

The metrical organization of Classical Sanskrit verse

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Abstract: In generative metrics, a meter is taken to be an abstract periodic template with a set of constraints mapping linguistic material onto it. Such templates, constrained by periodicity and line length, are usually limited in number. The repertoire of Classical Sanskrit verse meters is characterized by three features which contradict each of the above properties — (a) templates constituted by arbitrary syllable sequences without any overtly discernible periodic repetition: **aperiodicity**, (b) absolute faithfulness of linguistic material to a given metrical template: **invariance**, and (c) a vast number of templates, ranging between 600–700: **rich repertoire**.

In this paper, I claim that in spite of apparent incommensurability, Sanskrit meters are based on the same principles of temporal organization as other versification traditions, and can be accounted for without significant alterations to existing assumptions about metrical structure. I demonstrate that a majority of aperiodic meters are, in fact, surface instantiations of a small set of underlying quantity-based periodic templates and that aperiodicity emerges from the complex mappings of linguistic material to these templates. Further, I argue that the appearance of a rich repertoire is an effect of nomenclatural choices and poetic convention and not variation at the level of underlying structure.

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1. INTRODUCTION

A small set of metrical traditions constitutes the empirical grounding of the generative metrics framework (e.g. English (Halle & Keyser 1971, Kiparsky 1977); Perso-Arabic (Maling 1973, Hayes 1979, Prince 1989); Greek (Prince 1989)). These provide a theoretical conception of verse meter as (a) an abstract periodic template together with (b) a set of correspondence constraints that regulate the mapping of linguistic material to the template. Since possible patterns are constrained by periodicity and line length, the number of such verse templates within a metrical tradition is usually (c) limited. The repertoire of Classical Sanskrit verse is characterized by three features which, at first glance, appear to contradict each of the above properties of meters in familiar metrical traditions — aperiodicity, invariance, and rich repertoire.

1.1 *Aperiodicity*

Periodicity is defined as a regular alternation of more prominent and less prominent events, generating a potentially infinite pulse. Metrical structure is rhythmic; being minimally based on a regular pulse composed of relatively weaker and stronger metrical positions and characterized additionally by a hierarchical structure that organizes the metrical positions into higher prosodic constituents. In most traditions, abstract metrical templates relate in a transparent way to a periodic hierarchical structure. However, a significant subset of the Sanskrit meters (especially the more frequently used ones) is marked by a lack of overtly discernible periodic iteration. In contrast to templates of n -fold iterations of smaller prosodic constituents, these meters appear to be arbitrary sequences of heavy and light syllables.¹

Some commonly occurring Sanskrit meters are given in (1).² The first line contains the sequence of heavy and light syllables that define the particular meter. The macron (–) stands for heavy syllables and the breve symbol (˘) for light syllables. The colon indicates the location of the caesura as described in traditional descriptions.

- (1) a. – – – ˘ ˘ – ˘ – ˘ –
 viś vam tiṣ ṭha ti kuk ṣi ko ṭa re
 viśvam tiṣṭhati kukṣikoṭare

‘The universe rests in the cave of the womb.’ Śuddhvirāṭ
 (H.2.109)

- b. — ◡ — ◡ ◡ — ◡ — ◡ —
 de va de va ja ga tām pa te vi bho
deva deva jagatām pate vibho
 ‘O God, the lord of this world, the shining one.’ **Rathoddhatā**
 (H.2.141)
- c. — — ◡ — ◡ ◡ — : ◡ ◡ — ◡ — —
 śrī rā ma can dra ca ra nau : ma na sā sma rā mi
śrīrāmacandracaraṇau manasā smarāmi
 ‘I recall with my mind the feet of Rāmacandra.’ **Vasantatilakā**
 (H.2.231)
- d. — — ◡ — — ◡ ◡ — ◡ — —
 lab dho da yā can dra ma sī va le khā
labdhodayā candramasīva lekhā
 ‘like the crescent of the risen moon.’ **Indravajrā** (H.2.154)
- e. — — — — : ◡ ◡ ◡ ◡ — : — ◡ — — ◡ — —
 an tas to yañ : ma ñi ma ya bhu vas : tuñ ga mabh rañ li hāg rāḥ
antastoyañ mañmayabhuvā tuñgamabhrañlihāgrāḥ
 ‘You (clouds) are filled with water; they (buildings) have bejewelled floors. You are at lofty heights; they kiss the skies.’
Mandākrantā (H.2.290)

1.2 Invariance

In verse traditions such as English, metrical lines belonging to an abstract metrical template often show imperfect correspondences. However, these imperfect mappings are governed by a set of constraints (correspondence constraints) which determine whether the deviation of the linguistic material from the ideal template can be considered metrical. In Sanskrit, the linguistic material instantiating a given metrical template can *never* deviate from the pattern that constitutes it. For instance, a poem written in the Mandākrantā meter follows the same sequence of heavy and light syllables as given in (1e), in every one of its lines. Since all verse lines are maximally faithful to the abstract template they correspond to, a system of correspondence constraints mapping text to form is completely superfluous in an account of the Sanskrit metrical tradition.

1.3 Rich repertoire

Hundreds of meters are instantiated in classical Sanskrit literature and many more are listed (and illustrated) by traditional metrical texts. The most exhaustive listings of these, modern compilations by Velankar (1949) and Patwardhan (1937) contain more than 600 meters. The size of this

metrical repertoire substantially exceeds the repertoires of all other studied traditions, inviting the empirical question about the universal inventory of metrical constituents and the limits of exploiting it. While the rich number of patterns in a versification tradition does not in itself present a challenge to a generative metric account, it does make the task of metrical analysis complex.

1.4 *The solution*

The Sanskrit repertoire presents a formidable puzzle to generative metrics. What does it mean for a metrical template to be a strictly defined *random* sequence of heavy and light syllables without iteration of smaller prosodic constituents such as metrical feet? What forces rigid adherence to a given aperiodic template, disallowing the slightest deviation of the surface material from abstract form? Moreover, does the property of invariance obviate the need for assuming two levels of metrical structure: abstract form vs. its surface realization? Basically, how can the properties of the Sanskrit metrical repertoire be reconciled to existing assumptions about metrical structure and organization?

The main claim in this paper is that Sanskrit meters are fundamentally based on the same principles of temporal organization as other versification traditions, and can be accounted for without significant alterations to theories of metrical structure. On the analysis proposed here, Sanskrit metrical descriptions are not abstract metrical templates (as the English iambic pentameter or the Greek dactylic hexameter), but rather, the surface instantiations of such abstract templates.

The primary evidence that I offer in support of this claim is the formal similarity between classes of documented meters. I demonstrate that the traditionally documented repertoire contains groups of meters with minimally differing surface properties (*metrical families*), which provide evidence for abstract underlying templates subject to a set of implicit correspondence constraints. These groups of meters are not given by the traditional classification (which is based on syllabic count rather than identity of metrical structure), but must be identified on the basis of a set of formal properties. Less centrally, I also provide evidence from parts of versified texts which do not adhere to the invariance condition. In these parts, verse lines from different meters and undocumented syllable sequences occur in the same formal context (such as a quatrain or couplet), thus violating the invariance requirement. These data provide additional evidence for the central thesis of this paper that the documented meters are surface variants of a limited number of abstract templates. Finally, I show that performance practice (Sanskrit is a *chanted verse* rather than a *spoken verse* tradition) offers another sort of evidence for positing particular

underlying structures for the surface syllable sequences corresponding to individual meters.

Each of these pieces of evidence converges towards a two-level analysis of Sanskrit meters where abstract metrical patterns are not given in the metrical descriptions themselves but must be inferred from the properties of (sets of) surface instantiations. While such a proposal might appear straightforward, it is novel because neither in the Sanskrit tradition of metrical analysis nor in the available modern descriptions, which follow traditional metrical treatises (Velankar 1949, Patwardhan 1937), have Sanskrit meters been analyzed as derivable from abstract periodic patterns. The apparent incommensurability of Sanskrit meters to a periodic account is, I argue, a combined effect of two distinct but connected properties:

- a. Nomenclatural and poetic conventions specific to the Sanskrit tradition,
- b. The complexity of mappings between linguistic material and abstract template.

The rest of this paper is organized as follows. §2 discusses the nature of the repertoire and briefly describes the account of this repertoire offered by the indigenous metrical tradition and the coexisting oral tradition of meter recitation. §3 clarifies the peculiar relationship between abstract templates and surface instantiations in this repertoire as contrasted with templates from more familiar traditions. In §4, I lay out the basic elements required for the analysis of Sanskrit meters and provide a detailed analysis for one set of meters — the *Indravajrā* metrical family. In §5, I discuss the role of metrical devices such as syncopation and anacrusis that must be factored in for an accurate analysis of some meters. In the next section, I account for a set of frequently used popular meters, which can be best accounted for only if we assume that Sanskrit utilizes these metrical devices. Finally, in §7, I discuss the implications of the Sanskrit metrical repertoire for the theory of generative metrics and conclude.

2. THE TRADITION

2.1 *The repertoire*

Old-Indo Aryan versification patterns fall into three basic types:

- a. Syllabic Verse (*akṣaravṛtta*): Quantity-neutral syllable counting meters, where each verse-line has the same number of syllables. This type is instantiated in most archaic Vedic poetry (Velankar 1949, Arnold 1905). For example, the *Anuṣṭubh* meter contains eight syllables per line, while the *Jagati* contains twelve syllables. These are instantiated most commonly in stanzas of four homometric lines.

- b. Quantitative Verse (*mātrāvṛtta*): Quantity-based meters with the mora as the relevant scanning measure. These meters consist of tetramoraic feet and are used in both Sanskrit and Prakrit poetry. Common examples are the *Mātrāsamaka* and *Āryā* meters.
- c. Syllabo-Quantitative Verse (*akṣaragaṇavṛtta*/*Varṇavṛtta*): These meters are peculiar to Classical Sanskrit and are defined as a sequence of a fixed number of syllables in a fixed order of succession. These meters are (often aperiodic) strings of heavy and light syllables in a predetermined sequence. This predetermined sequence is absolute and may not be violated by any verse line written in that meter. The meters are largely of the *Samavṛtta* (even-meter) kind, which means that they are formally instantiated in four-line stanzas.

It is the last set of meters that poses the puzzles of aperiodicity and invariance to generative metrical theory. The scope of this paper is limited to this part of the Sanskrit metrical repertoire and all reference to Sanskrit meters here is intended to apply to the set of Classical Sanskrit meters falling under the class *akṣaragaṇavṛtta*. In the next section, I discuss the indigenous tradition of metrical analysis and its account for the meters of this class.

2.2 The textual tradition

The Sanskrit metrical repertoire has been documented, classified, and defined in a traditional branch of scholarship called the *Chandaḥśāstra*. The *akṣaragaṇavṛtta* class, totaling over 600 meters, occupies an important position in these descriptive treatises (Velankar 1949: 56). Information about individual meters includes the exact sequence of heavy-light syllables defining a meter, location of caesurae or phrase boundaries, and illustrations of the documented meters. Meters are classified on the basis of the number of syllables they contain, a practice inherited from the earlier Vedic system of syllabic versification.

The tradition, starting from Pingala's *Chandaśśāstra*, employs an interesting (but, unfortunately, not very enlightening) system to describe the hundreds of meters that it so carefully documents. Every meter is scanned using a measure of heavy and light syllables organized into sequences of three. Given that there are two weight distinctions and three positions onto which they may map, there are eight (2^3) unique sequences, which may be the constitutive units of any meter. If a metrical template cannot be exhaustively scanned in terms of these measures (the case with every template in which the number of syllables is not a multiple of three) the final one or two syllables are explicitly stated in the description of the meter. A fixed sequence of the ten syllables given in (2) is used to generate the possible sequences in the measures. The first three syllables form the first

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measure, the next measure contains three syllables starting from the second syllable, the third measure starts from the third syllable, and so forth. Each measure is called a *gaṇa* ‘group’ while the system itself is called the *trika* ‘triad’ system.

(2)	◡	—	—	—	◡	—	—	◡	◡	◡	—
	ya	mā	tā	rā	ja	bhā	na	sa	la	gā	
	—————			—————		—————		—————			

The first syllable of every *gaṇa* or measure (actually the relevant consonant and a schwa) is the mnemonic assigned to that *gaṇa*. The mnemonics for these measures are given in (3). The penultimate and final syllables in the sequence in (2) also stand alone as mnemonics for light and heavy syllables respectively.

(3) Mnemonics for measures in the trika system

ya mā tā:	ya	ja bhā na:	ja
mā tā rā:	ma	bhā na sa:	bha
tā rā ja:	ta	na sa la:	na
rā ja bhā:	ra	sa la gā:	sa
laghu (light syllable):	la	guru (heavy syllable):	gā

These eight trisyllabic measures and the basic measures for heavy and light syllables form the descriptive core of the *trika* system. The unique sequence of measures with the specification of the leftover heavy or light syllables, and information about caesurae (represented here by the colon) constitutes the definition of a meter. (4) shows how the meters in (1) are described in this tradition. The brackets mark the scansion based on the measures in (3).

(4) Describing meters in the Trika system

METER	REPRESENTATION					
a. Śuddhavarāṭ	(— — —)	(◡ ◡ —)	(◡ — ◡)	—		
	ma	sa	ja	gā		
b. Rathoddhatā	(— ◡ —)	(◡ ◡ ◡)	(— ◡ —)	◡ —		
	ra	na	ra	la gā		
c. Vasantatilakā	(— — ◡)	(— ◡ ◡)	(◡ — ◡)	(◡ — ◡)	—	—
	ta	bha	ja	ja	gā	gā
d. Indravajrā	(— — ◡)	(— — ◡)	(◡ — ◡)	—	—	
	ta	ta	ja	gā	gā	
e. Mandākrāntā	(— — —)	(— : ◡ ◡)	(◡ ◡ ◡)	(— : — ◡)	(— — ◡)	— —
	ma	bha	na	ta	ta	gā gā

The descriptive mechanism embodied in the *trika* system can describe every Sanskrit meter, actually *any possible* syllable sequence – even prose, a fact recognized in traditional treatises. As illustrated in (5), the tradition, in fact, values the generative power of such a simple system that can account for any existing meter and also allow for the creation of new ones.

- (5) *myarastajabhna-ga-iḥ* *l-ānta-iḥ* *e-bhiḥ* *daśa-bhiḥ*
 m-ya-ra-s-ta-ja-bh-na-ga-INS.PL la-ending-INS.PL these-INS.PL ten-INS.PL
akṣara-iḥ
 letters-INS.PL
samasta-m vāṇmaya-m *vyāpta-m* *trailokya-m*
 all-NOM.SG literature-NOM.SG pervaded-NOM.SG three worlds-NOM.SG
iva viṣṇu-nā
 like V-INSSG

All of literature is pervaded with these ten letters, ma-ya-ra-sa-ta-ja-bha-na-ga, ending with la, just as the three worlds are pervaded by the Lord Viṣṇu.

(Kedāra Bhaṭṭa's *Vṛttaratnākara* (1:6))

On a serial, non-hierarchical view of metrical templates, the combinatorial possibilities of stringing together units from the inventory of [heavy, light] are much vaster than even the vast repertoire seen in Sanskrit. A system of description based on syllable count and heavy-light sequence, therefore, does not contribute to an understanding of the structure of Sanskrit metrical templates. It leaves unanswered questions such as what sequences of syllables yield allowable meters and what constraints determine the metricality or unmetricality of individual syllable sequences within this metrical tradition. Moreover, a crucial piece of evidence that the trisyllabic units of description do not capture the underlying organization of the Sanskrit meters is that they often violate caesura boundaries which are explicitly stated in the metrical description. For instance, the *trika*-based scanning of Mandākrāntā meter, as given in (4e), creates ternary groupings which do not respect major metrical breaks in the line. This mismatch between perceived metrical units and the descriptive units of the tradition is an indication that the *trika* groupings do not correspond to the internal divisions of the meter. The account offered by the indigenous metrical tradition, therefore, provides us with very little information to build a generative analysis upon.

