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Studies in Greek and Vedic Prosody, Morphology, and Meter

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by

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LIST OF ABBREVIATIONS

C	consonant
H	heavy syllable; also = laryngeal
L	light syllable
L	prominent light syllable
N	*n* or *m*
R	*r* or *l*
T	stop
V	vowel
#	word boundary
(α)	foot consisting of α
[α]	word consisting of α; also = metron consisting of α
ǀ	caesura
ǁ	verse end
⌣	breve
–	longum
×	anceps
<α>	designates that α is extrametrical
§	cross reference within this dissertation

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ABSTRACT OF THE DISSERTATION

Studies in Greek and Vedic Prosody, Morphology, and Meter

by

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The dissertation comprises three case studies on the role of prosody in word formation and versification. In the first study, a change in the formation of (Ancient) Greek verbal nouns in -μα (type χεῦμα > χύμα) is analyzed as a case of Trochaic Shortening, a process whereby the phonological preference for well-formed bimoraic trochaic feet at the right edge of the word motivates a categorical change in syllable weight: a word-final H(eavy)L(ight) syllable sequence is converted to a LL sequence. Unlike the better-known cases of Trochaic Shortening in other languages, where the process is purely phonological, in Greek it is lexically conservative: it only takes place where suffixing -μα to a pre-existing stem allomorph (e.g., χυ-) results in a word-final LL syllable sequence.

The second study is concerned with the effects of foot structure on subcategorical syllable weight as reflected in two types of antistrophic correspondence in Aristophanes, trochaic-paeonic and paeonic-dochmiac responsion. It is argued that Aristophanes preferentially aligns (LL) moraic trochaic feet, which have a subcategorical strong-weak rhythm (**L**L) determined by foot structure, so that they correspond with HL syllable sequences, whose strong-weak rhythm is categorically determined. The teleology of the compositional tactic is to heighten the rhythmic similarity between surface implementations of underlyingly different metra. The practice is paralleled by Aristophanes' preference to match categorical syllable weight in better-understood types of responsion.

In the third study, a method is proposed whereby emendations to the text of the Rigveda may be more accurately judged. The method is applied to determine whether a given form has the prosodic shape reflected by its spelling in the Saṃhitā text or the shape that has been suggested as an emendation on the basis of its distribution in the meter. In order to judge between the two, the metrical distribution of the form is compared with the metrical distribution of all forms that have its spelling shape, then again with all forms with its suggested shape. The acceptability of the emendation is determined by the statistical significance of the distributional differences.

0 General introduction

The dissertation contains three studies on the prosody of Ancient Greek and Rigvedic Sanskrit. Since each study is prefaced with its own introduction, I offer only a brief overview here, beginning with the languages studied. In the first study, I focus on a change in the formation of verbal nouns in -μα(τ)- that is primarily reflected in Greek of the late classical period and the Hellenistic κοινή. The second study is dedicated to the poetic idiolect of Aristophanes. In the third, I treat the language of the Rigvedic poets, though questions about the diachronic phonological development of laryngeals lead us to consider reconstructed stages of Proto-Indo-Iranian as well.

As for prosody, I mainly deal with rhythmic organization at the level of the word, the foot, and the syllable. In the first study, I discuss the interaction of foot structure, categorical syllable weight, and morphology in Greek. I propose that the morphological change that we observe in the -μα(τ)-stem nouns serves a foot-based prosodic preference for a sequence of two word-final light syllables, i.e., that the change is a form of Trochaic Shortening. According to the prosodic typology that I subscribe to, which is essentially that of Hayes (1995), the existence of Trochaic Shortening in Greek implies that Greek speakers organized syllables into moraic trochees, i.e., feet consisting of either two light syllables (LL) or one heavy syllable (H). My account of the change and its implications for foot structure corroborates the analysis of the recessive accent as calculated on the basis of a moraic trochee at the right edge of the word (Golston 1990).

In the second study, I propose that the way Aristophanes organized language in the lyric passages of his comedies reflects the interaction of moraic trochaic foot structure and subcategorical syllable weight. I argue that when Aristophanes departed from the normal type of "exact" responsion by placing underlyingly different metrical units in "inexact" responsion, he actively heightened the rhythmic similarities between the corresponding sequences on the surface by matching footed (**L**L) syllable sequences, which had a subcategorical strong-weak rhythm due to the inherent sonority profile of the moraic trochee, with HL sequences, which had a strong-weak rhythm due to categorical distinctions that were independent of foot structure. The preferential matching of (**L**L) with HL in inexact responsion is especially plausible in light of the fact that Aristophanes preferentially matched *categorical* syllable weight in exact responsion. On this view, inexact and exact responsion may be viewed as two variants of the same underlying compositional technique.

Subcategorical distinctions in syllable weight are briefly met again in the third study, where we see that the Rigvedic poets located LLH-shaped words surprisingly often in pāda-final position in Gāyatrī-type octosyllabic verse, such that the initial light syllable of the word occupies a strictly regulated preferentially heavy position in the meter, which ends –⏑×‖. As already seen by Oldenberg (1888: 10-13 and fn. 1), this seems to be a special property of word-initial light syllables of the LLH-shaped word class. The implication is that something about the rhythmic organization of that particular word shape renders those initial light syllables weightier than others—not weighty enough to be categorically heavy, but enough to be better suited for location in a longum than most other light syllables.

The prosodic unit of primary concern in the third study is the word. There, I propose an improved method for judging metrically motivated textual emendations, i.e., for cases where scholars have suggested that the spelling of a particular word in the received text does not accurately represent its prosodic value, because that word is distributed in the verse in such a way that it appears to regularly violate the metrical preferences for syllable weight distribution. The basic point that is accounted for in the new method is that the poets composed verses in words and phrases rather than in syllables. Consequently, we judge the emendations on the basis of the way the poets distributed word shapes in the verse rather than on the basis of the average distribution of heavy and light syllables in each metrical position. The method has a further potential application, which is briefly introduced by way of a few examples. It allows us to distinguish between the prosodic factors governing word order in the Rigveda and other factors, such as morphosyntax, since distributional differences within classes of word shapes cannot be attributed to prosodic factors.

1 The role of foot structure in the formation of verbal nouns in -μα(τ)-

1.1 Introduction

This chapter is concerned with the relationship between word formation and foot structure in Greek. Generally speaking, evidence for Greek foot structure has not been sought so much in word formation patterns as in meter, accentual phenomena, and the musical fragments. One gets a sense of this from the impressive collection of data that Devine and Stephens martial for their theory of Greek foot structure (1994: 102-117). Of the thirty-five phenomena they set out to explain, only one has to do with word formation, namely the well-known morphophonological stem vowel lengthening in comparatives and superlatives in -τερος and -τατος to o-stem adjectives, whereas fourteen are metrical phenomena. In the following pages, I offer an analysis of a change in word formation that affected the productive class of verbal nouns in -μα(τ)- (§1.2). I propose to understand the innovative word formation pattern as reflecting Trochaic Shortening, a process whereby word-final H(eavy)L(ight) sequences are converted to LL sequences (§1.3.1). Trochaic Shortening is thought to be found only in languages with moraic trochaic feet, and Greek has been independently analyzed as such a language (§1.3.2).

The innovative pattern of forming -μα(τ)-stem nouns turns out to be restricted in an interesting way. Speakers were only willing to adjust the problematic word-final HL sequence by borrowing a pre-existing allomorph to use as the phonological base. I adopt

Steriade's theory of Lexical Conservatism to capture this restriction and model the word formation patterns (§1.4). After pointing to further cases of word formation that may reflect the same avoidance of word-final HL sequences, and by extension, moraic trochaic feet (§1.5), I conclude by comparing my analysis with previous treatments of the change (§1.6).

1.2 χεῦμα versus χύμα: a description of two word formation patterns[1]

The class of verbal nouns in -μα(τ)-, such as χεῦμα, (gen. sg.) χεύματος 'that which is poured', was one of the most productive in Greek. The word list in Buck and Petersen (1945: 221 ff.) runs to over 3,600, and most items exhibit the compositional (i.e., synchronically predictable) semantics associated with productivity.[2] The nouns typically have a result reading, though action readings are attested as well. It is thanks to this high degree of productivity that we are able to obtain such an accurate picture of the change in word formation that affected these nouns, since the word formation patterns before and after the change only differ where the base verb had an alternating (synchronic) root or stem. Since the vast majority of Greek verbs do not exhibit root

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[1] The following scholars discuss this change in word formation: Buck and Petersen (1945: 222); Chantraine (1933: 175-190 and *passim*); Fraenkel (1910: 187); Glaser (1894: 52-59, 81-83); Hatzidakis (1895: 111; 1897: 103); Osthoff and Brugmann (1881: 132-141); Peters (1980: 333); Schwyzer (1898: 47-49; 1939: 522-524); Specht (1931: 50); Stratton (1899); Wackernagel (1916: 76, fn. 1).

[2] This, of course, does not hold for the small group of lexicalized items such as αἷμα 'blood', ὄνομα 'name', σῆμα 'sign', σῶμα 'body', etc.

alternation, the vast majority of deverbal nouns in -μα are formed the same way according to both patterns.

1.2.1 An overview of the two patterns

In Archaic Greek, verbal nouns in -μα(τ)- basically reflect one productive word formation pattern, which I will refer to as the conservative, or χεῦμα-type pattern. In the conservative formations, -μα(τ)- is suffixed to the strong root/stem of the verb, if the base verb exhibits a strong ~ weak morphological stem alternation: χεῦ-μα is formed to the strong allomorph χευ- of the verb 'pour', which exhibits the alternation χευ- ~ χυ-; to πω- ~ πο- 'drink', πῶ-μα (Aeschylus+) 'drink' is formed; to εὑρη- ~ εὑρε- 'find', εὕρη-μα (Herodotus+) 'discovery' is formed, etc. In the conservative-type formations, the choice of the base of affixation is *morphological*, and may be described as STRONG + -μα(τ)-, as in Table 1.

Table 1: The conservative, χεῦμα-type word formation pattern

STRONG ~ WEAK	STRONG + -μα(τ)-	WEAK + -μα(τ)-
χευ- ~ χυ-	χεῦ-μα	
πω- ~ πο-	πῶ-μα	
εὑρη- ~ εὑρε-	εὕρη-μα	
δηκ- ~ δακ-	δῆγ-μα	
ζευγ- ~ ζυγ-	ζεῦγ-μα	
λειπ- ~ λιπ-	λεῖμ-μα	

Beginning with Pindar's use of πό-μα 'drink', an innovative word formation pattern is attested. According to the innovative pattern, -μα(τ)- is suffixed to the weak root/stem of alternating verbs if and only if that weak stem ends in a short vowel. This is reflected in πό-μα (Pindar+) 'drink', εὕρε-μα (Hippocrates+) 'discovery', and χύ-μα (Aristotle+) 'that which is poured'. If the weak root does not end in a short vowel, -μα(τ)- continues to be suffixed to the strong stem: δῆγ-μα (Aristotle+) 'bite, sting' continues to be formed with the strong root δηγ- of the verb meaning 'bite', which alternates δηγ- ~ δαγ-; to ζευγ- ~ ζυγ- 'join', ζεῦγ-μα (Thucydides+) 'that which is used for joining' is formed; to λειπ- ~ λιπ- 'leave', λεῖμ-μα (Herodotus+) 'remains' is formed, etc. No changes are attested in formations to those stems. In short, in the innovative, χύμα-type formations, the choice of the base of affixation must be stated in *morphological and phonological* terms. Table 2, which provides an overview of the innovative pattern, reflects the distinction that has emerged between roots whose weak allomorph ends in -V and those that end in -VC.

Table 2: The innovative, χύμα-type word formation pattern

	STRONG ~ WEAK	STRONG + -μα(τ)-	WEAK + -μα(τ)-
WEAK in -V			
	χευ- ~ χυ-		χύ-μα
	πω- ~ πο-		πό-μα
	εὑρη- ~ εὑρε-		εὕρε-μα
WEAK in -VC			
	δηκ- ~ δακ-	δῆγ-μα	
	ζευγ- ~ ζυγ-	ζεῦγ-μα	
	λειπ- ~ λιπ-	λεῖμ-μα	

The innovative formations become more frequent in the Hellenistic κοινή, and it is clear from prescriptive statements of the Atticists that they were stigmatized as such.[3] This points to a sociolectal element in the variation between the conservative and innovative patterns reflected in the texts, at least during the later period.

1.2.2 Presentation of the data

The data below is presented just as in Table 2 above. First, I present the -μα formations to the alternating roots with a strong allomorph that ends in a long vowel or diphthong (e.g., πω-, χευ-), and a weak allomorph that ends in a short vowel (e.g., πο-, χυ-). I will refer to the class as °VV- ~ °V- roots. I then present the -μα formations to

[3] Cf. εὕρημα οὐκ εὕρεμα (Phrynichus, *Eclogae*, entry 420), "[correct/Attic usage is] 'εὕρημα', not 'εὕρεμα'".

the alternating roots with a strong allomorph that ends in a long vowel or diphthong plus a consonant (e.g., δηκ-, ζευγ-), and a weak allomorph that ends in a short vowel plus a consonant (e.g., δακ-, ζυγ-). I will refer to that class as the °VVC- ~ °VC- roots. The morphophonological aspect of the innovative -μα formation pattern emerges from a comparison of the two classes.

I first present the clearest examples of the change in

Table 3. These involve cases where a conservative and an innovative form are not only attested to the same verbal root, they are attested to exactly the same verbal stem, i.e., simplex or compound verb. The data is organized into sets of four forms. Above each set of forms, I list the root allomorph alternation and the citation form of the verb (the first principal part) in parentheses. Immediately below that, I juxtapose the conservative -μα formation to the strong allomorph (S) with the innovative formation to the weak allomorph (W).

χευ- ~ χυ- 'pour' (χέω)
(S) χεῦ-μα (*Iliad*+) 'that which is poured or flows'
(W) χύ-μα (Aristotle+) 'id.'

The rest of the set consists of root-related forms that also contain the weak allomorph—the allomorph adopted in the χύμα-type formation. First, I list a verb form with the weak allomorph (V). In the °VV- ~ °V- class, this is typically the perfect medio-passive (where the root is preceded by a reduplicant).

(V) κέ-χυ-μαι (*Iliad*+)

If no such perfect medio-passive is attested, I list the aorist passive (where the weak root/stem is preceded by the past indicative augment ἐ-, and suffixed with -(θ)η-).

(V) ἐ-χύ-θη-ν (*Odyssey*+)

The root-related action noun in -σις closes the set.

(N) χύ-σις (Aeschylus+) '(act of) pouring'

The root-related items with the weak allomorph may be viewed as the donors, or the sources, of the innovative weak phonological base, the intuition being that the χυ- in χύ-μα results from borrowing the χυ- form χύ-σις, κέ-χυ-μαι, etc., as has been suggested in previous discussions of the change (§1.6).[4] For clarity of exposition, I list only one (simplex or prefixed) form per verbal root. In addition to the innovative simplex formation εὕρε-μα, our first example below, there are five derivatives to compound verbs: καθεύρε-μα, ἐξεύρε-μα, ὑπερεύρε-μα, ἀφεύρε-μα, and ἀναφεύρε-μα. In addition to the conservative simplex formation εὕρημα, there are seven derivatives to compound verbs. I list the total number of conservative and innovative formations to the root below each lexical configuration. Some limited commentary on the data is given in the footnotes.

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[4] Verbal nouns in -μα were certainly not derived from an abstract verbal root in Greek. This is clear from cases where they inherit phonological material peculiar to particular inflectional stems of the verb, such as the -σ- in κέλευσμα and the numerous derivatives in °σ-μα, which was clearly adopted from the perfect medio-passive (cf. Blevins and Garrett 2009). Such "inheritances" are not restricted to the perfect medio-passive, however.

Table 3: °VV- ~ °V- roots with exact conservative-innovative juxtapositions[5]

1) εὑρη- ~ εὑρε- 'find, discover' (εὑρίσκω)

(S) εὕρη-μα (Herodotus+) 'invention, discovery'

(W) εὕρε-μα (Hippocrates+)[6] 'id.'

(V) εὑρέ-θη-ν (Aeschylus+)

(N) εὕρε-σις (Herodotus+) 'discovery'

Total S: 8

Total W: 6

2) ἑψη- ~ ἑψε-[7] 'boil' (ἕψω)

(S) ἕψη-μα (Plato+) 'that which is boiled'

(I) ἕψε-μα (Septuagint)[8]

(V) ἥψε-μαι (*Anthologia Graeca*) [ἡψε- ← ἕψε via reduplication]

(N) *ἕψε-σις [unattested]

Total S: 7

Total W: 1

[5] The data was obtained from Buck and Petersen (1945: 222 ff.), TLG searches, and the literature cited at §1.5. I attempted a complete collection through the 2nd c. CE. The references to inscriptional attestations are meant to be representative, not exhaustive.

[6] Cf. the inscriptional attestation at IG.VIII.3074, Boeotia, 2nd c. BCE.

[7] The weak stem ἑψε- is a late, weakly attested innovation. It is metrically secure at *Anthologia Graeca*, *Oracula*, Epigram 264.15 in a 3sg. perfect medio-passive ἥψεται. Its rarity may explain the absence of *ἕψεσις.

[8] Cf. the inscriptional attestation at IG.VII.3064, Boeotia, 301 CE.

3) θη- ~ θε- ‘put, place’ (τίθημι)

(S) ἀνά-θη-μα (*Odyssey*+) ‘thing dedicated or set up’

(W) ἀνά-θε-μα, ἄν-θε-μα (Theocritus+) ‘id.’

(V) ἀν-ε-τέ-θη-ν (Herodotus+) [with -τε- ← /-θε-/ via dissimilation of aspirates]

(N) ἀνά-θε-σις (Lysias+) ‘dedicating’

Total S: 14

Total W: 21

4) κρῑ- ~ κρι- ‘distinguish, choose, decide’ (κρῑ́νω)

(S) κρῖ-μα (Aeschylus+) ‘(matter for) decision’

(W) κρί-μα (*JWI* 2.366[9]) ‘id.’

(V) κέ-κρι-μαι (*Iliad*+)

(N) κρί-σις (Parmenides; Aeschylus+) ‘decision’

Total S: at least 1[10]

Total W: at most 8

5) πω- ~ πο- ‘drink’ (πῑ́νω)

(S) πῶ-μα (Aeschylus+) ‘drink’

(W) πό-μα (Pindar+) ‘id.’

(V) πέ-πο-μαι (Theognis+)

(N) πό-σις (*Iliad*+) ‘drink(ing)’

Total S: 3

Total W: 4

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[9] A 1st c. CE metrical inscription, according to the LSJ Supplement (*non vidi*).

[10] Since the length of the iota is not noted in the spelling, the only secure example of a long vowel is the metrically secured one in Aeschylus, and it is not possible to tell whether formations like κρίματα in prose contain the strong stem or the weak stem.

6) ῥευ- ~ ῥυ- 'flow' (ῥέω)

(S) ῥεῦ-μα (Aeschylus+) 'that which flows, current, stream'

(W) ῥύ-μα (Orphica 10.22)[11] 'id.'

(V) ἐ-ρρύ-η-ν (*Iliad*+)

(N) ῥύ-σις (Plato+) 'flow'

Total S: 2

Total W: 2

7) σχη- ~ σχε- 'hold, have' (ἔχω)

(S) σχῆ-μα (Aeschylus+) 'form, figure'

(W) σχέ-μα (Hesychius)

(V) ἔ-σχε-μαι (Philoxenus)

(N) σχέ-σις (Aeschylus+) 'state, condition'

Total S: 4

Total W: 1

8) φορη- ~ φορε-[12] 'bear, wear' (φορέω)

(S) φόρη-μα (Sophocles+) 'that which is carried or worn'

(W) φόρε-μα (Hippolytus) 'id.'

(V) ἐ-φορέ-θη-ν (*Cyanides*), ἐ-φόρε-σ-α (Diodorus Siculus+)

(N) φόρε-σις (Scholiast to Aristophanes *Birds* 156) 'wearing (of clothes)'

Total S: 18

Total W: 2

---

[11] Cf. the inscriptional attestation at IG IX.1.692, Corcyra, 2nd c. BCE.

[12] There is a late development of a weak stem φορε- in this verb, comparable to the development of ἑψε-. It is relatively well attested in the aorist active and middle ἐφόρεσα, and eventually makes its way into the aorist passive.

9) χευ- ~ χυ- 'pour' (χέω)

(S) χεῦ-μα (*Iliad*+) 'that which is poured or flows'

(W) χύ-μα (Aristotle+)[13] 'id.'

(V) κέ-χυ-μαι (*Iliad*+)

(N) χύ-σις (Aeschylus+) '(act of) pouring'

Total S: 3

Total W: 15

In addition to the examples given in Table 3, there are numerous χύμα-type formations that are not matched exactly by a χεῦμα-type predecessor with respect to the prefix, or lack thereof. There are various reasons for this. In part, this may be ascribed to the fact that a -μα derivative to the particular compound verb was only formed by authors of later periods when the innovative pattern was better represented. In other cases, morphological blocking was likely involved. For example, there is no simplex form *δῆμα attested, which we would predict either as the Greek outcome of an Indo-European **déh$_1$-mn̥* (cf. Vedic *dā́man-* n. 'band, bond'), or as a later Greek-internal χεῦμα-type formation to the strong allomorph of δη- ~ δε- 'bind' (δέω). It was presumably not formed during that period because δεσμός 'band, bond', which had likely been lexicalized since Mycenaean (*de-so-mo*), meant essentially the same thing. It is absolutely clear, however, that *δῆμα would have been the conservative-type formation, from comparison with the -μα formations made to compounded forms of the same verb, such as ἀνάδημα (Pindar+) 'hair band', to ἀναδέω 'bind on top, crown'.

[13] Cf. the inscriptional attestation at IG.VII.303, Oropos, ca. 240 BCE.

Thus, the inexact juxtapositions between conservative and innovative -μα formations given in Table 4 reflect the same change in word formation as the exact juxtapositions in Table 3. In each case, -μα is suffixed to a weak allomorph of a °VV- ~ °V root. I list one example of each verbal root involved. In place of an exact χεῦμα-type match, I supply a root-related conservative form where possible.

Table 4: °VV- ~ °V roots with inexact juxtapositions

10) αἱρη- ~ αἱρε- ‘take’ (αἱρέω)

(S) παρ-αίρη-μα (Thucydides+)

(W) ἀφ-αίρε-μα (Septuagint+) ‘that which is taken away; tribute’

(V) ἀφ-αιρέ-θη-ν (Aeschylus+)

(N) ἀφ-αίρε-σις (Plato+) ‘taking away’

Total S: 7

Total W: 10

11) βη- ~ βα- ‘step, go’ (βαίνω)

(S) βη-μα (*Homeric Hymns*+)

(W) παρα-σύμ-βα-μα (Chrysippus+) ‘secondary accident or circumstance’

(V) ξυμ-βέ-βα-σθαι (Thucydides+)

(N) σύμ-βα-σις (Euripides+)

Total S: 4

Total W: 5

12) δη- ~ δε- ‘bind’ (δέω)

(S) ὑπό-δη-μα (Homer+)

(W) δέ-μα (Polybius+) ‘band, tow rope’

(V) δέ-δε-μαι (Theognis+)

(N) δέ-σις (Plato+) ‘binding’

Total S: 8

Total W: 4

13) δω- ~ δο- ‘give’ (δίδωμι)

(S) *(-)δω-μα ‘gift’ [unattested][14]

(W) δό-μα (Plato *Definitiones*, Plutarch+) ‘gift’

(V) δέ-δο-μαι (Homer+)

(N) δό-σις (Herodotus+)

Total S: 0

Total W: 10

14) ἡ- ~ ἑ- ‘release’ (ἵημι)

(S) ἧ-μα (Homer+)

(W) ἔν-ε-μα (Dioscorides+) ‘injection’

(V) ἐν-έ-θη-ν (Dioscorides+)

(N) ἔν-ε-σις (Hippocrates+) ‘injection’

Total S: 3

Total W: 3

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[14] In addition to the presence of lexicalized items meaning ‘gift’, such as δῶρον, *δῶμα ‘gift’ may have been avoided due to potential homonymy with δῶμα ‘house’ (cf. Chantraine 1933: 179).

15) κλῑ(ν)- ~ κλι- ‘(make) lean, slope’ (κλίνω)

*?(-)κλῑ-μα [unattested?][15]

κλί-μα (Pseudo-Scymnus+) ‘inclination, direction, region’

κέ-κλι-μαι (*Iliad*+)

κλί-σις (Euripides+) ‘inclination; (place for) lying down; region, clime’

Total S: 0?

