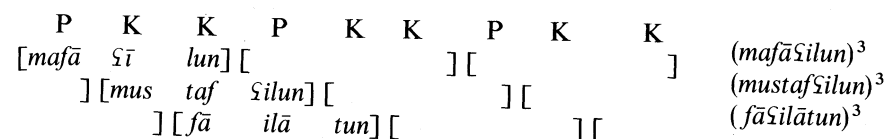
The fundamental question raised by the tabulation (32) is this: why do some strings of Ps and Ks constitute meters and others not? We cannot hope to prune every branch and filament from the ramified tree of unrealized possibilities using just the tools of metrical theory: for example, the rarity of *mutadārik* (KP)<sup>n</sup> should probably be compared with the virtual lack of trochaic pentameter in English. But we can certainly expect endotheoretic illumination as to why PKP, KK, KKKP, and so on, are not iterable units of meter; why there are only three complex meters in I, given the much broader range of plausible two unit–three unit alternating patterns; why K can be resolved to L in just two meters.

Before we set out our own answers to these questions, it will be worthwhile to briefly consider Halle's treatment of the meters (Halle 1966; Halle and Keyser 1977), ground-breaking work which contains essential insights and novel formal conceptions that all later analysts build on. Halle holds that all meters are based on the sequence PKK, repeated *n* times (*n* = 2, 3, 4). The other meters are derived from the basic pattern by the transformation of CYCLIC PERMUTATION—moving the last element of the line around to the beginning. By this PKKPKK becomes KPKKPK, which becomes KKKPKK; one further permutation and we are back where we started. At this point, Halle defines the foot as what ends after every third element in the line types. The remaining meters are derived by selective deletion of K: *mutaqārib* (PK)<sup>4</sup> deletes K in the env. —]P; *tawīl* (PKPKK)<sup>2</sup> uses the same rule in odd-numbered feet; and so on.

I suggest that Halle's permuting derivations are rendered unnecessary when the foot is fully accepted as the basic unit of structure. A first crucial observation is that Arabic P and K are but thinly disguised versions of S and W. Just as the foot of universal metrics culminates in a single strongest S, so does the Arabic foot necessarily contain one and only one P. This is why there are no feet PKP, KKK, and so on. The barest theory of ternary feet would join an S with two Ws, generating [S W W], [W S W], and [W W S]—the entire repertory. (We of course find that binary articulation is an essential refinement.) *Mutaqārib* (PK)<sup>4</sup> is evidently [S W]<sup>4</sup>; the later rare meter *mutadārik* (KP)<sup>3,4</sup>—called by the punning author of the *Muḥit mutadārik* 'supplied' because it is non-al-Xalīlīc in nature, having been added to the canon by the epigonal al-Axfaš—is, equally evidently, [W S]<sup>3,4</sup>; and these are the only two-position feet there are. The conclusion is clear: virtually any definition of foot that has it culminating in a single distinguished position gives us the Arabic metrical space without cyclic permutation.

Halle's proposal arose as a novel interpretation of the traditional method of representing the meters.<sup>6</sup> Al-Xalīl divided the meters into five groups—hence the taxonomy of (32)—and each of these groups was represented on a circle. Each foot has a mnemonic name: PKK, for example, is *mafāṣīlun*; the quantity of the syllables in the name represent the underlying values assigned to P(˘) and K(˘) by al-Xalīl. KKP is thus *mustafṣīlun* (˘˘˘); KPK, *fāṣīlātun* (˘˘˘). The subsystem III, for example, is represented by writing the PKK word three times around the outside of a circle, the KKP word inside it, and the KPK word innermost, with the words aligned P with P, K with K, as in diagram (33) (adapted from Weil, 1960):

(33)