2.3 The oral tradition

In direct contrast to the textual tradition, is the rich oral tradition of verse recitation, which has been transmitted through the generations although

its antiquity is not clearly established. Meters are associated with a fixed chanting pattern or tune. Sometimes, a single meter may be associated with more than one chanting pattern, but the repertoire of patterns is limited, and in many cases, multiple meters map onto a single pattern. Participants in this tradition (poets, their audience, and, presumably, the writers of metrical texts) can easily associate a given metrical verse with its pattern of recitation. Moreover, participants are often able to ‘perform’ unfamiliar meters by mapping them onto a familiar performance pattern. This performance practice is based on relatively simple rhythmic schemata, and can be taken to presuppose an underlying metrical structure that is common to both the surface syllable sequence and its performance. This knowledge about metrical performance is an integral part of the metrical competence for participants in the Sanskrit metrical tradition. As a fluent participant in this tradition, I will refer to my own knowledge about metrical performance (confirmed with four other individuals who share this tradition) wherever I make reference to performance practice.³

Performance practice and the intuitions of fluent participants serve two important purposes in the generative analysis of Sanskrit verse. First, for a large number of meters, performance patterns provide corroborating evidence for independently posited metrical structures. In this case, a small number of theoretical assumptions allow us to hypothesize underlying metrical templates and implicit correspondence constraints for a set of meters. Performance practice serves to confirm the accuracy of these hypotheses. In the other class of cases, performance offers crucial clues into the mapping between surface syllable sequences and underlying metrical structure. This class includes meters that involve non-transparent syllable-to-template mapping and require an enriched inventory of metrical devices such as syncopation and the possibility of non-isochronous rhythm. Performance practice allows us to clearly identify which precise metrical devices are used in the construction of these meters.

3. TEMPLATES AND LINES

In familiar versification traditions such as English or Greek, metrical lines composed in a particular meter may deviate in constrained ways from the ideal metrical template. (6) illustrates the nature of this constrained deviation for the iambic tetrameter in English. (6b) contains some lines from Vikram Seth’s novel in verse ‘The Golden Gate’ (1986), written in iambic tetrameter (6a). The template has eight positions, constituted by four iambic (WS) feet. But not every line in (6b) is a pure eight syllable line with a simple weak-strong alternation. Two lines contain extrametrical syllables (marked in boldface), there are two instances of the line-initial trochee (italicized); there is one case of resolution where the strong position

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is filled by two open syllables instead of one (the word ‘passionate’), and one case where the paraphonology derives a bisyllabic representation from the trisyllabic word ‘corporate’.

- (6) a. (W S) (W S) (W S) (W S)
- b. John, thóugh his córporate stóck is bóoming
 For áll his móhair, sérgé, and twéed
Sénses his life has rún to séed
 A pássionate mán with équal párts **of**
írritábílítý and chárm (The Golden Gate, 1986)

The use of devices such as extrametricality, resolution, and exploitation of prosodic variation allowed by the phonological component to derive surface variation in metrical rhythm is fairly well-studied in generative metrical analyses of English verse (Halle & Keyser 1971, Kiparsky 1977). Metrical verse lines in this (and many other) traditions represent surface instantiations of the abstract structure on which they are based. The Sanskrit repertoire stands in strong contrast to this kind of constrained variation. Invariance demands that there be no surface variation in a given sequence of light and heavy syllables constituting the template.

The key to Sanskrit metrical structure lies in unraveling the interrelations between precisely those properties of the meters which appear to defy a generative analysis: aperiodicity, invariance, and rich repertoire. The vast repertoire of apparently aperiodic metrical templates on the one hand and an absolutely rigid realization pattern on the other suggests that the interface between metrical template and the linguistic material mapping onto it is not at all identical to the interface between the two in other traditions. A familiar way of inferring the metrical structure of a template involves abstracting away from surface variation in metrical lines occurring in the same formal context – e.g. a single piece of verse. However, this is not possible in the Sanskrit repertoire since invariance rules out all surface variation. This brings us to an impasse. If there is no way of inferring some kind of underlying metrical structure, we must assume that the aperiodic syllable sequences of Sanskrit meters are themselves the abstract underlying templates, forcing us to concede that metrical templates may be aperiodic, arbitrary sequences of syllables, determined by convention, rather than rhythmic structure. An alternative hypothesis, that I will adopt, is the following:

- (7) The aperiodic syllable sequences listed as distinct meters in the Sanskrit tradition are NOT the underlying metrical structure; they are actually SURFACE INSTANTIATIONS of a relatively small set of underlying periodic structures.

Consider the meters in (8). The tradition lists each of the syllable sequences in (8) as a distinct meter, with its own name (marked in boldface in the right hand column). Every syllable sequence adds up to sixteen moras, divisible into four units of four moras each. Each meter, then, is some combination of four such units, which may be realized as spondees, dactyls, anapests, or as four light syllables. The abstract structure common to all the meters is four tetramoraic trochaic feet, a pattern very familiar from musical and rhythmic traditions across cultures. (8) lists only some of the Sanskrit meters belonging to this pattern. I call this pattern the Sanskrit trochaic tetrameter and represent it with the grid in (8).

(8) **The Sanskrit trochaic tetrameter**

S	W	S	W	S	W	S	W	
*	*	*	*	*	*	*	*	(Metrical Position)
*		*		*		*		(Foot)
*				*				(Dipod)
								Meter
´	–	´	–	´	–	´	–	Source
´	–	´	–	´	–	´	–	Vidyunmālā (H.2.74)
´	–	´	–	´	–	´	–	Mattā (H.2.107)
´	–	´	–	´	–	´	–	Bhramaravilasitā (H.2.138)
´	–	´	–	´	–	´	–	Paṇava (H.2.110)
´	–	´	–	´	–	´	–	Haṁsagrīḍā (Jk.2.95)
´	–	´	–	´	–	´	–	Uddhata (H.2.124)
´	–	´	–	´	–	´	–	Rukmāvatī (H.2.113)
´	–	´	–	´	–	´	–	Śrī (H.2.132)
´	–	´	–	´	–	´	–	Patitā (H.2.140)
´	–	´	–	´	–	´	–	Moṭanaka (H.2.147)
´	–	´	–	´	–	´	–	Lalanā (H.2.186)
´	–	´	–	´	–	´	–	Maṇigūṇanikara (H.2.245)
´	–	´	–	´	–	´	–	Achaladhṛti (H.2.269)
´	–	´	–	´	–	´	–	Kusumavicitrā (H.2.168)
´	–	´	–	´	–	´	–	Kalagīta (Mm.13.7)
´	–	´	–	´	–	´	–	Vaktra (H.2.88)
´	–	´	–	´	–	´	–	Bandhuka (Jk.2.94)
´	–	´	–	´	–	´	–	Sundaralekhā (Jk.2.74)
´	–	´	–	´	–	´	–	Suṣamā (Pp.2.96)
´	–	´	–	´	–	´	–	Madirākṣī (Jk.2.88)

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Following Prince (1989) and Hayes (1979), I assume that a metrical position in quantitative metrical systems is a bimoraic trochee with the rhythmic status of a musical beat. A heavy syllable (macron) occupies a full beat, while a light syllable (breve) maps onto half a beat. The rhythmic structure of these and all other meters is formally represented here by the grid notation developed in Liberman (1978) and Lerdahl & Jackendoff (1983). A metrical grid contains rows of vertically aligned asterisks (or other markers) representing (typically) an isochronous pulse. The strength of a beat is determined by the height of the asterisk column that it corresponds to. Here, the lowest level, represented by the first asterisk row, is the level of the metrical position, the rows below which mark the foot and the dipodic levels respectively.

The total number of permutations, given eight metrical positions that can be realized by either a single heavy or two light syllables is 256 (2^8). Although the tradition doesn't document all these permutations, it does document as distinct meters approximately fifty, some of which are in (8). It is clear from this set of meters that the nomenclatural system of Sanskrit metrics differs considerably from that of other traditions. The surface instantiation of a periodic rhythm is adopted as the level of nomenclature. On the other hand, in other traditions, the metrical template is abstracted away from multiple possible surface rhythms, and possibilities of rhythmic variation are incorporated in the definition of the meter. Take for example, the dactylic hexameter in Greek, in which any dactyl, except the fifth, may be realized as a spondee, while the last one must be realized as such. Such a definition allows variation in the rhythmic surface, as shown in (9), without labeling every possible surface rhythm as a distinct meter. All the variations presented in (9) are valid hexameter lines. The Indian nomenclatural system would require each such unique sequence of heavy and light syllables possible within the constraints of the dactylic hexameter to be named distinctly, thus potentially expanding the size of the Greek repertoire.

(9) The dactylic hexameter

(* *)	(* *)	(* *)	(* *)	(* *)	(* *)	
*	*	*	*	*	*	Meter
— — —	— — —	— — —	— — —	— — —	— —	Dactylic Hexameter-a
— —	— —	— —	— —	— — —	— —	Dactylic Hexameter-b
— — —	— —	— — —	— —	— — —	— —	Dactylic Hexameter-c
— —	— — —	— — —	— —	— — —	— —	Dactylic Hexameter-d
— — —	— — —	— — —	— —	— — —	— —	Dactylic Hexameter-e

Crucially, what might be regarded as a ‘verse line’ in a tradition such as Greek, is given the status of a distinct meter in Indian metrical classification. The Indian tradition documents surface rhythms and not the periodic templates, which underlie them. This choice is possibly not arbitrary and connected to conventions in Sanskrit poetic form. Poetic convention requires that a particular ‘meter’ (syllable sequence yielding a specific surface rhythm) selected by an author be adhered to for the length of at least one verse (four lines), oftentimes entire poems with scores of verses. A verse written in a particular meter has four identical *pāda* (literally translated as feet, but in reality, corresponding to lines) composed in the exact syllable sequence that defines that meter. So, although the meters Rukmavati, Paṇava, or Mattā (given in (8)) are all instantiations of the same underlying template, a verse written in one of these meters may not contain lines that correspond to the syllable sequences characteristic of any other meter.

Taking the surface instantiation of a periodic structure as the level of description obviates the need for a system of constraints regulating the correspondence between linguistic material and abstract form since the ‘meter’ represents precisely this mapping. The nomenclature is applied to the surface realization of an underlying rhythm – the output that results from the interaction of some abstract template with some implicit set of correspondence constraints. Both the nature of the abstract template and the set of constraints that govern its surface realization must be inferred through an examination of the metrical repertoire for *families* of related meters that can perform the same function in determining properties of metrical structure that verse lines do in other traditions.

3.1 Summary

In this section, I put forward the hypothesis that the templates labeled ‘meters’ in the Indian tradition should be construed as surface instantiations of abstract periodic structures, rather than as the abstract structures themselves. This hypothesis has several advantages. First, it reduces the rich repertoire problem to a more manageable magnitude by grouping together families of surface rhythms that correspond to a single abstract template. Since the documented meters represent possibilities of variation in the surface rhythm, it follows that further variation in the linguistic material is not possible within the metrical definition. This, in combination with Sanskrit poetic conventions that demand adherence to the same surface rhythm through the length of a piece of text, provides a straightforward explanation to the invariance puzzle. Finally, the apparent lack of periodicity in the heavy-light sequence of syllables is at least partially attributable to the fact that the underlying periodic structure is implicit.

4. THE METRICAL STRUCTURE

In the previous section, it was shown how the nomenclatural system of Sanskrit metrics obscures the real relation between abstract and surface metrical structure, resulting in an inflated, apparently aperiodic metrical repertoire. However, the differences are not limited to labeling systems, but extend to the realization of periodic structure.

4.1 *The inventory of feet*

A basic assumption in generative metrics is that all metrical templates are constituted by iterated prosodic feet with two metrical positions in either SW (trochaic) or WS (iambic) configuration. In quantitative templates, the default metrical position is equivalent to a musical beat, i.e. a bimoraic trochee (Prince 1989). A bimoraic metrical position may be either unbranched (realized by a single heavy syllable) or branched (realized by two light syllables). Moreover, additional constraints on the correspondence between abstract form and linguistic material may affect the realization of metrical positions in terms of quantity. For instance, weak positions in some meters may be realized as monomoraic, yielding iambic and trochaic templates with trimoraic feet in contrast to templates with tetramoraic feet.

The realization of periodic structure and the syllabic constitution of a metrical position (or foot) is determined by both branching and correspondence conditions relative to a given metrical repertoire. In this section, I will identify the branching and correspondence constraints that govern foot structure in the Sanskrit repertoire. The set of constraints to be presented allow for a total of seventeen possible syllable sequences that realize metrical feet in this system, of which nine are iambic (presented in (14)) and eight are trochaic (presented in (15)).

4.1.1 *Branching conditions*

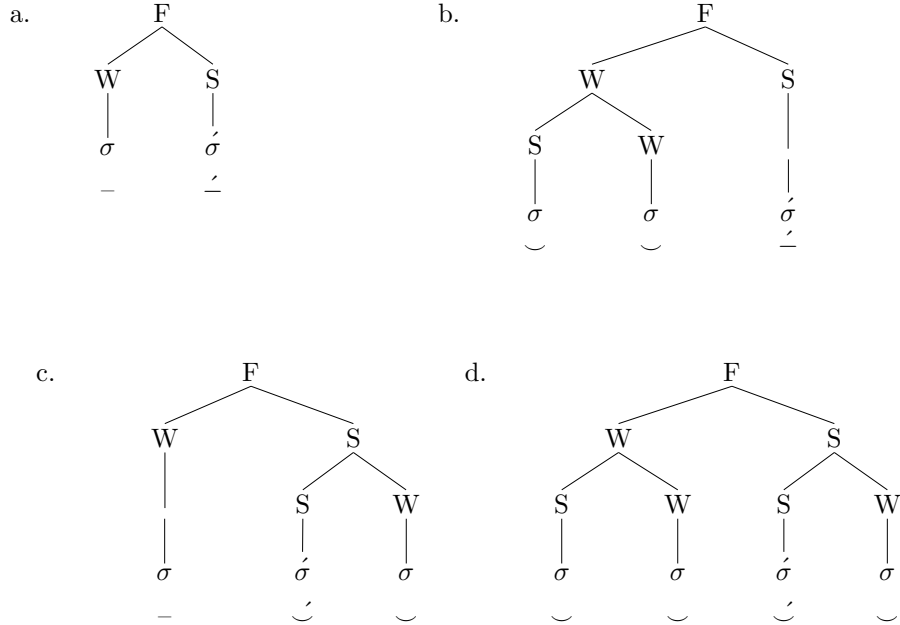
The metrical system for Classical Sanskrit quantitative verse is governed by the following branching conditions:

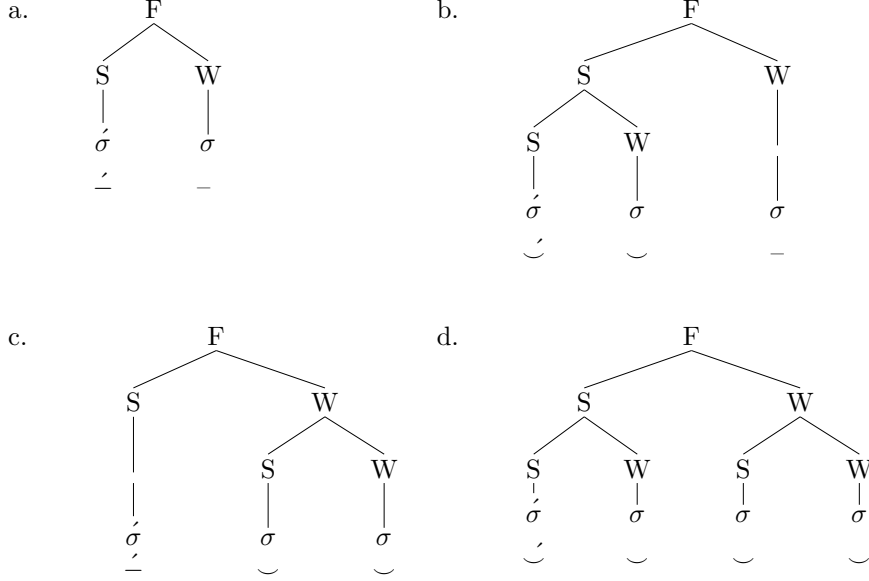
- (10) a. All metrical feet are constituted by two metrical positions in WS (iambic) or SW (trochaic) configuration.
- b. Both metrical positions of a foot may be subdivided, i.e. realized by more than one syllable – a phenomenon commonly known as beat-splitting (Prince 1989, Hayes 1979).⁴

This implies that a permissible foot in Sanskrit meters is minimally **bisyllabic** and maximally **tetrasyllabic**. Given these branching conditions and the assumption that the metrical position is bimoraic by default,

we have the branching possibilities (and corresponding syllable sequences) in (11) and (12). Note that the syllable sequences realizing iambic and trochaic feet overlap completely, showing that branching properties of feet neither completely determine nor are they determined by the rhythmic configuration of feet. The feet type introduced in (11) and (12) represent only a subset of the permissible feet in Sanskrit; the remaining feet types are determined by the correspondence constraints, introduced in §4.1.2.