Total W: 9

The one apparent exception to the pattern above are the formations in -στε-μα to compounded forms of στη- ~ στα- ‘stand’ (ἵστημι) such as σύστεμα (well attested inscriptionally from the 2nd c. BCE on), διάστεμα, παράστεμα, κατάστεμα, and ὑπόστεμα, where we would expect *-στα-μα. Attributing these to an irregular phonological shortening of η → ε seems problematic, since the change happens regularly in -μα formations to that root. It is exactly what we would expect to find if there were a weak stem στε-. Here, there are two possibilities. The stem στε-, attested in ἐ-στε-σ-α, could have served as the base (Hatzidakis 1895: 111; 1897: 103), but ἔστεσα is first attested two or three hundred years later than σύστεμα, which may or may not be problematic. A second possibility is that the aorist subjunctive forms στῶ, στῇς, στῇ, etc. were synchronically analyzed as derived from the contraction of στε- + inflectional

[15] I have not been able to find evidence for the κλῖμα cited by Chantraine (1933: 179) as the older form. It may well never have been formed during the attested period, since the strong root/stem allomorph was arguably κλῑν- (or perhaps κλῐν-) by that point in time, as evidenced by its presence in the aorist ἔ-κλῑν-α, as well as in the present, where the -ν- originated as a suffixal element. If the -ν- was reanalyzed as part of the strong root/stem early enough, a strong formation *(-)κλῑν-μα would have been avoided due to the illicit phonotactic sequence *-νμ-.

endings, and that the stem στε- was essentially extracted from those, and used as a derivational base for the formations in -μα.[16] Various analogical proportions have been suggested as well (Schwyzer 1898: 47-49). It is difficult to judge between the explanations.

In Table 5, I give a survey of the -μα formations to °VVC- ~ °VC- roots. Here, the distribution of the weak root allomorph in the verbal paradigm and related nominal formations is somewhat different from the °VV- ~ °V- roots.[17] Most notably, the action nouns in -σις do not exhibit the weak root allomorph. Since the change in the -μα formation pattern does not affect this class, it is impossible to tell whether a given formation to the strong allomorph reflects the conservative formation pattern or the innovative one.

Table 5: Absence of innovation in formations to °VVC- ~ °VC- roots

1) δηκ- ~ δακ- 'bite, sting' (δάκνω)

(S) δῆγ-μα (Xenophon, Aristotle+) 'bite, sting'

(W) *δάγ-μα [unattested]

(V) ἐ-δακ-ον (Homer+)

(N) δάκ-ος (Aeschylus+) 'bite, sting; biting, stinging (beast)'

Total S: 4

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[16] This possibility was pointed out to me by P. Sfyroeras (p. c.). From a synchronic standpoint, if the subjunctive forms were derived from the weak stem στα-, we would expect *στᾷς, *στᾷ, etc.

[17] This is due in part to an earlier morphophonological change discussed by Kuryłowicz (1956: 185, 203-204; 1968: 249) and Peters (1980: 345-349), whereby the weak allomorph was replaced with the strong allomorph before consonant-initial morphemes including -σις. The change seems to have taken place very early, and the inherited weak stems in those formations are only found in scattered remnants.

2) ζευγ- ~ ζυγ- ‘join’ (ζεύγνυμι)

(S) ζεῦγ-μα (Thucydides+) ‘that which is used for joining’

(I) *ζύγ-μα [unattested]

(V) ἐ-ζύγ-η-ν (Pindar+)

(N) σύ-ζυγ-ος (Aeschylus+) ‘paired, united’

Total S: 4

3) λειπ- ~ λιπ- ‘leave (behind)’ (λείπω)

(S) λεῖμ-μα (Herodotus+) ‘that which is left; remains’

(W) *λίμ-μα [unattested]

(V) ἔ-λιπ-ον (*Iliad*+)

(N) ἐλ-λιπ-ής (Thucydides+) ‘omitting’

Total S: 9

4) ληβ- ~ λαβ- ‘take’ (λαμβάνω)

(S) λῆμ-μα (Sophocles+) ‘that which is taken in or received’

(W) *λάμ-μα [unattested]

(V) ἔ-λαβ-ον

(N) λαβή (Alcaeus+) ‘grip, hold’

Total S: 11

5) πηγ- ~ παγ- ‘(become) fix(ed)’ (πήγνυμι)

(S) πῆγ-μα (Aeschylus+) ‘thing fastened or congealed’

(W) *πάγ-μα [unattested]

(V) ἐ-πάγ-ην (*Iliad*+)

(N) πάγ-η (Aeschylus+) ‘thing that fixes or fastens’

Total S: 8

6) ῥηγ- ~ ῥαγ- ‘break, tear’ (ῥήγνυμι)

(S) ῥῆγ-μα (Eupolis+) ‘break, tear’

(W) *ῥάγ-μα [unattested]

(V) ἐ-ρράγ-η-ν (Aeschylus+)

(N) αἱμο-ρραγ-ίᾱ (Hippocrates+) ‘hemorrhage’

Total S: 9

1.2.3 The differences in distribution as a significant *argumentum ex silentio*

It emerges clearly from the data that according to the innovative pattern -μα was suffixed to the weak allomorph if it ended in a short vowel, and otherwise to the strong allomorph. One might argue, however, that taking the absence of WEAK + μα(τ) formations to the °VVC- ~ °VC- roots to be significant is an *argumentum ex silentio*, and that the absence of such formations can be attributed to an accident of attestation. We can quantify what the likelihood of such a claim is from the overall distribution, given in Table 6.[18]

[18] I have removed the data from κλῑ(ν)- ~ κλι- from the tally, since it is arguably not a °VV- ~ °V- root, as well as the data from κρῑ- ~ κρι-, since it is not possible to clearly distinguish between strong and weak allomorphs in many cases (cf. fn. 10 and 15, respectively).

Table 6: Distribution of STRONG + μα(τ) and WEAK + μα(τ) in °VV- ~ °V- and °VVC- ~ °VC- roots

	STRONG + μα(τ)	WEAK + μα(τ)	Total
°VV- ~ °V-	81	84	165
°VVC- ~ °VC-	45	0	45

The odds that the differences in distribution could be attributed to chance (given samples of this size) are infinitesimal. The p-value given by a Fisher's Exact Test is 2.531e-12. In short, we are dealing with a statistically (highly) significant *argumentum ex silentio*.

1.3 The phonological aspect of the innovation

We have noted that in the innovative formations the weak root allomorph was only used as the base of affixation if it ended in a short vowel. This is descriptively true, but by stating the phonological aspect of the innovation in prosodic terms, we may bring the change in line with a phonological process that we find in other languages, namely Trochaic Shortening (§1.3.1). The innovative formations based on the weak root allomorph all end in a sequence of two light syllables:

L L#	H L L#	L L#	L L#	
πό.μα,	εὔ.ϱε.μα,	κϱί.μα,	ῥύ.μα,	etc.

Putative (unattested) WEAK + μα(τ) formations to roots of the other type would all have ended in a heavy-light sequence:

H L# H L# H L#

*δάγ.μα, *ζύγ.μα, *πάγ.μα, etc.

That is to say that the allomorph replacement of STRONG → WEAK / __ + μα(τ) only occurred where it resulted in LL#. We may thus state the phonological nature of the allomorph replacement in prosodic terms as H → L / __ L#.

1.3.1 Trochaic Shortening

The adjustment of word-final HL sequences to LL sequences, or differently stated, the conversion of H → L / __ L#, is known as Trochaic Shortening. In this section, I introduce Trochaic Shortening by way of Fijian and Samoan, where the change in the weight of the penultimate syllable is brought about by various phonological processes including shortening underlying long vowels (e.g., /eː/ → [e]), monophthongizing diphthongs (e.g., /ai/ → [e]), breaking diphthongs and long vowels (e.g., /ai/ → [a.i], /eː/ → [e.e]), etc. (Hayes 1995: 145 ff.; Zuraw, Orfitelli and Yu: 2008). The following examples are from Fijian (cf. Hayes 1995: 145).

(A) Trochaic Shortening in Fijian

(1) /nreː-ta/ → [nréta] 'pull' H → L / __ L#

(2) /taː-y-a/ → [táya] 'chop it' H → L / __ L#

(3) /rai-ða/ → [réða] 'see it' H → L / __ L#

In examples (1) and (2), the word-final HL sequence is converted to LL via phonological shortening of the underlying long vowels, i.e., Vː → V __ CV#. In example (3), the diphthong is monophthongized. In other dialects, the diphthong is broken into a disyllabic sequence *ra.í.ða*, both strategies resulting in LL#. Samoan exhibits similar processes, as in these examples cited by Homer (2007) and Zuraw, Orfitelli and Yu (2008).

(B) Trochaic Shortening in Samoan

(1) /tsuːsi/ → [tsúsˑi] 'write'		H → L / __ L#
(2a) /peleː-ŋa/ → [pelé ŋˑa]		H → L / __ L#
(2b) or	→ [pèle.éŋˑa]	H → L / __ L#

In (1), the underlying long vowel is shortened. In (2a) and (2b) there is some variation: (2a) reflects shortening of the long vowel; (2b) reflects an alternative strategy whereby the long vowel is broken into two short vowels. Both effect the same change to LL#. The slight lengthening of the consonant following the stressed vowel occurs regardless of the underlying length of the preceding vowel.

From a prosodic standpoint, the innovative -μα formations to the °VV- ~ °V- roots reflect the same adjustment.

(C) H → L / __ L# as reflected in the innovative -μα formations

(1) χεῦμα > χύμα 'stuff poured' H → L / __ L#

(2) πῶμα > πόμα 'drink' H → L / __ L#

(3) εὕρημα > εὕρεμα 'discovery' H → L / __ L#

1.3.2 Trochaic shortening and moraic trochees

Trochaic Shortening is usually ascribed to foot construction, i.e., the grouping of syllables into feet, specifically to the construction of moraic trochaic feet (Prince 1992; Hayes 1995: 145-149). Moraic trochees are one of the three types of (bounded) feet in the inventory proposed by Hayes (1995), which has become standard in prosodic phonology and morphology, and which I assume for the analysis of Greek foot structure proposed here. Each moraic trochaic foot consists of two moras, such that a foot may consist of either one heavy syllable (H), or two light syllables (LL). Trochaic Shortening is found in languages where the most prominent of the moraic trochees is preferentially aligned with the right edge of the word. A word-final HL sequence poses a problem for footing in languages with right-aligned moraic trochees because it is impossible to align a bimoraic foot with the right edge of the word. For example:

/tsuːsi/ → *(tsuːsi) yields a trimoraic right-aligned foot

/tsuːsi/ → *(tsuː)si yields a bimoraic foot that is not right-aligned

/tsuːsi/ → *(tsuː)(si) yields a monomoraic right-aligned foot

Shortening the long vowel, or making whatever other phonological adjustments effect a change of H → L / __L#, allows for a complete parse of the word-final sequence into a bimoraic right-aligned foot: /tsuːsi/ → (tsú.sˑi).[19]

Greek has been analyzed on independent grounds as a language with right-aligned moraic trochees by Golston (1990), building on the proposal of Sauzet (1989). These studies treat the recessive (i.e., the default, non-lexical) accent calculus as their primary evidence for foot structure.[20] Below, I provide a brief description of moraic trochee formation in Greek, according to what I will refer to as the Sauzet-Golston analysis.[21]

According to their analysis, Greek speakers grouped syllables into moraic trochees proceeding from right to left through the word. In Greek, as in a number of other languages, one word-final consonant is extrametrical, which is to say that for purposes of the recessive accent calculus, it is not included in the final syllable (Steriade 1988; Probert 2003: 28-33).[22] Thus, the final syllable of ἄνθρωπος 'man, human being' is a light πο, not a heavy πος, for purposes of the recessive accent calculus. Following the standard convention, I mark the extrametrical consonant with angled brackets (e.g.,

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[19] For footing-related phonological shortening processes in Latin, such as *brevis brevians* and "cretic shortening", cf. Mester (1994) and Fortson (2008: 176 ff.).

[20] The Sauzet-Golston approach to the recessive accent is superior to that of Devine and Stephens in two important respects. First, Sauzet and Golston relate the accent calculus to foot structure, whereas Devine and Stephens consider the two prosodic systems to be unrelated (Devine and Stephens 1994: 152-156). Second, Sauzet and Golston operate with the *far* more restrictive foot inventory proposed by Hayes (1995), For Devine and Stephens, feet *in Greek alone* can be bimoraic, trimoraic, iambic and trochaic (117-156).

[21] For an excellent survey and discussion of various generative analyses of Greek foot structure, cf. Probert (2010).

[22] For evidence for extrametricality, and the analysis thereof, cf. Hayes (1995: 56-60, 105-108).

πο<ς>), syllable boundaries with a dot, and feet with parentheses. Where syllable boundaries align with foot boundaries, I do not mark them with a dot, since the syllable boundary is implied by the foot boundary. Forming moraic trochees (LL) or (H) from right to left, beginning with the most prominent foot at the right edge of the word, we arrive at the following foot structures (where the accent is momentarily left off):

(D) Syllabification and construction of moraic trochees

(1) ἐδυναμην → ἐ(δυ.να)(μη)<ν>

(2) ἐδυναμεθα → ἐ(δυ.να)(με.θα)

The word-initial syllable ἐ cannot be incorporated into a bimoraic foot, and is left unfooted. Words like ἄνθρωπος, with word-final HL sequences, present the same problem for footing that is "fixed" by Trochaic shortening in Fijian and Samoan, since it is impossible to group that sequence into a bimoraic foot at the right edge of the word:

(3) ἀνθρωπος → (ἀν)(θρω)πο<ς>

Unlike Fijian and Samoan, however, Greek does not exhibit widespread phonological Trochaic Shortening. Thus, in most instances, a word-final HL sequence is not altered, and the word-final syllable is left unfooted, as is the case in most of the languages with moraic trochaic feet surveyed in Hayes (1995).

According to the Sauzet-Golston analysis, the recessive accent placement results from the association of a High-Low* tonal melody with the most prominent syllable of the most prominent foot of the word, i.e., the first syllable of the word-final moraic trochee. The Low* part of the melody "docks" directly to that syllable (and is therefore marked with a post-posed asterisk). The High part of the melody, which is represented by the graphic acute accent, is thereby located on the mora preceding that syllable.[23] In the examples given in (E) below, the High-Low* tonal melody is represented Hi–Lo*. I use boldface type to highlight the syllable to which the melody docks.

(E) Moraic trochees as reflected by the recessive accent

Hi–Lo*
(1) ἐ(δυ.νά)(**μη**)<ν>

Hi–Lo*
(2) ἐ(δυ.νά)(**με**.θα)

Hi – Lo*
(3) (ἄν)(**θρω**)πο<ς>

The Sauzet-Golston analysis elegantly relates the recessive accent calculus to foot structure, specifically to a moraic trochee at the right edge of the word, bringing the recessive accent calculus in line with prosodic systems of other languages. Furthermore, it supports our association of the innovation in the χύμα-type with Trochaic Shortening, since Trochaic Shortening is only found in languages with moraic trochees (though only a small subset of those languages exhibit Trochaic Shortening). In short, if Greek speakers grouped their syllables into moraic trochees, it would be typologically unsurprising to find evidence for Trochaic Shortening.

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[23] For a discussion of the phonetic correlate of the accent as high pitch, cf. Devine and Stephens (1994: ch. 4, with refs.)

1.4 The lexically conservative aspect of the innovative word formation process

That Greek does not exhibit regular, phonological Trochaic Shortening is clear from a comparison between the small group of alternating roots of the °VV- ~ °V- sort, and the far larger group of non-alternating roots/stems, sketched out in Table 7.

Table 7: -μα formation patterns in alternating and non-alternating roots/stems

	Root	HL#		LL#
Non-Alternating				
	γευ-	γεῦ-μα		
	καρπω-	κάρπω-μα		
	μετρη-	μέτρη-μα		
Alernating °VV- ~ °V-				
	χευ- ~ χυ-	χεῦ-μα	>	χύ-μα
	πω- ~ πο-	πῶ-μα	>	πό-μα
	εὑρη- ~ εὑρε-	εὕρη-μα	>	εὕρε-μα

If Greek exhibited purely phonological Trochaic Shortening, we would find hundreds of formations like *γύμα, *κάρπομα, *μέτρεμα, etc. Speakers only fixed the footing problem where suffixing -μα to the *pre-existing* weak root allomorph yielded a word-final LL sequence: (χύ.μα), (πό.μα), (εὕ)(ρε.μα), etc.

In recent work (1999a; 1999b; 2008; typescript), Steriade has described and analyzed a number of word formation processes which reflect a similar interaction between phonology, morphology, and the lexicon, which Steriade refers to as Lexical Conservatism. The basic notion is this: under certain circumstances, speakers are unwilling to create new phonological variants of a stem to satisfy a phonological preference, but they *are* willing to use pre-existing variants to do so. Differently stated, in lexically conservative word formation processes, the phonological modification of a stem is blocked, unless that modification already exists in the paradigm of the derivational base, or in a root-related word. This quite accurately captures the innovative -μα formation pattern. Speakers would like to avoid the sequence HL# by converting the H → L / __ L#. However, they are unwilling to phonologically modify the strong (or only) verbal root/stem to avoid HL#. They are unwilling, for example, to delete the /e/ in γευ- in order to generate a *γύμα that would avoid HL#. And so they continue to produce γεῦμα (Euripides+) 'taste' as the result noun formed to γεύω (Homer+) 'taste', which has only one root allomorph γευ-. When generating a result noun to χέω 'pour', however, they are willing to break with the usual STRONG + μα(τ) pattern and "borrow" the weak root allomorph χυ- from a root-related formation. When they form a result noun to ζεύγνῡμι 'join', they adhere to the STRONG + μα(τ) pattern because none of the pre-existing allomorphs (ζευγ-, ζυγ-) allows them to avoid the footing problems posed by HL#.

Steriade's analyses are couched in a framework with correspondence constraints (McCarthy and Prince 1995), which evaluate the identity between the input and the output candidates, with one major addition. Correspondence constraints evaluate the identity between *one* input and the output candidates. To these, Steriade adds a set of correspondence constraints that evaluate the identity between the output candidates and *one of a set* of root-related forms. In the analysis offered below, I use a set of somewhat informal constraints, which I hope will lend perspicuity to the analysis without doing injustice to the theory. Instead of fleshing out the set of constraints involved in moraic trochaic footing and Trochaic Shortening, I posit one informal markedness constraint *HL#, which militates against the problematic word-final HL sequences. In addition to this, I posit two identity constraints, MAX-MS(STRONG)-STEM and MAX-LEX-STEM. The first requires material in the pre-suffixal stem of the strong morphosyntactic base allomorph to have corresponding material in the output. It basically requires that the output have the -ευ of the strong root allomorph found in ἔχευ(σ)α. MAX-LEX-STEM requires material in the syllable rhyme of one of the set of root-related items to have corresponding material in the output. It requires that the output have either the -ευ of the strong allomorph or the -υ of the weak one contained in κέχυμαι, χύσις, etc. With these three constraints, I first model the conservative -μα formation grammar, then the innovative one.[24]

[24] In Greek, I assume the following constraint ranking for the conservative grammar:
FTBIN, DEP, MAX-MS(STRONG)-STEM, MAX-LEX-STEM >> EDGEMOST-R, PARSE-σ.
For the innovative grammar, I assume: FTBIN, DEP, MAX-LEX-STEM >> EDGEMOST-R >> MAX-MS(STRONG)-STEM, PARSE-σ.
Thus, the informal *HL# may be thought of as representing EDGEMOST-R in the analysis below.

1.4.1 The conservative grammar: deriving πῶμα and πῆγμα

The conservative grammar values phonological identity between the strong allomorph and the output more highly than it values prosodic well-formedness. This is captured by the following contraint ranking:

MAX-MS(STRONG)-STEM, MAX-LEX-STEM >> *HL#

In the tableaux below, I give a form of the base verb with the strong root/stem as the input. It is the one input form referred to by MAX-MS(STRONG)-STEM. I list the lexically related forms above the tableaux. Together with the strong stem of the base, they represent the set of items referred to as possible inputs by MAX-LEX-STEM, the lexically conservative correspondence constraint. In each derivation, I give three candidates. First, I give a formation to the strong stem, then a formation to the weak stem, and finally, a formation that has undergone purely phonological changes to produce a light pre-suffixal syllable.

Tableau 1: Deriving πῶμα in the conservative grammar

Lexically related forms: πέ-πο-μαι, πό-σις

Input: πέ-πω-κα	MAX-MS(STRONG)-STEM	MAX-LEX-STEM	*HL#
☞ πῶμα			*
πόμα	*!		
πόομα	*!	*	

Tableau 2: Deriving πῆγμα in the conservative grammar

Lexically related forms: ἐ-πάγ-η-ν, πάγ-η

Input: πήγ-νῡ-μι	MAX-MS(STRONG)-STEM	MAX-LEX-STEM	*HL#
☞ πῆγμα			*
πάγμα	*!		*
πάμα	*!	*	

The conservative grammar rules out the formations to the weak allomorph, πόμα and *πάγμα, as well as the Samoan-type *πόομα, and a putative *πάμα, which has undergone deletion of rhyme material, all on the same grounds. They all violate the undominated MAX-MS(STRONG)-STEM, the constraint that requires the output to have a pre-suffixal stem that is identical to the pre-suffixal stem in the strong allomorph of the verbal base. It is worth noting that there is no evidence for the presence (or ranking) of the MAX-LEX-STEM constraint in the conservative grammar. This is because each candidate that violates it also violates MAX-MS(STRONG)-STEM (but not vice versa). In the innovative grammar, however, the MAX-LEX constraint becomes visible.

1.4.2 The innovative grammar: deriving πόμα and πῆγμα

The innovative grammar captures a lexically conservative derivation with a slightly different ranking of the same constraints:

MAX-LEX-STEM >> *HL# >> MAX-MS(STRONG)-STEM

In this grammar, the lexically conservative correspondence constraint is undominated. MAX-LEX-STEM rules out -μα formations that are not formed to the root allomorph contained in one of the lexically related forms, i.e., those that have undergone Fijian/Samoan-type phonological modifications. But unlike the conservative grammar in §1.4.1, it values prosodic well-formedness more highly than identity between the output and the strong allomorph.

Tableau 3: Deriving πόμα in the innovative grammar

Lexically related forms: πέ-πο-μαι, πό-σις

Input: πέ-πω-κα	MAX-LEX-STEM	*HL#	MAX-MS(STRONG)-STEM
πῶμα		*!	
☞ πόμα			*
πόομα	*!		*

While MAX-MS(STRONG)-STEM is ranked lower in the innovative grammar than in the conservative one, it is nevertheless active. This is apparent in the derivation of -μα formations to the °VVC- ~ °VC- roots.

Tableau 4: Deriving πῆγμα in the innovative grammar

Lexically related forms: ἐ-πάγ-η-ν, πάγ-η

Input: πήγ-νῡ-μι	MAX-LEX-STEM	*HL#	MAX-MS(STRONG)-STEM
☞ πῆγμα		*	
πάγμα		*	*!
πάμα	*!		

Where there is no lexically related allomorph that would satisfy the prosodic constraint, MAX-STRONG-STEM prefers the candidate that is derived by the STRONG + μα(τ) pattern to the form derived from the weak allomorph, since they perform equally badly with respect to the markedness constraint *HL#. In effect, this grammar prefers outputs with a word-final LL sequence, as long as the base of affixation corresponds to an allomorph found in a related form, such as the perfect medio-passive or the verbal noun in -σις.

1.5 Further evidence for HL# avoidance

In order to make the analysis of χεῦμα > χύμα more plausible as a case of lexically conservative Trochaic Shortening, we should look for further Greek-internal evidence for the avoidance of HL#. This may be difficult because, as I have argued, speakers were unwilling to perform purely phonological operations in order to avoid the sequence. Further evidence would therefore most likely be morphophonological in nature.[25] Here, I mention a general area that could lend further evidence to the analysis, where the diachronic development of innovative suffix allomorphs results in LL# sequences, and I treat another case of word formation in more detail.

There is a general diachronic pattern in Greek whereby -VCo-shaped adjectival suffixes develop as functional variants of more conservative -Co-shaped ones. In the list given in (F), which is not exhaustive, the notation -VCo- ~ -Co- signifies "-VCo- develops as a functional variant of -Co-".

(F) -VCo- as innovative functional variants of -Co-shaped suffixes

-ιμο- ~ -μο-: διαμόνιμος 'steadfast', διαπόμπιμος 'exported', etc.
-ανο- ~ -νο-: πιθανός 'persuasive', τραγανός 'edible'
-ινο- ~ -νο-: ἀληθινός 'authentic', ῥαδινός 'supple'
-ερο- ~ -ρο-: δολερός 'tricky', φανερός 'apparent', γλυκερός 'sweet'
-υρο- ~ -ρο-: φλεγυρός 'flaming', ἁλμυρός 'salty'

It is by no means clear that all the functional variants in -VCo- are due to a prosodic constraint against HL# sequences, though such a constraint might well be reflected in the general pattern of diachronic development whereby nominal formations ending -VC-Co- are replaced with formations of the shape -VC-VCo-. Below, I briefly

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[25] It could also involve subcategorical adjustments to H syllables / __ L#. It is possible that Dionysius of Halicarnassus's statements in *de comp. verb.* (ch. 17, 12, 20) provide evidence for such durational adjustments. Recent contributions to the problematic interpretation of these passages are Ruijgh (1987) and Prauscello (2001).

treat a slightly different case, where I suggest that a number of adjectives in -α-ϱό- may reflect the avoidance of -ᾱ-ϱό-.