Why did al-Xalīl bother with elaborating the circle theory when the basic information is already present in the mnemonic words? Gotthold Weil (1960) has a good answer. He observes that the words with a non-initial light syllable are metrically ambiguous: *mustafṣīlun* is either [K mus] [K taf] [P ṣīlun] as desired above—or [K mus] [Q tafṣi] [K lun], as in *xafīf*; *fāṣīlātun* is either [K fā] [P ṣilā] [K tun], as above, or [Q fāṣi] [K lā] [K tun], as in the late meter *mudariṣ*. Most mnemonic words fail to clearly represent the location of S and W, crucial information in al-Xalīl's generative metrical grammar. This problem, Weil proposes, is solved by the alignment of the words in the circles. The unambiguous word *mafāṣīlun* determines the sequence P K K; anything lined up with P is a P; and so disambiguation proceeds (the unambiguous word *mafṣūlātu* works for Q). According to Weil's view, then, al-Xalīl did not intend us to understand the meters to be derived from one another by cyclic permutation, as Halle ingeniously suggests; rather, al-Xalīl USED the fact that

<sup>6</sup>Halle's proposal is not, as some might assume, merely formalistic. Intuitive content can be extracted from it, or applied to it, in the following way. Imaging an infinite ternary grid

x      x      x

... x x x x x x x x x x ... Since every position *N* is equivalent to all positions *N* + 3*k* (−∞ < *k* < +∞), this space can be "compactified" without change of structure by wrapping it around a circle (an infinite number of times) in such a way as to superimpose equivalent positions. Halle's choice of a basic line PKKPK... can be interpreted as an instruction to get on the grid and ride, starting out at a strong position. Cyclic permutation, operating on a readout of the compactified image of the infinite temporal grid, amounts to an instruction to start out one position over. This apparatus, then, enumerates the three distinct starting points of ternary rhythm. In the domain of the linear grid, this is all extremely natural: how else can one initiate a meter?

meters stand in a certain cyclical relationship to express an important structural feature that he lacked a real notation for. Modern theory has the (S W) representation and does not need the circles.

Weil extends his argument to claim that the S-position so distinguished must bear ICTUS, or stress, a point of dispute for which strong evidence has never been brought forth. It is clear that P need not contain a word stress; it is not clear whether there are significant tendencies, or unexpected restrictions such as Porson's Law in the Greek tragic trimeter, that could be explained by assigning a role to ictus (Allen 1973). At any rate, contrary to Weil's apparent belief and that of his uncomprehending critics, P need not bear ictus in order to have a significant part to play in the correct description of the meters: P stands out as a distributional unit, whatever its implementation.

#### 4.2. The System of Arabic Meter

Al-Xalil's P/Q and K/L are projected from the S and W of current metrics. Our theory interprets the feet that they cluster into as in (34).

- (34) a. PK = [S W]  
 b. KP = [W S]  
 c. KKP = [  $\begin{array}{c} W \\ S \quad W \end{array}$  S ]  
 d. KPK = [W  $\begin{array}{c} S \\ S \quad W \end{array}$  ]  
 e. PKK = [S  $\begin{array}{c} W \\ S \quad W \end{array}$  ] or [  $\begin{array}{c} S \\ S \quad W \end{array}$  W ]

There is only one ambiguity, (34e); below we see some realizational evidence suggesting that *ṭawīl* calls on the right-dactyl [S [S W]], as does *wāfir*, while *hazaj* presupposes the left-dactyl [[S W] W].

The abstract patterns of circles II–V are arrived at by simple *n*-fold iteration of these feet; it is the mixed meters of circle I that have the interesting arrangements. They are given in (35),

- (35) Circle I  
 a. *ṭawīl* PK PKK PK PKK  
 b. *basīt* KKP KP KKP (KP)  
 c. *madīd* KPK KP KPK (KP)

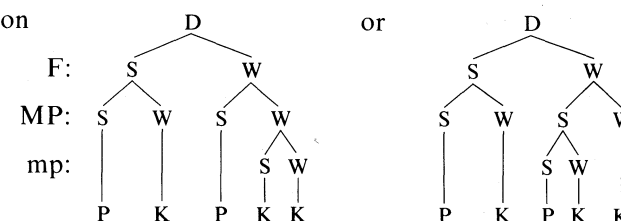
Each ternary foot gives rise to just one mixed meter out of a much larger field

of a priori possibilities. Such particularity raises two questions: (1) What determines the choice of the accompanying binary foot? Why is there no anti-*madīd* KPK PK...? (2) What determines the order of binary and ternary feet? Why, for example, is there no anti-*ṭawīl* PKK PK..., no anti-*basīt* KP KKP..., no pseudo-*ṭawīl* PK PKK PKK PK?