(11) **Branching conditions on iambic feet**



(12) **Branching conditions on trochaic feet**4.1.2 *Correspondence conditions*

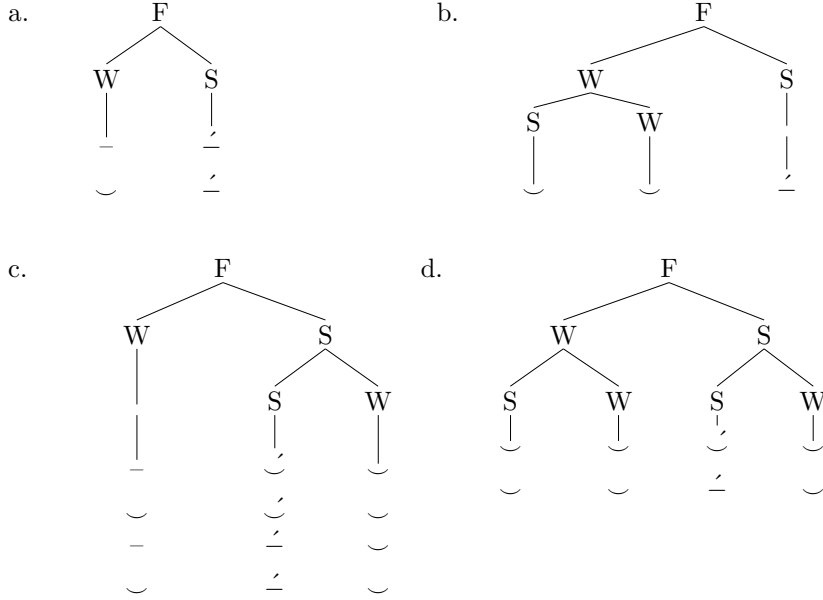
The feet inventory in (11) and (12) assumes that metrical positions are bimoraic. Unbranched metrical positions correspond to a single heavy syllable while branched metrical positions correspond to two light syllables. However, Sanskrit allows for correspondences in which metrical positions are realized by more or less than two moras. The following correspondence conditions constrain the realization of feet in the Sanskrit metrical repertoire.

- (13) a. By default, metrical positions are bimoraic.
 b. The weak metrical position may be monomoraic i.e. realized by a single mora, or one light syllable.
 c. The strongest terminal node of a foot may be bimoraic i.e. the strong node of a branching strong metrical position may be realized by a heavy syllable.

These conditions imply that a permissible foot in the Sanskrit metrical repertoire is minimally **trimoraic** and maximally **pentamoraic**. Trimoraic feet can be characterized without reference to moraic count as feet with a monomoraic weak position, while pentamoraic feet can be characterized as feet with a branching strong position and a bimoraic strong terminal node.

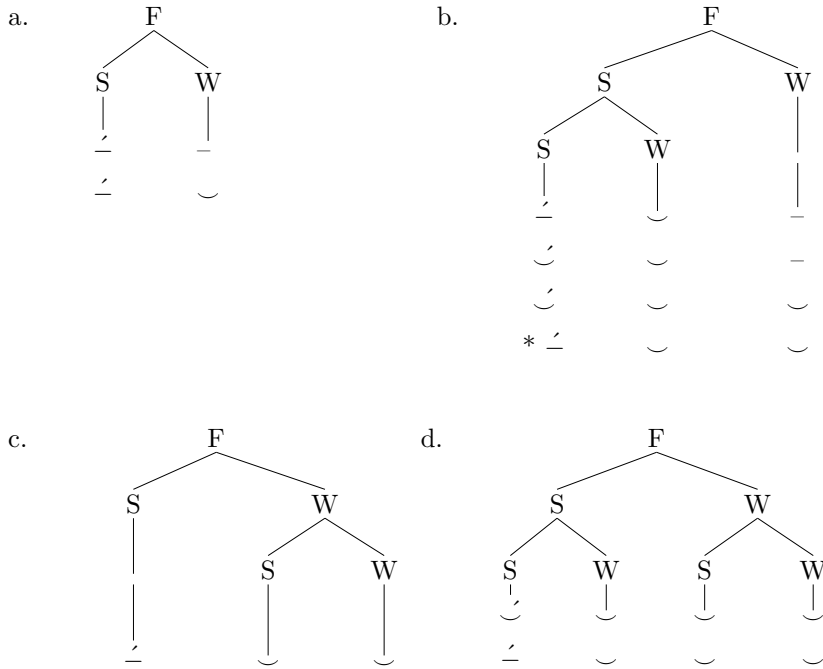
Tetramoraic feet constitute the default and need no specification. (14) and (15) show the entire set of possible syllable sequences that may be validly parsed as feet given the branching and correspondence constraints of the Sanskrit metrical system. For instance, there are four syllable sequences corresponding to the right-branching structure in (14c). The first sequence in (14c) contains a heavy syllable in the weak position and two light syllables in the strong position. Each metrical position is bimoraic. The second sequence has a monomoraic weak position, by the condition in (13b). In the third sequence, the strong terminal node of the strong metrical position is realized by a heavy syllable, corresponding to the condition in (13c). This yields a pentamoraic foot. In the final sequence, both conditions (13b) and (13c) are operational, yielding a tetramoraic iamb, with a light-heavy-light sequence.

(14) **Permissible iambic feet in Sanskrit**



(15) contains the syllable sequences for trochaic rhythm corresponding to the different branching and correspondence conditions. The final sequence in (15b) is marked with an asterisk because it is generated as a possible foot by the branching and correspondence conditions given above, but a more intuitive parse for such a syllable sequence appears to be the one given in (15c).

(15) **Permissible trochaic feet in Sanskrit**



4.1.3 Summary

In §4.1.1 and §4.1.2, I presented a set of constraints on branching and moraic correspondence that generate the inventory of permissible feet in Sanskrit.⁵ The inventory of permissible feet in Sanskrit is distinguished by the availability of the branching option for both metrical positions and the possibility of non-bimoraic metrical positions. In the next section, I address the question of the *iteration* of metrical feet. Given the variety of surface realizations of the abstract iambic and trochaic rhythms, what are the constraints on their iteration within a single metrical template? Specifically, is it the surface realization or the basic rhythmic foot type that iterates across the metrical template?

4.2 Iteration of metrical constituents

The Sanskrit metrical repertoire allows for non-branching, right-branching, left-branching, and dual-branching iambic and trochaic feet whose realization is constrained by a set of correspondence conditions. In (14) and (15), I listed the sequences of heavy and light syllables that emerge as the output

of the interaction between the branching and correspondence conditions in the Sanskrit metrical system. How are the feet (and the syllable sequences corresponding to them) in (14) and (15) strung together to yield different metrical templates? The minimal assumption that needs to be made (if we are to have a periodic analysis for Sanskrit verse) is that all the feet in a given metrical template belong to the same rhythmic type; i.e. they are all either iambic or trochaic. With this constraint in place one can conceive of three logical possibilities for iteration:

A. *Strict Uniformity*

Every foot in a given metrical template is governed by identical branching (10) and/or correspondence (13) conditions. This yields perfectly periodic metrical templates with an iteration of feet of the same surface rhythm across the template. An example for this type of iteration, the meter Kāmāvatāra, is in (16) where the basic foot is a pentamoraic iamb, with a trimoraic strong metrical position.

(16) $- \acute{\cup} \cup \quad - \acute{\cup} \cup \quad - \acute{\cup} \cup \quad - \acute{\cup} \cup$ **Kāmāvatāra** (H.2.167)

B. *Weak Uniformity*

Every foot in a template belongs to the same rhythmic type (iambic or trochaic) but may vary with respect to branching or correspondence conditions. In such metrical templates, the iambic or trochaic configuration would be maintained across feet, but there would be no further constraints on how this configuration may be realized. An example is the hypothetical syllabic sequence in (17), which has iterating iambic feet of differing quantities with no obvious pattern. To the best of my knowledge, metrical templates governed by precisely these conditions do not exist.

(17) $\cup \acute{\cup} \quad \cup \acute{\cup} \quad - \acute{\cup} \quad - \acute{\cup} \cup \quad \cup \acute{\cup} \cup \quad \cup \acute{\cup} \cup$ **Unattested**

C. *Constrained Variation*

Every foot in a template is at least partially constrained by identical branching (10) or correspondence (13) conditions. The precise constraints on iterated feet can be explicitly articulated individually for (sets of) metrical templates. An example for a metrical template with varying but constrained feet iteration is given in (18a). The popular meter Indravajrā involves an alternation of pentamoraic and tetramoraic iambs (iteration at the dipodic level). Additionally, the weak position of the third foot is specified as a branching position. Thus, the iambic feet in the Indravajrā

meter are not identical, but yet constrained by at least some branching and correspondence conditions (18b).⁶

(18) a. $- \acute{\cup} \cup \quad - \acute{\cup} :$ $\cup \cup \acute{\cup} \cup \quad - \acute{\cup}$ **Indravajrā** (H.2.154)

b. **Constraints on the Indravajrā meter:**

- Four iambic feet.
- Branching strong position in odd feet with a bimoraic terminal strong node.
- Branching weak position in the third foot.

Since templates in which periodic iteration satisfies only the weak uniformity condition (possibility B) are unattested, it appears reasonable to pursue the stronger hypothesis that metrical templates in the Sanskrit repertoire involve constrained variation in the periodic iteration of feet (possibility C). Strict uniformity (possibility A) constitutes a sub-case of constrained variation.

Within the Sanskrit repertoire, instances of meters defined by strict uniformity at the foot level abound. Examples are given in (19).

- (19) a. $\cup \acute{\cup} \cup \quad \cup \acute{\cup} \cup \quad \cup \acute{\cup} \cup \quad \cup \acute{\cup} \cup$ **Mauktikadāma** (H.2.172)
 b. $\cup \acute{\cup} \quad \cup \acute{\cup} \quad \cup \acute{\cup} \quad \cup \acute{\cup} \quad \cup \acute{\cup}$ **Pañcacāmara** (Vr. 3.64.4)
 c. $\acute{\cup} \cup \cup \quad \acute{\cup} \cup \cup \quad \acute{\cup} \cup \cup \quad \acute{\cup} \cup \cup$ **Modaka** (Pp.2.135)
 d. $\acute{\cup} \cup - \quad \acute{\cup} \cup - \quad \acute{\cup} \cup - \quad \acute{\cup} \cup -$ **Sragviṇī** (H.2.171)
 e. $\cup \cup \acute{\cup} \quad \cup \cup \acute{\cup} \quad \cup \cup \acute{\cup} \quad \cup \cup \acute{\cup}$ **Toṭaka** (H.2.162)
 f. $\acute{\cup} \cup \cup \cup \quad \acute{\cup} \cup \cup \cup \quad \acute{\cup} \cup \cup \cup \quad \acute{\cup} \cup \cup \cup$ **Achaladhṛti** (H.2.269)
 g. $\acute{\cup} - \quad \acute{\cup} - \quad \acute{\cup} - \quad \acute{\cup} -$ **Vidyunmālā** (H.2.74)

Similarly, there are many meters which involve a simple alternation of surface foot types within the template, yielding iteration at the dipodic level. Examples are in (20).

- (20) a. $\acute{\cup} \cup \cup \cup \quad \acute{\cup} - \quad \acute{\cup} \cup \cup \cup \quad \acute{\cup} -$ **Kusumavicitrā** (H.2.168)
 b. $\acute{\cup} - \quad \acute{\cup} \cup - \quad \acute{\cup} - \quad \acute{\cup} \cup -$ **Suṣamā** (Pp.2.96)
 c. $\cup \acute{\cup} \cup \quad \cup \cup \acute{\cup} \quad \cup \acute{\cup} \cup \quad \cup \cup \acute{\cup}$ **Jaloddhatagati** (H.2.169)
 c. $\cup \cup \acute{\cup} \quad \cup \acute{\cup} \cup \quad \cup \cup \acute{\cup} \quad \cup \acute{\cup} \cup \quad -$ **Kanakaprabhā** (P.8.7)
 d. $- \acute{\cup} \quad \cup \acute{\cup} \quad - \acute{\cup} \quad \cup \acute{\cup} \quad - \acute{\cup} \quad \cup \acute{\cup} \quad - \acute{\cup} \quad \cup \acute{\cup}$ **Mandākinī**
 (Mm18.14)
 e. $\cup \cup \acute{\cup} \quad - \acute{\cup} \quad \cup \cup \acute{\cup} \quad - \acute{\cup}$ **Kalagīta** (Mm. 13.7)

Moreover, the meters in (8) demonstrate that iterated feet may be characterized by identity in quantity, allowing for variation in both branching and correspondence conditions. Each foot in the templates in (8) is tetramoraic, without any constraint on the surface realization of individual feet. This constitutes a slightly different case of strict uniformity, where the quantity parameter is kept constant across all feet in a given template.

4.3 *Constrained variation and metrical families*

Describing Sanskrit templates that adhere to conditions of strict uniformity (e.g. those in ((8), (19), and (20)) is relatively straightforward. However, a significant number of meters cannot be described as instantiating simple iteration of some fixed branching, correspondence, or quantity parameters at the foot or the dipodic level. If the hypothesis of constrained variation is correct, then at least *some* constraints on iteration of metrical constituents in addition to identity of the basic iambic or trochaic rhythm are expected to underlie the diverse surface meters of Sanskrit. The program for a generative metrical analysis of the Sanskrit repertoire, then, must be concerned with identifying and explicating the precise constraints on surface metrical templates and feet iteration based on the set of conditions in (10) and (13).⁷ How do we even begin to identify these constraints without recourse to knowledge about even the abstract underlying templates, on the basis of the surface syllable strings that the tradition has defined as meters?

Abstract metrical templates and the conditions that constrain the realization of these templates are not given in a versification tradition but must be inferred from a corpus of surface realizations. In the English or the Greek tradition, the occurrence of different surface syllable sequences in a shared formal context (e. g. the same poem) provide the formal evidence that these distinct surface structures are instantiations of an identical underlying abstract template. The differences in the nomenclatural system and poetic conventions of the classical Sanskrit repertoire preclude the existence of such shared formal contexts in which all surface realizations instantiate the same template. A verse (or a larger poem), composed in a given meter is supposed to be absolutely faithful to the *surface* template and consists of a repetition of the same syllable sequence throughout. On the other hand, if my analysis is correct, the Sanskrit metrical repertoire itself is a (partial) list of the surface instantiations for a limited number of abstract templates.

This still leaves us with the problem of determining correspondences between the set of abstract metrical templates and their surface instantiations documented in the tradition. (8) illustrates a case where these correspondences can be easily determined by formal similarity — all the meters in (8) contain sixteen moras, divisible into four tetramoraic feet.

Let me call such sets of meters *metrical families*. A metrical family is constituted by a set of surface syllable sequences that may realize an abstract metrical template. The meters in (8) represent a partial metrical family for the trochaic tetrameter. Unfortunately, identifying other such metrical families by examining *only* the formal properties of the surface templates provided by the tradition proves to be a rather difficult task for at least two reasons. First, the tradition classifies meters by their syllabic count, a rather unintuitive classification for a quantity-based repertoire. Second, even in the case of metrical sequences with identical mora count, it is not clear that the syllable-to-foot mapping is identical. So we cannot rely on the formal property of moraic count in identifying metrical families that realize the same abstract template.

In the next section, I will demonstrate that it is possible to identify such constraints for one particular set of meters (the *Indravajrā* metrical family) by examining textual sub-domains which do not strictly adhere to the invariance condition. These are parts that are ostensibly written in a single meter but that *do* show variation in surface syllable sequences within a verse and across verses.