From a morphosyntactic point of view, these adjectives seem to be derivatives in -ϱό- from ᾱ-stem nouns. In these derivatives, the suffix -ϱό- serves its well-attested function as a denominal suffix that forms adjectives with possessive (or more broadly exocentric) semantics. This seems likely from a semantic standpoint as well. As an example, we may take σϰιαϱός 'shady'. The derivational base, from a morphosyntactic and semantic standpoint, seems to have been σϰιᾱ́ 'shade'.

What is unexpected in formations like σϰιαϱός is the phonological shape of the base of affixation. The α-vowel of the derivative σϰια-ϱό- is short, while the α-vowel of the derivational base σϰιᾱ- is a long. Usually, in -ϱό- (as generally in -Co-shaped) derivatives from ᾱ-stem (Attic/Ionic η-stem) nouns, the long stem-final vowel of the derivational base is retained, as shown in (G).

(G) The unmarked derivation X-ᾱ → X-ᾱ-ϱός

ἀνίη (Homer+) 'grief'	→	ἀνιηϱός (Homer+) 'grievous'
ἄτη (Homer+) 'delusion'	→	ἀτηϱός (Theognis+) 'delusional'
ὀδύνη (Homer+) 'pain'	→	ὀδυνᾱϱός (Pindar+) 'painful'

To judge by equations like that of Latin *barbātus* with OCS *bradatŭ* and Lithuanian *barzdótas*, the resulting -ā-Co- is also the inherited pattern (< I-E *-eh$_2$-Co-).[26] It seems

[26] Cf. (Hajnal 1993:130-131).

significant that the -α-ϱό- adjectives with the unexpected short α-vowel always have a nominal formation in -άδ- in their lexical paradigm. The -άδ- stems, which were originally derived from nouns in -ᾱ (Attic/Ionic -η) as well (Rau: forthcoming), are arguably the source of the short α-vowel in the -α-ϱό- adjectives, via a lexically conservative word formation process. In (H), I list the -α-ϱό- adjectives, the morphosyntactic base nouns in -ᾱ, and the lexically related nominal in -άδ- (cited in the nom. sg. -άς).

(H) -α-ϱό- adjectives attested beside ᾱ-stem nouns and nominals in -άδ-

σϰιαϱός (Pindar+) 'shady'
σϰιᾱ́ (Homer+) 'shade, shadow'
σϰιάς (Eupolis+) 'providing shade'

σοβαϱός (Aristophanes+) 'rushing, violent'
*σοβᾱ '(act of) rushing, rush(er)'[27]
σοβάς (Eupolis+) 'insolent, capricious'

The following two formations are nouns that are plausibly derived from older adjectives in -α-ϱό-. οἴναϱον (Cratinus+) 'tendril, leaf' is plausibly a substantivized neuter form of *οἰναϱός 'of or belonging to the vine', and νομάϱιον· σϰεῦος τϱαγιϰόν (Hesychius) may plausibly be derived from *νομαϱός 'of or belonging to the pasture'.

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[27] cf. μυιο-σόβη (Menander) 'flyflap'

(I) Nouns plausibly derived from -α-ϱό- adjectives

οἴναϱον (Cratinus+) 'tendril, leaf'
οἴνη (Hesiod+) 'vine'
οἰνάς (Myc., Simonides+) 'vineyard'

νομάϱιον· σκεῦος τϱαγικόν (Hesychius)
νομή (Herodotus+) 'pasturage'
νομάς (Pindar+) 'nomad'

To judge by their semantics, which are less compositional, and their dates of attestation, the word formation process that produced these adjectives in -α-ϱό- (and their derivatives, such as οἴναϱον) was no longer productive in the classical period. We seem to be dealing with a lexical residue of an earlier productive process. This makes it plausible that that the following forms in -αϱό- were also derived from ᾱ-stem bases, but that the bases, which are not attested, were lost or replaced. The related nominals in -άδ- are attested.

(J) -α-ϱό- nominals attested beside -άδ- nominals

σιναϱός (Hippocrates) 'damaged'
σινάς (Hesychius) 'destructive'

στιβαϱός (Homer+) 'sturdy'
στιβάς (Sophocles+) 'bed of straw'

λογάϱια (Aristophanes+) 'petty speeches'
λογάς (Herodotus+) 'select' (of troops)

It is at least *prima facie* plausible that the pattern of attestation that we find in archaic and classical Greek reflects an older, moribund word formation process much like the one that produced the innovative formations of the χύμα type. Essentially, prosodically problematic HL# sequences were avoided only where a lexically related formation in -άδ- provided a phonological stem with a short -α, i.e., one that resulted in a LL# sequence. The grammar that would produce these is essentially the same lexically conservative grammar sketched out above. Here, the MAX-LEX constraint refers specifically to the pre-suffixal syllable rhyme. The constraint ranking is:

MAX-LEX-RHYME >> *HL# >> MAX-MS

Here, the cyclical correspondence constraint MAX-MS, which requires the output form to be stem-identical to the morphosyntactic base noun σκιᾱ-, lacks the additional morphological stipulation (STRONG) reflected in the -μα stems. The ᾱ-stem base nouns do not exhibit stem alternation.

Tableau 5: Deriving σκιαρός in a lexically conservative grammar

Lexically related item: σκιάς, gen. sg. σκιάδος

Input: σκιᾱ-	MAX-LEX-RHYME	*HL#	MAX-MS
σκιᾱ-ρός		*!	
☞ σκια-ρός			*

Under this ranking, the grammar prefers the prosodically well-formed adjectives whose phonological bases correspond to the lexically related -άδ-stems. Where there is no lexically related formation in -αδ-, the grammar produces forms derived from the morphosyntactic base, such as ἀνιᾱρός.

1.6 Conclusion

The core contribution offered here is a description of the innovative -μα formation process that notes that systematic differences between derivatives depend on the phonological shape of the verbal root/stem allomorphs. This asymmetry has not been noted in previous treatments of the change, to my knowledge, and it must be accounted for under any future analysis. I have proposed to equate the phonological aspect of the innovation with Trochaic Shortening, a process found in other languages which descriptively involves the adjustment of H → L / __L#. According to current phonological theory, Trochaic Shortening is only found in languages with moraic trochaic feet, and Greek has been analyzed as such a language on the basis of the recessive accent calculus. A further point of interest is that once the phonological shape of the root/stem allomorphs is taken into account, the change may be viewed as *regular*, insofar as a χύμα-type formation is attested for most every °VV- ~ V- root to which such a verbal noun was productively formed.

This particular change in word formation is not only interesting from a phonological standpoint and for its potential implications for foot structure. It also has implications for our understanding of the nature of word formation and morphological change. This is clear from previous discussions and analyses of the change, where the apparent borrowing of the weak allomorph from a related word is referred to as "contamination".[28] I have adopted Steriade's theory of Lexical Conservatism to capture the intuition of allomorph borrowing more explicitly. It is worth noting that a number of questions raised in the earlier scholarship have counterparts in Steriade's work. Where is the innovative allomorph taken from? An inflectional form of the base verb? From the lexically (and semanantically) related action nouns in -σις? Either? The problem has to do with the identification of the derivational base, and in theories that recognize multiple bases, such as Lexical Conservatism, it has to do with how to constrain the set of possible bases. I have adopted a relatively unconstrained definition of the lexical correspondence constraint, whereby any root-related form can "provide" the phonological base, though more restrictive approaches may be possible.

With one exception (Schwyzer 1898: 47-49), the actual *process* resulting in contamination is neither defined nor discussed.[29] One can infer from the conception of contamination found in Paul (1920: 160-173) that the semantic and phonological similarity between χεῦμα 'that which is poured' χύσις '(act of) pouring' and/or

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[28] The following scholars refer to the change as contamination: Buck and Petersen (1945: 222); Chantraine (1933: 175-190); Hatzidakis (1895: 111: 1897: 103); Peters (1980: 333); Schwyzer (1898: 47-49); Schwyzer (1939: 522-524); Specht (1931: 50); Stratton (1899), etc.

[29] Schwyzer views the change as a kind of suffix replacement, whereby speakers replaced -σις with -μα during the *koiné* period, without adjusting the base of affixation. This is perfectly in line with the analysis provided here, insofar as the *phonological* base of affixation is "borrowed" from the -σις nouns, or other lexical items with the weak root allomorph.

nominalizations of the perfect passive such as τὸ κεχυμένον 'that having been poured' reflected a close psychological association of the forms that induced a change effecting even greater phonological similarity between the forms. Such a view is on the right track insofar as it locates the process in the mind of the speaker and in that it relates the innovative pre-suffixal stem of the -μα formations to that of semantically and lexically related items. The analysis of the change as a lexically conservative type of Trochaic Shortening that I offer here may be viewed as a more explicit model of such a psychological process that takes the prosodic nature of the change into account as well.

2. The role of foot structure in inexact responsion in Aristophanes

2.1 Introduction

In this chapter, I discuss two problematic aspects of Aristophanes' versification, trochaic-paeonic and paeonic-dochmiac responsion. I argue that these types of so-called inexact responsion are like exact trochaic-trochaic responsion in that they reflect the poet's preference to closely match the surface rhythms in correspondence. Following a suggestion by Dale, who seems to intuit the role of foot structure in inexact responsion (Dale 1968: 64-65), I propose that Aristophanes arranged the verses using foot-based prominence relationships between light syllables to heighten the rhythmic similarities between dochmiac and paeon in strophic correspondence. Simply put, he preferred to match (LL) moraic trochees, which have a foot-based trochaic rhythm (**L**L), with the HL sequences in the corresponding metra. This is reflected in the statistically significant difference between the distribution of (LL) moraic trochaic feet in dochmaics which respond with paeonic dimeters and dochmiacs which do not.

In Chapter 1, I presented a case where the interaction of foot structure and syllable weight resulted in a categorical change in syllable weight, from heavy to light. In this chapter, we are concerned with subcategorical distinctions, specifically with differences among light syllables. There are two major factors that contribute to subcategorical syllable weight distinctions. One is the segmental make-up of the syllable, and the other is foot structure. Both have been shown to be relevant to Greek meter.[30] I propose that inexact responsion in Aristophanes provides further evidence for the latter type.

2.2 Defining exact and inexact responsion

The basic characteristics of unusual, “inexact” types of strophic responsion are best defined against the backdrop of responsion as we regularly find it. I begin by briefly describing strophic responsion as it is usually encountered in Aristophanes, and introducing the metrical constituents that are most relevant to this study.

The lyric passages in Aristophanes that we are concerned with here are composed in stanzaic units referred to as strophes, which are followed by metrically matching antistrophes. They were sung to the accompaniment of music, and range in length from short strophes of ca. 30 metrical positions (roughly equivalent to syllables) to longer strophes consisting of 100 metrical positions or more. The strophe contains multiple levels of hierarchical metrical structure that parallel and are presumably ontologically related to the prosodic phrasing of everyday language. Here, we will primarily focus on the relatively basic building blocks of the strophe known as metra. Aristophanes uses 12 or 13 different types of metra in strophic composition. The three involved in the types of

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[30] For the relevance of the segmental composition of the syllable for subcategorical (*alias* infracategorical) weight distinctions as reflected in the hexameter, cf. Ryan (forthcoming). For foot-based and other suprasegmentally-based distinctions, cf. Devine and Stephens (1982; 1994: 105 ff.)

inexact responsion treated here are the trochaic metron, the paeon, and the dochmiac. (I will also refer to the trochaic metron as the trochee.) Since ancient times, Greek metrists have conceived of a metron as having one abstract, underlying form and various possible surface instantiations. The underlying form of the trochaic metron is [⏔⏑⏔×]. (I will use square brackets to enclose underlying metra.) It contains four metrical positions, and has a strong-weak-strong-weak trochaic rhythm. The first (⏔), a strong position, may be implemented with either one heavy or two light syllables. The implementation with a heavy syllable is the more common, unmarked type. The marked implementation with two light syllables, referred to as resolution, is relatively rare, and subject to a number of restrictions involving word and other prosodic boundaries. (The more common implementation is placed below the less common one in the notation ⏔, here and elsewhere.) The second position is weak, and it is the most strictly regulated position in the metron. In lyric verse, Aristophanes virtually never implements it with anything but a light syllable. The third is a strong position like the first, though resolution is roughly three times rarer. The fourth and final weak position may be implemented with either a light or heavy syllable. It is referred to as an anceps (×) position. There are thus eight possible surface instantiations of the trochaic metron (which I enclose with vertical bars). I list them in order of the frequency with which Aristophanes used them in lyric verse:

|–⏑––|, |–⏑–⏑|, |⏖⏑–⏑|, |⏖⏑––|, |–⏑⏖⏑|, |⏖⏑⏖⏑|, |⏖⏑⏖–|, |–⏑⏖–|

The instantiations may have 4 or 5 morae, depending on whether the anceps position is filled with a heavy or light syllable, and between 4 and 6 syllables, depending on whether the first and/or the third position is resolved.

The second metron relevant to our analysis is the paeon. It has an underlying form [–⏑⏖], and two possible surface instantiations, a paeonic and a cretic, respectively:[31]

|–⏑⏕|, |–⏑–|

Paeonic verse shares a “falling” (strong-weak) rhythm with trochaic verse, with which it is often combined in the strophe. The polymorphous metron known as the dochmiac is the final character in our cast of three. With the somewhat spectacular underlying form [×⏖⏖×⏖], the dochmiac has 32 logically possible instantiations. At least 6 are completely unattested, and many are very rarely encountered anywhere in Greek lyric.[32] In the extant, non-fragmentary comedies, Aristophanes uses 13 different instantiations according to Parker’s tally (1997: 68), of which the five most common are:

|⏑––⏑–|, |⏑⏕–⏑–|, |–⏕–⏑–|, |⏑⏕⏕⏑⏕|, |⏑⏕–⏑⏕|

These have from 8 to 10 morae, and from 5 to 8 syllables. In Aristophanes, 104 of the 113 dochmiacs have 8 morae, like the canonical instantiation |⏑––⏑–|, though

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[31] The question of whether to classify the paeon as a cretic metron [⏖⏑⏖] also goes back to ancient times (White 1912: 194), and has no real bearing on our inquiry. We are dealing with a type of verse which descriptively consists of surface repetitions of |–⏑⏑⏑| and |–⏑–|, and has clear affinities with trochaic rhythm, with which it is often combined. On the exceptional |⏕⏑–| sequences, and the problem of the classification of this verse type in general, cf. White (1912: 192) and Parker (1997: 47).

[32] There is a descriptive gap in attestation where a heavy implementation of the second anceps would be followed by a resolved final position, i.e., where the instantiation would descriptively end in a dactylic sequence –⏑⏑|. Cf. West (1982: 108 ff.) and Parker (1997: 65 ff.), with references.

instantiations with 9 and 10 (the maximum) are attested, and the fully resolved octosyllabic forms |⏑⏖⏖⏑⏖| are not uncommon (11%).

The poets did not freely combine all types of metra within the strophe. In addition to other factors, rhythmic affinities between types of metra, such as the affinity between trochaic and paeonic mentioned above, clearly constrained the combinations. The relationship *between* strophe and antistrophe is far more constrained. There is a highly regular correspondence of metra referred to as responsion. For example, if a strophe begins with three trochaic metra and a cretic (–⏑–), the antistrophe will almost always begin the same way, and the correspondence holds, metron for metron, through the songs. As an example, I cite the beginning of a strophe and antistrophe from Aristophanes' *Birds*, 1470 ff. = 1482 ff.[33] (The = signifies 'responds with'.)

Strophe
[⏕⏑⏕×]   [⏕⏑⏕×]   [⏕⏑⏕×]   [–⏑–] ...
|– ⏑ – –| |– ⏑ – –| |– ⏑ – ⏑||– ⏑ –| ...
πολλὰ δὴ καὶ καινὰ καὶ θαυμάστ᾿ ἐπεπτόμεσθα καὶ ...

Antistrophe
[⏕⏑⏕×] [⏕⏑⏕×] [⏕⏑⏕×] [–⏑–] ...
|– ⏑ – –| |– ⏑ – –| |– ⏑ – –||– ⏑ –| ...
ἔστι δ᾿ αὖ χώρᾱ πρὸς αὐτῷ τῷ σκότῳ πόρρω τις ἐν ...

[33] Unless otherwise noted, I cite the text according to Parker (1997), and follow her metrical analysis, except that what I refer to as a paeon, Parker refers to as a cretic.

In the usual type of responsion, the correspondence between *underlying* metra is exact, but the surface implementations may differ. For example, the third trochaic metron of the strophe cited above is implemented:

| – ⏑ – ⏑ |

-μασ.τε.πεπ.το- (the dot marks syllable boundaries)

The responding metron in the antistrophe, however, has a different implementation of the anceps position:

| – ⏑ – – |

-τῷ σκό.τῷ πόρ-

This type of surface mismatch is relatively common, whereas a mismatch with respect to resolution is relatively rare. The question arises as to whether the rarity of the various types of surface mismatches is a function of the overall rarity of the surface instantiations involved or whether it reflects a preference on the part of the poet to match the surface rhythms exactly. For example, we only encounter |–⏑––| responding with |⏖⏑––| 6 times. Is this because Aristophanes avoided the surface mismatch, or is it because he avoided resolving the first position |⏖⏑––| of the metron more generally? While a detailed treatment of this subject is beyond the scope of this dissertation, I briefly give the evidence from trochaic responsion in Aristophanes.

In order to test whether Aristophanes preferred to match responding trochaic metra on the surface or not, we first tally each responding pair, given in Table 8.

Table 8: Responding trochaic metra in Aristophanes

Instantiations		|–⏑––|	|–⏑–⏑|	|⏖⏑–⏑|	|⏖⏑––|	|–⏑⏖⏑|	|⏖⏑⏖⏑|	|⏖⏑⏖–|	|–⏑⏖–|
299	|–⏑––|	97	84	11	6	3	1	0	0
156	|–⏑–⏑|		32	5	0	1	1	1	0
29	|⏖⏑–⏑|			4	4	0	1	0	0
18	|⏖⏑––|				3	1	0	1	0
7	|–⏑⏖⏑|					0	1	0	1
6	|⏖⏑⏖⏑|						1	0	0
2	|⏖⏑⏖–|							0	0
1	|–⏑⏖–|								0
Total instantiations: 518									
Total pairs in responsion: 259									

Reading the first row from left to right, we see that there are 299 instantiations of the shape |–⏑––|. There are 97 pairs of surface-exact responsion of |–⏑––| = |–⏑––|. There are 84 pairs where |–⏑––| responds with the ditrochaic instantiation of the metron |–⏑–⏑|. Those differ with respect to the implementation of the anceps position, and so forth.

In order to judge whether these pairings reflect a preference for exact matching or not, we then take all of the implementations that occur in the strophe (not both strophe and antistrophe, since they potentially depend on one another) and match those at random. I performed the random matching twice, and took the average, given in Table 9.

Table 9: Randomly paired trochaic metra

Instantiations		|–⏑––|	|–⏑–⏑|	|⏖⏑–⏑|	|⏖⏑––|	|–⏑⏖⏑|	|⏖⏑⏖⏑|	|⏖⏑⏖–|	|–⏑⏖–|
144	|–⏑––|	38	49	10	4.5	2.5	2	0	0
73	|–⏑–⏑|		6.5	4.5	2.5	1.5	1.5	1	0
19	|⏖⏑–⏑|			1	1.5	0.5	0.5	0	0
10	|⏖⏑––|				0	1	0.5	0	0
6	|–⏑⏖⏑|					0	0.5	0	0
5	|⏖⏑⏖⏑|						0	0	0
1	|⏖⏑⏖–|							0	0
0	|–⏑⏖–|								0

Total instantiations: 258[34]

Total pairs in responsion: 129

The figures in Table 9 represent what we would expect to find in the text if Aristophanes did not care at all about surface identity between the metra. Next, we need to classify the degrees of exactness of surface identity between the responding metra. I have chosen the following classification, though others are possible as well, e.g., a classification in terms of syllable count and/or mora count identity. Under the scheme I have chosen, the pairs

1) match exactly (Exact)
2) differ with respect to anceps implementation only (A)
3) differ with respect to one resolution (1-R)
4) differ with respect to one resolution and the anceps implementation (1-R & A)
5) differ with respect to two resolutions (2-R)
6) differ with respect to two resolutions and the anceps implementation (2-R & A)

[34] To arrive at an even total for pairing, I omitted one |–⏑––| metron, this being the most common type.

In Table 10, I compare the differences between responding pairs that we observe in Aristophanes, and those that we would expect under the hypothesis that he matched them without respect to surface identity.

Table 10: Frequency of surface identity observeds vs. expected

	Exact	A	1-R	1-R & A	2-R	2-R & A	Total
Observed	137 (53%)	89 (34%)	15 (6%)	14 (5%)	1 (0%)	3 (1%)	259
Expected	46 (35%)	51 (39%)	12 (9%)	16 (12%)	2 (3%)	4 (3%)	129

The percentage of exactly matching pairs in Aristophanes is quite a bit higher than the expected value. We can test for the significance of this by comparing the observed and expected distributions of exactly and inexactly responding metra, given below:

	Exact	Inexact	Total
Observed	137	122	259
Expected	46	83	129

A Fisher's Exact Test shows that the differences in distribution are significant. There is only about a one in a thousand chance that differences this great would have have arisen by chance in samples of this size ($p = 0.001227$).

In sum, we can say that Aristophanes preferred matching the surface metra exactly, but the preference was not particularly strong, since 47% of the pairs do not match exactly, and hypothetically, there could be exact matching in virtually all cases. While this result is unlikely to surprise Greek metrists, it allows us to securely define the usual, “exact” strophic response as involving an exact correspondence between underlying metra, and a *preferentially exact* correspondence between surface implementations.

The “inexact” trochaic-paeonic and paeonic-dochmiac response, in contrast, involves strophic correspondence between *underlyingly different* metra. At *Birds* 327 ff. = 343 ff., the strophe and antistrophe open with exact correspondence between anapaestic metra, after which we encounter four dochmiacs in the strophe in correspondence with four paeonic dimeters in the antistrophe. I cite the first of the five responding sets 333a ~ 349a (the ~ signifies “responds inexactly with”).

Strophe		Antistrophe
dochmiac		2 paeons
[×⏕⏕×⏕]		[–⏑⏕] [–⏑⏕]
|– ⏑ ⏑ ⏑ ⏑ ⏑ ⏑ ⏑|		|– ⏑ ⏑ ⏑||– ⏑⏑ ⏑|
ἐς δὲ δόλον ἐκάλεσε	~	οὔτε γὰρ ὄρος σκιερὸν

It is worth briefly noting something that we will return to in more detail below, namely that the surface similarity between the instantiations of the underlyingly different metra is striking. The sequences are isosyllabic, and differ only with respect to the weight of the fifth syllable, suggesting that inexact response may reflect a preferentially exact correspondence between surface rhythms as well.

This and like passages involving inexact response have come over the last century or so to be recognized as authentic Aristophanic composition, though metrists may disagree about the textual legitimacy of one case or another.[35] The grounds for this are neatly expressed by Dale: "[i]t is clear that, in comedy especially, metrical irregularities traceably similar in type, where the text is otherwise irreproachable, occur so often that emendation of all to conformity with a rigid metrical scheme is mistaken purism" (Dale 1968: 91). In the following section, I further characterize the two types of inexact responsion primarily by way of Dale's discussion.[36] I begin with broader issues of genre and rhythmic context, then return to address whether Aristophanes matches surface rhythms in inexact responsion.

2.3 Inexact responsion as a comic license

As reflected in the quotation above, in Dale's view inexact responsion was essentially restricted to comedy, though she suggests that a number of problematic metrical phenomena in Euripides are related (Dale 1968: 97). An examination of the Euripidean passages is beyond the scope of this study, but if inexact responsion reflects a technique associated with the freer compositional style of comedy, its presence in Euripides would be unsurprising, and perhaps even expected. This is because during the last twenty or so years of his fifty-year career as a tragedian, Euripides' style of versification became increasingly more like that of the less strict forms associated with satyr plays and comedy. The best-studied example of this is his use of resolution. In

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[35] For an overview, cf. Parker (1997: 113-119).

[36] The topic is treated in Dale (1968: 56-57, 64-66, 78-79, 89-91, 97, 112, 190, 207).

short, the consistently increasing frequency of resolution and the expanding set of rhythmic configurations in which resolution is found in the later plays of Euripides become steadily more like Aristophanes' use of resolution in comedy.[37] In addition, Devine and Stephens have demonstrated that Euripides steadily relaxed a constraint against a heavy syllable followed by a low-level prosodic boundary at Porson's bridge in the iambic trimeter (Devine and Stephens 1994: 309 ff.). Here again, Euripides departs from the stricter style of versification reflected in Archilochus, Semonides, and Solon, and moves towards the unconstrained treatment of Porson's bridge in comedy. It seems perfectly plausible to view inexact responsion along similar lines. Its rarity and its restriction to comedy (or comedy and Euripides) would then be due to the fact that while inexact responsion was not unmetrical (i.e., metrically ungrammatical), there was both a strong precedent and preference for exact responsion.