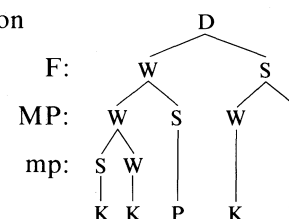
Our theory of metrical organization provides the answers. The mixed-meter half-line has a dipodic structure, each half-line consisting of a repeated metron; the metron itself contains one ternary and one binary foot. This ensures the alternation of ternary and binary units, eliminating such sequences as KKP KP KP KKP. The hierarchical and relational structures of the individual metra are dictated in all crucial respects by the general theory.

#### (36) Circle I Metra

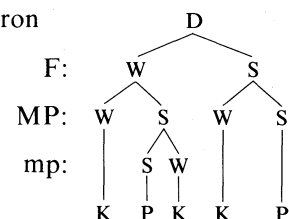
##### a. *ṭawīl* metron



##### b. *basīt* metron



##### c. *madīd* metron



How is the binary foot selected? In each case it is simply the unexpanded version of the ternary foot. For *ṭawīl* it is [S W], the dactyl—left or right branching—contracted; for *basīt* it is [W S], the contracted anapest. The *madīd* configuration is the most interesting, because the [W S W] sequence is rhythmically ambiguous. It is a rising rhythm like the anapest but also a falling rhythm like the dactyl; linear considerations do not sufficiently limit its



affiliations. The principle of Maximal Articulation is insufficient as well, for by it alone *madīd*'s amphibrach could either be rising [W [S W]] or falling at the MP-level—[[WS]<sub>S</sub> W] with S split [W S]. The Tactus Level hypothesis—that MPs are the basic unit of rhythm, dividing therefore to [S W]—ensures that there is a unique analysis; and it is the correct one. Here, I think, we can claim some depth of explanation, for the character of *madīd* follows from the way specific rules needed elsewhere (for *ṭawīl* and *basīṭ*) interact with quite general principles that are rooted in part outside the domain of metrics per se.

What determines the order of binary and ternary feet? A glance at (36) confirms that it is always the W-foot of the metron that is subdivided—the first foot for *madīd* and *basīṭ*, both [W S]; the second foot for *ṭawīl*, [S W]. The principle of Uniformity predicts, once again correctly, that the strength relation between the feet in a trochaic metron [[S W] [S W]] is opposite to that in the iambic metron [[W S] [W S]]. As in Greek, the facts at our disposal do not suffice to nail down the absolute order of F/S and F/W; it is only oppositeness that is absolutely required. For Arabic it is intuitively plausible to suppose that the ternary feet, superior in bulk to their neighbors and bearing as well the functional load of distinguishing *madīd* (KPK) from *basīṭ* (KKP), are actually the strong ones; this is the reverse of Uniformity of Labeling. Lacking firmer evidence on the point, we stand by Uniformity, aware that it might be replaced by another principle that has the same property of enforcing a trochaic–iambic distinction at the metron level. More significant in the present context is the fact that our generalization about the order of binary and ternary feet in circle I cannot be rephrased in terms of serial order of MPs in the metron. In Greek the W–MP adjacent to the metron boundary is strict in realization, or—as we prefer to put it—the W–MP of the strong foot. In Arabic the W–MP adjacent to the metron boundary is indeed the one that divides in *ṭawīl* [PK P<sub>KK</sub>] and *basīṭ* [KKP KP], but it is an S–MP that splits in *madīd* [KPK KP], and an internal one. The effects of serial order and S/W structure, confounded in Greek, are distinct in Arabic, and the hierarchy of relations proves to be the determining factor, giving valuable empirical support to the conclusion reached above (p. 67) on methodological grounds that it was wrong to bring in the vocabulary of serial order where the relational vocabulary was already required. Observe finally that for the proper sequencing of binary and ternary feet, as for the choice of binary foot, it is crucial that KPK be analyzed [W [SW]], as the theory dictates.