4.4 The *Indravajrā* metrical family

In §1, I reported the standard view that the Sanskrit repertoire is characterized by invariance, which means that every verse line written within the same formal context shows exactly the same surface instantiation of an underlying template. This view is, for the most part, correct. The meters of classical Sanskrit verse discussed here belong to the type called *sama-vṛtta* ‘even meters’, which are defined as meters having the same syllable sequence in each verse-line or *pāda*, of which a verse has four. However, there are some textually common meters labeled the *ardha-sama-vṛtta* ‘semi-even meters’ which mix two related surface syllable sequences within the same verse. The tradition labels these frequently occurring combination meters by distinct names as well.

Consider the *Upajāti* meter, which mixes lines from two distinct meters, *Indravajrā* (18a) and *Upendravajrā*, in the same verse (allowing any combination of these lines within a verse).⁸ An example of a verse in *Upajāti* meter is in (21).

- (21) a. — ˊ — ˊ — ˊ — ˊ —
 vā sām̐ si jīr nā ni ya thā vi hā ya
 vāsām̐si jīrṇāni yathā vihāya (BhG 2.22a)
- b. — ˊ — ˊ — ˊ — ˊ —
 na vā ni gṛh nā ti na ro pa rā ṇi
 navāni gṛhṇāti naraḥ aparāṇi (BhG 2.22b)

THE METRICAL ORGANIZATION OF CLASSICAL SANSKRIT VERSE

- c. ◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡
 ta thā śa rī rā ṇi vi hā ya jīr ṇā-
 tathā śarīrāṇi vihāya jīrṇā- (BhG 2.22c)

- d. – ◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡
 -nyan nyā ni sañ yā ti na vā ni de hi
 -ni anyāni sañyāti navāni dehi (BhG 2.22d)

Just as a man, having discarded his old clothes, accepts other new ones, so does the (soul), discarding old bodies, enter other new ones. (BhG 2.22)

This type of surface variation between Indravajrā and the Upendravajrā is one of the few ones documented in the tradition. The fact that these two meters are free variants in the same formal context of a verse provides explicit evidence that the syllable sequences corresponding to Indravajrā and Upendravajrā realize the same abstract metrical template. Surprisingly, further examples of such free variation within the same formal context are attested in some parts of the Bhagavad Gītā (BhG), a popular religious text, which appear to be written in an Upajāti-type meter.⁹ The free mix of Indravajrā and Upendravajrā lines is very common as expected, but there are additional variants that may or may not correspond to documented meters in the tradition. A set of these variants are listed in (22). In cases where the occurring variant has a documented meter that corresponds to it, I have listed the meter against the syllable sequence. All other variants do not correspond to any meter documented in the tradition.

(22) **Indravajrā in the Bhagavad Gītā**

W	S	W	S	W	S	W	S	
*	*	*	*	*	*	*	*	
	*		*		*		*	
		*						
—	┐	—	┐	—	┐	—	┐	BhG2.5c
—	┐	—	┐	—	┐	—	┐	BhG2.6d
—	┐	—	┐	—	┐	—	┐	BhG2.20a
—	┐	—	┐	—	┐	—	┐	BhG2.20b
—	┐	—	┐	—	┐	—	┐	BhG9.21d
—	┐	—	┐	—	┐	—	┐	BhG11.17a
—	┐	—	┐	—	┐	—	┐	BhG11.22a
—	┐	—	┐	—	┐	—	┐	BhG11.23d
—	┐	—	┐	—	┐	—	┐	BhG2.20d
—	┐	—	┐	—	┐	—	┐	BhG2.7b
—	┐	—	┐	—	┐	—	┐	BhG2.22b
—	┐	—	┐	—	┐	—	┐	BhG2.29b
—	┐	—	┐	—	┐	—	┐	BhG2.6a
—	┐	—	┐	—	┐	—	┐	BhG2.20c
—	┐	—	┐	—	┐	—	┐	BhG2.7d

Indravajrā**Layagrāhī****Upendravajrā****Śruti****Vātormi**

The facts are as follows: Indravajrā and Upendravajrā lines freely vary with lines corresponding to some other meter such as the Śruti or the Layagrāhī, or with one of the undocumented metrical variants listed in (22) in these parts of the text. Moreover, in some verses within this same stretch, none of the lines in the verse belong to Indravajrā, Upendravajrā, or any documented meter. The entire verse is made up of undocumented syllable sequences, and occurs within the stretch of verses that appear to belong to the Upajāti (Indravajrā~Upendravajrā) meter.

The existence of such variant syllable sequences as listed in (22) within a poetic text is only surprising from the Sanskrit perspective, which posits invariance as a condition on verse construction. In a metrical tradition like English, such variance within the same formal context is the norm, and, in fact, constitutes the evidence that variant syllable sequences realize an identical metrical template. I believe that the appearance of the variants in (22) in the same formal context should also be taken to be evidence of an underlyingly identical metrical structure.

The hypothesis then is that all the variants in (22) realize an identical abstract template and are members of a broader family of surface sequences, say the Indravajrā metrical family. What is the abstract underlying template and what are the branching and correspondence constraints that can account for the existence of these metrical variants as surface instantiations of this template?

My preliminary proposal for the underlying template and correspondence conditions is given in (23) and (24). The realization of both the strong and

weak positions is subject to variation as can be seen through the conditions in (24). The bimoraic non-branching weak positions and the branching strong positions in (23b) only represent the default realization of the underlying template so that the periodicity of this template is transparent.

(23) **The underlying template:**

- a. An iambic tetrameter with branching strong position (except in final foot) and bimoraic terminal S node
- b. $- \acute{\cup} \quad - \acute{\cup} \quad - \acute{\cup} \quad - \acute{\cup}$

(24) **Correspondence conditions:**

- a. The strong position is optionally non-branching, except in the third foot where it must be branching (BHG2.20b, BhG2.5c).
- b. The strong position is non-branching in the fourth foot.
- c. The weak position is optionally monomoraic in the first foot.
- d. The weak position is non-branching except in the third foot.
- e. An extra mora is allowed between the second and the third feet (BhG11.22a, BhG2.6a)
- f. A bimoraic strong position may be realized by two light syllables (BhG2.6d, BhG2.20a, BhG2.29b).
- g. A light or a heavy extrametrical syllable is allowed at the left edge of the line (anacrusis) (BhG2.6a, BhG2.20d).

Each of the syllable sequences in (22) can be analyzed as surface instantiations of the template in (23) constrained by the correspondence conditions given in (24). If the constraint set in (24) is accurate, then it predicts several more licit surface instantiations that may or may not correspond to metrical sequences documented in texts or as distinct ‘meters’ by the tradition. In §4.5, I will examine a set of meters documented in the tradition that approximately conform to the template and the correspondence conditions I posited for the textual variants in (22).

The relevant parts of the BhG text show that fluent participants in the metrical tradition consider meters narrowly defined by the tradition such as *Indravajrā*, *Vātorṃi*, or *Lāyagrāhi* to be equivalent. On the other hand, the tradition painstakingly distinguishes between each of these surface variants via its nomenclatural system. The terminology refers to surface realizations and not underlying templates because these surface realizations are perceived as distinct and consistently adhered to in many formal contexts (the invariance condition still applies to a large part of Sanskrit versified texts).

This shows that it is important to distinguish between the narrow *Indravajrā* or *Vātorṃi* meters and the broader *Indravajrā* metrical family,

which I have posited as a distinct level of structure. The *Indravajrā* family refers to a set of surface realizations (distinct meters in the sense of the Indian metrical tradition) that adhere to the template in (23) and the constraints in (24). The *Indravajrā* meter refers to only one of these surface realizations, viz. the one documented by the tradition as the *Indravajrā* meter. Naturally, this surface realization is subject to a more restrictive and categorical set of constraints drawn from the optional conditions in (24). These have already been specified in (18b). The relation between the broader *Indravajrā* family and the narrow *Indravajrā* or *Vātormi* meters is one of subsumption — the *Indravajrā* family is my name for an entity of a type higher (an abstract metrical template) than the narrow *Indravajrā* meter (a surface variant of this template). Participants are capable of both identifying the similarity in the underlying template for different surface variants and discerning between the distinct surface variants themselves based on how they realize the abstract template.¹⁰

4.4.1 *Metrical variation and performance practice*

Before I proceed to discuss the textually documented meters, it is important to point to some implications of the data from the BhG. The fact that we find textual variation within a verse (and a set of verses written in what appears to be the same meter) suggests that invariance might not be as strict a poetic convention as assumed on the basis of traditional documentation. This opens up the possibility of using shared formal context (the existence of variant surface structures within the same verse/verse group) as evidence for positing shared underlying structure, parallel to the sort of evidence used in analyzing other metrical systems. This possibility had been considered to be unavailable for the Sanskrit metrical repertoire due to traditional definition of meters in terms of fixed sequences of syllables that iterate across all verse-lines.

More significantly, this lack of invariance suggests that fluent participants in the metrical tradition (composers as well as their audience) perceive distinct surface syllable strings as realizing an identical underlying abstract template, lending support to my basic hypothesis that the Sanskrit metrical repertoire in fact, is a list of (some) surface instantiations of a limited number of abstract templates, and not a list of the abstract templates themselves.

The metrical competence of such participants is also reflected in the performance practice of these meters. First, participants have the intuitive knowledge of aligning a verse line from a familiar metrical template to a fixed melodic-rhythmic pattern (tune) and grouping together familiar meters that are aligned to the same pattern (similar to the text-setting intuitions that English speakers have about aligning a line to a periodic

template). Second, this knowledge of performing familiar meters facilitates parsing the metrical structure of unfamiliar syllable sequences in a metrical context, by aligning them optimally to a familiar performance pattern or tune. In other words, given an unfamiliar metrical sequence, fluent participants in the metrical traditions can, by aligning it to a familiar performance pattern, find a scansion that best fits the syllable sequence. In the case of the BhG metrical variants from (22), fluent participants are easily able to recite these variants by aligning them to the familiar *Indravajrā/Upendravajrā/Upajāti* pattern. Moreover, the text-to-tune alignment is largely unconscious; performers often fail to recognize that the metrical variants do not narrowly conform to the syllabic strings of the *Indravajrā/Upendravajrā/Upajāti* pattern. This correspondence in the performance of familiar syllable sequences such as that defining the *Indravajrā* meter and the unfamiliar variants attested in texts provides further evidence that the analysis I proposed, positing identity of underlying metrical structure for the set of syllable sequences in (22), is on the right track.

4.5 *The Indravajrā metrical family in the documented tradition*

In §4.4 I examined a piece of text to identify the distinct surface variants that are considered to correspond to an identical underlying metrical structure. On the basis of attested patterns, I proposed a preliminary template and correspondence constraints for the broad *Indravajrā* metrical family. I now turn to a set of meters from the traditionally documented repertoire that approximate the template and correspondence conditions proposed in (23) and (24)

A list of these meters is are presented in (25).¹¹ This list was obtained by aligning the traditionally documented meters against the template in (23) and testing them for ‘fit’ based on the correspondence conditions in (24).¹²

(25) The *Indravajrā* family: documented meters

W	S	W	S	:	W	S	W	S	
*	*	*	*		*	*	*	*	
	*		*			*		*	
			*					*	
—	′	—	′	—	′	—	—	′	— Kāmāvatāra (H.2.167)
—	′	—	′	—	′	—	—	′	Layagrāhī (H.2.129)
—	′	—	′	—	′	—	—	′	Tārāmati
—	′	—	′	—	′	—	—	′	Āndolikā (Mm.16.8)
—	′	—	′	—	′	—	—	′	Indravajrā (H.2.154)
—	′	—	′	—	′	—	—	′	Samupasthitā
—	′	—	′	—	′	—	—	′	Upendravajrā (H.2.155)
—	′	—	′	—	′	—	—	′	Pratiṣṭhā
—	′	—	′	—	′	—	—	′	Kola (H.2.193)
—	′	—	′	—	′	—	—	′	Upasthita (H.2.134)
—	′	—	′	—	′	—	—	′	Upasthitā (H.2.133)
—	′	—	′	—	′	—	—	′	Kekirava (H.2.191)
—	′	—	′	—	′	—	—	′	Vātormi (H.2.136)
—	′	—	′	—	′	—	—	′	Śruti (Jk.2.146)

This set of documented meters, in fact, allows us to formulate a more general characterization of the templates and the correspondence conditions than those proposed in (23) and (24) respectively. The modified proposal for the underlying template for the *Indravajrā* metrical family and the constraints determining its surface realizations are given in (26) and (27). The attested meter *Kāmāvatāra* provides evidence for positing a more uniform template with iteration of formally identical feet. This is in contrast to the template for the *Indravajrā* metrical family proposed in (23) based only on the attested variants in the BhG, where the final foot had to be stipulated as non-branching.

(26) The underlying template:

- a. An iambic tetrameter with branching strong position and bimoraic terminal S node (instantiated by *Kāmāvatāra* in (25)).¹³

b. — ′ — — ′ — — ′ — — ′ —

(27) **Correspondence conditions:**

- a. The strong position is optionally non-branching, except in the third foot where it must be branching (Samupasthita, Upasthita).¹⁴
- b. The weak position in odd feet is optionally monomoraic (Upendravajrā, Andolika)
- c. The weak position is optionally branching except in the fourth foot (Kekirava, Upasthita, Indravajrā).
- d. An extra mora is allowed between the second and the third feet (Vātormi).
- e. A bimoraic strong position may (rarely) be realized by two light syllables (Śruti).
- f. A light or a heavy extrametrical syllable is allowed at the left edge of the line (anacrusis) (BhG2.6a, BhG2.20d).

The availability of additional attested variants also enables us to state the correspondence conditions on the Indravajrā metrical family more generally as in (27), rather than those in (24). For instance, (24b) need not be stated as a constraint anymore, while (24c) is generalized as a condition on odd feet (27b). Similarly (24d) can be generalized as an option for all non-final feet (27c). The possibilities for the surface variants of the Indravajrā metrical family (factoring out extrametrical syllables at the left edge) are summarized in (28).

(28)	W	S	—	W	S	—	W	S	—	W	S	—	
	—	—	—	—	—	—	—	—	—	—	—	—	Template
	—	—	—	—	—	—	—	—	—	—	—	—	Branching W
	—	—	—	—	—	—	—	—	—	—	—	—	Monomoraic W
	—	—	—	—	—	—	—	—	—	—	—	—	Unbranched S
	—	—	—	—	—	—	—	—	—	—	—	—	Mora at Caesura
	—	—	—	—	—	—	—	—	—	—	—	—	Bimoraic branching S

The Indravajrā metrical family thus corresponds to an abstract periodic template and a set of constraints on foot realization that are shared by all its attested surface variants, whether they are documented as distinct meters or not. In those cases where these surface meters are classified as distinct meters by the tradition, we only need to identify the additional set of constraints that can derive the particular syllable sequence that corresponds to a given meter. This additional set of constraints is a result of restrictive modification or parametric choice (for optional constraints) of the constraints for the broader Indravajrā family.

Needless to say, the documented and otherwise attested metrical variants do not exhaust the possibilities of surface variation, but only suggest the principles along which such variation is organized. This leaves open the

possibility of the creation of new ‘meters’, which on the traditional system, correspond to previously undocumented surface realizations of an abstract template.

4.6 *Summary*

In this section, I presented a method for analyzing classical Sanskrit meters, based on the hypothesis that the documented meters are, in fact, surface outputs of the interaction between abstract periodic templates and an implicit set of correspondence constraints. This involved an examination of text-internal and verse-internal variation in subparts of one text (a surprising phenomenon given the Sanskrit setup) and an identification of closely corresponding metrical sequences from the traditionally documented metrical repertoire. These provided a pool of syllable sequences that can be reliably hypothesized to belong to an identical underlying template. Independent evidence for the underlying similarity of the template for this pool of syllable sequences comes from performance practice — participants align the surface variants in the BhG as well as the traditionally documented meters from the Indravajrā family to the same chanting pattern or tune.