2.4 The rhythmic context for inexact responsion

Next, we consider Dale's suggestion that inexact responsion was restricted to particular rhythmic contexts. Dale refers to these as "patter-rhythms" (1968: 97), and

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[37] The study of resolution in Euripides as a chronological criterion goes back at least to J. G. Hermann. For a survey of the literature through the late 1970s, cf. Ceadel (1941: 66-69) and Schein (1979: 55-58). Extensive and more recent work has been done by Devine and Stephens, including a useful (1980) review and reworking of Zieliński (1925), and a series of articles (1978; 1981; 1982) culminating in a book-length treatment of resolution and Porson's bridge (1984), which in turn is placed within a larger book-length analysis of Greek prosody (1994: 107-111 *et passim*). Cf. also Cropp and Fick (1985) and Philippides (1981).

expresses the opinion that “it is hard to resist the inference that the relation of – to ⏑ in the comic trochee and paeon was far from being the rigid 2:1 that might appear from the mathematical precision of the ancient musicians’ formulas” (90). A number of other scholars have suggested that the durational ratio of – to ⏑ was reduced in trochaic contexts and faster performance rates.[38] This is most likely not peculiar to Aristophanes, dramatic performance, or the Greek language. There is experimental evidence for reduction of this sort in the recitation of trochaic verse in a number of other languages, and the phenomenon has plausibly been taken to reflect a linguistic universal grounded in the way humans perceive rhythm.[39] Reduction of durational ratios at faster rates of speech is extremely well documented crosslinguistically as well, and it is quite fair, I think, to infer that trochaic rhythm and increased performance rate in Aristophanes gave rise to a significantly greater surface similarity between trochaic –⏑–⏑ and paeonic –⏑⏑⏑ sequences. This would arguably hold for paeonic-dochmiac responsion by transitivity: trochaic ~ paeonic ~ dochmiac. That is not to say that the dochmiac was underlyingly trochaic, but that the particular instantiations of the dochmiac that correspond with paeons had a quasi-trochaic rhythm. I will argue below, for example, that where the dochmiac was implemented with –⏑⏑⏑⏑⏑⏑⏑, Aristophanes effected a surface rhythm that

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[38] Cf. Wilamowitz (1904: 265 ff.; 1921: 470 ff.) and White (1912: 82 ff.), with references to the earlier statements of Rossbach and Westphal. For related statements in the ancient sources, cf. Devine and Stephens (1994: 116).

[39] Cf. Hayes (1995: 79-81) for the “iambic/trochaic law”, and Hay and Diehl (2007) for more recent experimental work.

more closely approximated the rhythm –⏑⏑⏑–⏑⏑⏑ of the paeonic dimeter with which it responded, with the result that both sequences had a clear overall "falling" rhythm.

While the five repetitions of paeonic-dochmiac response cited above constitute strong evidence that the phenomenon cannot be attributed to textual corruption, evidence for the authenticity of trochaic-paeonic responsion comes from Aristophanes' combination of trochaic and paeonic *within* the strophe and stichic verse in such a way that suggests that he felt the two to be quasi-interchangeable (cf. White 1912: 82-85). There is an especially striking use of a paeon in place of the expected trochaic metron in a sequence of over 20 recitative tetrameters at *Lysistrata* 1014-1036 (Dale 1968: 89). They have the following form:

[⏓⏑⏓×] [⏓⏑⏓×] |–⏑⏑⏑| |–⏑–|

In this context, we expect the usual trochaic tetrameter catalectic:

[⏓⏑⏓×] [⏓⏑⏓×] [⏓⏑⏓×] |–⏑–|

I do not give the paeon, which appears in place of the expected third trochaic metron, as [–⏑⏓], because we only find the sequence |–⏑⏑⏑| through the entire passage. I believe everyone would agree that the reason for this is that a cretic |–⏑–| instantiation of the *third* metron would constitute too great a departure from the expected rhythm, which is basically |–⏑–⏑| or |–⏑––|. Since the *verse-final* cretic is the typical clausular sequence for both trochaic and paeonic tetrameters, it is completely chameleonic in this context. The fact that in this exchange between the chorus of old men and the chorus of old women Aristophanes places the peculiar tetrameters in the mouth of the men, whereas the chorus of old women recite the expected trochaic tetrameters, and the fact that the rhythmically slightly aberrant tetrameters end exactly at the kiss of reconciliation between the two choruses, is unmistakably intentional.

2.5 Dale's "theory of syllable-counting"

For the same reasons that the paeon always appears in its four-syllable form where it functions as a kind of rhythmic equivalent of the trochaic metron *within* the verse, the trochaic metron and paeon are always isosyllabic where they are in strophic response. I cite *Wasps* 1062 ~ 1093 as an example, where the surrounding metrical context likewise involves trochaic metra and clausular cretics. The inexactly responding sequences are underlined.

Strophe:

trochee paeon trochee (clausular) cretic

[⏔⏑⏔×] [–⏑⏔] [⏔⏑⏔×] |–⏑–|

|– ⏑ – ⏑ ||<u>– ⏑ ⏑ ⏑</u>||– ⏑ – ⏑||– ⏑ –|

καὶ κατ' αὐτὸ <u>τοῦτο μόνο</u>ν ἄνδρες ἀλκιμώτατοι.

Antistrophe:

trochee trochee trochee (clausular) cretic

[⏔⏑⏔×] [⏔⏑⏔×] [⏔⏑⏔×] |–⏑–|

|– ⏑ – ⏑||<u>– ⏑ – ⏑</u>||– ⏑ – ⏑||– ⏑ –|

τοὺς ἐναντί<u>ους, πλέων ἐ</u>κεῖσε ταῖς τριήρεσιν.

In her discussion of this passage, Dale notes that "[i]t seems clear therefore that this is another instance where syllable-counting takes the place of quantitative accuracy in responsion" (Dale 1968: 89). This and like statements have led scholars to attribute a "theory of syllable-counting" to Dale, which receives a relatively harsh review from Parker, for one, who recognizes its potential to overpredict, asking why syllable-counting is so rare if it is an acceptable alternative to quantitative composition (Parker 1997: 117). Certainly, in a completely unconstrained form, the theory would predict that Aristophanes (and possibly also Euripides) could abandon quantitative correspondence in responsion for syllable-counting correspondence whenever he pleased. Several things must be said in Dale's defense. First, the "theory" is nowhere discussed at length, much less formalized in any way, but consists of a number of suggestions scattered throughout the work. This is perhaps due in part to the "justified hatred of self-supporting theoretical structures" that Parker attributes to Dale (*loc. cit.*), but whatever the case may be, the reader is left to construct anything approaching a theory. Secondly, Dale points to numerous ways to constrain the theory. Her view of inexact responsion as a comic license and her suggestion about the durational reduction in trochaic-paeonic contexts already serve to constrain the theory considerably: inexact responsion is a compositional practice restricted to quasi-trochaic rhythmic contexts in freer compositional styles; the rhythms in surface correspondence must be isosyllabic.

2.6 From syllable-counting to syllable-grouping

In my view, Dale's most important point regarding inexact responsion is that it, like other departures from the strict rhythmic norm, is alleviated by diaeresis (correspondence of word boundary and metron boundary) and what she terms "syllable-grouping" (Dale 1968: 64-65). The basic idea, as I understand it, is that in these contexts especially, the poets aligned word boundaries and "syllable groups" with the metrical boundaries in such a way as to preserve rhythmic regularity. In other words, they are using the natural rhythm of the prosodic word even more carefully. It is here (on my reading) that Dale intuitively describes the role of foot structure in inexact responsion—what else is a foot but a syllable group?

This invites us to attempt to flesh out Dale's intuition in a way that is both rhythmically plausible and respects the foot structure argued for in Chapter 1. If we briefly survey the surface sequences attested in trochaic-paeonic and paeonic-dochmiac responsion, we see that one inexact rhythmic correspondence is common to all but one of them:

Table 11: Types of trochaic-paeonic and paeonic-dochmiac response

Trochaic-paeonic			
	Trochee	Paeon	Attestations
Type A	–⏑–⏑	–⏑⏑⏑	4
Type B	–⏑––	–⏑⏑⏑	2

Paeonic-dochmiac			
	Paeons	Dochmiac	Attestations
Type A	–⏑⏑⏑–⏑⏑⏑	–⏑⏑⏑⏑⏑⏑⏑	1
Type B	–⏑⏑⏑–⏑⏑⏑	⏑⏑⏑⏑⏑⏑⏑⏑	2
Type C	–⏑⏑⏑–⏑–	–⏑⏑⏑⏑⏑–	1
Type D	–⏑⏑⏑–⏑–	⏑⏑⏑⏑⏑⏑–	2

If the ⏑⏑ sequences that correspond with –⏑ sequences were implemented with two light syllables that belonged to the same (LL) foot, the strong-weak sonority profile that is crosslinguistically characteristic of moraic trochaic feet (Hayes 1995: 69) would plausibly result in greater surface identity between ⏑⏑ and –⏑.[40] I turn to the cases of trochaic-paeonic responsion to sketch out the rhythmic scenario in more detail.

[40] How exactly the prominence was manifested phonetically in Greek is unclear. It may have involved (subphonemic) stress, as argued by Allen (1973), an increase in duration, as argued extensively by Devine and Stephens (1982; 1984; 1994) *contra* Allen, or both, as in word-final feet in Samoan (Zuraw, Orfitelli and Yu 2008).

2.7 Trochaic-paeonic responsion

If we return to the example of (Type A) trochaic-paeonic responsion at *Wasps* 1062 ~ 1093, we see that the responding sequences are:

paeon		trochee
[–⏑⏖]		[⏖⏑⏖×]
|– ⏑ ⏑ ⏑|		|– ⏑ – ⏑|
τοῦτο μόνο-	~	-ους, πλέων ἐ-

On the analysis of Greek foot structure discussed in Chapter 1, μόνον would have been footed as (μό.νο)<ν>, and the foot-internal prominence relationship would yield (**μό**.νο)<ν>. (I use boldface type to identify the prominent syllables of feet.) Essentially, **μό** is rendered a weightier type of light syllable by virtue of its position in the foot. It remains categorically light, though. This **L**L would be a better match for the corresponding HL sequence implemented by -ω.νε- (of πλέ<u>ων ἐ</u>κεῖσε) in terms of relative strong-weak (SW) prominence:

|– ⏑ ⏑ ⏑|		|– ⏑ – ⏑|
S W S W		S W S W
τοῦτο (**μό.**νο-)	~	-ους, πλέων ἐ-

The foot-based prominence lent to **μό** would give the paeonic sequence an overall ditrochaic rhythm. In the other three cases of trochaic-paeonic responsion, the final ⏑⏑ sequence of the paeon is implemented by a (**L**L) foot as well. The second example comes just after the first, at *Wasps* 1064 ~ 1095. I present the data in somewhat more abbreviated form:

|– ⏑ – ⏑|| – ⏑ ⏑ ⏑||– ⏑ – ⏑| |– ⏑ – –||– ⏑ – ⏑||– ⏑ – ⏑|
οἴχεται, κύκνου τε πολιώτεραι δὴ ~ ῥῆσιν εὖ λέκσειν ἐμέλλομεν τότ’ οὐδὲ[41]

Here, the relevant ⏑⏑ sequence is implemented by the word-initial foot of (**πο**.λι)(ώ)(**τε**.ρα)<ι>. The other two examples of Type A, and both examples of Type B trochaic-paeonic responsion are found at *Lysistrata* 781 ff. = 805 ff., where the strophe and antistrophe are also composed in trochaic, paeonic, and cretic sequences, with the addition of spondees (|––|) that punctuate larger metrical phrases. The semi-choruses performing are the same old men and women who participate in the recitative exchange involving the paeonic-trochaic substitution noted above. The examples are found at *Lysistrata* 788 ~ 811 and 789 ~ 812, respectively:

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[41] The eta of δὴ undergoes “epic correption” (i.e., antevocalic shortening in phrasal context) before the following αἴδ’, according to Parker. This is unusual in trochaic lyric, and it is not clear to me why we should not simply take this as one of many examples where |–⏑––| corresponds with |–⏑–⏑|. The text reads λέξειν. In order to capture the syllable boundary [lék.se:], I print λέκσειν.

|– ⏑ ⏑ ⏑||– –| |– ⏑– ⏑||– –|
τοῖς ὄρεσιν ᾤκει· ~ Ἐρῑνύων ἀπορρώξ

|– ⏑ ⏑ ⏑||– –| |– ⏑ – ⏑||– –|
κἆτ᾽ ἐλαγοθήρει ~ οὗτος οὖν ὁ Τῑ́μων

The ⏑⏑ implementations are ὄ(**ρε**.σι)<ν> and ἐ(**λα**.γο)(θή)(ρει).

In Type B trochaic-paeonic responsion, the anceps position of the trochee is implemented by a heavy syllable: |–⏑––| ~ |–⏑⏑⏑|. There is a tendency among metrists and editors not to class it together with Type A. West, for example, effectively excludes it: "it seems to be just this paeonic form that has the special affinity with the trochaic metron, as if –⏑×⏑ was the essence of trochaic rhythm so far as comic song/dance was concerned" (1982: 108). There is also a tendency among editors to regard it as illegitimate, and therefore textually corrupt. The editorial treatment of *Lysistrata* 785-786 ~ 808-809 reflects this. The received text is:

|– –| |– ⏑– –||– ⏑ ⏑ ⏑||– –| |– –| |– ⏑ ⏑⏑||– ⏑ ⏑ ⏑||––|
οὕτως ἦν νεᾱνίσκος Μελανίων τις ~ Τῑ́μων ἦν τις ἀίδρῡτος ἀβάτοισιν

In this case, the first two syllables of (**ἀ**.ί)(δρῡ)το<ς> implement the ⏑⏑ sequence. Bentley emended the antistrophe by changing the order to Τῑ́μων ἦν ἀίδρῡτός τις, which results in perfect correspondence. The emendation is printed by Henderson, who accepts Type A as legitimate, but not Type B.[42] However, a second example immediately follows it, at 787 ~ 810:

|– ⏑ – –| | – ⏑ ⏑ ⏑|

ἐρημίᾱν κἀν ~ περιειργμένος Ἐρῑνύων

Here, the ⏑⏑ sequence is not implemented by a (**L**L) foot, but the final syllable of (**πε**.ρι)(ειργ)(**μέ**.νο)<ς> and the initial syllable of ᾿Ε(ρῑ)νύ(ω)<ν>.

There are several reasons to view Type A and Type B as a responsional class. First, we encounter two cases of Type B trochaic-paeonic responsion in the same songs that we find two examples of Type A. The overall rhythmic character of the songs is trochaic-paeonic. Above, I defined inexact responsion as strophic correspondence of underlyingly different metra, and we are in the process of exploring the nature of the restrictions on surface similarity. Clearly Aristophanes strongly preferred (or required) the surface correspondence to be exact with respect to syllable count, but it is not clear what the further restrictions on similarity were. Descriptively, Type B trochaic-paeonic responsion involves a surface form of the trochee that has the same syllable count as the surface form of the paeon. The rejection of Type B as legitimate is made on the implicit but unfounded assumption that |–⏑––| and |–⏑⏑⏑| are too rhythmically different to be legitimate. However, in the case of paeonic-dochmiac responsion examined below, we

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42 Cf. the discussion at Parker (1997: 379). Zimmermann also prints Bentley's emendation (1987: 65).

see different degrees of matching as well. There, both |–⏑⏑⏑⏑⏑⏑⏑| and |⏑⏑⏑⏑⏑⏑⏑⏑| respond with paeonic dimeters of the shape |–⏑⏑⏑||–⏑⏑⏑|. The former dochmiac differs from the paeonic dimeter with respect to the syllable weight of the fifth position, and the latter, with respect to both the first and fifth positions. We have seen that in exact trochaic-trochaic responsion, while Aristophanes preferred to match the surface rhythms exactly, various degrees of surface identity are attested. We have every reason to expect, I think, that if Aristophanes did prefer to match more than syllable count in inexact responsion, the system of preferences would have worked much like it did in trochee-trochee responsion. Since the preferences there were not so strict as to completely rule out a surface pairing like |–⏑–⏑| = |–⏑––|, so there is no *a priori* reason to expect a Type B pairing to be ruled out either |–⏑––| ~ |–⏑⏑⏑|. I sketch out the proposed parallel between the types of response below:

	Identical (as possible)	Not identical (as possible)
Trochaic-trochaic	–⏑–⏑ = –⏑–⏑	–⏑–⏑ = –⏑––
	–⏑–– = –⏑––	
Trochaic-paeonic	(A) –⏑–⏑ ~ –⏑⏑⏑	(B) –⏑–– ~ –⏑⏑⏑
Paeonic-dochmiac	(A) –⏑⏑⏑–⏑⏑⏑ ~ –⏑⏑⏑⏑⏑⏑⏑	(B) –⏑⏑⏑–⏑⏑⏑ ~ ⏑⏑⏑⏑⏑⏑⏑⏑

On this view exact and inexact responsion are variants of the same basic compositional strategy, where Type B trochaic-paeonic responsion and Type B paeonic-dochmiac responsion are the correlates of the surface mismatch of |–⏑–⏑| and |–⏑––| in trochaic-

trochaic responsion—the syllable count is as close as possible, but the distribution of syllable weight is not.

In Table 12, I provide a tally of the ⏑⏑ sequences that are filled with a (**L**L) foot, and and those which are not.

Table 12: ⏑⏑ implementation in trochaic-paeonic responsion

		(**L**L)	Other LL	Total
Type A	–⏑–⏑ ~ –⏑⏑⏑	4	0	4
Type B	–⏑–– ~ –⏑⏑⏑	1	1	2

While the 5:1 implementation of ⏑⏑ with a (**L**L) moraic trochee in trochaic-paeonic responsion is consistent with the hypothesis that foot structure contributed to greater surface similarity between paeon and trochee, it cannot be shown that Aristophanes aligned (**L**L) feet at the end of the paeonic metron more often than we would expect, since word boundary between the final two syllables of the paeonic sequence ("split resolution") is generally avoided whether they are in responsion with trochees or not. At most, one could argue that the avoidance of split resolution in the paeon contributed to the rhythmic naturalness of trochaic-paeonic responsion. Paeonic-dochmiac responsion provides a better testing ground for the hypothesis that Aristophanes actively arranged the syllable groups.

2.8 Paeonic-dochmiac response

The polymorphous nature of the dochmiac provides for a more interesting case study than the somewhat rigid paeon, with its two possible surface instantiations and the constraint against split resolution. Essentially, the dochmiac's flexibility allows us to test whether Aristophanes went beyond matching the syllable count and actually used foot-based syllable prominence to heighten the rhythmic resemblance between the dochmiac and the paeonic dimeter. There are five types of paeonic-dochmiac response by surface instantitation:

	Paeonic-dochmiac		
	Paeons	Dochmiac	Attestations
Type A	–⏑⏑⏑–⏑⏑⏑	–⏑⏑⏑⏑⏑⏑⏑	1
Type B	–⏑⏑⏑–⏑⏑⏑	⏑⏑⏑⏑⏑⏑⏑⏑	2
Type C	–⏑⏑⏑–⏑–	–⏑⏑⏑⏑⏑–	1
Type D	–⏑⏑⏑–⏑–	⏑⏑⏑⏑⏑⏑–	2

Each dochmiac has either one or two ⏑⏑ sequences that correspond with the –⏑ sequence with which the paeon begins. As we did with the cases of trochaic-paeonic response, we will tally how often Aristophanes filled those positions with (**L**L) feet. We then collect all of the dochmiacs that have the same (Type A, B, C, or D) surface instantiations, but do *not* respond with paeons, and perform the same tally. The comparison allows us to check whether Aristophanes distributed (**L**L) feet differently in dochmiacs that he placed in responsion with paeons or not. I divide both data sets into two classes, one in which *all* of the relevant ⏑⏑ sequences are filled with (**L**L) feet, and one in which they are not all filled with (**L**L) feet.

Five of the six cases of paeonic-dochmiac responsion are found at *Birds* 327 ff. = 343 ff. The inexact responsion runs from 333a-335 ~ 349a-351:

<table>
<tr><td>Strophe</td><td>Antistrophe</td></tr>
<tr><td>dochmiac</td><td>2 paeons</td></tr>
<tr><td>[×⏕⏕×⏕]</td><td>[–⏑⏕] [–⏑⏕]</td></tr>
<tr><td>|– ⏑ ⏑ ⏑ ⏑ ⏑ ⏑ ⏑|</td><td>|– ⏑ ⏑ ⏑||– ⏑⏑ ⏑|</td></tr>
<tr><td>ἐς δὲ δόλον ἐκάλεσε</td><td>οὔτε γὰρ ὄρος σκιερὸν</td></tr>
<tr><td>|⏑ ⏑ ⏑ ⏑ ⏑ ⏑ ⏑ ⏑|</td><td>|– ⏑ ⏑ ⏑||– ⏑ ⏑⏑|</td></tr>
<tr><td>παρέβαλέ τ᾽ ἐμὲ παρὰ</td><td>οὔτε νέφος αἰθέριον</td></tr>
<tr><td>|⏑ ⏑ ⏑ ⏑ ⏑⏑ ⏑⏑|</td><td>|– ⏑ ⏑ ⏑||– ⏑ ⏑ ⏑|</td></tr>
<tr><td>γένος ἀνόσιον ὅπερ</td><td>οὔτε πολιὸν πέλαγος</td></tr>
<tr><td>|–⏑ ⏑ ⏑ ⏑ ⏑ –|</td><td>|– ⏑ ⏑ ⏑||–⏑ –|</td></tr>
<tr><td>ἐξότ᾽ ἐγένετ᾽ ἐμοὶ</td><td>ἔστιν ὅ τι δέξεται</td></tr>
<tr><td>|⏑ ⏑ ⏑⏑ ⏑ ⏑ –|</td><td>|– ⏑ ⏑ ⏑||– ⏑ –|</td></tr>
<tr><td>πόλεμιον ἐτράφη.</td><td>τώδ᾽ ἀποφυγόντε με.</td></tr>
</table>

Cases where the foot structure follows straightforwardly from the presentation in Chapter 1 are: (**ἐ**.κά)(**λε**.σε), (**γέ**.νο)<ς>, (**ἀ**.νό)(**σι**.ο)<ν>, (**πό**.λε)(**μι**.ο)<ν>, and (**ἐ**.τρά)(φη). I did not discuss Golston's (1990) analysis of foot structure as it applies to clitic groups, which I follow as well. Disyllabic enclitics, such as ἐμέ, are footed, whereas monosyllabic enclitics, such as τε, are not. This follows from the requirement that the minimum foot in Greek (and the minimum word) is bimoraic. The foot structure of the clitic group παϱέβαλέ τ᾽ ἐμὲ results from the phrasal compilation of (**πα**.ϱέ)(**βα**.λε) + τε + (**ἐ**.μέ). Elision and resyllabification in phrasal context yields **πα**.ϱέ.**βα**.λέ.**τε**.μέ.

I assume that the foot-based syllable prominence of citation forms is generally preserved in phrasal context, in the same way that the position of the recessive accent (also assigned on the basis of the citation form) is preserved. There are cases where elision of a word-final vowel results in a kind of prominence clash, where we might expect on typological grounds that there was a phrasal readjustment, as in the well-known readjustment in English: *thìrtéen* + *mén* → *thírtèen mén*.[43] The prominence relations in ἐγένετ᾽ ἐμοί present precisely this sort of problem. After elision operates on (**ἐ**.γέ)(**νε**.το) + (**ἐ**.μο)<ί> in phrasal context, we predict **ἐ**.γέ.**νε**.**τε**.μοί. One could argue that the strong syllable of the word-final foot would have been more prominent than the strong syllable of the enclitic, and that -νε.τε- would thus have a strong-weak relationship.[44] On this view, -νετ᾽ ἐμοί would have had a strong-weak-strong rhythm to match the corresponding δέξεται, but the case is relatively insecure.

The sole example of paeonic-dochmiac responsion outside of the *Birds* is found at *Wasps* 339 ~ 370:

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[43] For a theory of phrase-level prosodic adjustments in Greek, cf. Devine and Stephens (1982; 1984: 114-127).

[44] This would essentially be parallel to situations in English and other stress-based prosodic systems where "clash" between contiguous primary and secondary stress is more readily permitted than clash between two contiguous primary stresses.

|⏑⏑ ⏑ ⏑ ⏑ ⏑ –| |– ⏑ ⏑ ⏑||– ⏑ –|

<u>τίνα</u> πρόφα<u>σιν ἔ</u>χων; ~ ἀλλ᾽ ἔπαγε τὴν γνάθον.

Here, the first ⏑⏑ sequence is filled with a (**L**L) foot, but the second is not: (**<u>τί</u>**.<u>να</u>) but πρό(**φα**.<u>σι)ν ἔ</u>(χω)<ν>. Thus, in four of the six dochmiacs involved in paeonic-dochmiac responsion, all the ⏑⏑ sequences that respond with –⏑ sequences are filled with (**L**L) feet. In one case (ἐγένετ᾽ ἐμοί) the sequence *may* be filled with a strong-weak LL sequence, and one case belongs to the group where the relevant ⏑⏑ sequences are not all filled with a (**L**L) foot.