*Basīṭ* (KKP) and *madīd* (KPK) contrast with *ṭawīl* (PKK) in one further respect: they each allow a half-line length of three feet, one and a half metra, while *ṭawīl* always uses the full two-metra measure. Table (32) shows that such shortening of the half-line is a general property of meters based on the foot [W S] (data derived from Wright 1898). For circle I it is attractive to relate

this to metron structure: we can say that a (sub-)meter can be generated by leaving the S-foot empty at the end of the line; *ṭawīl* projects its essential [S W] up to the metron level and therefore always positions a W-foot at the end of metron and line (=D<sup>2</sup>). The other ancient meters that shorten—*kāmil* (LKP), *rajaḥ* (KKP), *ṣafīf* (KPK)—are three feet long at their longest, so they are poor candidates for metron analysis. If we project the foot-labeling all the way up the line tree, iambic lines have the final foot S, trochaic lines have it W, no matter what branching structure is assumed, and the generalization “empty S-foot at end of half-line” can be upheld. But a certain plausibility is lacking from the proposed extension of Uniformity from bottom to top. Following a suggestion of Bruce Hayes, we might simply say that iambic feet are liable to loss at the end, without trying to reduce it in any interesting way to a relational property of the foot as a whole. Perhaps too this could be viewed as a kind of percolating catalexis; in just those feet where the head (MP/S) is adjacent to the half-line terminus, catalexis—dropping of a final unit—can be generalized from the head to the foot as a whole. At any rate, the facts of shortening are yet a third instance where KKP and KPK fall together.

Summarizing our conclusions, we circumscribe the mixed meters through the following two conditions:

- (37) Circle I
- Each half-line contains two metra:  $|\frac{1}{2}L| = D D$
  - A metron consists of an undivided S-foot and a divided W-foot.

If we hold (similar to our treatment of the Greek hexameter) that each foot in the abstract pattern should be identical, then “undivided” means that one weak position is assigned null occupancy. Condition (37b) can then be formalized as follows:

- (38) Metron Structure
- One MP in F is divided.
  - $|mp/w| = \emptyset$  in F/S

Since ten of the eleven clearly distinct ancient meters fall under (38a), it is probably best to regard it as a general condition on the system, with *mutaqārib* (PK)<sup>4</sup> requiring the special condition that no MP is divided.

Finally, we record the principle of shortening:

- (39) Foot Dropping
- If a half-line ends in MP/S, the final foot may be dropped to form a new meter.

Rule (39) applies just once, to the basic long form of the half-line. *Munsariḥ* is the only exception among the meters, ancient and not so ancient, if we inhibit the rule from applying where it would shorten a line to a single foot.



### 4.3. Realizing the Meters

Al-Xalil laid out his meters according to the method of pegs and cords, assigning to the cord (K) the underlying form of a heavy syllable. This is visible in his choice of mnemonic words: *mafāṣīlun* for P( $\bar{\sigma}$   $\bar{\sigma}$ ) K( $\bar{\sigma}$ ) K( $\bar{\sigma}$ ), etc.) To describe the details of actual metrical practice, he attached to the system of basic patterns a collection of some thirty-two generative rules of deviation. This rather tangled plethora has led many Western scholars to reject the entire analysis, preferring instead an insightful (if usefully exhaustive) catalogue of licit syllable sequences, such as is provided by Wright (1898). But there is a simple explanation for the traditional superabundance of deviations: the Arabs lacked a general notation, lacked even the concept of the syllable, and so were reduced to expressing realizational possibilities (deviations) in terms of numerous very specific ORTHOGRAPHIC operations on the mnemonic words. The thorough and perceptive work of Maling (1973) vindicates al-Xalil's theory by showing that when framed in modern notation the rules of deviation are respectably small in number and general in relevance. In this section we examine the major patterns of syllabic realization of metrical positions (and subpositions), putting aside null realization—catalexis—for a future work (not that catalexis is either intractable or trivial).