5. ADDITIONAL METRICAL DEVICES

So far, I have relied on a restricted set of theoretical assumptions to account for two subsets of meters. The trochaic tetrameters listed in (8) can be derived from an underlying template of four tetramoraic feet. The variants of the Indravajrā family are derivable from an underlying iambic tetrametric template, with additional constraints on how strong or weak positions may be realized. The set of meters that I examined and the analysis I proposed for these, brings the Sanskrit metrical repertoire structurally closer to well-understood metrical traditions. The original problems of aperiodicity, invariance, and rich-repertoire no longer pose as big a challenge to generative metrical theory as they did at the onset of this paper. I have shown that apparently aperiodic-looking templates are, in fact, periodic, and that invariance, where it does exist, is a consequence of conventions of poetic form. The rich repertoire problem becomes manageable if we take into account the nomenclatural differences between Sanskrit and other metrical traditions, a difference also arising out of poetic conventions. The broader result of the analysis proposed here is that Sanskrit metrical verse, although apparently deviant, on closer examination, does conform to the basic assumption in generative metrics that periodic rhythm underlies all metrical verse.

5.1 *An apparent impasse*

A subset of meters in the repertoire fails to receive an analysis even we take into consideration the relatively flexible inventory of permissible feet (and syllable sequences that may realize them) available to the Sanskrit metrical tradition. The hypothesis that Sanskrit meters instantiate iterated foot types with surface variation constrained by a set of correspondence conditions fails to establish an underlying periodic template for these meters. In other words, these meters cannot be parsed straightforwardly as iterations of feet with partially identical properties with respect to quantity or branching.

Some examples are given in (29). Take, for instance, the meter Candravartma, from (29a). Parsing the syllable sequence in (29a) as iterations of quantity-based (trimoraic, tetramoraic, or pentamoraic) feet always results in a misalignment of foot boundaries and syllable boundaries, i.e. heavy syllables are divided between consecutive feet in at least one case, for each of these parses. Moreover, it is not obvious how this sequence may be parsed as iterating feet or dipods with similar branching structure.¹⁵

- (29) a. — ◡ — ◡ ◡ ◡ — ◡ ◡ ◡ — **Candravartma** (H.2.161)
 rā ja vart ma ra hi tam ja na ga ma naiḥ
rājavartma rahitam janagamanaiḥ
 ‘The royal way, devoid of (deserted by) the traffic of people.’
- b. ◡ ◡ ◡ ◡ ◡ — ◡ — — ◡ — **Prabhā** (H.2.182)
 ta ru ṇa pa ra bhṛ taḥ sva nam rā gi ṇām
taruṇaparabhṛtaḥ svanam rāgiṇām
 ‘The song of a passionate (amorous) young cuckoo...’
- c. — — — — ◡ ◡ ◡ ◡ — **Haṁsi** (Vr.3.28.6)
 man dā krān tāt tya ya ti ra hi tā
mandākrāntā antyayatirahitā
 ‘(It is) Mandākrāntā, without the last phrase.’
- d. ◡ ◡ ◡ ◡ ◡ — — ◡ — — ◡ — **Kuṭilagati** (H.2.202)
 ha ri ṇa śi śu dṛ sām nṛt ya tibh rū yu gam
hariṇaśiśudṛśām nṛtyati bhrūyugam
 ‘The pair of eyebrows dances like the young ones of a deer.’
- e. — — — — ◡ — — ◡ — — **Śālinī** (H.2.135)
 e ko de vaḥ ke śa vo vā śi vo vā
eko devaḥ keśavo vā śivo vā
 ‘There is (only) one God, whether (he is called) Keśava or Śiva.’

- f. ◡ – ◡ – – ◡ – ◡ – **Cāruhāsinī** (Jk.2.77)
 nṛ pāt ma jā cā ru hā si nī
nṛpātmaajā cāruhāsinī
 ‘(The meter) Nṛpātmaajā, also known as Cāruhāsinī.’
- g. ◡ – – – – – ◡ – – ◡ – – **Candriṇī** (H.2.204)
 su var ṇa prā kā re śā nya dig bhit ti bhā ge
suvarṇaprākāreśānyadigbhitibhāge
 ‘In the northeast portion of the golden dwelling...’

The problem of assigning a periodic structure to a syllable sequence designated as a meter, is common to all the meters in (29). While a quantity-based parse results in foot-boundary–syllable-boundary mismatches, there seems to be no branching or realization pattern that iterates across the line. These meters, in contrast to the meters seen so far, really do seem to lack an underlying periodic structure. How can these meters be reconciled to the idea that metrical verse is always periodic? Does this subset of meters pose a real challenge to periodicity as a fundamental property of metrical verse? Taken at face value, this does seem to be the case, but I will argue in this section that it need not be if we make certain plausible additional assumptions about the properties of the Sanskrit system. The periodicity assumption can be saved if we enrich the existing set of metrical devices available for the construction of meters. Specifically, I want to suggest that the four metrical phenomena in (30) are responsible for the appearance of aperiodicity in the templates in (29).

- (30) a. **Syncopation:** Phenomenal (surface) accent in a metrically weak position or lack of phenomenal accent in a metrically strong position.
 b. **Non-Isochronous rhythm:** Variation of foot quantity within a line marked by caesura.
 c. **Catalexis:** Feet with an unrealized metrical position in line (or phrase) final positions.
 d. **Anacrusis:** Unaccented extrametrical material at the left edge of a template.

Significantly, each of the phenomena in (30) are attested in either versification or musical traditions across cultures, suggesting that their basis lies in general properties of perception of rhythm. The poetic counterpart of syncopation is a constrained mis-alignment of phonological accent and metrical accent in accentual poetry. Hayes (1979) uses syncopation rules for his analysis of Persian verse. The same account also posits a deletion rule to delete the final beat of a line, to account for unrealized line-final metrical positions (catalexis). Similarly, only the strong metrical

position of the final foot is realized in trochaic verse in English while the American folk verse corpus contains lines with a final degenerate iambic foot (Hayes & MacEachern 1998) – both constituting examples of catalexis. Non-isochronous rhythmic organization, instantiated by variation in foot-quantity in the Sanskrit repertoire finds a parallel in the West African complex rhythmic cycles, and closer to the Indian tradition, in some non-isochronous *tālas* of classical Indian music (Clayton 2000, Chaudhary 1997).

Given the universality of these metrical phenomena, it seems reasonable to expect that these also play a role in the Sanskrit versification tradition. However, there is one complicating factor to incorporating them into an analysis of Sanskrit meters. Each of these phenomena presuppose a transparently periodic *background* template against which these devices are foregrounded. Syncopation, for instance, presupposes a periodic rhythm, which is then violated by placing the phenomenal accent in a metrically weak position. Anacrusis and catalexis only make sense if other realizations of the underlying template lack the anacrusic syllable or realize the missing position in a catalectic foot. The problem for Sanskrit is that there is *no* transparently available background template against which metrical variants with syncopated or anacrusic syllables can be evaluated.¹⁶ All that is given is the partial list of surface variants documented by the tradition, without any sub-classification into related meters. Further, verse-level invariance still applies for the most part, giving rise to verses with the same syllable sequence iterating across lines. How are we to determine if a particular meter shows syncopation or contains a catalectic foot or an anacrusic syllable?

My belief is that there is no sure-fire solution to this problem given the facts of the Sanskrit system. The invariance condition makes it highly unlikely that syncopated and non-syncopated metrical variants or variants with and without an anacrusic syllable could systematically appear in the same formal context such as a single verse. On the other hand, we do know that the documented metrical templates are surface instantiations of abstract templates, and are exactly the sort of objects which could realize syncopated rhythm or contain an anacrusic syllable. Based on these facts, it appears reasonable to pursue the hypothesis that the aperiodic-looking meters do not receive an easy periodic parse because they involve much more rhythmically complex mappings between abstract templates and surface material – specifically mappings which factor in the four phenomena listed in (30). In the rest of this section and the paper, I will pursue this hypothesis as far as possible, positing metrical structures for the so-called aperiodic meters that factor in these additional properties. In most cases, I will provide support for the plausibility of the structures that I posit by referring to documented variants that constitute minimal pairs to the aperiodic meters.

5.2 Syncopation

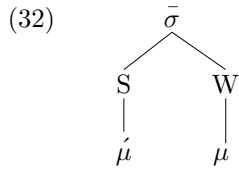
Syncopation occurs when the rhythmic surface violates an inferred metrical structure, without forcing a reanalysis of this metrical structure (Jackendoff & Lerdahl 1983: 17-18). This may be achieved in two distinct ways: An accented surface element may be aligned with a weak underlying metrical position, or an unaccented surface element may be aligned with a strong metrical position.

In the case of Sanskrit meters, syncopation involves the alignment of linguistic material to the abstract template in two distinct ways:

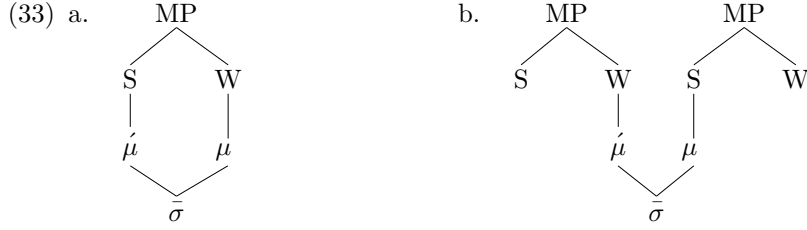
- (31) a. The initial mora of a heavy syllable is aligned with the weak node of a metrical position while the final weak mora is carried over to a stronger position.
- b. The strong node of a metrical position is specified as empty i.e. devoid of any linguistic material.

5.2.1 Surface accent in weak metrical position

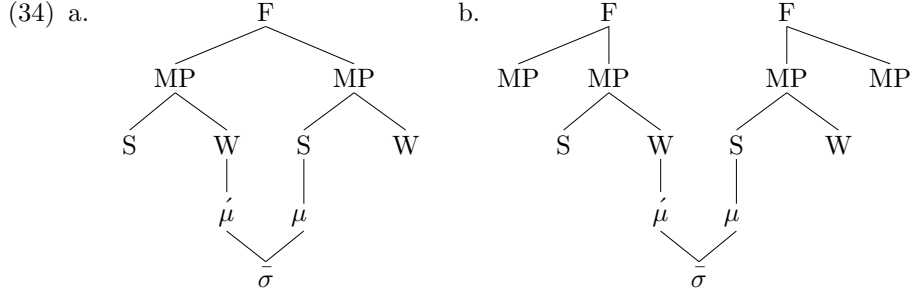
By default, a metrical position is a bimoraic trochee, equivalent to a musical beat. Similarly, a heavy syllable is a bimoraic trochee: the first mora being stronger than the second.



A non-syncopated alignment of heavy syllables with a metrical position requires that its first mora be aligned with the strong node of a minimally bimoraic metrical position as in (33a). Any other alignment results in syncopation since there is a mismatch between the surface and underlying accents (33b). The accented mora of a heavy syllable is mapped onto a *weaker* position than the unaccented mora.



A heavy syllable may be divided between two metrical positions both within the foot and across foot boundaries. Both possibilities are shown in (34a-b).



Syncopation may be used to create rhythmic variety in an underlying tetrametric template. The Candravartma and the Prabhā meters in (29 a-b) can be seen as cases of syncopated tetrameter lines, as can the Śuddhvirāṭ and the Rathoddhatā meters from (1). In each of these cases, the total moraic count adds up to sixteen moras but the moras cannot be divided into four feet on a left-to-right parse without violating syllable boundaries. If we assume that Sanskrit verse does allow syncopation, then it is possible to make sense of this distribution of syllables in these meters.

In Candravartma, a heavy syllable is initiated in the weakest position of the first foot and carried over to the second foot. Here and elsewhere in the paper, the shorter macrons represent the two moras of a syncopated heavy syllable straddling adjacent feet. The phenomenal accent, which is aligned with the first mora of any heavy syllable, is marked by the acute accent on the first mora of the syncopated syllable, while the grid shows the location of the metrical accent. The misalignment of these accents can be seen in (35b).

- (35) a. — ◡ — ◡ ◡ ◡ — ◡ ◡ ◡ ◡ — **Candravartma** (H.2.161)
 rā ja vart ma ra hi tam ja na ga ma naiḥ
rājavartma rahitam janagamanaiḥ

A. DEO

'The royal way, devoid of (deserted by) the traffic of people.'

b. $\begin{array}{cccc} \dot{\cup} & \cup & \dot{\cup} & \\ * & * & & \\ & & \cup & \cup & \cup & \cup & \cup & \cup \\ * & & * & & * & * & * & * \\ * & & * & & * & & * & \\ * & & & & * & & & \end{array}$

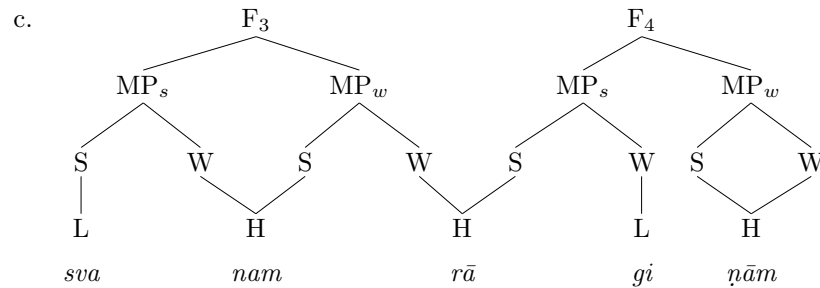
Prabhā requires a more complex analysis, with consecutive syncopation across three metrical positions: a heavy syllable is initiated in the weak node of the strong metrical position in the third foot and carried over to the strong node of the weak metrical position in the same foot. A heavy syllable is again initiated in the weak node of this weak position and carried over to the next foot. The misalignment of these accents can be seen in (36b). (36c) provides a clearer hierarchical representation of the third and the fourth feet of the Prabha meter.

(36) a. $\cup \cup \cup \cup \cup \cup - \cup - - \cup -$ **Prabhā** (H.2.182)

ta ru ṇa pa ra bhr̥ taḥ sva nam rā gi ṇām
taruṇaparabhr̥taḥ svanam rāgiṇām

‘The song of a passionate (amorous) young cuckoo...’

b. $\begin{array}{cccc} \smile & \smile & \smile & \smile \\ * & & * & \\ * & & & \\ * & & & \end{array} \quad \begin{array}{cc} \smile & \smile \\ * & * \\ * & \end{array} \quad \begin{array}{cc} \smile & \smile \\ * & * \\ * & * \\ * & \end{array} \quad \begin{array}{cc} \smile & \smile \\ * & * \\ * & * \end{array}$



The possibility of syncopation generates a number of meters of four tetramoraic feet, with a dominant trochaic configuration, slightly complicated by syncopated syllables. In (37), I list some examples of syncopated tetrametric templates. The syllable sequences are aligned against the metrical grid of a trochaic tetrameter. The surface accent, which falls on the first mora of a heavy syllable, is marked by the acute accent. Overwhelmingly, syncopation across foot boundaries occurs between the first and second feet, and/or the third and the fourth feet. I have been able to find only one meter, Navamālīnī, where a heavy syllable is divided

between the second and the third foot. This suggests that syncopation across dipods is dispreferred.

(37) **The syncopated Sanskrit trochaic tetrameter**

S	W	S	W	S	W	S	W	
*	*	*	*	*	*	*	*	
*		*		*		*		
*				*				Meter
´	˘	˘	˘	´	˘	˘	˘	Candravartma (H.2.161) (29a)
´	˘	˘	˘	´	˘	˘	˘	Prabhā (H.2.182) (29b)
´	˘	˘	˘	´	˘	˘	˘	Swāgatā (H.2.142)
´	˘	˘	˘	´	˘	˘	˘	Rathoddhatā (H.2.141) (1b)
´	˘	˘	˘	´	˘	˘	˘	Priyamvadā (H.2.174)
´	˘	˘	˘	´	˘	˘	˘	Pañktikā (H.2.108)
´	˘	˘	˘	´	˘	˘	˘	Ruciravibhramā
´	˘	˘	˘	´	˘	˘	˘	Śuddhvirāṭ (H. 2. 109) (1a)
´	˘	˘	˘	´	˘	˘	˘	Aparāntikā (Jk.2.105)
´	˘	˘	˘	´	˘	˘	˘	Mālati (H.2.180)
´	˘	˘	˘	´	˘	˘	˘	Dīpakamālā (Vr. 3.28.2)
´	˘	˘	˘	´	˘	˘	˘	Navamālinī (H.2.179)

To conclude, the existence of a number of meters where the moraic count adds up to sixteen moras (similar to the trochaic tetrameters in (8)) but where the syllable sequence does not allow a homomoraic parse, supports the hypothesis that Sanskrit meters tolerate syncopation in the form of syllable boundary-foot boundary mismatches. The syncopated tetrameters realize the same underlying template as the non-syncopated tetrameters with the additional rhythmic complexity effected by syncopation.