2.8.1 Dochmiacs not found in inexact responsion

Below, I present all of the dochmiacs that have the same surface instantiations, but are not in paeonic-dochmiac responsion.[45] These are either in (exact) dochmiac-dochmiac responsion, or they are in monodes.

Type A comparanda

|–⏑ ⏑ ⏑ <u>⏑ ⏑</u> ⏑ ⏑| |– ⏑ ⏑ ⏑<u>⏑⏑</u> ⏑ ⏑|

Birds 1193 = 1265: ἀέρα πε<u>ρινέ</u>φελον = μηδέ τιν᾽ ἱ<u>ερό</u>θυτον

|– ⏑ ⏑⏑ <u>⏑ ⏑</u> ⏑ ⏑|

Thesmophoriazusae 1026: ἐφεστὼς ὀλοὸ<u>ν ἄφι</u>λον ἐκρέμασε

[45] I omit *Birds* 1266 and *Thesmophoriazusae* 685-686, both of which are corrupt, rather than relying on one of the emendations.

Type B comparanda

	|◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡|
Birds 234:	ὅσα τ᾽ ἐν ἄλοκι θαμὰ
	|◡ ◡ ◡ ◡ ◡◡ ◡ ◡|
Birds 1194:	ὃν Ἔρεβος ἐτέκετο
	|◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡| = |◡ ◡ ◡ ◡ ◡ ◡ ◡◡|
Acharnians 362 = 390:	πάνυ γὰρ ἐμέ γε πόθος = σκοτοδασυπυκνότριχά
	|◡◡ ◡ ◡ ◡◡ ◡ ◡|
Thesmophoriazusae 725:	ἐπὶ κακὸν ἑτερότρος
	|◡◡ ◡ ◡◡ ◡ ◡◡|
Thesmophoriazusae 914:	λαβέ με, λαβέ με, πόσι
	|◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡|| ◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡|
Thesmophoriazusae 915:	φέρε, σὲ κύσω, ἄπαγέ μ᾽ ἄπαγ᾽ ἄπαγ᾽ ἄπαγέ με
	|◡ ◡ ◡ ◡ ◡ ◡ ◡◡|
Thesmophoriazusae 1039a:	ἄνομ᾽ ἄνομα πάθεα

Type D comparanda

	| ◡ ◡ ◡ ◡ ◡ ◡ –|
Birds 239:	κλάδεσι νομὸν ἔχει,
	|◡ ◡ ◡ ◡ ◡ ◡ –|
Thesmophoriazusae 724:	τάχα δὲ μεταβαλοῦσ᾽
	|◡◡ ◡ ◡ ◡ ◡ –|
Thesmophoriazusae 914:	περίβαλε δὲ χέρας

Note that since the only dochmiac of the shape |–⏑⏑⏑⏑⏑–| is found in paeonic-dochmiac responsion, there are no Type C comparanda.

Of the fifteen, there are three cases where the foot-based prominence follows straighforwardly, and all relevant ⏑⏑ sequences are implemented with (**L**L) feet:

ἱ(**ε**.ϱό)(**θυ**το)<ν>, (**ὅ**.σα) ... ἄ(**λο**.κι), (**σκο**.το)(**δα**.συ)(**πυ**.κνό)(**τϱι**.χά)

There are ten cases where at least one (**L**L) implementation is lacking. I use the shorthand notation “X but Y” for cases like ἐπὶ κακὸν ἑτεϱότϱος (*Thesmophoriazusae* 725), where (**ἐ**.πὶ) gives a (**L**L) implementation, but ἑ(**τε**.ϱό)(**τϱο**.πο)<ς> does not, and “X despite Y” for the reverse order:

ἄ(**φι**.λο)<ν>, ὃν Ἔ(**ϱε**.βο)<ς> despite (**ἐ**.τέ)(**κε**.το), (**πά**.νυ) but (**ε**.μέ)γε, (**ἐ**.πὶ) but ἑ(**τε**.ϱό)(**τϱο**.πο)<ς>, (**λα**.βέ)με but (**λα**.βέ)με, ἄ(**νο**.μ’) ... ἄνομα πά(**θε**.α), ἄ(**πα**.γ’) ... ἄ(**πα**.γέ)με, κλά(**δε**.σι) ... (**νο**.μὸ)ν ἔ(χει), (**τά**.χα) but (**με**.τα)βα(λοῦσ’), (**πε**.ϱί)(**βα**.λε) but δὲ (**χέ**.ϱα)<ς>

Three cases require some further discussion. The foot structure of πεϱινέφελον and μεταβαλοῦσ’ involve a factor that is not treated by Golston (1990). There is evidence from meter that disyllabic prefixes such as πεϱι- and μετα- formed their own phonological words and thus domains for footing in Greek, as also in Dutch, Italian, Polish, etc.[46] The evidence is twofold. In tragedy, leftward (i.e., onset to coda)

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[46] Cf. Booij (1999); Oostendorp (1999); Peperkamp (1997); Rubach and Booij (1990). This is especially true of prefixes like πεϱι- with enough phonological material to pass minimum word requirements. In many languages, there is a minimum number of morae or syllables required of a lexical word. The

resyllabification of the first segment of a stem-initial *muta cum liquida* cluster across the boundary between a prefix and stem (+) is avoided, as is leftward resyllabification across word boundary (Devine and Stephens 1994: 35). The poets syllabify the clusters as if they were word-initial:[47]

ἀπο+τρέ.που (*Iphigenia Aulidensis* 336)

ἀπο+τρο.πᾱ́ (*Helena* 360)

Second, in the stricter styles of the iambic trimeter, the poets avoided resolution of a disyllabic prefix in LL+LH-shaped words such as ἀπο+λαβών.[48] In this respect, too, they treat the prefix-stem boundary like a word boundary (#), since resolution of LL# sequences is likewise avoided.[49] This points to a typologically common, compound-like prosody, where two prosodic words are involved (square brackets enclose prosodic words): [περι] [νέφελον] [μετα] [βαλοῦσα]

Prosodic words are the domain for foot structure:

[(**πε**.ρι)] [νέ(**φε**.λο)<ν>] [(**με**.τα)] [βα(λοῦ)σα]

The third case involves the prominence relationships in φέρε, σὲ κύσω. ἄπαγέ (*Thesmophoriazusae* 915). There, the first ⏑⏑ sequence is implemented with (**φέ**.ρε).

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standard analysis of word minima (McCarthy and Prince 1986) relates the restriction to foot structure: a word must consist minimally of one foot. Thus, the bimoraic lexical word minimum in Greek points to bimoraic feet (Golston 1991). For discussions of word minima, cf. Devine and Stephens (1994: 93), Mester (1994: 20 ff.), and Hayes (1995: 47).

[47] Exceptions to this are rare, but exist: ἀ.πό+τ.ρο.ποι (*Phoenissae* 586)

[48] Cf. (Devine and Stephens 1984: 80-81; 1994: 149-150).

[49] Devine and Stephens suggest that both reflect prosodic domain-final lengthening (*loc. cit.*).

The second presents a problem. In phrasal context, the final long vowel of κύ(σω) is shortened before the initial vowel of ἄ(**πα**.γε) by "epic correption". One could assume that the the result was κύ.**<u>σο</u>** <u>ἄ</u>.**πα**.γε, i.e., that the second syllable retained its prominent status, and that the resulting **<u>σο</u>** <u>ἄ</u> was a strong-weak **L**L sequence. It is hard to say what sort of empirical evidence could be brought to bear on this question, so I will categorize this example as insecure.

2.8.2 Comparison of foot distribution and conclusion

I sum up the results for comparison in Table 12, where δ ~ p represents the group of dochmiacs that respond with paeons and δ elsewhere represents the control group of dochmiacs in exact dochmiac-dochmiac response and in monodes, leaving out the two cases labeled as insecure above.

Table 13: (**L**L) distribution in dochmiacs

	(**L**L) in all ⏑⏑	(**L**L) absent	Total
δ ~ p	4	1	5
δ elsewhere	3	12	15

We see that 80% of dochmiacs in responsion with paeons have a (**L**L) moraic trochee implementing all the ⏑⏑ positions that respond with –⏑ sequences in the paeonic dimeter, whereas only 20% of the dochmiacs in the control group do. A Fisher's Exact Test shows that the distributional difference is statistically significant in a sample of this size (p = 0.0307).[50] The result is consistent with the hypothesis that Aristophanes arranged words so as to align strong-weak rhythms based on foot structure with strong-weak rhythms based on categorical syllable weight, i.e., that he preferred matching **L**L with HL in inexact responsion. Clearly, it was not an absolute requirement, but this is consistent with the way his surface-matching preferences worked in exact trochee-trochee responsion.

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[50] Strictly speaking, we should not include the one example of Type C paeonic-dochmiac responsion, since there are no comparanda involving a dochmiac of the shape |–⏑⏑⏑⏑⏑–|. If we do not, the p-value sinks to 0.00903, i.e., the difference between the distributions is even more significant and thus remains consistent with our hypothesis. If we include the two insecure cases discussed above, the difference becomes more significant yet.

3. A new method of judging emendations to the Rigveda

3.1 Introduction

Prosody played a prominent role in the grammar of the poets who composed the verses passed down to us in the Rigveda. They arranged their words and phrases into rhythmic patterns that reveal a complex system of preferences that refer to various levels of prosodic structure, of which the best understood are syllable weight and word boundary. Despite the remarkably conservative oral tradition that preserved the hymns over a long period and the impressive accuracy with which it was carried over into writing, the study of Vedic meter has convincingly shown that the Saṃhitā text does not perfectly reflect the compositions it transmits.[51] In the following pages, we will see a number of examples of such inaccuracies.

In the present study, I present a refined method of judging emendations to the Saṃhitā text (henceforth S. text) that have been proposed because of a discrepancy between the prosodic shape suggested by the spelling of a word and the location of that word in the meter. Before introducing the method, I briefly exemplify the type of discrepancy that motivates textual emendation. In the following pages, I will refer to the prosodic shape reflected by the way a form is written in the S. text as its spelling shape, and the shape of the emendation as its suggested shape. Thus, in pausa, the spelling

[51] Grassmann (1873), Oldenberg (1888; 1909), Pischel and Geldner (1889), Arnold (1905), and Seebold (1972) are several pioneering works in this area.

shape of the masc. nom. sg. of the adjective *pāvakáḥ* ‘pure’ is HLH. The first syllable *pā* is heavy (H), the second syllable *va* is light (L), and the final syllable *káḥ* is heavy. The suggested shape of the form, according to a universally accepted emendation *pavākáḥ* is LHH. I will use light and heavy to refer to the prosodic shape of specific forms, and the symbols ⏑, –, and × (i.e., breve, longum, and anceps) to refer to metrical positions. We can represent the pāda-final location of *pāvakáḥ* in the 11-syllable Triṣṭubh, for example, as in (1).

(1) *pāvakáḥ* pāda-finally in the Triṣṭubh

Meter of Triṣṭubh positions 9-11: ⏑ – ×
Spelling shape of the S. text form: H L H
Form: *pā va káḥ*

The word-initial HL-sequence is a very poor implementation of the breve-longum of the meter, which are very strictly regulated verse-finally. The emendation to *pavākáḥ** (postposed asterisks mark emendations and restorations), which is based on the frequent mismatches between meter and spelling shape of the sort shown in (1), yields the better metrical fit given in (2).

(2) *pavākáḥ** pāda-finally in the Triṣṭubh

Meter of Triṣṭubh positions 9-11: ⏑ – ×
Suggested shape of the form: L H H
Form: *pa vā káḥ**

The method I will put forward in the following pages differs significantly from the standard approach in that it takes every location in the verse into account, as opposed to concentrating only on the stretches of the verse where the distribution of heavy and light syllables is most strictly regulated, i.e., the cadence, as in (1) and (2), and to a lesser extent, the post-caesural portion of trimeter verse. As an example, we may take the metrical distribution of the set of inflectional forms of *pāvaká-* which have the spelling shape HLH and suggested shape LHH (*pāvakás*, *pāvakám*, *pāvaké*, *pāvakā́s*, *pāvakā́n*). I will refer to the set as HLH/LHH forms of *pāvaká-*, or as *pāvakás*-type forms.[52]

In 11-syllable verse, 28 HLH/LHH forms of *pāvaká-* are attested. Of those, 22 are located pāda-finally, 5 are located immediately before the caesura 5|, and one is located immediately before the caesura 4|. I give an example of each in (3), drawn from an electronic version of the van Nooten and Holland (1994; henceforth vNH) metrically

[52] Note that by this definition, forms are treated according to their surface shape, and as if in pausa. This means that forms are excluded which underlyingly have the spelling shape HLH, but due to sandhi have the shape HLL, such as *pāvaká,* which happens not to occur in 11-syllable verse, but occurs in 8- and 12-syllable verse (3.27.4b, 7.15.10c, 8.13.19c, 9.24.7a) and includes forms that have the shape HLH in pausa, but not in context, such as at 9.24.6c, where the word-final *-o* is presumably shortened by antevocalic correption *śúciḥ pāvakó ádbhutaḥ*. One could argue for grouping the forms in other ways, e.g., in terms of their underlying shape. The most important thing, though, is to define the groups consistently, such that in general, what is included and excluded from the set of HLH/LHH forms of *pāvaká-* (or whatever set of forms is under consideration) by this particular definition is also included and excluded from the comparanda.

restored text,[53] which I alter in order to undo the emendation of *pāvaká-* to *pavāká-**. (The | represents caesura, and the || represents verse end.)

(3) *pāvaká-* locations in 11-syllable verse

pāda-final (22x)

ví yá inóti | *ajáraḥ* ***pāvakó*** || (6.4.3c)

before the caesura 5| (5x)

śúcim ***pāvakáṃ*** | *ghṛtápṛṣṭham agním* || (5.4.3b)

before the caesura 4| (1x)

yáḥ ***pāvakáḥ*** | *purutámaḥ purū́ṇi* || (6.6.2c)

I present the same data in Table 14, in which the columns refer to the metrical positions, numbered 1-11, of the verse. In the row, *pāvakás* refers to the *pāvakás*-type forms, i.e., the set of inflectional forms with the shape HLH/LHH.

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[53] The electronic text I use is derived from the text made available online by the University of Texas Linguistics Research Center, Karen Thomson and Jonathan Slocum, which is itself virtually identical to the vNH text, save for a number of (mostly typographical) corrections including, incidentally, correcting inconsistencies in the emendation of *pāvaká-* to *pavāká-**. I will refer to this as the UTvNH text where it is necessary to distinguish it from the vNH text.

Table 14: Metrical distribution of *pāvakás* in 11-syllable verse[54]

	Metrical Positions									
	1-3	2-4	3-5	4-6	5-7	6-8	7-9	8-10	9-11	Total
pāvakás	0	1	5	0	0	0	0	0	22	28

Reading the row from left to right, we see that a *pāvakás*-type form is never located spanning positions 1-3 of the Triṣṭubh. It is located spanning positions 2-4 of the Triṣṭubh once, spanning positions 3-5 five times, etc. Taking the entire metrical distribution of the form or set of forms under consideration into account is a significant improvement. As we will see in greater detail below, the poets located words according to strong distributional tendencies even in the less strictly regulated portions of the verse such as the opening. It is not accidental, for example, that the poets never located a HLH/LHH form of *pāvaká-* pāda-initially in the Triṣṭubh. When composing in 11-syllable meter, the Rigvedic poets located only 10% of the LHH-shaped words they used in pāda-initial position.

The factors determining the location of particular word shapes in the less regulated portions of the verse are far from being fully understood. Certainly, preferences for syllable weight distribution play a role, though they are less strictly adhered to than they are towards the end of the verse. Preferences for and against word boundary in particular metrical positions, primarily the location of the caesura after the

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[54] Here and throughout, "11-syllable verse" refers to Triṣṭubh-type verse, such that 11-syllable verses that are both located in a 12-syllable context and exhibit Jagatī-type cadences are excluded. For a list of such verses, see Gippert (1997: 66-67).

fourth or fifth syllable in trimeter verse, are also involved, and while it would be overly simplistic to view the opening as a kind of dumping ground for forms that are difficult to locate in the break and cadence, it is clear that part of the reason why the poets rarely placed certain word shapes in the opening was because those shapes filled out some portion of the break or cadence so well, and vice versa. Using the method proposed here, by considering the entire metrical distribution of a set of forms, we take these factors into account whether we understand them or not. This allows us to better judge emendations and restorations of forms that are infrequently found in the cadence, either because their shape is not well suited for location in the cadence, or because the forms are infrequently attested overall.

From a more general standpoint, considering the distribution across the entire verse broadens the focus of inquiry, which is currently restricted to the comparison of a form with a "yard-stick" representation of the more strictly regulated portions of the meter (i.e., a conception in terms of breve, longum, etc.). Essentially, we turn our attention to the compositional process that produced the verse in its entirety. This is not at all to say that the type of comparison that focuses primarily on the rhythmic patterns in the more regulated portions of the verse is poor. To the contrary, it has produced many successful emendations, two of which we will confirm in sections §3.2 and §3.3. In fact, the emendation of *pāvaká-* to *pavākā́-** is a kind of *glänzende Bestätigung* of the method. As I demonstrate in the discussion of *pīpiyānéva* (§3.4), however, the danger associated with operating with the yard-stick comparison and not considering word shape distribution is to make emendations that result in a more regular rhythm in a short, strictly regulated portion of the verse, but do not respect the composition of the verse as a whole. If we are to continue to use the meter to probe what the prosodic shapes of various forms were for the poets themselves, and if we are to do this in a conservative and accurate manner, we must take the entire verse into account.

In order to put this desideratum into practice, we compare the metrical distribution across the verse of the form or set of forms in question first to the metrical distribution of *all* words that have its *spelling* shape, then again to the metrical distribution of *all* words that have its *suggested* shape. After we have done this, we are in a position to compare the distributions, and decide whether the form or set of forms in question patterns with the one group or the other. Since it is easy to make impressionistic errors when dealing with small samples such as the distribution of the *pāvakás*-type forms presented above, we associate the differences in distributions with an objective, statistically grounded numerical value (§3.2). While this sort of comparison would be extremely tedious to do by hand, we are now in a position to do this with greater ease with a digitalized corpus of the Rigveda, and a program that syllabifies and parses the verses.[55] In the following section, I demonstrate the method with *pāvaká-* as a kind of control case, since it is agreed that the result should support the emendation to *pavāká-**.[56]

[55] I rely on a corpus based on the UTvNH text, and I use a Perl program created by Kevin Ryan (UCLA), to whom I am indebted both for the programming and numerous substantive discussions of the project.
[56] Ideally, the method would be applied to every item in the Rigvedic lexicon.

3.2 Exemplifying the method with a control case: *pāvaká-* and *pavākā-**

In order to determine what prosodic shape HLH/LHH forms of *pāvaká-* had for the Vedic poets, we test whether the poets distributed HLH/LHH forms of *pāvaká-* in the verse as they distributed words of the shape HLH or as they distributed words of the shape LHH. The method requires three sets of data. First, we need to know what the metrical distribution of HLH/LHH forms of *pāvaká-* was in a particular meter. This was given in Table 14 above. Next, we need the same information for the location of all HLH-shaped words and all LHH-shaped words in 11-syllable verse. I present these three data sets in Table 15.

Table 15: Metrical distribution of *pāvakás*, HLH-, and LHH-shaped words in 11-syllable verse

	Metrical Positions									
	1-3	2-4	3-5	4-6	5-7	6-8	7-9	8-10	9-11	Total
pāvakás	0	1	5	0	0	0	0	0	22	28
HLH	125	583	177	25	1038	818	14	404	32	3216
LHH	606	75	817	2	91	89	47	0	4392	6119

Reading the table from left to right, beginning with the HLH row, we see that when composing 11-syllable verse, the poets located 125 HLH-shaped words in pāda-initial position, 583 spanning positions 2-4 (the vast majority of which are followed by the the caesura 4|), 177 spanning positions 3-5 (followed by the caesura 5|), etc. The total number of HLH-shaped words that the poets used in 11-syllable verse was 3216. A glance at the LHH row tells us that the poets located 606 of a total of 6119 LHH-shaped words pāda-initially, 75/6119 spanning positions 2-4, etc. Since the totals (28, 3216, 6119) differ so drastically, it is easier to view the same information in terms of the proportion of forms that occur in each metrical location, as given in Table 16, where the totals are retained in the rightmost column (N).

Table 16: Proportional distribution of *pāvakás*, HLH-, and LHH-shaped words in 11-syllable verse

	Metrical Positions									
	1-3	2-4	3-5	4-6	5-7	6-8	7-9	8-10	9-11	N
pāvakás	0.00	0.04	0.18	0.00	0.00	0.00	0.00	0.00	0.79	28
HLH	0.04	0.18	0.06	0.01	0.32	0.25	0.00	0.13	0.01	3216
LHH	0.10	0.01	0.13	0.00	0.01	0.01	0.01	0.00	0.72	6119

With the exception of pāda-initial position, we see that the group of *pāvakás*-type forms patterns far more closely with the LHH-shaped words with respect to metrical distribution, not only in the more strictly regulated post-caesural portion of the line, but throughout the entire verse, with the exception of the pāda-initial location. In the case of *pāvaká-*, a word which is well attested and frequently located in the cadence, it is hardly necessary to look beyond the cadence of the Triṣṭubh to come to the conclusion that the word must have had the shape LHH for the poets. The Iranian cognates (Parthian *pw'g* 'pure', Farsi *pāk* 'id.') corroborate the view that the inherited form must indeed have been *pavāká-**, and a likely source of the transmission error has been identified in the *pāvaka-* 'fire' of Classical Sanskrit (cf. AiGr 2,2: 266-267, EWAia *s. v.* PAV[I], with refs.). It is perhaps as sure a case for emendation as there could be.

It is worth pointing out, however, that using the method proposed here, we might consider emending *pāvaká-* on the basis of the opening of the verse alone. Looking only at the opening goes contrary to the point of taking the entire metrical distribution, and by extension, more of the poets' compositional process into account, but I would like to use the opportunity to introduce Fisher's Exact Test, as well as to show just how informative the less regulated portions of the meter are. I give the token frequencies and percentages for the opening alone in Table 17 and Table 18.

Table 17: Metrical distribution of *pāvakás*, HLH-, and LHH-shaped words in the opening of 11-syllable verse

	Metrical Positions			
	1-3	2-4	3-5	Total
pāvakás	0	1	5	6
HLH	125	583	177	885
LHH	606	75	817	1498

Table 18: Proportional distribution of *pāvakás*, HLH-, and LHH-shaped words in the opening of 11-syllable verse

	Metrical Positions			
	1-3	2-4	3-5	N
pāvakás	0.00	0.17	0.83	6
HLH	0.14	0.66	0.20	885
LHH	0.40	0.05	0.55	1498

If we had only this information available to us, e.g., if the post-caesural portion of every Triṣṭubh line in the Rigveda had been tragically lost in transmission, we might notice that HLH/LHH forms of *pāvaká-* pattern more closely with LHH-shaped words in two of the three positions, but hesitate to assign either shape to the forms in question, because of the small sample size. With only 6 attestations, what are the odds that these forms of *pāvaká-* actually had the spelling shape HLH, but were distributed more like LHH-shaped words by chance? The statistical test known as Fisher's Exact Test (extended to matched-length column tables) accounts for the small sample size and answers precisely this question.

When we perform the Fisher's Exact Test comparing the distribution of the *pāvakás*-type forms and HLH-shaped words in the opening of the verse, the test yields a value that reflects the probability that the distributional differences can be ascribed to chance (a p-value). A p-value of 0.2 would inform us that (assuming that the *pāvakás*-type forms have the same underlying distribution as all the other HLH-shaped words) if 6 of the *pāvakás*-type forms were distributed over and over in the opening of the verse, there is a 20% chance that a distribution equally (or more) different from the overall distribution of the HLH-shaped words would arise. In this study, I assume a standard significance value of p = 0.05, which is to say that if the p-value is less than 0.05, the distributional differences cannot be ascribed to chance, and if it is greater than 0.05, they can.

When we perform the test comparing the distribution of *pāvakás*-type forms and HLH-shaped words in the opening of the Triṣṭubh, we are calculating the p-value on the basis of the distributions shaded gray.

	1-3	2-4	3-5
pāvakás	0	1	5
HLH	125	583	177

The test yields a p-value of 0.003. The distributions are significantly different. There is only is a 0.3% chance that such differences could have arisen by chance. The test comparing the distribution of *pāvakás*-type forms and LHH-shaped words yields a p-value of 0.05529, which is to say that the differences are not significant at the p = .05 level, but very nearly so. We will see below that taking factors such as morphosyntax and formulaics into account in addition to word shape often explains the sorts of differences we see between the distribution of *pāvakás*-type forms and LHH-shaped words in this case. The basic point here is that the distribution of *pāvakás*-type forms in the opening of the Triṣṭubh—part of the verse that is usually left completely out of consideration when metrical evidence for or against an emendation is being weighed—might lead us to consider emending the form.