First let us note that P/Q and K/L can be defined relationally. P/Q is the head of the foot, the terminal node of the abstract pattern that is dominated only by S within F; from now on, let us reserve the symbol P for this entity. K/L is a nonhead, a metrical terminal dominated somewhere by W in F; let us use K for this. The primary rules for P and K we have already seen:

#### (40) Unmarked Realization

- a. |P| =  $\bar{\sigma}$   $\bar{\sigma}$
- b. |K| =  $\sigma$

P also comes out as Q( $\bar{\sigma}$   $\bar{\sigma}$ ) by metathesis, or perhaps opposite division of a three-mora sequence (1 + 2 vs. 2 + 1), but we have little to say about this. K resolves to L( $\bar{\sigma}$   $\bar{\sigma}$ ) in circle II in a hierarchically determined context to be discussed below.

We use the symbol  $\bar{K}$  to mean a K realized as  $\bar{\sigma}$ ,  $\check{K}$  to mean K realized as  $\bar{\sigma}$ . The central core of Maling's theory can be recast as a single filter:

#### (41) *Muṣāqaba*

\* $\check{K}$   $\check{K}$  except in the env. [<sub>F</sub> —

Filter (41) expresses a generalization called *muṣāqaba* in the traditional literature, doing the work of Maling's rules (41), (42), and (43). It is necessary to mention K here because the sequence  $\bar{\sigma}$   $\bar{\sigma}$  is by no means excluded from non-foot-initial position: *wāfir*, for example, is based on PLK, where L is either  $\bar{\sigma}$   $\bar{\sigma}$

or  $\bar{\sigma}$ , and *rajaz* (KKP) allows its second K to be  $\bar{\sigma}$  even though it precedes P( $\bar{\sigma}$   $\bar{\sigma}$ ). However, it does appear that the constraint ought to be slightly generalized; from the tabulations of Wright (1898) it appears that Q( $\bar{\sigma}$   $\bar{\sigma}$ ) is always followed by  $\bar{K}$ , a consequence of *muṣāqaba* if restated as (42):

#### (42) *Muṣāqaba* +

\* $\bar{\sigma}$   $\check{K}$  except in the env. [<sub>F</sub> —

Maling goes to some lengths to show that *muṣāqaba* is indeed true of Arabic metrical practice. The data collected in Wright (1898) shows however that, although *muṣāqaba* (42) is a necessary condition on metricality, it is far from sufficient, allowing many variations that are not observed in individual meters. Consider the PKK meters *hazaj* and *ṭawīl*: *muṣāqaba* alone allows  $\bar{P}\bar{K}\bar{K}$ ,  $\bar{P}\bar{K}\check{K}$ , and  $\bar{P}\check{K}\bar{K}$ , but Wright's inventory shows that  $\bar{P}\bar{K}\check{K}$  is not in *ṭawīl*,  $\bar{P}\check{K}\bar{K}$  not used in *hazaj*. Similar restrictions are found for all the other meters except *rajaz/sariṣ* (KKP), to which *muṣāqaba* does not even apply. It turns out that there is a striking systematicity to the additional restrictions which becomes visible when the whole array of patterns is laid out. Here is a table summarizing Wright's data for the non-Q ternary meters.

#### (43) Realizations of Q-less Ternary Feet (circles I, II, III)

|            | Monopodic               | Dipodic                 | Resolving               |
|------------|-------------------------|-------------------------|-------------------------|
| dactyl     | <i>hazaj</i>            | <i>ṭawīl</i>            | <i>wāfir</i>            |
| PKK        | $\bar{P}\bar{K}\bar{K}$ | $\bar{P}\bar{K}\bar{K}$ | $\bar{P}\bar{L}\bar{K}$ |
| amphibrach | <i>ramal</i>            | <i>madīd</i>            |                         |
| KPK        | $\bar{K}\bar{P}\bar{K}$ | $\bar{K}\bar{P}\bar{K}$ | —                       |
| anapest    | <i>rajaz</i>            | <i>basīt</i>            | <i>kāmil</i>            |
| KKP        | $\bar{K}\bar{K}\bar{P}$ | $\bar{K}\bar{K}\bar{P}$ | $\bar{L}\bar{K}\bar{P}$ |