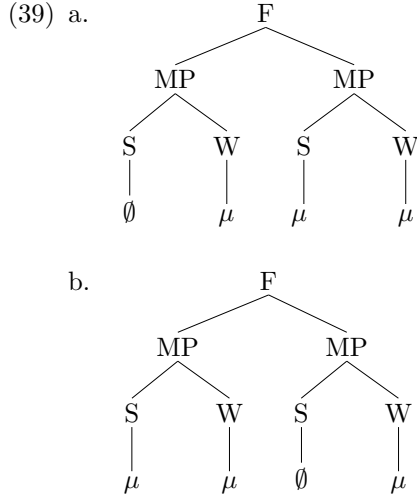
An empirical fact about (35), (36), and (37), (and all the cases which will be examined later) is that syncopation is only attested in meters (or phrases) composed of tetramoraic feet.¹⁷ Feet with syncopated syllables and the larger sequence in which they are contained never deviate from the default condition that metrical positions are bimoraic (13a). Syncopation is played out only against this default periodic template. It is possible to speculate that metrical templates which involve both syncopation and deviations from the default periodic structure (e.g. templates containing trimoraic or pentamoraic feet, derived from the conditions in (13b-c)), would be computationally more complex and obscure the underlying periodicity of the rhythm. On this hypothesis, syncopation and the correspondence constraints in (13b-c) are expected to be in complementary distribution. No metrical phrase could simultaneously deviate along both parameters.¹⁸

5.2.2 *Lack of accent in strong metrical position*

Compare the syllable sequences for the meters Bhramaravilasitā and Haṁsī.

- (38) a. ' – ' – ' ~ ~ ~ ' ~ – **Bhramaravilasitā** (H.2.138)
 b. – – – – ~ ~ ~ ~ – **Haṁsī** (Vr.3.28.6)

Bhramaravilasitā, listed in (8), is an instantiation of the trochaic tetrametric template. The syllable sequence for Haṁsī is the same as Bhramaravilasitā, except for one light syllable (and one mora) less. Bhramaravilasitā fits perfectly in a sixteen mora template with four tetramoraic feet; Haṁsī does not. Is there any way at all to reconcile Haṁsī to a tetrametric template with four tetramoraic feet? Haṁsī could be analysed as realizing a tetrametric template if we posit yet another means of achieving syncopation. I propose that in Sanskrit syncopation may also occur when there is no surface accent (or syllable) corresponding to a strong node in an underlying metrical structure. The possible foot structures are given in (39).



If the hypothesis that Sanskrit allows empty strong nodes is correct, then Haṁsī can be analyzed as a syncopated instantiation of the trochaic tetrametric template, exactly like Bhramaravilasitā. However, it is still unclear what an accurate parse for Haṁsī should be, since the syncopated empty node could in principle be any of three terminal strong nodes in the third and fourth feet as seen in (40).

- (40) a. $\acute{\text{—}} \text{—} \quad \acute{\text{—}} \text{—} \quad \emptyset \text{—} \text{—} \text{—} \quad \acute{\text{—}} \text{—} \text{—}$
 b. $\acute{\text{—}} \text{—} \quad \acute{\text{—}} \text{—} \quad \text{—} \text{—} \emptyset \text{—} \quad \acute{\text{—}} \text{—} \text{—}$
 c. $\acute{\text{—}} \text{—} \quad \acute{\text{—}} \text{—} \quad \text{—} \text{—} \text{—} \text{—} \quad \emptyset \text{—} \text{—}$

Which of these three possibilities is actually realized by *Haṁsī*? Regardless of which of the three nodes is not realized by a syllable, it is clear that such a node should be associated with a pause or a break within the line. The traditionally documented description of *Haṁsī* specifies that the meter is characterized by a caesura only after the fourth syllable. *Bhramaravilasitā*, the minimal pair for *Haṁsī*, lacks such a caesura. This caesural pause, following the fourth syllable, can be plausibly taken to be an indication that the strong node of the strong metrical position in the third foot is unrealized in *Haṁsī*. The correct sequence for the *Haṁsī* template is thus (40a).

Haṁsī fits in perfectly in the abstract template of a trochaic tetrameter if the documented caesura after the fourth syllable is interpreted as effected by syncopation, where a strong node is left unrealized. The proposed structure for *Haṁsī* is in (41b) with four tetramoraic feet.

- (41) a. $\text{—} \quad \text{—} \quad \text{—} \quad \text{—} \quad \emptyset \text{—} \text{—} \text{—} \text{—} \text{—} \quad \mathbf{Haṁsī}$ (Vr.3.28.6)
 man dā krān tā -ntyā ya ti ra hi tā
mandākrāntā antyayatirahitā
 ‘(It is) *Mandākrāntā*, without the last phrase.’
 b. $\begin{array}{cccc} \acute{\text{—}} \text{—} & \acute{\text{—}} \text{—} & \emptyset \text{—} \text{—} \text{—} & \acute{\text{—}} \text{—} \text{—} \\ * & * & * & * \\ * & * & * & * \\ * & & * & \end{array}$

The performance tradition provides independent evidence that this is the correct parse for *Haṁsī*. In chanting this meter, participants take an obligatory pause at the downbeat immediately following the fourth syllable, and the fifth syllable must coincide with the following upbeat. This shows that the caesura is not an ordinary line break between feet, but that it represents an empty position that is counted as part of a tetramoraic foot in the meter.

5.2.3 Summary

This section demonstrated that an adequate account of some aperiodic-looking meters in Sanskrit require us to assume that the metrical system productively uses the device of syncopation to generate a variety of surface rhythms based on the same abstract template. The placement of a surface accent in a metrically weak position or the specification of strong positions

as empty renders the relation between an abstract template and the rhythmic surface complex, but maintains the underlying periodicity of the sequence. Assuming syncopation results in making the aperiodicity problem of the Sanskrit repertoire more tractable.

5.3 *Non-isochronous rhythm*

A further formal property of some documented meters is non-isochrony. Meters appear to be divided in two parts by a caesura that also marks change in foot quantity. The meter Kuṭilagati, from (29d), is an example. The meter consists of four trochaic feet, with a caesura after the second foot. The first two feet are tetramoraic, while the third and the fourth feet are pentamoraic. The structure for this meter is given in (42b).

- (42) a. $\cup \cup \cup \cup \cup \cup - - \cup - - \cup -$ **Kuṭilagati** (H.2.202)
 ha ri ṇa śi śu dṛ sām nṛt ya tibh rū yu gam
harīṇaśiśudṛśām nṛtyati bhrūyugam
 ‘The pair of eyebrows dances like the young ones of a deer.’
- b. $\begin{array}{ccccccc} \acute{\cup} & \cup & \cup & \cup & \acute{\cup} & \cup & - \\ * & & * & & * & * & : & \acute{\cup} & \cup & - \\ & & & & * & & & * & * & \\ * & & & & * & & & * & & * \\ * & & & & & & & * & & \end{array}$

Line-internal variation of this kind is most often attested for tetramoraic and pentamoraic feet. In §6, I will describe some frequently occurring meters whose parse requires the assumption of non-isochronous rhythm within the line.

5.4 *Catalexis*

Catalectic feet are feet which contain unrealized metrical positions. In order to establish that certain meters contain catalectic feet, there must exist minimal pairs for these meters that do realize these positions. Compare the meters Jalaughavegā and Cāruhāsinī (29f).

- (43) a. $\cup \acute{\cup} \cup - \acute{\cup} \cup \acute{\cup} \cup - \acute{\cup}$ **Jalaughavegā**
 b. $\cup - \cup - - \cup - \cup -$ **Cāruhāsinī** (Jk.2.77)

Jalaughavegā has a fairly transparent metrical structure with four iambic feet, and a branching structure that iterates at the dipodic level. Cāruhāsinī is exactly like Jalaughavegā except that it lacks the final syllable. If we assume that the final foot in Cāruhāsinī is degenerate, then Cāruhāsinī receives the same parse as Jalaughavegā with four iambic feet. The suggested metrical structure for Cāruhāsinī is given in (44b).

(44) a. $\cup - \cup - - \cup - \cup -$ **Cāruhāsinī** (Jk.2.77)

nṛ pāt ma jā cā ru hā si nī

nṛpātmaajā cāruhāsinī

‘(The meter) Nṛpātmaajā, also known as Cāruhāsinī.’

b. $\begin{array}{cccc} \cup & \acute{\cup} & \cup & - & \acute{\cup} & \cup & - & \emptyset \\ * & * & & * & * & * & * & * \\ & & * & & * & & * & * \\ & & & * & & & * & * \end{array}$

The trochaic tetrameter template, the basis for many Sanskrit meters, can also be taken to underly a whole group of fourteen-mora meters if we assume a final catalectic foot.

(45) **Trochaic tetrameter with final catalectic foot**

S	W	S	W	S	W	S	W	
*	*	*	*	*	*	*	*	
*		*		*		*		
*				*				Meter
$\acute{\cup} -$		$\acute{\cup} -$		$\acute{\cup} -$		$\acute{\cup} -$		Gāndharvī (H. 2.52)
$\acute{\cup} -$		$\acute{\cup} \cup \cup \cup$		$\acute{\cup} -$		$\acute{\cup} -$		Makaralatā (Kd. 4.21)
$\acute{\cup} \cup \cup$		$\acute{\cup} -$		$\acute{\cup} \cup \cup$		$\acute{\cup} -$		Maṇimadhyā (Vr. 3.21.1)
$\acute{\cup} -$		$\acute{\cup} -$		$\acute{\cup} \cup \cup \cup$		$\acute{\cup} -$		Siṃhākrāntā (H. 2.105)
$\acute{\cup} -$		$\acute{\cup} \cup \cup$		$\acute{\cup} \cup \cup$		$\acute{\cup} -$		Kanaka (H. 2.97)
$\acute{\cup} \cup -$		$\acute{\cup} \cup -$		$\acute{\cup} -$		$\acute{\cup} -$		Tāra (H. 2.98)
$\acute{\cup} \cup \cup$		$\acute{\cup} \cup \cup$		$\acute{\cup} \cup \cup$		$\acute{\cup} -$		Citragati (H. 2. 113)
$\acute{\cup} \cup \cup$		$\acute{\cup} -$		$\acute{\cup} \cup \cup \cup$		$\acute{\cup} -$		Mṛgacapalā (H. 2.122)
$\acute{\cup} -$		$\acute{\cup} \cup \cup$		$\acute{\cup} \cup \cup \cup$		$\acute{\cup} -$		Kumudinī (H. 2.123)
$\acute{\cup} \cup \cup \cup$		$\acute{\cup} \cup \cup$		$\acute{\cup} -$		$\acute{\cup} -$		Vipulabhujā (H. 2.125)
$\acute{\cup} \cup \cup \cup$		$\acute{\cup} -$		$\acute{\cup} \cup \cup \cup$		$\acute{\cup} -$		Kamaladalākṣī (H. 2.150)

Yet another meter with a catalectic final foot is Śālinī, from (29e), repeated in (46a). This is a trochaic meter, characterized by both variation in foot quantity and a catalectic final foot. The two feet before the caesura are tetramoraic, while the feet following the caesura are pentamoraic. In the final foot, moreover, only the strongest position is realized.

(46) a. $- - - - : - \cup - - \cup - -$ **Śālinī** (H.2.135)

e ko de vaḥ ke śa vo vā śi vo vā

eko devaḥ keśavo vā śivo vā

‘There is (only) one God, whether (he is called) Keśava or Śiva.’

				A. DEO					
b.	´ —	´ —	:	´ —	´ —	´			
	* *	* *		* *	* *	*	*	*	*
	*	*		*	*	*	*	*	*
	*			*		*		*	

5.5 Anacrusis

We have already seen examples of extrametrical material at the left edge of a verse line in (22), in some variants of the Indravajrā family found in texts. Recognizing anacrusis is difficult in the documented meters of classical Sanskrit, since there is never an available abstract template as a base-point against which extrametrical linguistic material may be clearly distinguished. However, there are cases of minimally varying meters, where the only point of difference between two syllable sequences appears to be a single syllable at the left edge of the line. Further, the inventory of permissible feet from (14) and (15) constrain what syllable sequences can be validly parsed as feet. Compare the meters Layagrāhi and Bhujangaprayāta. The Layagrāhi meter, listed in (25), has four iambic feet, of which the first three have a branching strong position with a bimoraic strong syllable. Bhujangaprayāta is identical to the Layagrāhi meter except for a light syllable at the left edge of the line.

(47) a. — ´ — — ´ — — ´ — — ´ **Layagrāhi** (H.2.129)

b. — — — — — — — — **Bhujangaprayāta** (H.2.170)

Bhujangaprayāta cannot be parsed as consisting of four identical trisyllabic feet (— — —) because that syllable sequence is not a permissible foot type in the Sanskrit inventory of feet. A bisyllabic parse fares even worse, since it forces a mixing of iambic and trochaic feet within the same line. If we assume, however, that the underlying structure for Bhujangaprayāta is identical to the structure for Layagrāhi (which is the same broader template assumed for the Indravajrā metrical family), the parsing becomes much more straightforward. On this assumption, the leftmost syllable must be considered extrametrical — a case of anacrusis. The structure for Bhujangaprayāta is given in (48).

(48) a. — — — — — — — — **Bhujangaprayāta**

bha vā nī ka la tram bha je pañ ca vak tram
bhavānī kalatram bhaje pañcavaktram

‘I worship the five-faced one, the husband of Bhavānī.

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b.	◡	—	◡	◡	—	◡	◡	—	◡	◡	—	◡	◡
		*	*		*	*		*	*		*	*	
			*		*		*		*		*		*
					*		*		*		*		*

Given the constraints on possible feet in Sanskrit that I have assumed, this parse constitutes the best fit for Bhujangaprayāta. Further evidence that this is indeed the correct analysis comes from the performance of this meter. In chanting this meter, the first syllable does not correspond to a beat. On a beat count where the metrical position is the tactus level, the counting begins only at the second syllable, with stress falling on the syllables corresponding to the strong terminal node of the strong metrical position in each foot (the third, the fifth, the ninth and twelfth syllables in the syllable sequence of the meter). Moreover, the chanting pattern followed for Bhujngaprayāta is identical to that of the Indravajrā meter, providing even more support for the proposed structure, and the extrametricality of its first syllable.

The meter Candriṇī in (29g) provides another instance of a meter with an extrametrical anacrustic syllable. Candriṇī is like the popular meter Śālinī (structure in (46b)), except for the light syllable at the left edge, and an additional heavy syllable in the first half of the line. If the first is factored out as ancrustic, the metrical structure is very simple. Candriṇī is divided in two equal parts of three trochaic feet each, with only the strong position of the final foot being realized in each half. Additionally, there is variation of foot quantity after the caesura, similar to the Śālinī meter.

(49) a. ◡ — — — — — ◡ — — — — — **Candriṇī** (H.2.204)

su var ṇa prā kā re śā nya dig bhit ti bhā ge

suvarṇaprākāreśānyadigbhittibhāge

‘In the northeast portion of the golden dwelling...’

b.	◡	◡	—	◡	—	◡	:	◡	◡	—	◡	◡	—	◡	◡	—	◡	◡
		*	*		*	*		*	*		*	*		*	*	*	*	*
		*		*		*		*		*		*		*		*		*
		*		*		*		*		*		*		*		*		*

Candriṇī, on this analysis, has a line-internal catalectic foot. There is a whole metrical position within the line that does not correspond to any syllabic material but that must be part of the periodic temporal structure of the meter. The caesura specified by the tradition reflects this since it shows that there must be an obligatory pause after the third strong position before the first syllable of the next foot can be uttered. In performance, the strong syllable of the pre-caesural catalectic foot is typically lengthened to occupy the empty weak position of the third foot, making the caesural

pause very small in practice. The next section discusses caesurae and their performance correlates.