That said, we want to take as much data as possible into account, and in the case of *pāvaká-*, we have much more data to judge the distributions by than the opening of the Triṣṭubh verse. A Fisher's Exact Test comparing the distribution of forms like *pāvakás* across the entire verse with the distribution of HLH-shaped forms across the entire verse yields a p-value of less than 2.2e-16 (i.e., 2.2 times 10^{-16}). The differences in distribution across the entire verse are *highly* significant. The same test comparing the distribution of forms like *pāvakás* with LHH-shaped words across the entire Triṣṭubh verse yields a p-value = 0.36. The distribution of forms like *pāvakás* is not significantly different than that of LHH-shaped words. They would arise by chance 36% of the time. Below, we will see that in practice, p-values reflecting highly significant distributional differences generally reflect that the forms in question had a different prosodic shape for the poets than is suggested by the S. text spelling, whereas non-significant distributional differences typically arise from non-prosodic factors affecting the compositional process, such as morphosyntax and formulaics. We will also see that in extreme cases, non-prosodic factors can lead to significant differences as well, with the result that the form in question is distributed differently from both sets of comparanda.

3.3 A second case: *pīpāya* and the emendation *pipāya**

In 1901, Oldenberg expressed the opinion that the 3sg. perf. indic. act. to *pay^{i}*-'swell', *pīpā́ya* and unaccented *pīpāya*, should be read with a short reduplication vowel, as *pipāya*. (I will use *pīpāya* to refer to both the accented and unaccented 3sg. forms.)

He provides a brief descriptive sketch of the textual state of affairs that motivates the emendation (Oldenberg 1901: 299):

> *pīpā́ya* (resp. *pīpāya*) steht an 5 unter 10 Stellen so dass das Metrum Kürze der ersten Silbe verlangt; von den übrigen 5 Stellen sind 4 metrisch indifferent, eine (VIII, 29, 6) spricht, wenn auch nicht mit Bestimmtheit, eher für die Kürze. Also wird *pipāya* zu schreiben sein.

Noting the emendation again in passing (1906: 161), Oldenberg added that the source of interference in transmission may well have been *pīpayat* and related verbal forms that have a long reduplication vowel but do not belong to the inflectional paradigm of the perfect. This would be somewhat parallel to the change of *pavāká-** to *pāvaká-* in transmission, where the probable source of interference has been identified in Classical Sanskrit *pāvaka-* 'fire'.[57]

I cite the 10 occurrences of *pīpāya* in the Rigveda below, drawing again from the electronic version of the vNH text. I undo the subset of attestations where vNH emend *pīpāya* to *pipāya*, and refer the reader to the footnotes regarding the inconsistencies in the vNH text and in their *Metrical Notes*. The occurrences where Oldenberg considered the meter to require a light first syllable are the following 5, where the form occurs pāda-finally in Triṣṭubh verse. I group the attestation at 4.3.9d, a pāda with ten syllables, together with the other four 11-syllable pādas, since from a compositional standpoint, the post-caesural portion of the pāda, the portion where *pīpāya* is located, is compositionally

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[57] Arnold independently suggested the same emendation (1905: 128).

equivalent to a Triṣṭubh {break + cadence} that normally follows the caesura 5|. The raised dot marks the "rest".[58]

Pāda-final location (5x)[59]

1.181.8c *vṛ́ṣā vāṃ meghó vṛṣaṇā* ***pīpāya*** ||
4.3.9d *jā́maryeṇa • páyasā* ***pīpāya*** ||
6.44.21c *vṛ́ṣṇe ta índur vṛṣabha* ***pīpāya*** ||
6.66.1c *márteṣu anyád doháse* ***pīpā́ya*** ||
7.27.4c *ánūnā yásya dákṣiṇā* ***pīpā́ya*** ||

Given the poets' relatively strict preference for the rhythm –⏑–×|| at the close of the Triṣṭubh, these five occurrences are strong evidence that the form had a weight template LHL for the poets who composed the pādas, not the HHL shape suggested by the spelling *pīpāya* in the S. text. The occurrence where Oldenberg thought the meter suggested, but

[58] It is also possible to read *jā́mariyeṇa** with Grassmann (1873, *s. v.*), but the form is a *hapax*. From the standpoint of word shape distribution, this metrical location would be unremarkable for a word of the shape HHHL, about 75% of which are so located in 11-syllable verse, as well as for a word of the shape HHLHL, about 88% of which are so located in 11-syllable verse.

[59] Unfortunately, the editorial treatment of the 3sg. act. perfect forms is inconsistent in the vNH text. At 1.181.8c, vNH print *pipāya**, and in the *Metrical Notes*, the editors reference Arnold's statement cited above. In the second case, at 4.3.9d, vNH print *pipāya*, but in the *Metrical Notes*, they treat it as if they have chosen to print the *pīpāya* of the S. text. The entry reads "9d Tr. 10 syllables. Uncommon opening: ⏓⏑⏑–. Rare cadence: –––⏓." The note suggests that vNH read *jā́mariyeṇa**, though they print *jā́maryeṇa*. (They treat the 5th syllable as part of the break, even when it precedes the caesura.) In the following two cases (6.44.21c, 6.66.1c), the editors print *pīpāya* and *pīpā́ya* respectively. In the *Metrical Notes*, they refer to the rare cadence, without reference to Arnold, and in the final case (7.27.4c), they print *pīpā́ya*, refer to the cadence as rare in the note, and refer to Arnold.

did not require, a light first syllable is at 8.29.6a, where *pīpāya* is located after the caesura 4| in a Jagatī pāda.

Location after the caesura 4| (1x)[60]

8.29.6a *pathá ékaḥ* | ***pīpāya*** *táskaro yathāṁ*

Oldenberg's logic is that after the caesura 4|, the rhythm ⏑–⏑ is 4 or 5 times as common as ––⏑.[61] Therefore, all else being equal, it is more likely that a form in that position had the shape LHL than HHL. I will return to this in the discussion of *pīpiyānéva* below (§3.4). The remaining forms are located in the opening of trimeter verse.

Location in the opening[62]

pāda-initial (2x)

1.153.3a ***pīpā́ya*** *dhenúr áditir ṛtā́ya*

6.10.3a ***pīpā́ya*** *sá śrávasā mártiyeṣu*

spanning positions 2-4 (1x)

2.2.9b *dhī́ṣ* ***pīpāya*** | *bṛháddiveṣu mā́nuṣā*

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[60] There, vNH print *pipāya*, "to avoid the uncommon break".

[61] I say 4 or 5x, because it is not possible to tell on the basis of vNH's table (p. xviii), due to a misprint. Both rhythms ⏑–⏑ and ––– are represented as ––– there.

[62] There, vNH print received *pīpāya* and *pīpā́ya* in all cases. There is no note regarding the form at 1.153.3a. The relevant note to 2.2.9b reads "pipāya for S. pīpāya (Arnold) not necessary in this position. However, in other positions in the line pīpāya should be scanned with a light first syllable." There is no comment regarding the forms at 2.35.7b or 6.10.3a.

spanning positions 3-5 (1x)

2.35.7b *svadhā́m* ***pīpāya*** | *subhú ánnam atti*

The proposed emendation has escaped notice, to some extent. It is not noted by Mayrhofer (EWAia *s. v.* PAY^I), and Krisch (1996: 50) treats *pīpāya* as a long reduplicated perfect that displays a phonologically conditioned alternation of the reduplication vowel, such that the reduplication vowel is long / __ CV (*pīpay-*, *pīpāy-*, *pīpi-*), but short / __ CC (*pipy-*). Kümmel, however, both notes the proposed emendation and argues that no reduplicated form that can securely be assigned to the perfect stem is located in the meter in a position that points to a reduplicant *pī-* (2000: 298), though he lists the root *pay^i-* among the group of roots that exhibit long reduplication in the perfect and share the full grade root shape *CaU^i-* (2000: 22).

The proposed emendation of *pīpāya* to *pipāya** presents us with a somewhat more interesting case than that of *pāvaká-* to *pavākā́-**, since it may be possible to extend the emendation to other forms of the perfect. It also raises a potential complication, since the reduplicant may not have had a constant prosodic shape. In the case of *pāvaká-*, we took a group of inflectional forms that either all had the spelling shape HLH or the suggested shape LHH. The stem, to be sure, did not exhibit an alternation such as *pāvaká-* ~ *pavākā́-*. If in fact the perfect to *pay^i-* belonged to the recessive class of long reduplicated perfects—and this itself is uncertain, as Kümmel points out—it is *prima facie* possible that the perfect stem did exhibit stem alternation. Of the long reduplicated perfects, there are two major types. There is a minority type, which exhibits an inner-paradigmatic quantitative alternation of the reduplication vowel, which is morphologically conditioned, such that the strong stem exhibits a short reduplication vowel (*vavardha*, *yuyodha*), and the weak stem exhibits a long reduplication vowel (*vāvṛdhvā́ṃsam*, *yūyudhuḥ**).[63] It is unlikely that the perfect forms to *pay^i^*- exhibit this sort of alternation, which in the Rigveda is restricted to roots of the shape *CaRC*- ~ *CṚC*- (where R represents a sonorant).[64]

There are, however, other possible processes that may have left various forms of the perfect to *pay^i^*- with stem allomorphs that differed with respect to the length of the reduplication vowel. These seem to have conspired to eliminate ante-consonantal perfect stem allomorphs of the shape *CŪCŪ*- (where U = high vowel) either via shortening of the reduplication vowel, yielding *CUCŪ*- (e.g., *ninī*-, *bibhī*-), or via shortening of the root vowel, yielding *CŪCU*- (e.g., *dīdi*-, *dīdhi*-). While the history of these changes is not particularly clear, they may have affected forms of the perfect to *pay^i^*-, including the active participle *pīpivā́ṃsam*, which occurs twice, in pāda-initial position of a Triṣṭubh and Gāyatrī verse (5.76.1d, 7.96.6a), and it is thinkable that an allomorph *pīpi*-, originally phonologically regular in ante-consonantal position (e.g., in *pīpivā́ṃsam*), might have

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[63] *yūyudh-** is itself an emendation for the *yuyudh-* of the S. text, which is highly secure, and goes back to Arnold. See also Krisch (1996: 27) and Kümmel (2000: 409) for discussion. The rhythmic distribution proposed for the alternation in these stems by Kuryłowicz (1956: 341 ff.) fails to capture forms such as *vāvṛdhvā́ṃsam*.

[64] As I argue elsewhere (2009), this type originated in perfects formed to Indo-Iranian roots with a laryngeal + sonorant onset.

been extended to the perfect middle participle *pīpiyānā́*, which occurs at 3.33.10c, immediately following the caesura 4|.

ní te naṃsai | ***pīpiyānéva*** *yóṣā*

For further discussion of this form, see section §3.4 below.

In order to apply our method, we must take care to choose as large a group of perfect forms as possible that both occur in the same meter and are not affected by processes that would secondarily yield a short reduplication vowel. The most robust group of this sort are the 8 3sg. act. forms cited above that occur in the Triṣṭubh. These have the spelling shape HHL, and the suggested shape LHL. The relevant metrical distributions are given in Table 19 and Table 20 below.

Table 19: Metrical distribution of *pīpāya*, HHL-, and LHL-shaped words in 11-syllable verse

	Metrical Positions									
	1-3	2-4	3-5	4-6	5-7	6-8	7-9	8-10	9-11	Total
pīpāya	2	0	1	0	0	0	0	0	5	8
HHL	505	136	658	10	0	1	120	0	11	1441
LHL	520	32	556	0	30	18	210	3	2196	3565

Table 20: Proportional distribution of *pīpāya*, HHL-, and LHL-shaped words in 11-syllable verse

	Metrical Positions									
	1-3	2-4	3-5	4-6	5-7	6-8	7-9	8-10	9-11	N
pīpāya	0.25	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.63	8
HHL	0.35	0.09	0.46	0.01	0.00	0.00	0.08	0.00	0.01	1441
LHL	0.15	0.01	0.16	0.00	0.01	0.01	0.06	0.00	0.62	3565

It is quite clear that *pīpāya* patterns more closely with the LHL-shaped words than with the HHL-shaped words. Given that the poets located roughly half of all HHL-shaped words immediately preceding the caesura 5| in 11-syllable verse—a portion of the verse that is usually not taken into consideration when judging metrically motivated emendations—we would expect more forms of *pīpāya* in that position. And we would of course expect fewer forms of *pīpāya* in pāda-final position. In pāda-initial position, the percentage of *pīpāya* forms lies between the percentage of HHL- and LHL-shaped words, and in the location spanning positions 2-4, where the overall location of HHL- and LHL-shaped words differs significantly as well, *pīpāya* does not occur, apparently patterning with the LHL-shaped words. Once again, however, we should ask what it means for 25% of *pīpāya* forms to be attested in pāda-initial position, and 0% spanning positions 2-4, given that the total number of occurrences in the Triṣṭubh is 8. Fisher's Exact Test takes the sample size into account, and a comparison of the metrical distribution of *pīpāya* with that of HHL-shaped words yields a p-value of 6.347e-08. The probability that the differences in distribution would arise by chance in this sample size is infinitesimal. A comparison of the metrical distribution of *pīpāya* with that of LHL-shaped words yields a p-value of 0.8773, meaning that distributional differences of that magnitude or greater would arise by chance about 88% of the time.

In sum, the close distributional agreement *throughout the verse* between *pīpāya* and the class of LHL-shaped words provides extremely strong evidence that the reduplication vowel of the forms located in the opening of the verse was short as well. If we recall Oldenberg's argument for the emendation, that 5 of the 10 forms required a short vowel, a sixth suggested it, and the rest were metrically indifferent, we get a sense of the increased potential of the method proposed here. Essentially, we may now say that *all 10* forms require the emendation, and none is indifferent, and bring confirmation to Oldenberg's suggestion.

3.4 A closer look at *pīpiyānéva*

In the case of *pīpāya*, the proposed method allowed us to extend our editorial reach into the opening of the verse with more security. In this section, I attempt to show how the method requires a more conservative treatment of material in the latter part of the verse. In pointing out that there is no strong metrical evidence for a long reduplication vowel in any perfect formed to *pay*^{i}-, Kümmel briefly discusses the location of all of the forms that can securely be assigned to the perfect stem (as opposed to the reduplicated aorist *pīpay(a)*-), and claims that "das Ptz. Med. *pīp*$_{i}$*yāná*- steht nach der Zäsur, was eine Lesung **pipiy*^{o} begünstigt" (2000: 298). While this claim is in perfect keeping with the usual method of judging emendations by the meter, and Kümmel should not be faulted for it in any way, it is incorrect, and serves to exemplify a case where we come to a very different conclusion once we take word shape into account. I repeat the verse:

ní te naṃsai | ***pīpiyānéva*** *yóṣā* (3.33.10c)

Kümmel's claim is based on the fact mentioned above, that following the caesura 4|, the rhythm ⏑⏑– is much more common than the rhythm –⏑–. We can represent this in yard-stick format as 4| ⏓⏑–, reflecting that following the caesura 4|, positions 5-7 of the Triṣṭubh are filled with a LLH sequence of syllables (four times) more frequently than they are filled with a HLH sequence. I schematize Kümmel's implicit assumption in (4).

(4) Since we find

four caesura 4| ⏑⏑–	for every	caesura 4| –⏑–

we would also expect

more caesura 4| $[\text{LLHHL}]_{\text{word}}$	than	caesura 4| $[\text{HLHHL}]_{\text{word}}$

The main methodological point I would like to make is that it does not necessarily follow from the yard-stick (⏓⏑–), which represents the average frequency of heavy and light *syllables* in particular metrical positions, that a *word* of the shape LLHHL is preferred to a word of the shape HLHHL following the caesura 4|. In Table 21, we see that in 11-syllable meter, LLHHL- and HLHHL-shaped words occupy one of two positions in the verse. They either span positions 1-5 or 5-9, which is to say that they are either pāda-initial, or occur immediately following the caesura 4|.

Table 21: Metrical distribution of HLHHL- and LLHHL-shaped words in 11-syllable verse

	Metrical Positions		
	1-5	5-9	Total
HLHHL	13	84	97
LLHHL	19	164	183

Table 22: Proportional distribution of HLHHL- and LLHHL-shaped words in 11-syllable verse

	Metrical Positions		
Positions	1-5	5-9	N
HLHHL	0.13	0.87	97
LLHHL	0.10	0.90	183

While LLHHL-shaped words are roughly twice as common as HLHHL-shaped words in 11-syllable verse, we see from Table 22 that they are distributed with nearly identical frequency in the same locations in the Triṣṭubh. While it is true that following the caesura 4|, the rhythm ⏑⏑– is 4 or 5 times more common than the rhythm –⏑–, *words* of the shape LLHHL and HLHHL are equally common following the caesura 4|, despite the fact that they result in precisely those post-caesural rhythms. By taking word shape into account, in this case, we come to a much more conservative conclusion than we do if we only consider the frequency with which particular metrical positions are filled with heavy and light syllables. While the yard-stick comparison seems to invite an emendation of *pīpiyanéva* to *pipiyanéva**, once we consider how the poets located words, we see that the evidence from versification does not favor either the S. text reading or the emendation. We are left to decide on other grounds whether or not the form had a long reduplication vowel.[65]

3.5 The evidence for laryngeals making position in vedic meter

It was first suggested by Kuryłowicz (1927: 240) and later independently by Schindler (cf. Gippert 1999: 97) that certain sequences that are spelled -VCV- in the S. text, but derive from earlier *-VCHV- sequences (where H represents a laryngeal), still reflect a syllabification -VC.HV- in their distribution in Vedic meter. According to this view, the laryngeal, or some later non-syllabic segmental development thereof, is still reflected in the metrical distribution of certain words in the Rigveda. Since it is not clear exactly what phonetic value the laryngeal or its later reflex would have had at the time when the Vedic hymns were composed, I represent it with *x* in proposed emendations, where *x* stands for a non-syllabic segment whose other features are not known. Thus, if we assume that the noun meaning 'person', which is spelled *jána-* in the S. text, and derives from Indo-Iranian **jánHa-*, was syllabified *ján.xa-** at the time of the composition of a verse such as 6.11.4d

añjánti suprayásam páñca jánāḥ

[65] I would like to note the potential application of the method proposed here to the problem of deciding between "alternative resolutions" (cf. vNH: ix). In the vNH text, the choice is based on the yard-stick approach, which potentially results in word locations that were not actually favored by the poets.

then *páñ.ca ján.xāḥ* gave a regular (i.e., very frequent) verse-final rhythm –⏑–×‖, while the prosody suggested by the S. text spelling *páñ.ca já.nāḥ* gives an irregular (i.e., much less common) cadence –⏑⏑×‖. (The ‖ represents verse end.) According the the tallies in vNH (p. xvii), the rhythm –⏑–×‖ outnumbers –⏑⏑×‖ in 8-syllable verse by a ratio of approximately 100:1.

Neither Kuryłowicz nor Schindler published an extensive study of these putative effects, and despite two relatively recent article-length treatments by Gippert (1997; 1999), which I return to immediately below, it remains unclear how extensively *-VC.HV- syllabification is reflected in the Rigveda. We know that at some point between the Indo-Iranian proto-language and Classical Sanskrit, *-VC.HV- sequences developed into -V.CV- sequences, which is to say that eventually, the laryngeal was lost in that context without any lasting effect on the weight of the preceding syllable.[66] The heavy status of the first syllable of the *-VC.HV- sequence did not survive into Classical Sanskrit via compensatory lengthening, or any other process of moraic preservation. The S. text spelling of the relevant sequences reflects the -V.CV- state of affairs. Given this

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[66] I should clarify by saying that in Classical Sanskrit, the laryngeal was lost without having any effect on syllable weight at the level of the binary opposition between heavy and light syllables. For syllable weight differences at the sub-categorical level in Classical Sanskrit, cf. Ryan (2009; forthcoming). Interestingly, Ryan demonstrates that t^h in the context V_V was more geminate-like than *t* in the same context, so that while t^h was not enough like a geminate to cause the first syllable in a Vt^hV sequence to be heavy, poets avoided placing such syllables in crucially light positions of the meter. One possible explanation of the geminate-like quality of t^h would be its historical origin as a bi-segmental sequence $*th_2$, and the same explanation could be extended to the behavior of all of the voiceless aspirated stops such as the p^h of *śaphá-* ‘hoof’ < *ćap^hHá-* < * *ḱoph₂ó-*, and the k^h of *sákhi-* ‘companion’ < *$*sák^hHa-$* < *$*só/ék^wh_2i-$*.

development and chonological trajectory, it is logically possible that the evidence from Rigvedic meter could reflect a stage of development anywhere between *-VC.HV- and *-V.CV-. At the one extreme, words like *jána-* ‘person’ and *rátha-* ‘chariot’ would have always had a heavy first syllable for the poets (i.e., **ján.xa-*, **ráth.xa-*). At the other extreme, the hypothesis that laryngeals make position in Vedic meter is false, and words like *jána-* and *rátha-* always had a light first syllable for the poets, just as they do in Classical Sanskrit verse. The meter could also reflect any number of intermediate stages of development. The laryngeal-induced effects on syllabification could be restricted to some subset of -VCV- < *-VCHV- strings, and this subset could in theory be circumscribed in any number of ways: phonologically (e.g., restricted to word-initial syllables), morpho-syntactically (e.g., restricted to nouns), lexically, etc., or some combination thereof. The fact that we have to do with an oral poetic tradition could complicate matters in an interesting way. It seems perfectly possible that the effects were (in part) limited to traditional words and phrases, for example, and the older syllabification could well have been retained as a prosodic option. (This could be viewed as a type of lexical restriction, assuming the phrases in question were lexicalized in the poetic grammar.) This was more or less the scenario envisioned by Kuryłowicz.

If this hypothesis is correct, a form like *jána-* is like *pāvaká-* insofar as its spelling in the S. text does not reflect the prosodic shape that the form had for the poets, but while the error in transmission of *pāvaká-* was presumably restricted to that one lexical item, the putative scansions reflecting laryngeal effects may in fact involve a much more widespread discrepancy between word shape as reflected in the S. text and word shape as reflected by the way the poets located forms in the meter. The question of how widespread these effects are is therefore of interest for those concerned with the history and the restoration of the text of the Rigveda, as well as for those concerned with the historical phonology of Indo-Iranian and Indo-European languages. In this section, I will suggest some ways in which the comparison of word shape distribution can be applied to this question.

The hypothesis that *-VC.HV- sequences were *all* retained as *-VC.xV- at the time of composition is implicit in, or at least compatible with the only detailed treatments of the topic, namely Gippert's two articles just mentioned (1997; 1999). I should explicitly state that Gippert (unlike Kuryłowicz) does not discuss what sort of compositional scenario his analysis is compatible with. Instead of running the risk of misrepresenting the author's views, I present a brief review of his articles coupled with a discussion of his method and what I take the implications of his approach to be for our understanding of Rigvedic composition.

3.5.1 Gippert 1997

In his 1997 article, Gippert treats a corpus of Triṣṭubh verses that exhibit the irregular (i.e., less frequently attested) verse-final rhythm ⏑×||, according to the scansion suggested by the S. text. The usual closing rhythm –×|| outnumbers ⏑×|| by approximately 70:1.[67] After excluding cases that are generally agreed to require emendation/restoration, the corpus numbers 215 verses.[68] Gippert then proceeds to identify 100 cases that would scan with the far more frequent closing rhythm – × ||, on the hypothesis that every -VCV- sequence in those cadences that continues an earlier *-VCHV- sequence was syllabified as -VC.xV-. These 100 putatively regular cadences include cases where there is general agreement among Indo-Europeanists that the string in question was *-VCHV- in Indo-Iranian, e.g., 5 forms of _rátha-_ ‘chariot’ < *_Rat^{h}Ha-_, as well as cases where the reconstruction of a *-VCHV- sequence is tenuous at best, such as the locative of the word for ‘day’ _áhan_, which occurs 3 times verse-finally in Triṣṭubh meter, on the basis of which Gippert suggests an Indo-Iranian pre-form *_áǰ^{h}Han_.[69] In closing, Gippert tentatively suggests a number of ways in which further irregular cadences not involving *-VCHV- strings could be explained as rhythmically regular,

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[67] This figure is derived from the tallies in vNH (p. xvii).

[68] The cases Gippert excludes are _pāvaká-_ for _pavākā́-*_, _nṛṇā́m_ for _nr̥̄ṇā́m*_ ~ _nr̥̄ṇáam*_, _-VchV-_ for _-VcchV-*_, and _-Vḷ(h)V-_ for _-V̄ḷ(h)V-*_, _-VẓḍV-*_, _vel sim_.

[69] Note that in the case of _áhan_, Gippert offers no evidence for the laryngeal aside from the irregular rhythm. The logic is perfectly circular. The 100 cases also include a small set of cases where Gippert suggests regularity arising from laryngeal effects that do not involve *-VCHV- strings, which I exclude from the discussion, such as one verse-final instance of _vi var_, where Gippert suggests reading _vī var*_ < *_u̯i Hu̯ar_, and five instances where he suggests reading _iṣīrá-*_, with _ī_ < *H, for trisyllabic verse-final forms of _iṣirá-_ ‘lively’, contra Jamison (1988: 222 and fn. 16). Note, however, that if we follow Gippert’s approach, we would actually expect _iṣirá-_ not to have a putative light-heavy onset, but rather a heavy-light onset, due to the development of *_(H)išHrá-_ > *_(H)iš.Hə.rá-_, as in his reconstructed development of *_pR̥t^{h}Hu̯íH_ > *_pR̥t^{h}.Hə.u̯íH_ and *_d^{h}ug^{h}Htár-_ > *_d^{h}ug^{h}.Hə.tár-_. That is, they should all involve the same development of *-VCHCV- > *-VC.Hə.CV-.

leaving the reader with the impression that he may well be of the opinion that the cadence rhythms of Rigvedic verse were all but completely regular.