Two notes, should be added: (1) *ramal*:  $\bar{K}$  can be  $\bar{\sigma}$  "though very rarely, in which case the next foot [ $\bar{K}\bar{P}\bar{K}$  -A.P.] must begin with a long syllable [ $\bar{K}$  -A.P.]" (Wright 1898:366), i.e., *muṣāqaba* is enforced. (2) *basīt*:  $\bar{K}$  is "occasionally"  $\bar{\sigma}$  in the first metron, but it is "very rare" for it to be light in the second (Wright 1898:365). Note that *rajaz/sariṣ* is entirely free; *basīt* enjoys some of this freedom.

For all these meters, with the exception of *rajaz* (KKP) and *hazaj* ( $\bar{P}\bar{K}\bar{K}$ ), it is the second K position that is fixed. For the anapest [[S W] S] and the amphibrach [W [S W]], this is just the W-subposition. The dactyl comes in two varieties, and it is exactly in the dactylic row of table (43) that systematic variation is found: *hazaj* ( $\bar{P}\bar{K}\bar{K}$ ) must be the left-dactyl [[S W] W], with its first K an mp/W; *ṭawīl* and *wāfir* ( $\bar{P}\bar{K}\bar{K}$ ,  $\bar{P}\bar{L}\bar{K}$ ) must be the right-dactyl [S [SW]]. *Rajaz* is simply free of restriction, and indeed all the other

nonresolving anapestic meters (*basīṭ*, *munsariḥ*, *muqtadab*) are free in their first feet. The distribution of  $\bar{K}$  follows then from the location of W subpositions:

(44)  $\bar{K}$  Rule for Non-Q Meters

$$|mp/W| = \bar{\sigma}$$

The following codicils and assignments are required:

- (45) a. *Hazaj* is based on the right-branching dactyl.  
 b. *Tawīl* is based on the left-branching dactyl.  
 c. Anapestic meters fall under the  $\bar{K}$  rule either tendentially in the first foot and strongly elsewhere, or not at all.

A little calculation shows that the  $\bar{K}$  Rule (44) if rigidly enforced would completely eliminate the need for *muṣāqaba* (42). If the only support for *muṣāqaba* per se comes from very rare infractions of the  $\bar{K}$  Rule, its evidentiary base cannot be broad or certain. Further research into the details of metrical practice is required to settle the status of *muṣāqaba*.

Both resolving meters — *wāfir* (PLK) and *kāmil* (LKP)— fall under the  $\bar{K}$  Rule. The rule of resolution is evidently this:

(46) Resolution

$$|mp| = \bar{\sigma} \bar{\sigma} \quad (\text{optional}) \quad (\text{only in monopodic meters})$$

The rule cannot apply in  $mp/W$  because the  $\bar{K}$  Rule takes precedence. It cannot apply in the amphibrach  $[W [S W]]$  because there is no free position: the subordinate W-sister to terminal S is fixed by the  $\bar{K}$  Rule and the other W is a full MP, not a subposition as required by (46). Similarly, there can be no resolution in binary feet, because the sole W is a full MP. The  $\bar{K}$  Rule and the rule of Resolution jointly entail that there can be only two resolving meters — one based on the anapest  $[[S W] S]$ , giving LKP, the other based on the right-dactyl  $[S [S W]]$ , giving PLK. The left-dactyl is excluded for the same reason as the amphibrach, trochee, and iamb: lack of a suitable  $mp$  position, necessarily  $mp/S$  by the  $\bar{K}$  Rule. Given (44) as the statement of Resolution, the only additional stipulation required is that DIPODIC meters are nonresolving (note that we were justified in not listing *wāfir* under (45) as a stipulated right-dactyl).