5.6 *The status of caesurae*

So far, I have followed traditional documentation regarding the location of caesurae (the Sanskrit term is *yati*) in the description of meters. A caesura is standardly understood to be a line-internal break which may be realized as an audible pause in the performance of a meter and which is associated with obligatory word boundaries. In Sanskrit traditional descriptions, such line-internal breaks correspond to at least two distinct phenomena, which have been lumped together under the term *yati*. In the first class of cases, the caesura correlates with the absence of syllabic material to fill up a specific metrical position within a line. The caesural pause occupies a position in the periodic structure of the meter and therefore must be factored into the metrical parse. (41) provides an instance of this in the context of syncopation, while (49) contains a line-internal catalectic foot with an empty weak position. Both kinds of empty positions are described in the tradition as caesurae, but it is obvious that these breaks bear a more structural load. In the second class of cases, the caesura marks a line-internal break where the pause is not factored in while parsing a given meter. In a subset of these cases, the caesura also corresponds to a change in foot quantity (§5.3). Line-internal breaks in the Sanskrit tradition thus perform a range of functions and, accordingly, have distinct performance correlates.

In those meters where the caesura marks an empty metrical position, the period between the pre-caesural and post-caesural syllables is appropriately adjusted. In the case of a moraic empty position (e.g. (41)) there is no syllable aligned with the syncopated downbeat while the post-caesural syllable is aligned with the following upbeat. The bimoraic empty position is treated similarly (e.g. (49)). Typically, the pre-caesural syllable is lengthened in order to fill up the empty position in these templates. Occasionally, the empty position is realized by a pause.

Meters where the caesura does not reflect empty positions contrast with the other set of meters in the duration of the caesural pause. Although there is a pause between syllables separated by a caesura, it is brief and never alternates with the vowel lengthening that is typical for meters with empty positions.¹⁹ In those cases where caesurae correspond to a change in foot quantity, it appears that there is a change in the tempo of the meter (to be expected given that these caesurae usually mark a transition from feet with lower moraic count to feet with higher moraic count).

In terms of the effect of caesurae on the formal construction of meters, I should note that the tradition strictly prohibits violation of caesurae;

word boundaries must coincide with the location of these breaks. However, the violation of this constraint (termed *yati-bhāṅga* ‘caesura violation’) is not unknown and also receives attention (and criticism) in the metrical literature. A proper treatment of caesurae in Sanskrit meters and their effects is far beyond the scope of this paper and must await further research.

6. ACCOUNTING FOR THE FREQUENTLY OCCURRING APERIODIC METERS

The previous section demonstrated how rhythmic devices such as syncopation, catalexis, and anacrusis are crucial to the construction of a number of Sanskrit meters. In this section, I will show that many frequently occurring aperiodic meters involve complex mappings to a periodic structure involving one or more of these rhythmic devices. These meters, being used very often, are familiar to most people who have knowledge of the metrical tradition.

6.1 *Mālinī* (H.2.246)

Mālinī is a simple iterating meter, with six trochaic feet, divided into two equal parts by a caesura. The first part contains tetramoraic feet while the second part contains pentamoraic feet. Like the meter *Candriṇī* (49), only the strong position is realized in the final feet of both parts. There is an obligatory pause after the eighth syllable and the metrical parse begins afresh after the caesura, which is why adjacent syllables (the initial syllables in the third and the fourth foot) appear to be accented at the second level in the metrical grid.²⁰

- (50) a. ◡ ◡ ◡ ◡ ◡ ◡ – – : – ◡ – – ◡ – – **Mālinī**
 vi ka ca ka ma la gaṇ dhaiḥ : an dha yaṇ bhr̥ṇ ga mā lāḥ
vikacakamalagandhairandhayan bhr̥ṇgamālāḥ
 ‘Swarms of bumblebees, blinded by the smell of lotuses...’
- b. ◡ ◡ ◡ ◡ ◡ ◡ – ◡ ◡ – ◡ : ◡ ◡ – ◡ ◡ – ◡ ◡
 * * * * * * * : * * * * * * *
 * * * * * * * : * * * * * * *
 * * * * * * * : * * * * * * *

The properties of the *Mālinī* template are in (51).

- (51) a. **Pattern:** Six trochaic feet.
 b. **Non-isochronous rhythm:** Three tetramoraic trochaic feet followed by three pentamoraic trochaic feet.
 c. **Catalexis:** Only the strong position of the final feet in both parts is realized.

A meter with the exact underlying template as Mālinī, is the Vaiṣvadevī meter, where all tetramoraic feet are realized by heavy syllables.

- (52) a. – – – – – : – ◡ – – – – – **Vaiśvadevī** (H.2.177)

dr̥ṣṭvā śvo yam yad : vis ma yam yān ti pau rāḥ
dr̥ṣṭvā śvo yam yadvismayam yānti paurāḥ.

‘A (cavity) such that seeing which tomorrow, the towns-people may be wonder-struck.’

- b. $\begin{array}{cccccc} \acute{\text{—}} & \acute{\text{—}} & \acute{\text{—}} & : & \acute{\text{—}} & \acute{\text{—}} & \acute{\text{—}} \\ * & * & * & * & * & * & * \\ * & * & * & * & * & * & * \\ * & & * & & * & & * \end{array}$

6.2 Mandākrāntā (H.2.290)

The Mandākrāntā is a very frequently used meter whose invention is attributed to the playwright Kālidāsa.²¹ The tradition describes this meter as having two caesurae – after the fourth and the tenth syllables. The syllable sequence until the second caesura is identical to the syllable sequence in the Hamsi meter given in (41) and receives an identical metrical parse. The first four feet are tetramoraic with an empty node in the strong position of the third foot. Like Hamsi, the fifth syllable must be taken on the upbeat following the fifth downbeat (assuming the metrical position as the tactus level). Often, the immediately preceding heavy syllable is lengthened to fill up the unrealized node of the strong metrical position. The syllable sequence after the second caesura involves change in the foot quantity to pentamoraic trochaic feet. The final heavy syllable in the meter realizes the strongest position of the third foot in the pentamoraic sequence.

- (53) a. – – – – – : ◡ ◡ ◡ ◡ ◡ – – : – ◡ – – – – –

an tas to yaṁ ma ṇi ma ya bhu vas tuṅ ga mabh raṁ li hāg rāḥ
antastoyanṁ maṇimayabhuvastuṅgamabhrāṁlihāgrāḥ

‘You (clouds) are filled with water; they (buildings) have bejewelled floors. You are at lofty heights; they kiss the skies.
Mandākrāntā

- b. $\begin{array}{cccccc} \acute{\text{—}} & \acute{\text{—}} & : & \emptyset & \acute{\text{—}} & \acute{\text{—}} & \acute{\text{—}} & \acute{\text{—}} & \acute{\text{—}} \\ * & * & * & * & * & * & * & * & * \\ * & * & * & * & * & * & * & * & * \\ * & & * & & * & & * & & * \end{array}$

The properties of the template are given in (54).

- (54) a. **Pattern:** Seven trochaic feet.

- b. **Non-isochronous rhythm:** Four tetramoraic trochaic feet followed by three pentamoraic trochaic feet.
- c. **Catalexis:** Only the strong position is realized in the final foot.
- d. **Syncopation:** The strong metrical position in the third foot must be unfilled.

The Citralekhā (H.2.303) meter is exactly like Mandākrāntā, without syncopation in the third foot. The first mora of the third foot is filled by a light syllable rather than being specified as empty.

- (55) a. — — — — : ◡ ◡ ◡ ◡ ◡ — : — ◡ — — ◡ — —
 śan ke 'muṣ min ja ga ti mṛ ga dṛ śām sā ra rū pam ya dā sīt
śanke amuṣmin jagati mṛgadṛśām sārārūpam yad āsīt
- b. ◡ — ◡ — : ◡ ◡ ◡ ◡ ◡ — : ◡ ◡ — ◡ ◡ — ◡
 * * * * * * * * * * * * * *
 * * * * * * * * * * * * * *
 * * * * * * * * * * * * * *

Notice that the tradition still specifies a caesura after the fourth syllable. In Mandākrāntā, this caesura corresponds to an empty node in the third foot. There is no such function for the caesura in Citralekhā. The performance correlate of this caesura is a perceived break in the recitation that does not affect the time of utterance for the following syllable. On a beat count where the metrical position is taken to be the tactus level, the fifth syllable must be aligned with the fifth downbeat unlike Mandākrāntā where it must be aligned with the upbeat following the fifth downbeat.

6.3 Śikhariṇī (H.2.286)

The Śikhariṇī pattern is in (56).

- (56) a. ◡ — — — — : ◡ ◡ ◡ ◡ ◡ — : — ◡ ◡ — — Śikhariṇī
 ku put ro jā yet ta : kva ci da pi ku mā : tā na bha va ti
kuputro jāyeta kvacidapi kumātā na bhavati
 'It is possible that a son be evil, but it is never possible for a mother to be evil.'
- b. ◡ ◡ — ◡ — ◡ — ◡ ◡ ◡ — ◡ ◡ — ◡ ◡ — ◡
 * * * * * * * * * * * * * *
 * * * * * * * * * * * * * *
 * * * * * * * * * * * * * *

This is a meter composed entirely of tetramoraic feet, rendered complex by syncopation and anacrusis. The first syllable is extrametrical and the

A. DEO

metrical parse must begin at the second syllable. The meter is composed of seven trochaic feet. The caesura positions mark syncopation achieved by specifying strong nodes as empty. There is an obligatory one-mora pause in the third foot at the strong node of the weak position. The first light syllable following the string of heavy syllables constitutes the final mora of this foot. This syllable must be recited on the upbeat following the sixth downbeat (metrical position as *tactus*). The syncopation in the fifth foot is even more complex. The strong node of the weak position is specified as empty, just as in the third foot. Additionally, a heavy syllable is initiated at the weak node of the weak position of the fifth foot and carried over to the strongest node of the sixth foot. Śikhariṇī, thus instantiates both kinds of syncopation: surface accent in a weak metrical position and lack of accent in a strong metrical position.

The properties of the Śikharinī template are:

- (57) a. **Pattern:** Seven tetramoraic trochaic feet.
 b. **Catalexis:** Only the strong position of the seventh trochaic foot is realized.
 c. **Anacrusis:** The first syllable is extrametrical.
 d. **Syncopation:** The strong nodes of the weak positions of the third and the fifth foot must be left unfilled .
 e. **Syncopation:** A heavy syllable is initiated at the weakest position in the fifth foot and carried over to the strong position of the sixth foot.

6.4 *Vasantatilakā* (H.2.231)

The Vasantatilakā meter can be accounted for without any recourse to syncopation or anacrusis. It is a pentameter with iambic rhythm. The odd feet have a non-branching strong position, while the strong metrical position in even feet is obligatorily branching with a bimoraic strong terminal node. The weak position in the odd feet must be bimoraic, and is additionally specified as branching in the third foot. The weak position in the second foot must be monomoraic.

- (58) a. — ◡ — ◡ — ◡ : ◡ — ◡ — — Vasantatilakā
śrī rā ma caṇ dra ca ra ṇau ma na sâ sma rā mi
śrīrāmamacandracaraṇau manasā smarāmi
'I recall with my mind the feet of Rāmacandra.
- b. — ′ ◡ ′ ◡ ◡ ◡ ′ : ◡ ◡ ′ ◡ — ′
 * * * * * * : * * * *
 * * * * *

The Vasantatilakā template can be described as follows:

- (59) a. **Pattern:** Five iambic feet.
 b. Strong position in odd feet is non-branching; strong position in even feet is obligatorily branching with a bimoraic strong terminal node.
 c. Weak position must be branching in the third foot.
 d. Weak position is monomoraic in the second foot.
 e. The caesura is located after the third foot.

An examination of meters that are formally very similar to Vasantatilakā allow us to further abstract this template away from the specifics of the surface instantiation in Vasantatilakā. A meter very similar to Vasantatilakā is Ṛṣabha, a meter which has a branching weak position in the first as well as the third feet.

- (60) a. $\cup \cup - \cup - \cup \cup - : \cup \cup - \cup - -$ **Ṛṣabha** (H.2.242)
 b. $\begin{array}{ccccccc} \cup & \cup & \acute{\cup} & & \cup & \acute{\cup} & \cup & & \cup & \cup & \acute{\cup} & & : & \cup & \cup & \acute{\cup} & \cup & & - & \acute{\cup} \\ * & * & & * & * & & * & * & & * & * & & : & * & * & & * & * & & * & * \\ & & * & & * & & * & & & & * & & & * & * & & * & & & * & * \\ & & & & * & & & & & & & & & * & & & & & & & * \end{array}$

Another meter, Śīśu, given in (61), differs from Vasantatilakā in that the weak positions in both the second and the fourth feet are monomoraic.

- (61) a. $- - \cup - \cup \cup - : \cup - \cup - -$ **Śīśu** (H.2.259)
 b. $\begin{array}{ccccccc} - & \acute{\cup} & & \cup & \acute{\cup} & \cup & & \cup & \cup & \acute{\cup} & & : & \cup & \acute{\cup} & \cup & & - & \acute{\cup} \\ * & * & & * & * & & * & * & & * & * & & : & * & * & & * & * & & * & * \\ & & * & & * & & * & & & * & & & * & * & & * & & & * & * \\ & & & & * & & & & & & & & * & & & & & & & & * \end{array}$

Extrapolating from these three meters, it is possible to posit a more general abstract template whose surface instantiations include Vasantatilakā, Ṛṣabha, and Śīśu (and other possible undocumented metrical sequences). This more abstract template is given in (62).

- (62) a. **Pattern:** Five iambic feet.
 b. Strong position in odd feet is non-branching; strong position in even feet is obligatorily branching with a bimoraic strong terminal node.
 c. Weak position in odd feet is bimoraic and optionally branching.
 d. Weak position is optionally monomoraic in even feet.
 e. The caesura is located after the third foot.

6.5 *Pr̥thvī* (H.2.287)

The *Pr̥thvī* syllable sequence is given in (63a). The caesura is at the eighth syllable. The proposed structure for this meter is in (63b). This is an iambic meter with iteration at the dipodic level. The complexity in this meter is a result of syncopation in the third dipod.

- (63) a. ◡ – ◡ ◡ ◡ – ◡ – : ◡ ◡ ◡ – ◡ – – ◡ – **Pr̥thvī**
 la bhe ta si ka tā su tai : la ma pi yat na taḥ pī ḍa yan
labheta sikatāsu tailamapi yatnataḥ pīḍayan
 ‘It may be possible to obtain oil from even sand particles if they
 are pounded well.’
- b. ◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡ : ◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡
 * * * * * * * *
 * * * * * * * *
 * * * * * * * *

The properties of the *Pr̥thvī* template are as follows:

- (64) a. **Pattern:** Six iambic feet with iteration at dipodic level.
 b. **Odd feet:** Monomoraic weak position. Branching strong position. Terminal S node is bimoraic.
 c. **Even feet:** Branching weak position.
 d. **Syncopation:** A heavy syllable is initiated at a weak position (final node of the fifth foot) and carried over to a strong position in the sixth foot.
 e. Caesura immediately follows the strong syllable in the third strong position.

6.6 *Śārdūlavikr̥ḍita* (H.2.321)

This is a popular long meter with iambic rhythm and a caesura marking change in foot quantity. The first half has tetramoraic feet while the second half has pentamoraic feet with a final catalectic foot. The first syllable is extrametrical.

- (65) a. – – – ◡ ◡ – ◡ – ◡ ◡ ◡ – : – – ◡ – – ◡ –
 rā mān nās ti pa rā ya naṁ pa ra ta raṁ : rā ma sya dā so smya ham
rāmāt nāsti parāyaṇaṁ parataraṁ rāmasya dāso 'smi aham
 ‘There is no respite beyond Rāma; I am Rāma’s servant.’
Śārdūlavikr̥ḍita

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b. $\begin{array}{cccccccccccccccc} - & - & \acute{} & & \smile & \acute{} & & \smile & \acute{} & \smile & & \smile & \acute{} & : & - & \acute{} & \smile & & - & \acute{} & \smile & & - \\ * & * & & * & * & * & * & * & * & * & & * & * & & * & * & * & * & * & * & * & * & * \\ & & * & & & * & & & * & & * & & * & & * & * & & * & & * & & * & * \\ & & & & * & & * & & * & & * & & * & & * & & * & & * & & * & & * \end{array}$

- (66) a. **Pattern:** Seven iambic feet.
 b. **Anacrusis:** The first syllable is extrametrical.
 c. **Non-isochronous rhythm:** Four tetramoraic feet followed by three pentamoraic feet.
 d. Even feet in the first half have a branching weak position and a non-branching strong position.
 e. The third foot has a branching strong position with a bimoraic terminal strong node.
 f. **Catalexis:** Only the weak position of the final foot is realized.