Of the 100 Triṣṭubh cadences that Gippert claims are regular, the following items occur 5 times or more: *sákhi-* ‘companion’ < **sák*^{h}*Hi-* (6x); *jána-* ‘person’ < **ǰánHa-* (13x); *rátha-* ‘chariot’ < **Rát*^{h}*Ha-* (15x); and superlatives formed with the suffix *-tama-* (20x), which Gippert derives from **-tm̥Ho-*, a reconstruction that I would consider to be insecure.[70] All together, these constitute roughly half of the cases that Gippert would explain as regular due to laryngeal effects. The other items involved are attested fewer than 5 times, and often, just once.

We may now ask what sort of compositional scenario Gippert’s analysis is compatible with. Descriptively, his analysis requires that the poets knew in each of these cases where the Indo-Iranian laryngeals were, and where they were not. In my understanding, this implies that for the poets, either the laryngeals or their segmental reflexes were still phonologically present in the context -VC_V-. If the laryngeals had already been lost without a prosodically relevant trace in that context, it strikes me as

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[70] For the morphophonological history of *rátha-*, see Nussbaum *apud* Rieken (2003: 47, fn. 39) and for that of *sákhi-*, Nussbaum *apud* Rau (forthcoming). From an inner-Indo-Iranian point of view, the superlative formant *-tama-* could reflect either **-tm̥Ha-*, **-tm̥(m)a-*, with a prevocalic syllabic nasal, or **-tama-*. If the formant derives from **-tm̥Ho-*, we might expect better evidence for Italic **-tamo-*, but Latin *-timus* and Old Latin *-tumus* seem to point to Italic **-tomo-* < **-tm̥(m)o-*, with the developments of prevocalic *m̥* > *om*, as in *homō* ‘man’ < **ĝ*^{h}*m̥(m)ō* (Brent Vine, p. c.). See also Nishimura (2004, with refs), and Weiss (2009: 105, 357).

highly unlikely that the poets would have known exactly which -VCV- sequences derived from *-VCHV- sequences.

The next question we may ask is whether Gippert's analysis actually provides evidence for a stage of composition where laryngeals were still present in the context -VC__V-. This depends entirely on his implicit assumption that the cadence is just that much more regular than it would appear from the S. text. If we do not agree on that, then his analysis could be viewed as a circular exercise that involves re-inserting reconstructed Indo-Iranian laryngeals in Rigvedic forms wherever they yield a more regular cadence, the only confirmation of their presence being the more regular cadence rhythm itself. There are several sources of evidence that might be brought to bear on the question of just how regular we expect the cadence to be. First there is the diachronic comparison between Avestan and Vedic meter.[71] This would specifically involve the comparison of Avestan 4 + 7 syllable meter (i.e., 11 syllable meter with a caesura after the fourth) with the Triṣṭubh.[72] If it could be established on the basis of that comparison that we should expect early Indic verse to have inherited more regular cadence rhythms than we observe in the S. text from the Indo-Iranian poetic tradition, that would constitute good evidence. The comparison is vexed, though, mostly by the limited size of the Avestan metrical

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[71] For a convenient overview of the literature, cf. Korn (1998: 22-23, 25-29). Cf. also Westphal (1860: 449-458), Geldner (1877: i-xv), Bartholomae (1886: 1-31), Meillet (1925: 37 ff.), Oldenberg (1888: 43 ff.), Kuryłowicz (1952: 438 ff.; 1975: 102 ff.), Gippert (1988).

[72] It is not even agreed upon whether this 11-syllable meter, with a caesura after the fourth syllable, found in the Gāθā uštavaiti (Y. 43-46) and the Gāθā spəṇtā.mainiiuš (Y. 47-50), is to be directly equated with the Triṣṭubh. Cf. especially the views of Gippert (1988), which are based in part on word shape distribution.

corpus and our relatively poor understanding of Avestan prosody. There are a number of ways of understanding the Avestan data, and even more ways of reconciling this with Vedic meter. In any case, we cannot bring the evidence from diachronic metrics to bear on the question with any decent degree of certainty. We might also look to metrical typology for an answer. While there is a general (perhaps universal) tendency for metrical requirements to become more strict towards the end of a verse, syllable weight distribution in Vedic meter follows this pattern whether we assume laryngeal effects on scansion or not, and it is important to keep in mind that Gippert's approach to the Triṣṭubh cadence would result (at best) in an increase in the ratio of verse-final −×‖ to verse-final ⏑×‖ from approximately 70:1 to 130:1. The cadence, even without any of the suggested emendations, is more strictly regulated than the break, which is in turn more strictly regulated than the opening of the verse. To my mind, the question of just how much more regular we would expect the Triṣṭubh cadence to be remains open.

3.5.2 Gippert 1999

Gippert's 1999 inquiry proceeds along similar lines. There, Gippert collects all the -V̆(T)hi- sequences (Gippert's notation for short vowel + aspirated stop or *h* + *i*) that occur in the rightmost ictus position in both dimeter and trimeter meters, which is to say that they occur in the metrical position where the preference for a heavy syllable was strongest. There are 38 such cases. The Gāyatrī verse 3.59.7c is one such case.

abhí śrávobhiḥ pṛthivī́m

There, the sequence *-ṛthi-* of *pṛthivī́m* ‘earth’ (acc.) is located in the rightmost ictus (position 6 in Gāyatrī). If *pṛthivī́m* in 3.59.7c had the LLH prosodic shape suggested by its spelling in the S. text and by its LLH shape in Classical Sanskrit verse, then this Gāyatrī verse had a rare verse-final rhythm ⏑⏑×||.

⏑ – ⏑ – – ⏑ ⏑ – ||

a.bhí ś.rá.vo.bhiḥ. pṛ.thi.vī́m

If, however, we assume that at the time of the composition of this verse, the ‘earth’ word retained the HLH shape of the reconstruction **pR̥t*^{h}*.Hə.u̯ī́m* (< I-E **pl̥th*$_{2}$*u̯īm*) then the verse would have had a far more regular (i.e., more frequently attested) verse-final rhythm –⏑–||.

⏑ – ⏑ – – – ⏑ – ||

*a.bhí ś.rá.vo.bhiḥ. pṛth.Xi.vī́m**

Gippert explains all but 6 of the 38 cases of this sort as due to the effects of laryngeals on syllabification, again with the reconstruction of a laryngeal being more secure in some cases than others. This would (at best) result in an increase in the ratio of –⏑×|| to ⏑⏑×|| from approximately 25:1 to 29:1. Again, it is unclear whether we should assume that the cadence was that much more regular than it would appear from the S. text, and whether it is significant that 32 of the 38 -V̌(T)hi- sequences found there contained laryngeals, since laryngeals are one of the historical sources of both the aspiration of stops (whence also “plain” *h* via deocclusion of voiced aspirated stops) and the vowel *i* (cf. *duhitár-*

'daughter' < Early I-Ir *d^h*ug*^{h}*Htár-* < I-E *d^h*ugh*$_2$*tér-*).[73] Gippert himself raises the latter point. Most of the lexical items involved occur just once in the relevant metrical positions. In 8-syllable verse, the forms found most frequently are 5 inflectional forms of *dhā-* 'put' (*dadhiṣe*, *dadhire*), 4 forms of *pṛthivī́(m)* 'earth', and 2 forms of *duhitár-* 'daughter'.

There is a further important point to make regarding *pṛthivī́* and *duhitár-* (on *dadhiṣe* and *dadhire* see below). The putative *-VCHV- sequence in these two forms has a different phonological history from the *-VCHV- sequence reconstructed for *jána-* and *rátha-*. In the latter pair, as noted above, we have the development *-VCHV- > -VCV-, e.g., **jánHa-* > *jána-*, which is to say that the -VCV- sequence of the S. text and the Classical language derives from a *-VCHV- sequence as far back as we can reconstruct. In the former pair, however, the -VCV- sequence of the S. text and the Classical language derives, according to Gippert's reconstruction, from an earlier *-VCHə- sequence, which itself developed from an even earlier *-VCH- sequence in pre-consonantal position:

PIE		Early I-Ir		Late I-Ir		Vedic
**pl̥th*$_2$*u̯ih*$_2$	>	**pR̥t*^{h}*Hu̯íH*	>	**pR̥t*^{h}*Həu̯íH* (?)	>	*pṛthivī́*
**d*^{h}*ugh*$_2$*tér-*	>	**d*^{h}*ug*^{h}*Htár-*	>	**d*^{h}*ug*^{h}*Hətár-* (?)	>	*duhitár-*

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[73] By early Indo-Iranian, I refer to a stage of the proto-language before the "vocalization" of laryngeals in the context C_C. The question of an earlier vocalization in the context C_# has no bearing on the inquiry at hand.

The intermediate stage of development, the Late I-IR *-VCHə- assumed by Gippert, following Schindler, where the epenthetic vowel (ə) develops beween the laryngeal and the following consonant, is in fact based (at least in part) on the supposed evidence from scansion.[74] It is worth noting that there is no general agreement on the reconstruction of that particular stage, and there are other thinkable scenarios, such as a direct "vocalization" of *H / C__C (Rasmussen 1983: 374; 1989: 85, fn. 18). In short, the reconstruction of a *-VCHV- sequence (specifically, *-VCHə-) is far less secure for *pṛthivī́* and *duhitár-* than it is for the *jána*-type.

In summary, we have Gippert to thank for two studies that provide us with an excellent data collection and systematically represent the strong hypothesis that wherever we find what appears to be a -V.CV- sequence, the first syllable of which is located in the metrical position where a heavy syllable is strictly preferred, and wherever this sequence derives from an earlier -VC.HV- sequence (of either origin), we may assume that the syllable located in the ictus position scans as heavy, and reflects the older syllabification. In my view, this approach presupposes that the laryngeals or a non-syllabic segmental reflex thereof were still phonologically present for the poets in the context -VC_V-.

[74] For this particular reconstruction, cf. Schindler (1986: 386), and also Tichy (1985). I do not distinguish here between the vocalic outcomes of laryngeals in the contexts C__# and C__C, since I am only concerned with the latter environment. Hence my use of ə as opposed to the various other notations, for which cf. Kümmel (2000: 3 with refs.).

3.5.3 Word shape distribution and observed versus expected

Instead of asking how many cadences we can explain as regular due to laryngeals making position, I propose that we return to the basic claim as formulated by Schindler, namely that that there are "ganz deutliche und in überzufälliger Menge [*sc*. auftretende] Fälle in der indoiranischen Metrik, wo ein solcher Laryngal, neben dem ein *i* steht, noch Position bildet".[75] That is in my opinion the best way to formulate both the problem and the claim. The hypothesis rests on the claim that the relevant forms occur in the relevant metrical locations significantly more often than expected (given their spelling). I propose to use the evidence from word shape distribution to provide an objective expected value, by asking how often we would expect to find such forms in the cadence if they scan according to their S. text spelling, and how often we would expect to find them there if they scan according to the laryngeal effects hypothesis. The evidence from word shape distribution provides us with a way of comparing the observed distribution with two expected distributions.

[75] Thus an audio recording of Schindler's contribution to the Podiumdiskussion "Phonetik der Laryngale" at the *Fachtagung der indogermanischen Gesellschaft* in Copenhagen, 1993, as cited by Gippert (1999: 97 and fn. 3).

3.5.4 The distribution of the *pṛthivī́* group

For the tests, I separate the forms into two groups, those that possibly continue a *-VCHə- sequence (the *pṛthivī́* group), and those that securely continue a *-VCHV- sequence (the *rátha-* group). I begin with the *pṛthivī́* group. In order to effectively apply our method, we need the items to be relatively well attested. We also need to choose forms that we are reasonably certain contained laryngeals. In 8-syllable verse, LLH/HLH-shaped forms of *pṛthivī́* and *duhitár-* occur 20 and 17 times, respectively. I also test the distribution of *dadhiṣe* and *dadhire*, which together are attested 20 times in 8-syllable verse, although there are some questions involving the presence of a laryngeal in those forms, which I discuss below.

3.5.4.1 The distribution of *pṛthivī́* in 8-syllable verse

The four forms of *pṛthivī́(m)* in the cadence of 8-syllable meter that Gippert takes to be evidence for *pṛth.xi.vī́(m)** occur in the following verses.

yéṣām ájmeṣu pṛthivī́	(1.37.8a)
abhí śrávobhiḥ pṛthivī́m	(3.59.7c)
yát te dívaṃ yát pṛthivī́m	(10.58.2a)
dhruvā́ dyaúr dhruvā́ pṛthivī́	(10.173.4a)

As I just mentioned, we should ask not how we can explain each of these cadences as regular, but how often we would expect to find *pṛthivī́(m)* in the cadence of 8-syllable verse if it had the shape LLH for the poets, and how often we would expect to find it if it had the HLH shape suggested under the laryngeal effects hypothesis. Our null hypothesis should *always* be that a form had its spelling shape, i.e., the prosodic shape suggested by the S. text, and we should only emend the text where we are forced to do so. The metrical distribution of *pṛthivī́*, LLH-, and HLH-shaped words in 8-syllable verse is given in Table 23 and Table 24.

Table 23: Metrical distribution of *pṛthivī́*, LLH-, and HLH-shaped words in 8-syllable verse

	Metrical Positions						
	1-3	2-4	3-5	4-6	5-7	6-8	Total
pṛthivī́(m)	3	2	0	11	0	4	20
LLH	372	29	50	592	7	369	1419
HLH	270	85	28	980	5	4223	5591

Table 24: Proportional distribution of *pṛthivī́*, LLH-, and HLH-shaped words in 8-syllable verse

	Metrical Positions						
	1-3	2-4	3-5	4-6	5-7	6-8	N
pṛthivī́(m)	0.15	0.10	0.00	0.55	0.00	0.20	20
LLH	0.26	0.02	0.04	0.42	0.00	0.26	1419
HLH	0.05	0.02	0.01	0.18	0.00	0.76	5591

Given that 20% of LLH-shaped words in 8-syllable verse occur pāda-finally, we would expect precisely four occurences of *pṛthivī́(m)* in the cadence, assuming that the word simply has the LLH shape reflected by its spelling in the S. text. If the word really had the shape HLH for the poets, we would expect it to occur in the cadence 14 or 15 times, since about 75% of HLH-shaped words occur pāda-finally. Fisher's Exact Test reflects very significant distributional differences between *pṛthivī́(m)* and HLH-shaped words in the verse (p = 3.196e-06). It is virtually impossible that such distributional differences could have arisen by chance.

On the other hand, Fisher's Exact Test comparing the distribution of *pṛthivī́(m)* with LLH-shaped words yields a p-value of 0.1855. The distributions are not significantly different. While it is perfectly possible that the differences we observe could be ascribed to chance alone, it is clear that a word's prosodic shape is not the only factor that determines its distribution in the line. In this particular case, some of the differences, at least, are to be explained in light of the cooccurence of *pṛthivī́(m)* with *dyaúḥ* (and *dívam*) 'heaven'.[76] As in English, 'heaven' always precedes 'earth' in the collocation. If we think of word shapes as competing for certain positions, in this particular case, 'heaven' is always given an earlier position in the pāda than 'earth'. This might explain the slight underrepresentation of 'earth' pāda-initially, and its slight overrepresentation spanning positions 4-6.[77] Since 'heaven' and 'earth' in these passages

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[76] Thus as at 1.22.13a, 2.41.20a, 8.40.4d, 10.58.2a, and 10.173.4a. Note that cases of *dyā́vāpṛthivī́* are excluded by definition since they are a graphic word in our text, and that this is of course the right thing for the test, since the two constituents of the copulative compound are not freely separable (though it seems to be possible under certain conditions, as at 2.41.20a).

[77] Note also the noun-epithet phrase *pṛthivī́(m) mahī́(m)* 'great earth' at 8.40.4d, 10.60.9a, 10.85.2b, and 10.119.8b.

do not always occur in a phrase of the same prosodic shape, it is not possible to take this into account with the method presented here. (For a way of treating formulaic phrases with a *fixed* prosodic value, see the discussion of *duhitár-* below.)

In any case, the distribution of *pṛthivī́(m)* does not differ significantly from that of all other LLH-shaped words, and where *pṛthivī́(m)* does depart somewhat from the LLH average, it does not pattern more closely with HLH-shaped words.

3.5.4.2 The distribution of *duhitár-* in 8-syllable verse

The two forms of *duhitár-* discussed by Gippert occur pāda-finally in 8-syllable verse. They have the spelling shape LLH, and the suggested shape HLH, on the hypothesis that they reflect a syllabification *duh.xi.tár-**, reflecting an older **d^{h}ug^h.Hə.tár-* (a reconstruction which we noted was insecure), from early Indo-Iranian **d^{h}ug^{h}Htár-* (a highly secure reconstruction). While forms of the relevant shape are relatively well attested in 8-syllable verse, at a total of 17, we will see below that it is unfortunately not possible to say anything definite about their prosodic shape by comparing their distribution with that of LLH- and HLH-shaped words, due to the prosodic shape of the formula that most of the forms are bound up in. Nevertheless, I present the relevant frequencies in Table 25 and Table 26 below, where *duhitar* refers to the class of LLH/HLH-shaped forms of the word.

Table 25: Metrical distribution of *duhitar*, LLH-, and HLH-shaped words in 8-syllable verse

	Metrical Positions						
	1-3	2-4	3-5	4-6	5-7	6-8	Total
duhitar	0	0	0	15	0	2	17
LLH	372	29	50	592	7	369	1419
HLH	270	85	28	980	5	4223	5591

Table 26: Proportional distribution of *duhitar*, LLH-, and HLH-shaped words in 8-syllable verse

	Metrical Positions						
	1-3	2-4	3-5	4-6	5-7	6-8	N
duhitar	0.00	0.00	0.00	0.88	0.00	0.12	17
LLH	0.26	0.02	0.04	0.42	0.00	0.26	1419
HLH	0.05	0.02	0.01	0.18	0.00	0.76	5591

We can see from the tables that LLH/HLH-shaped forms of the word for 'daughter' are restricted to the locations spanning spanning positions 4-6 (88%) and 6-8 (12%). The distribution of the forms is significantly different from that of LLH-shaped words (p = 0.01007) *and* that of HLH-shaped words (p = 1.276e-07).

All but three of the forms in the location spanning positions 4-6 are bound up in a vocative formula *duhitar divaḥ* 'O daughter of heaven', referring to the dawn goddess *Uṣas*, as for example in *ví ucchā duhitar divaḥ* (1.48.1b = 5.79.3b = 5.79.9a).[78]

One of the remaining three occurs in an inflectional modification of the formula in the nominative case:

ucchántī duhitā́ diváḥ (7.81.1b)

In such cases, it is possible to treat the formula as if it were a single word (since we are dealing with an inseparable group of 5 syllables) in order to apply our method.[79] Here, the unit would have the spelling shape LLHLH, and the suggested shape HLHLH. I give the distribution of LLHLH- and HLHLH-shaped words in Table 27 and Table 28.

Table 27: Metrical distribution of LLHLH- and HLHLH-shaped words in 8-syllable verse

	Metrical Positions				
	1-5	2-6	3-7	4-8	Total
LLHLH	1	0	0	247	248
HLHLH	5	1	0	709	715

[78] The other vocative formulae occur at 1.30.22b, 1.48.9b, 1.49.2d, 5.79.2b, 5.79.8b, 7.81.3a, 8.47.14b, 8.47.15b, and 10.127.8b.

[79] The equation of a formula with a word of the same overall shape is, of course, not a perfect one. It would be impossible to make in cases where the caesura divides constituents of the formula, for example, and problematic in any other metrical environments that are sensitive to word boundary, or the prosodic effects of a word boundary. Nevertheless, it is a decent approximation.

Table 28: Proportional distribution of LLHLH- and HLHLH-shaped words in 8-syllable verse

	Metrical Positions				
Positions	1-5	2-6	3-7	4-8	N
LLHLH	0.00	0.00	0.00	1.00	248
HLHLH	0.01	0.00	0.00	0.99	715

In this particular case, though, words of the relevant shapes have an all but identical distribution (p = 1) in 8-syllable verse. They are virtually all located spanning positions 4-8, like the vocative formula. We also see that if we view the formula as an inseparable, word-like prosodic unit, its distribution follows from regular compositional patterns.[80]

If we remove all the cases of *duhitar divaḥ* (and sandhi variants thereof), as well as the one modification in the nominative case *duhitā́ diváḥ* (7.81.1b), we are left with only 4 attestations, two of which occur spanning positions 4-6:

dákṣa yā́ duhitā́ táva (10.72.5b)
átho me duhitā́ virā́ṭ (10.159.3b)

The other two are the two pāda-final occurrences on which the laryngeal effects hypothesis is based, the first of which also expresses 'daughter of heaven', in the nominative case, with a different word order.

[80] A more refined approach would take the formulae to be preferentially unified, and proceed to identify the conditions under which the consituents are separated.

divó adarśi duhitā́ (4.52.1c)

sómaṃ sū́ryasya duhitā́ (9.1.6b)

A Fisher's Exact Test comparing the distribution of *duhitā́* outside of the formula shows that the distribution could have arisen by chance both if it had a LLH- or HLH-type distribution.[81] In sum, we can say that the relevant forms of *duhitár-*, given their participation in the formula *duhitar divaḥ*, would have had the same metrical distribution no matter whether they had the prosodic value LLH, as suggested by the S. text, or the value HLH, according to the proposed emendation *duhxitar**. Taking a properly conservative approach to textual emendation, however, we would not emend, since their metrical distribution is perfectly in line with the received text.

At this point, I would like to briefly look at the context immediately surrounding 4.52.1c, where 'the daughter of heaven' occurs in an order other than the formulaic one, in order to make a suggestion about word order. I give the first stanza of 4.52, a Gāyatrī hymn to Uṣas, the dawn goddess, attributed to Vāmadeva. (The bolding is my own.)

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[81] If we consider the nominative modification at 7.81.1b to be "inside" the formula, the p-values are 0.3725 and 0.4554 compared with LLH- and HLH-shaped words, respectively. If we consider it "outside" the formula, the p-values are 0.6061 and 0.1851.

práti ṣyā́ sūnárī ***jánī***
viucchántī pári ***svásuḥ***
divó adarśi ***duhitā́***

She has just appeared, the spirited **woman**,
shining forth from (her) **sister**,
heaven's **daughter**.

No one would deny that factors other than rhythm play into the poet's choice of word order, and in this stanza, I think it is quite clear that the poet's choice to place *duhitā́* pāda-finally is motivated by his desire to juxtapose the pāda-final triad *jánī*, *svásuḥ*, *duhitā́*. (Note also the sound play between *-nárī*, *pári*, *-darśi*, and the d-alliteration in pāda c.) I consider it perfectly possible, if not likely, that the motivation for this juxtaposition, which clearly overrode the formulaic order of the vocative phrase that the poet of 7.81.1b retained when carrying over the phrase into the nominative *duhitā́ diváḥ*, may also have overridden the relatively strict preference for a closing rhythm –⏑×||.

The distribution of *duhitár-* in 11-syllable verse presents a very similar situation. It differs significantly from that of LLH-shaped words ($p = 0.02699$), and slightly more so from HLH-shaped words (0.002413). A full 65% (20/31) of the forms are located spanning 3-5 (as compared to 43% of LLH- and 33% of HLH-shaped words), where it is bound up in (at least) two formulaic phrases. The first, 'heaven's daughter', seems like a Triṣṭubh variant of *duhitar divaḥ*, except that the poets inflected it more readily: voc. *divo duhitar* (4x: 6.64.4d, 6.64.5c, 6.65.6a, 7.77.6a); nom. *divó duhitā́* (4x: 1.92.5d, 1.113.7a, 1.124.3a, 5.80.5d); gen. *divó duhitúr* (1x: 7.67.2d). The second is *duhitā́ sū́riyasya* 'the daughter of the sun', and a favorite of the poet Kakṣīvat (4x: 1.116.17a, 1.117.13c, 1.118.5b, 6.63.5a). There, too, the location of the formulae is consistent with the prosodic shape represented in the S. text spelling.