The Q meters show a somewhat different  $\bar{K}$  pattern, though it is consistent with the general tendency to fix one K per foot at  $\bar{K}$  everywhere except in the KKP meters. Wright gives the line patterns in (47):

(47) Q Meter Realizations

a. Ancient

- i. *munsariḥ*      KKP  $\bar{K}KQ \bar{K}\bar{K}P$   
 ii. *xafīf*        KP $\bar{K}$  KQ $\bar{K}$  (KP $\bar{K}$ )  
 (iii. *sariṣ*       KKP KKP  $\bar{K}\bar{K}\bar{Q}$ )

b. Later and Rare

- i. *muqtadab*      KKQ  $\bar{K}KP$   
 ii. *mujtaṭṭ*       KQ $\bar{K}$  KP $\bar{K}$   
 iii. *muḍāriṣ*     PKK Q $\bar{K}K$

*Sariṣ* is listed here for completeness since al-Xalīl considered it to be a Q-meter; as Maling (1973) notes, Q is always catalectic here —  $\bar{Q}$  — (because there are by convention no light syllables at line end) and therefore equivalent to  $\bar{P}$ ; so that *sariṣ* could just be a catalectic version of *rajaz*, with which it shares realizational freedom (excepting the last foot). I am not totally convinced by the argument, because in Wright's data  $\bar{P}$  (catalectic P) is always preceded by  $\bar{K}$ , whereas in *sariṣ*  $\bar{Q}$  is preceded by  $\bar{K}$ . Nevertheless, *sariṣ* could still be a variant of *rajaz*; the last foot could just as well be KP, a truncated or unexpanded version of KKP.

All the meters, ancient and after, observe the rule that the K following a foot-head (be it P or Q) is necessarily  $\bar{K}$ . *Muṣāqaba* as revised in (42) predicts  $\bar{K}$  after Q; apparently the actual restriction is more general. The only exception is *muḍāriṣ*, "one of the rarest metres and not employed by any early poet" (Wright 1898:364–365), where the first foot disallows only PK $\bar{K}$ , presumably because it would generate a sequence  $\bar{\sigma} \bar{\sigma} \bar{\sigma} \bar{\sigma}$ , which, Maling notes, is highly disfavored. Let us posit then the following rule:

(48)  $\bar{K}$  in Q Meters

$$|K| = \bar{\sigma} \text{ on the env. } P \text{ — } (P = \text{foot-head; } K = \text{nonhead})$$

As for Q itself, it shows up anciently in second foot (excluding *sariṣ*); lumping all the meters together, we can say: once per half-line, and neither first nor last in the half-line; and only in ternary meters, ancient or later. Though simple enough and clear, the restrictions on the Q meters seem somewhat arbitrary and of a more linear character than those we have seen before. Their major interest in the present context is that they take care of a refractory but coherent subsystem, opening the way for the  $\bar{K}$  Rule (44), which responds delicately and exactly to the subtle gradations of categorial and relational structure.

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## ADDENDUM TO PRINCE'S "METRICAL FORMS"

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In the huge area stretching from Spain in the West to Indonesia and the Philippines in the East, which has been and continues to be under the cultural and religious dominance of Islam, the meters of classical Arabic poetry were utilized by poets writing verses in languages other than Arabic. One of the earliest examples of this adaptation of Arabic meters is the Hebrew poetry produced by the Jewish poets living in Spain and Provence during the more than five hundred years that ended with the expulsion of Jews from Spain in 1492. It is generally agreed by specialists that the Arabic meters were introduced into Hebrew about 950 by Dunash ben Labrat (see Allony 1951:21). Dunash, who was born about 920 in Fez, Morocco, studied with Saadyah Gaon (882–942), head of the Jewish academy at Sura in Babylonia, and came to Spain where he was in the service of Hisdai Ibn Shaprut, the Jewish minister of the caliphs of Cordova. Dunash adopted, essentially intact, the different meters codified by the Arab scholar al-Xalīl, but modified the correspondence rules between the abstract entities of the meters and the syllables of actual lines of verse.

As noted by Prince, the basic phonetic distinction utilized for implementing the meters in Arabic was that between syllables with nonbranching rhymes, represented by a breve (˘), and syllables with branching rhymes, represented