6.7 Residual Cases

The analytical tools proposed so far can account for most of the frequently occurring aperiodic meters of the Sanskrit repertoire. The insight that meters are surface instantiations of underlying templates, conventionalized in the poetic tradition, allows us to factor in syncopation and extrametricality as obligatory parts of the definition of a meter. However, not all meters can be accounted for in the proposed system. These meters primarily fall into two classes: a) meters apparently involving an unpatterned change in rhythmic configuration within the line, and b) Documented meters with no clear rhythmic structure.

6.7.1 Change in rhythmic configuration

A section of the popular meters, with established performance patterns, do not receive a straightforward analysis because of the apparent variation between iambic and trochaic foot-types within the line. I will discuss two examples of this type of variation.

Sragdharā

Sragdharā (H.2.345) is a long meter with twenty-one syllables, with a syllable sequence exactly like the Citralekhā meter in (55), except for an extra foot in the first phrase. The extra foot is an iambic foot, the second foot in the sequence (with a question mark in the first grid row in (67b)). Both Mandākrāntā and its relative Citralekhā are trochaic meters. A possible metrical parse for Sragdharā, based the parses provided for Mandākrāntā and Citralekhā, is given in (67b).

- (67) a. $\begin{array}{cccccccccccccccc} - & - & - & - & - & - & : & - & - & - & - & - & - & - & - & : & - & - & - \\ \text{dhyā} & \text{yet} & \bar{a} & \text{jā} & \text{nu} & \text{bā} & \text{hum} & : & \text{dhṛ} & \text{ta} & \acute{s}a & \text{ra} & \text{dha} & \text{nu} & \text{ṣaṃ} & : & \text{bad} & \text{dha} & \text{pad} \\ \text{mā} & \text{sa} & \text{nas} & \text{tham} & & & & & & & & & & & & & & & & \\ - & - & - & - & - & & & & & & & & & & & & & & \end{array}$
dhyāyet ājānubahumī dhṛtaśaradhanuṣaṃ baddhapadmāsanasthamī
- b. $\begin{array}{cccccccccccccccc} \acute{a} & - & - & - & - & \acute{a} & - & : & - & - & - & - & - & - & - & : & \acute{a} & - & - & \acute{a} & - & - & \acute{a} \\ * & * & * & * (?) & * & * & : & * & * & * & * & * & * & * & * & * & : & * & * & * & * & * & * \\ * & & * & & * & & * & & * & & * & & * & & * & & * & & * & & * & & * \\ * & & & & * & & & & * & & & & * & & & & & * & & & & * & & \end{array}$

This parse assumes that Sragdharā has trochaic rhythm. Up until the second caesura, all feet but the second one, could possibly be parsed as either iambic or trochaic feet. The second foot is unambiguously iambic, while the feet in the final phrase are unambiguously trochaic. The performance pattern of Sragdharā closely resembles Mandākrāntā, with stress falling on the syllables at the left edge in all feet. The problem is the following: How can the second foot of Sragdharā, an iambic pentamoraic foot, be reconciled with the general trochaic rhythm of this meter? There is no way of accounting for this sequence without explicitly specifying the second foot as iambic, an undesirable ad hoc move.

The Indravamśā family

The Indravaiśā set of meters closely patterns with the Indravajrā family, with one small difference. The final foot in each of these meters seems to be a pentamoraic trochaic foot, with a branching strong position and a bimoraic terminal strong node. Examples are in (68). Each of these meters can be analyzed as members of the Indravajrā family, except for the final foot, which is unambiguously trochaic.

(68) **The Indravamśā Family**

W	S	W	S	:	W	S	S	W	
—	┐	—	┐		┐┐	┐	┐	┐	Indravamśā (H.2.158)
┐	┐	—	┐		┐┐	┐	┐	┐	Vamśastha (H.2.159)
┐	┐	—	┐┐		┐┐	┐	┐	┐	Mañjubhāṣiṇī (H.2.206)
—	┐	—	┐┐		┐┐	┐	┐	┐	Lakṣmī (H.2.214)
┐┐	┐	—	┐		┐┐	┐	┐	┐	Sudānta (H.2.217)
┐	┐	—	┐┐		┐┐	┐	┐	┐	Rucirā (H.2.198)

These syllable sequences might lead us to assume complex metrical schemata in which iambic and trochaic feet can be strung together in the same template, commonly known as trochaic substitution (see Kiparsky (2005) for arguments against trochaic substitution).

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$$(69) \quad \begin{array}{ccccccc} - & \acute{} & \smile & - & \acute{} & \smile & \smile & \acute{} & \smile & \acute{} & \smile & - \\ * & * & & * & * & * & & * & & * & & * \\ & & & & & & & & & & & * \end{array} \quad \text{Indravaiṁśā: trochaic substitution}$$

An alternative would be the refooting of syllables, yielding an iambic template with five feet, the final two of which are trimoraic.

$$(70) \quad \begin{array}{ccccccc} - & \acute{} & \smile & - & \acute{} & \smile & \smile & \acute{} & \smile & \acute{} & \smile & \acute{} & \smile & \acute{} & \smile \\ * & * & & * & * & * & & * & & * & * & * & * & * & * \\ & & & & & & & & & & & & & & * \\ & & & & & & & & & & & & & & * \end{array} \quad \text{Indravaiṁśā: pentametric template}$$

The meters of the Indravaiṁśā family are performed in the same pattern as the Indravajrā family meters and the perceived rhythm is tetrametric, not pentametric. Moreover, assuming a pentametric template renders the structure of the meter unintuitive, with no constraints on the branching and correspondence conditions in the iteration of feet. On the pentametric analysis, unlike in the Indravajrā family, there are no correspondences between odd and even feet in the meter. Moreover, lines in the Indravajrā or Upendravajrā meters may sometimes alternate with lines in the Indravaiṁśā or the Vaiṁśastha meters suggesting a shared underlying template. Examples are in (71), taken from Barooah (1882: 231).

- (71) a. $\smile \acute{} \smile - \acute{} :$ $\smile \smile \acute{} \smile - \acute{}$ **Upendravajrā** (H.2.155)
a tho su rā dīn : hṛ ta ya j ñ a bhā gān
atho surādīn hṛtayajñabhāgān (b. 16.20c)
- b. $\smile \acute{} \smile - \acute{} :$ $\smile \smile \acute{} \smile \acute{} \smile -$ **Vaiṁśastha** (H.2.159)
pra jā u tas vin : ma dha vat ya var ṣa ti
prajā utasvin madhavatyavarṣati (b. 16.20d)

Both the distribution of these meters and metrical performance seem to point to an analysis where the meters from the Indravaiṁśā family and the Indravajrā family share the same underlying template, lending little support to the pentameter analysis.

The trochaic substitution analysis, on the other hand, requires the positing of metrical schemata that combine feet with opposed rhythmic configurations, which is undesirable. The solution to this puzzle could possibly be along the lines of the ‘inversion’ analysis proposed for line and phrase-initial iambic feet that may contain stressed syllables in weak metrical positions (Hanson & Kiparsky 1996, Kiparsky 2005).

[illegible]

7. CONCLUSION

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tradition of sung verse is aligned closer to the more complex (surface) rhythmic structure characteristic of music than it is to the simpler one associated with spoken verse.

The implications of the parallelism between music and verse extend beyond characterizing the Sanskrit repertoire. Work in generative metrics, for the most part, is restricted to *spoken* verse, found only in a small set of traditions. Metrical verse in most cultures was, and still is, chanted or sung verse. This kind of verse is characterized (typically) by an isochronous rhythmic pulse onto which linguistic material is mapped. A growing body of work within generative metrics seeks to understand the properties of such mappings employing ideas from phonology and metrics (Hayes & Kaun 1996, Hayes & MacEachern 1998). This paper fits most naturally within this research program and brings a new range of data to further it.

However, it differs crucially from this earlier work, which examines the interaction of the prosodic properties of language (P-structure) with an isochronous rhythmic structure. This paper does not delve into the role of the prosodic structure of the Sanskrit *language* in the mapping between abstract rhythmic templates and linguistic material. The property of linguistic material that this analysis assumes relevant is syllable quantity; prosodic domains and prosodic phenomena above the syllable (foot-level, word-level, and phrase-level rhythmic structure) and the possibility of their interaction with metrical structure are ignored. On the analysis proposed here, the prosodic properties of Sanskrit do not interface directly with abstract metrical schemata, but rather, such an interface is mediated by the rich variety of surface rhythmic templates. These surface templates, in turn, are the output of the interaction between the abstract metrical schemata and correspondence conditions on rhythmic structure.

It has been demonstrated in the case of metrical systems for spoken verse that their most interesting and subtle characteristics are seen in their connections with phonological and prosodic properties of languages (Halle & Keyser 1971, Kiparsky 1977). The Sanskrit metrical repertoire suggests that sung and chanted verse systems might differ considerably from spoken verse systems in exploiting primarily variation in syllable duration within a language, in contrast to the entire range of its prosodic structure. The result of this is still a system of considerable complexity and subtle interactions between abstract template and surface form. Whether the phonological-prosodic properties of Classical Sanskrit other than quantity play any role at all in its versification system is a question for further research.

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FOOTNOTES

- 1 Classical Sanskrit verse is quantity-based with a two-way distinction between heavy (bimoraic or more) and light (monomoraic) syllables. Heavy syllables are those with a VV (ā, ī, ū, e, o, ai au), VC, or VVC rhyme. Light syllables are open with short vowels (a, i, u). The weight of a syllable is computed across word-boundaries. A word-final light syllable is counted as heavy if it is immediately followed by a complex onset from the following word. For example, the final syllable of *jāyeta* 'born' is counted as heavy when followed by a word such as *kvacit* 'seldom' (example from (56)). Finally,

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a final syllable whether heavy or light, counts as heavy, if it is so specified in the template (anceps).

- 2 The descriptions for all the meters listed in this paper are sourced from Velankar (1949), which is a critical edition of four important ancient texts on Sanskrit and Prakrit metrics, containing also a classified index of Sanskrit meters. The textual source I cite for each meter is based on this index. The abbreviations used are as follows: H = *Chando'nuśāsana* of Hemacandra (cir. 1150 A.D.); Vr. = *Vṛttaratnākara* of Kedārabhaṭṭa (pre-1100 A.D.); Jk. = *Chando'nuśāsana* of Jayakīrti (cir. 1000 A.D.); P = *Chandasśāstra* of Pingala (cir. 300 A.D.); Jd. = *Jayadevachandas* of Jayadeva (pre-900 A.D.); Pp. = *Prākṛta Paingala* (cir. 1300 A.D.); Mm = *Mandāramarandacampū*. For consistency, I have listed the reference from Hemacandra's *Chando'nuśāsana* wherever possible, and only used citations from other texts if Hemacandra does not refer to a particular meter.
- 3 The chanting patterns for some of the frequently occurring popular Sanskrit meters have been archived at www.stanford.edu/~adeo/meters. These patterns represent one style of recitation that is prevalent in the Maharashtra region of India.
- 4 Prince (1989) presents a universal inventory of feet restricting beat splitting to a single metrical position in a foot. The Sanskrit repertoire demonstrates that this is not a universal condition on foot-types.
- 5 I will justify this inventory in later sections by presenting as evidence meters which can only be parsed if we assume the conditions that I have proposed. My claim is that this is the minimal set of conditions needed for an accurate analysis of a large part of the Sanskrit repertoire; it cannot be a sufficient set of conditions since there are some meters that fail to receive a satisfactory parse even on these conditions (see §6.7).
- 6 Notice that the specification of the meter itself does not make reference to the moraic count of the odd and even feet in this meter. The specification that odd feet have a branching strong position with a bimoraic terminal node guarantees that odd feet are pentamoraic while even feet are treated as realizing the default tetramoraic unbranching option.
- 7 This paper cannot undertake a systematic exploration of what the limits on constrained variation are, or what conditions must be satisfied by feet (or dipods) across the template. But it will articulate the exact conditions on a subset of the Sanskrit meters, which can form the basis for further research in this direction.
- 8 Upendravajrā is exactly like Indravajrā except for the first syllable of the metrical sequence, which is heavy in Indravajrā and light in Upendravajrā.
- 9 The BhG is mainly written in the *Anuṣṭubh* meter (which is not discussed in this paper) and contains small stretches of verse that are written in the Upajāti. I am focusing on just one of these parts of the text.
- 10 I thank Francois Dell for explicitly pointing out this distinction between the two levels that might appear to be nomenclaturally identical.
- 11 The traditional system of classification is based on the number of syllables in a given metrical sequence and therefore the meters listed in (25) are found under different headings in the traditional documentation. The unification of these different meters under the label 'Indravajrā family' is motivated mainly by their formal similarity, which provides evidence for shared metrical structure.
- 12 This fit was also tested in another way. As stated in §4.4.1, the Indravajrā/Upendravajrā/Upajāti meters are associated with a common tune. This tune is also shared by yet another meter, Vāṭormi. I aligned the metrical sequences obtained from the traditional repertoire against this tune to establish yet another parameter for metrical fit. The list of meters that naturally fitted

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this performance template were compiled together as belonging to the Indravajrā metrical family.

- 13 The choice of Kāmāvātāra as the the meter instantiating the underlying template is determined by its availability as a surface variant in the documented metrical repertoire and the fact that it most transparently realizes the underlying structure. An unattested metrical sequence in (73) would also be acceptable as a metrical variant transparently instantiating the underlying template. In fact, any of the templates in (25) could substitute the sequence in (26a) because the underlying template is crucially *not* a sequence of syllables, but a sequence of abstract metrical feet governed by a set of constraints.

(73) * $\text{---} \text{---} \text{---} \text{---}$ $\text{---} \text{---} \text{---} \text{---}$ $\text{---} \text{---} \text{---} \text{---}$ $\text{---} \text{---} \text{---} \text{---}$

Note that the branching weak foot in this hypothetical (but possible) meter violates the constraint in (27b) which rules out a branching weak position in the final foot. But this constraint is motivated only by the attested empirical data and not by any theoretical constraint on metrical structure and so does not present a real problem to the analysis.

- 14 The strong position is preferentially, but not categorically non-branching in the fourth foot.
- 15 Of course there is always the possibility of assuming that these meters are governed by **weak uniformity** (§4.2) which only requires identity of iambic or trochaic rhythm, with no consideration of how such rhythm is realized. On this assumption, the meter could be easily parsed into constituents of pentamoraic, tetramoraic, or trimoraic feet, in random order. It is not clear what would constitute evidence for the accuracy of such a parse though.
- 16 Note that it was relatively straightforward to posit an anacrustic syllable for some of the textually attested variants culled from the BhG text in (22) because the formal context provided a background template without such a syllable. For a large part of the Sanskrit repertoire such a template is not readily available.
- 17 By phrases, I mean a part of larger metrical sequence separated by a caesura. In meters with non-isochronous rhythm (§5.3), syncopation only occurs in the metrical phrase with tetramoraic feet. An example would be the Mandākrāntā meter described in (53).
- 18 I thank a reviewer for pointing this out to me.
- 19 It is not clear to me how the caesural pause in these cases affects the vowel length of the preceding syllable. If we take the isochronous grid which I have posited for these meters seriously, it is to be expected that caesurae (if they are realized as pauses) should affect the length of the surrounding material. It would be worthwhile to obtain experimental evidence in order to compare the effects of the two kinds of caesurae on their syllabic environment.
- 20 The syllabic parse for this line given right under the metrical sequence in (52a) has the last syllable before the caesura as *dhaiḥ*. In the continuous text right below, *h* changes to *r*, conditioned by the vowel in the right context, by an automatic Sandhi rule of Sanskrit.
- 21 Kālidāsa's *Meghadūtam* is entirely composed in the Mandākrāntā. (53a) is a line from a verse in the *Meghadūtam*.
- 22 Many of these meters are rarely, if ever, attested in the literature and might, in fact, be artificial constructions of imaginative metricians, consisting primarily of patching different phrases from popular meters together. Their basis in the metrical intuitions of metrical practitioners is sometimes questionable, but that should not automatically eliminate them from the data set of the Sanskrit repertoire that requires explanation.