3.5.4.3 The distribution of *dadhiṣe* and *dadhire* in 8-syllable verse

Arguing against positional effects of laryngeals in the reduplicated forms to *dhā-* 'put' is not necessarily a strong argument against laryngeal effects in general, since laryngeal deletion processes may have affected the forms already in Indo-European. The (semi-regular?) deletion of laryngeals in reduplicated forms could have potentially affected the entire paradigm, and a first laryngeal may have been deleted between obstruents in a number of forms of the paradigm as well, including *dadhiṣe*, since the process would have applied to the (underlying) pre-form *d^he-d^hh_1-soi*, yielding (surface) *d^hetsoi* (with the regular regressive assimilation of the features [voice] and [spread glottis] in addition to the deletion of h_1).[82] If, in fact, forms such as *dhatsva* at 10.87.2d reflect the *lautgesetzlich* result of this process, then forms of *dadhiṣe* could well go back to earlier laryngeal-less forms, to which the *i* (or an earlier *ə) was added without the restitution of the laryngeal. Nevertheless, I present the distribution of these forms, as well as that of the words with the spelling shape LLH and the suggested shape HLH, in

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[82] For a formulation of the deletion of a first laryngeal between obstruents in non-initial syllables of Indo-European, cf. Jasanoff (2003: 77 and fn. 37).

Table 29 and Table 30, where *dadhire* stands for the set of *dadhiṣe* and *dadhire* forms in 8-syllable verse.

Table 29: Metrical distribution of *dadhire*, LLH-, and HLH-shaped words in 8-syllable verse

	Metrical Positions						
	1-3	2-4	3-5	4-6	5-7	6-8	Total
dadhire	1	1	1	12	0	5	20
LLH	372	29	50	592	7	369	1419
HLH	270	85	28	980	5	4223	5591

Table 30: Proportional distribution of *dadhire*, LLH-, and HLH-shaped words in 8-syllable verse

	Metrical Positions						
	1-3	2-4	3-5	4-6	5-7	6-8	N
dadhire	0.05	0.05	0.05	0.60	0.00	0.25	20
LLH	0.26	0.02	0.04	0.42	0.00	0.26	1419
HLH	0.05	0.02	0.01	0.18	0.00	0.76	5591

The p-values reflect an insignificant difference between the distribution of *dadhire*-type forms and LLH-shaped words ($p = 0.1138$), and a highly significant difference between *dadhire*-type forms and HLH-shaped words ($p = 1.102e-05$). In all of the locations except those spanning positions 1-3 and 4-6, *dadhiṣe* and *dadhire* clearly pattern very closely with LLH-shaped words. There are, however, far fewer forms of *dadhiṣe* and *dadhire* in pāda-initial position, and far more spanning positions 4-6, than the average

LLH-shaped words. When inspecting the distribution of *pṛthivī́* and *duhitár-* above, we noted some effects of formulaics on word order. While formulaics (and many other factors) must play a role in the distribution of *dadhire*-type forms as well, I would like to take the occasion to explore some effects of morphosyntax on the distribution of these particular forms. With some systematic exceptions, involving imperatives and imperatival modal forms, for example, verb-initial word order is a marked one in Sanskrit, as in many other languages. In Table 31 and Table 32, I present the distribution of LLH-shaped words (again), LLH-shaped verbs (LLH Vs), LLH-shaped verbs without imperatives (LLH Vs no Is), and finally the *dadhire*-type forms. (I did not remove imperatival modals, but only true imperatives from the penultimate set.)

Table 31: Metrical distribution of LLH words, LLH verbs, non-imperative LLH verbs, and *dadhire* in 8-syllable verse

	Metrical Positions						
	1-3	2-4	3-5	4-6	5-7	6-8	Total
LLH	372	29	50	592	7	369	1419
LLH Vs	60	4	19	100	1	50	234
LLH Vs no Is	21	4	8	67	1	50	151
dadhire	1	1	1	12	0	5	20

Table 32: Proportional distribution of LLH words, LLH verbs, non-imperative LLH verbs, and *dadhire* in 8-syllable verse

	Metrical Positions						
	1-3	2-4	3-5	4-6	5-7	6-8	N
LLH	0.26	0.02	0.04	0.42	0.00	0.26	1419
LLH Vs	0.26	0.02	0.08	0.43	0.00	0.21	234
LLH Vs no Is	0.14	0.03	0.05	0.44	0.01	0.33	151
dadhire	0.05	0.05	0.05	0.60	0.00	0.25	20

Separating LLH-shaped verbs from LLH-shaped words in general resulted in very little difference in distribution. Removing the imperatives, however, resulted in a substantial change. The increased similarity between the distribution of *dadhiṣe* and *dadhire* and the LLH-shaped non-imperative verbs is striking, and this is reflected in the p-value of 0.5556. Using the same approach, but taking morphosyntactic information of a finer grain such as argument structure into account would be one way of approaching questions of Rigvedic syntax, as it would allow us to tease apart syntactic and prosodic constraints on word order in Vedic versification.[83]

[83] We might, for example, test whether the class of unaccusative verbs tends to occupy verse-initial position more often than is expected of verbs in general, unergative verbs, transitives, etc. For a recent discussion of verb-initial order in Vedic, cf. Viti (2008).

3.5.5 The *rátha-* group[84]

Our second group of test forms consists of three items that securely continue an early Indo-Iranian *-VCHV- sequence, and are well-attested in 11-syllable verse: *jána-*, *rátha-*, and *sákhi-*. In attempting to test whether they are distributed like LH-shaped words, we are confronted with an interesting problem. The word shapes we have dealt with so far exhibit a very homogeneous distribution in the verse. LH-shaped words in 11-syllable verse, however, present a very different picture. While there are certain positions where they are clearly disfavored for metrical reasons, in the positions where they are not, different lexical items occur at surprisingly different rates. Without identifying and controlling for those factors—a project that is unfortunately beyond the bounds of this dissertation—a conclusive comparison between the forms of the *rátha-* group and LH-shaped forms is impossible. A comparison with HH-shaped words in 11-syllable verse, however, is possible. I begin with that, then briefly discuss the problems associated with the distribution of LH-shaped words.

[84] This data collection required me to mirror the specific Triṣṭubh corpus that Gippert used for his study as closely as possible. To do so, I extracted all the verses from the UTvNH text that contain 11 syllables and do not contain the symbol for a "break". This excludes the verses identified in vNH as 11-syllable Jagatī. I then removed 11 more verses that were identified by Gippert as 11-syllable Jagatī verses (pp. 66-67), and changed *-VchV-* sequences to *-VcchV-*. The resulting corpus contains 16,553 verses.

3.5.5.1 The distribution of the *rátha-* group

We noted some effects of morphosyntax on word shape distribution in the discussion of *dadhiṣe* and *dadhire* above. In order to more carefully control for those factors, I compare the distribution of the *rátha-* group with that of HH-shaped nouns in Table 33 and Table 34. I also require that the HH-shaped comparanda be *a*-stem nouns, i.e., nouns of the same inflectional class as *jána-* and *rátha-*. For *sákhi-*, which is inflectionally anomalous, the *a*-stem nouns serve as good comparanda from a phonological point of view as well. I control for additional phonological similarity by requiring the HH-shaped *a*-stem nouns to have the shape CVCCa-, so that they are as similar as possible to the putative *jánxa-**, *ráthxa-**, and *sákhxi-**.

Table 33: Metrical distribution of the *rátha-* group and CVCCa- nouns in 11-syllable verse

	Metrical Positions										
	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	Total
jána-	10	1	14	4	2	1	2	0	2	15	51
rátha-	27	0	40	9	5	5	1	0	7	5	99
sákhi-	20	0	6	0	1	0	1	0	5	4	37
CVCCa-	125	14	193	187	13	4	13	65	0	167	781

Table 34: Proportional distribution of the *rátha-* group and CVCCa- nouns in 11-syllable verse

	Metrical Positions										
	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	N
jána-	0.20	0.02	0.27	0.08	0.04	0.02	0.04	0.00	0.04	0.29	51
rátha-	0.27	0.00	0.40	0.09	0.05	0.05	0.01	0.00	0.07	0.05	99
sákhi-	0.54	0.00	0.16	0.00	0.03	0.00	0.03	0.00	0.14	0.11	37
CVCCa	0.16	0.02	0.25	0.24	0.02	0.01	0.02	0.08	0.00	0.21	781

The distribution of *jána-* and CVCCa- nouns is significantly different (p = 0.0001234), as is that of *rátha-* (p = 2e-06) and *sákhi-* (p = 1.667e-06), but *jána-* stands out from the others, as well as from all nouns with a LH spelling shape whose distributions I have examined in that it is located surprisingly often pāda-finally—even well above the expected rate for HH-shaped *a*-stem nouns. I return to the anomalous distribution of *jána-* below, in §3.5.5.2.

Both *rátha-* and *sákhi-* exhibit the kind of distributional variation typical of LH-shaped nouns, though they occur more frequently in pāda-final position than do most other LH-shaped nouns.[85] We may compare the LH-shaped forms of three well-attested nouns that certainly do not derive from forms with position-making laryngeals, but

[85] The frequency with which *sákhi-* occurs pāda-initially is in part due to a turn of phrase where pāda-initial nom. sg. *sákhā* is followed by a different case form of the same word: *sákhā sákhāyam* (acc. sg., 7.18.6d, 10.87.21c), *sákhā sákhye* (dat. sg., 5.29.7a), *sákhā sákhyur* (gen. sg., 1.72.5d, 3.43.4d), *sákhā sákhīn* (acc. pl., 3.4.1d), *sákhā sákhibhyas* (dat./abl. pl., 10.42/43/44.11d).

nevertheless occur pāda-finally: *nár-* ~ *nṛ́* 'man, hero' < **HnaR-*, *víś-* 'clan' < **u̯íḱ-*, and *páti-* 'lord, master' < **páti-*. I give only the proportional distributions in Table 35.

Table 35: Proportional Distribution of sample LH-shaped nouns not < *-VCHV- in 11-syllable verse

	Metrical Positions										
	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	N
nár-	0.16	0.00	0.58	0.04	0.07	0.05	0.02	0.00	0.04	0.04	122
víś-	0.45	0.03	0.29	0.03	0.06	0.03	0.03	0.00	0.03	0.03	31
páti-	0.22	0.00	0.31	0.12	0.06	0.08	0.08	0.00	0.12	0.02	51

Most nouns with LH-shaped inflectional forms that occur at least 14 times in 11-syllable verse do not occur pāda-finally, though, including forms that certainly did have *-VCHV-sequences at an earlier stage of the language, such as *háva-* 'call(ing), invocation' < **ǵʰáu̯Ha-*, *támas-* 'darkness' < **támHas-*, and *páyas-* 'milk, juice' < **pái̯Has-*. I give their distributions below, in Table 36.

Table 36: Proportional Distribution of sample LH-shaped nouns < *-VCHV- in 11-syllable verse

	Metrical Positions										
	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	N
háva-	0.10	0.00	0.48	0.03	0.07	0.03	0.00	0.03	0.24	0.00	29
támas-	0.07	0.00	0.36	0.07	0.14	0.21	0.07	0.00	0.07	0.00	14
páyas-	0.36	0.00	0.36	0.00	0.07	0.14	0.00	0.00	0.07	0.00	14

The samples given in Table 35 and Table 36 are intended to give some idea of the degree of distributional variation found in LH-shaped nouns, where the rate of occurrence spanning positions 1-2 varies from 7% to 45%, and from 3% to 21% spanning positions 6-7. The obvious inference is that factors other than the prosodic and morphosyntactic ones that we have taken into account play a more significant role in the distribution of LH-shaped words in 11-syllable verse than they do in the other word shapes we have studied so far. Given the deviations in the well-represented metrical locations, comparing the distribution of single LH-shaped items with the entire group is problematic until the factors involved in the distributional variation can be controlled for.

3.5.5.2 A note on the chronological distribution of *jána-*

A factor that we have not yet touched upon is the chronological stratification of the Rigveda. The subject is much debated, but there is a general consensus that the hymns in the Family Books (books 2-7) represent a more archaic stratum of composition than do the other books, which contain a mixture of younger-looking compositions as well as some archaic material.[86] Comparing the metrical distribution of *jána-* in the Family Books (FB) with its distribution outside of the Family Books (oFB) reveals a significant difference. The data is given in Table 37 and Table 38.

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[86] Cf. Jamison (1991: 10-11) and Witzel (1997: 261 ff.).

Table 37: Metrical distribution of *jána-* in and outside of the Family Books

	Metrical Positions										
	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	Total
jána- FB	3	0	9	0	1	1	2	0	1	11	28
jána- oFB	6	1	5	3	1	0	0	0	1	2	19

Table 38: Proportional distribution of *jána-* in and outside of the Family Books

	Metrical Positions										
	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	N
jána- FB	0.11	0.00	0.32	0.00	0.04	0.04	0.07	0.00	0.04	0.39	28
jána- oFB	0.32	0.05	0.26	0.16	0.05	0.00	0.00	0.00	0.05	0.11	19

The difference in the distribution of the word in these two strata is significant ($p = 0.0306$). Assuming that this broadly reflects a chronological change, with some noise from the archaic material in the non-Family Books, it appears that the younger poets are less willing to locate *jána-* pāda-finally, and prefer to locate it in pāda-initial position, and spanning 4-5. At this point, it is difficult to say what exactly has happened. It is clear that the change cannot be understood as a plain shift in prosodic shape from HH to LH, since in the Family Books, the form is not distributed like a HH-shaped *a*-stem noun. Among other differences, it is located far too regularly in pāda-final position. I leave the question for further study, but suggest one possible point of departure. The over-representation in pāda-final position may be due to its participation in a formula, perhaps *páñca jánāḥ/n* 'the five peoples'.[87] It is plausible that the poets would have retained an older HH phonological shape of *jána-* in the formula, which would have been located pāda-finally around 75% of the time, to judge by the location of HLHH-shaped words in 11-syllable meter. It is possible that the word *jána-* could have been associated with that position in the verse, and that the poets would have continued to locate it there, even outside of the formulaic context. With that speculation, I leave the problem.

3.5.6 Summary of the metrical evidence for laryngeals making position

All the forms in the *pṛthivī́* test group have a LLH shape to judge by their spelling in the S. text (*pṛ.thi.vī́*, *du.hi.tar*, *da.dhi.re*) and a HLH shape according to the hypothesis that laryngeals or their syllabic reflexes still affected the syllabification at the time of composition (*pṛth.xi.vī́**, *duh.xi.tar**, *dadh.xi.re**). We found that the metrical distribution of LLH/HLH-shaped forms of *pṛthivī́* did not differ significantly from that of LLH-shaped words ($p = 0.1855$), but that the difference between their distribution and that of HLH-shaped words was highly significant ($p = 3.196e-06$). Since 26% of LLH-shaped words occur pāda-finally in 8-syllable verse, the fact that 4 of the 20 forms of *pṛthivī́(m)* occur in that position is not at all unexpected, rather *pṛthivī́(m)* is represented pāda-finally just as we would expect of a LLH-shaped word.

[87] This occurs twice pāda-finally in 11-syllable verse in the Family Books (6.11.4d, 6.51.11b) and once in the same location outside of the Family Books (1.89.10c). It is also found pāda-initially in 11-syllable verse at 10.53.5a, and once in 8-syllable verse, spanning positions 3-6 (8.32.22b).

Our comparison of the distribution of *duhitár-* with LLH- and HLH-shaped words was inconclusive. Since most of the occurrences in 8-syllable verse are restricted to the formulaic vocative phrase *duhitar divaḥ*, its distribution is actually more like that of the first three syllables of a word of the shape LLHLH, or HLHLH on the laryngeal effects hypothesis. Since LLHLH- and HLHLH-shaped words have an identical distribution in 8-syllable verse, our method provides no further insight into the prosodic shape of the 'daughter' word. It is worth noting, however, that its two occurrences in the cadence do not merit any surprise. That is roughly half the number we would expect of it as a LLH-shaped word, and a far smaller fraction of what we would expect if it were distributed like a HLH-shaped word.

After noting that it is possible that *dadhiṣe* and *dadhire* might have lost their laryngeal due to early sound changes, and would thus have had a LLH shape on either hypothesis, we found that its distribution did not differ significantly from that of LLH-shaped words ($p = 0.1138$), but that it was quite significantly different from that of HLH-shaped words ($p = 1.102e-05$). We also noted some effects of morphosyntax on the word order, reflected in the increased similarity between the distribution of *dadhiṣe/dadhire* and that of LLH-shaped non-imperative verbs ($p = 0.5556$).

In sum, none of these forms is located in the cadence more frequently than we would expect of a LLH-shaped word, and there is no evidence that the poets situated them in the verse any differently than they did other LLH-shaped words. While we only treated the more robustly attested forms of the *-VCHə- group, if we consider them representative (as did Kuryłowicz and Schindler), it renders the hypothesis that laryngeals in forms < (putative) *-VCHə- had (significant) effects on the scansion of this group of forms highly improbable.

It is very interesting to note that *as a class*, LLH-shaped words are located pāda-finally in 8-syllable verse 26% of the time, while the pāda-final rhythm ◡◡×|| is so rare overall, representing roughly 4% of 8-syllable cadences. This may well point to a suprasyllabic phonological effect, which is to say that something about the rhythmic organization of LLH-shaped words rendered the initial light syllable significantly heavier than most other light syllables in the language. Similar effects are reflected in Greek meter, where for example the medial syllable of HHH-shaped words is better suited for location in a preferentially light position of the meter (the third anceps of the iambic trimeter) than other heavy syllables (cf. Devine and Stephens 1982; 1994: 105 ff.). Oldenberg considered the shape of the word to be a key factor, and it is worthwhile repeating one of his arguments in favor of this view. He points out that while the initial syllable of dat. sg. *ávase* is often located in a preferentially heavy position in the meter, the first syllable of the nom./acc. sg. *ávas* is not (1888: 10-13 and fn. 1).

The tests involving *rátha-* and *sákhi-* were inconclusive due to the fact that LH-shaped nouns are not homogeneously located in the verse, which foils a distributional comparison. Neither form patterns like a HH-shaped noun ($p = 2e-06$ and $1.667e-06$, respectively), and both seem—impressionistically speaking—to occur somewhat more often pāda-finally than other LH-shaped nouns. This certainly leaves room for a weaker version of the laryngeal hypothesis, along the lines of that proposed by Kuryłowicz, where certain traditional forms or phrases may have had (discreet) alternative scansions, e.g., nom. sg. *sá.khā* ~ *sákh.xā**. The way the poets located *jána-* may lend credence to this claim, assuming that the surprisingly high frequency with which it appears pāda-finally somehow reflects a HH scansion, though the details are far from clear. It is worth noting, though, that a laryngeal-based explanation for the weight of the initial syllable is certainly not the only one available.[88] Various processes, both phonological and morphological could have yielded a *jāná-*, including the operation of Brugmann's Law on a form which had undergone laryngeal deletion, perhaps as the second member of a compound (e.g., **X-ǵonh$_1$-o-* > **X-ǵon-o-* > **X-jāna-*), suffixation with *vṛddhi* of the root, etc.

3.6 Conclusion

I hope to have convinced the reader that comparing word shape distribution in the way proposed here is a more accurate way of judging textual emendations to the Rigveda. By considering the entire verse, we indirectly take compositional factors into account that are currently not completely understood. This is especially true of portions of the verse that are less strictly regulated with respect to the distribution of heavy and light syllables, primarily the opening of all verse types, and to a lesser extent, the post-caesural portion of trimeter verse. The value of this became apparent in our study of *pīpāya* (§3.3), where the method allowed us to confirm that the form is distributed like a LHL-shaped word not

[88] Cf. Oldenberg (1888: 478 ff.) for a discussion of the shape(s) of *jána-*, with an especially interesting point about the interaction of semantics and prosody.

only in pāda-final position, but throughout the entire verse, confirming Oldenberg's emendation *pipāya**. The importance of thinking about versification in terms of words as opposed to syllables was exemplified in the discussion of *pīpiyānéva* (§3.4). Held against the metrical yard-stick, it appeared that there were grounds for emending the form to *pipiyānéva**, since the spelling shape of the form yields a less common implementation of the first position following the caesura 4| in 11-syllable verse. Once word shape was taken into account, however, we saw that there were actually no metrical grounds for emending the form (though the fact that *pipāya* had a short reduplication vowel suggests that the participle may have had one as well). The poets were just as likely to have located a HLHHL-shaped form in that position as a LLHHL-shaped form. The usefulness of using entire classes of word shapes for comparison became especially clear in the treatment of the *pṛthivī́* group (§3.5.4), where it seems that the frequency with which we find those forms pāda-finally in 8-syllable verse is a property of LLH-shaped words *as a class*, and not the only the small subset that derive from pre-forms where a laryngeal (putatively) rendered the initial syllable heavy by position. The method allows us to transcend the confines of the cadence, and the Rigveda itself essentially becomes the yard-stick for comparison.

Along the way, I suggested a number of further applications for the method. It provides us with a way of teasing apart prosodic constraints and other compositional factors, since distributional differences *within* particular word shape classes cannot be attributed to prosody—at least not to the prosodic factors that we have taken into account. We saw the effects of syntax emerge in the discussion of *dadhiṣe* and *dadhire* (§3.5.4.3), where we compared the distribution of imperative verbs of the shape LLH with other verbs, and we noted several cases where formularity affected the distribution of particular items, such as *duhitár-* (§3.5.4.2). Finally, we briefly touched on the possibility of using the method to identify differences between compositional strata in the text, where we compared the distribution of *jána-* in the Family Books with its distribution in the other books. In sum, while the method is in need of much refinement, I believe that it has considerable potential for Rigvedic philology and linguistics.

4 Retrospective and prospective

The first two studies in this dissertation may be viewed as a step towards an analysis of foot structure in Greek. Any recent analysis of Greek prosody has the benefit of the enormously valuable contributions to the problem that Devine and Stephens made in over two decades of collaborative research that culminated in their monolithic work *The Prosody of Greek Speech* (1994). The analysis of Greek foot structure offered in the third chapter of that work operates with a foot inventory that includes both iambic and trochaic feet which can be either bimoraic or trimoraic. Such an inventory has become typologically implausible in light of more recent advances in phonology (Hayes 1995), and a new analysis of Greek foot structure that operates with a more restricted foot inventory is a desideratum. What I have offered here can only be considered a step towards such an analysis until all of the data martialed by Devine and Stephens have been sufficiently accounted for, leaving plenty of room for future work.

The focus of the first study in this dissertation is a change in word formation that affected verbal nouns in -μα(τ)-. My basic contribution to the problem is a more accurate description of the innovative grammar than has been offered in the past. The key observation is that there are systematic differences between derivatives that correlate with the phonological shape of the stem allomorph of the base verb. To account for the assymetry, I have proposed to equate the previously unnoticed phonological aspect of the innovation with Trochaic Shortening, which implies that speakers of Greek organized syllables into moraic trochaic feet, corroborating Golston's (1999) analysis of the recessive accent calculus.

With moraic trochees in hand, so to speak, in the second study I examine two interesting forms of inexact antistrophic responsion in Aristophanes, trochaic-paeonic and paeonic-dochmiac responsion. When we compare how the poet located (LL) feet in dochmiacs that respond with paeons with how he located them in other dochmiacs, we find that there is a statistically significant difference. The difference reflects Aristophanes' preference to align (LL) feet with the HL sequences of the corresponding paeon. On the typologically founded assumption that (LL) feet had a strong-weak foot-internal rhythm (**L**L), matching (**L**L) with HL resulted in greater rhythmic similarity between the surface instantiations of the dochmiac and paeon. I propose that we understand Aristophanes' preferential matching of (**L**L) with HL in inexact responsion in parallel with his preference to match HL with HL in exact responsion. They are two variants of the same overall preference to match strong-weak rhythms. The former relies on foot-based subcategorical weight distinctions between light syllables, and the latter relies on categorical weight distinctions that do not depend on foot structure. According to Dale (1968: 97) similar types of inexact responsion are found in Euripides. The Euripidean passages would thus be the most immediate and natural point of departure for further research.

In the third study, I proposed a more accurate method of judging whether words have the prosodic shape suggested by their spelling in the Saṃhitā text or not. The standard way of doing this involves checking how often a form appears to violate the preferences for syllable weight distribution in the meter. Since the poets composed verse by arranging words and phrases rather than than syllables, a better way of judging whether a form has the prosodic shape suggested by its spelling or not is to compare its metrical distribution with words of the same prosodic shape and with words that have the shape of the proposed emendation. The frequency with which certain LLH-shaped words appear finally in 11-syllable verse, implementing –⏑×‖, has led scholars to propose that the forms actually had the shape HLH, reflecting an older state of the language, where a laryngeal was still present *-VC.HV-. Upon comparing the metrical distribution of these forms with all the other LLH-shaped words, we saw that there was no significant distributional difference. Essentially, expectations based on the yard-stick of the meter (–⏑×‖) can be misleading, since the abstraction is based on the overall frequency of syllable weight distribution, which in some cases makes significantly different predictions from the frequency of word shape distribution. Ideally, we would check every lexical item of the Rigveda this way.

We also saw that prosodic shape is predictably not the only factor governing the metrical distribution of words in the verse. The comparison of LLH-shaped verbs with LLH-shaped imperatives revealed the effects of morphosyntax on the word order: the imperatives occur verse-initially far more often than do other verbs. The method has interesting potential for the study of Rigvedic syntax and formulaics, since distributional differences *within* word shape classes cannot be attributed to prosody, but must be due to other factors. Further research in this area would ideally involve tagging all forms in the corpus with morphosyntactic and other featural information, then comparing distribution within word shape classes.

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