Sanskrit

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1. HISTORICAL AND CULTURAL CONTEXTS

Sanskrit is an Indo-European language, a member of the Indo-Aryan branch of the Indo-Iranian subgroup of that family. It is chronologically and in terms of linguistic development the “oldest” Indo-Aryan language and consequently often referred to as Old Indic (Altindisch) or Old Indo-Aryan; its descendants include a range of linguistic varieties classified under the rubric Middle Indic (or Prâkrit, see Ch. 3), as well as the Modern Indic (New Indo-Aryan) languages spoken today, such as Hindi, Gujarati, Bengali. It is not related genetically to the Dravidian languages of South India, such as Tamil and Telegu.

The oldest form of Sanskrit is so-called Vedic Sanskrit, the language of the four collections of liturgical texts known as the Vedas and of the early exegetical literature on these texts. The oldest Veda is the Rgveda (Rig-veda), a compilation of 1,028 hymns which took shape around 1500 BC in northwest India, though the composition and collection of hymns clearly occupied several centuries. In language, style, and phraseology the Rgveda resembles the earliest texts of its closest linguistic relative, the Gàthàs attributed to the prophet Zarathustra, composed in Old Avestan (see Ch. 6).

Though the composition of Vedic texts can be dated with fair confidence to the period of c. 1500–500 BC, direct records of them are only found several millennia later. The “texts” were transmitted orally, with minimal alteration, and even after they were also committed to writing, the manuscripts were perishable and less reliable than the oral tradition.

Through the approximately thousand years of Vedic textual composition, the language shows gradual changes, especially in the loss of certain grammatical categories and the reduction of variant forms. Around 500 BC the Sanskrit then current among cultivated speakers received a magnificent description by the grammarian Pàñini in his treatise, the Aṣṭādhyàyì (“[Work] consisting of eight chapters”), whose level of detail and theoretical sophistication has not been equaled to this day.

Pàñini inadvertently froze the language in this particular form forever. What was composed as a descriptive grammar (though descriptive of a geographically and socio-culturally limited speech form, not the speech of the whole society) became a prescriptive grammar of a learned language. All subsequent Sanskrit follows, or attempts to follow, the rules of Pàñini. Though there are systematic variations in later texts, these are essentially stylistic and distributed according to textual genre. The language of the great epics, the Mahàbhàrata and the Ràmàyàna, deviates somewhat from the Pàñinian norm and is therefore sometimes distinguished as Epic Sanskrit; it displays some Middle Indic tendencies. Inscriptional Sanskrit also commonly shows nonsanctioned forms. Despite these minor exceptions, Sanskrit no longer had a history in the accepted linguistic sense of this term – even though the greater
part of its literature remained to be composed. The great flourishing of Sanskrit literary production lasted through the first millennium AD.

The language as fixed by Pāṇini is commonly known as Classical Sanskrit, or Sanskrit proper. Indeed, the term sanskrita means “perfected” and refers to the language generated according to Pāṇini’s rules, as opposed to the vernacular Prākṛts, from prākṛta “natural, unrefined.” Strictly speaking, the pre-Pāṇinian language of the Vedic texts is not “Sanskrit,” and is sometimes called simply Vedic, rather than Vedic Sanskrit. In this work, however, Sanskrit will denote all varieties of Old Indic.

2. WRITING SYSTEM

The earliest Sanskrit texts were composed and transmitted orally, not written down for centuries after their first “attestation.” Indeed, the first documentary evidence of Indo-Aryan languages in the Indian subcontinent comes not from Old Indic but Middle Indic: the inscriptions of the ruler Aśoka in the third century BC (see Ch. 3, §1.1) The first direct attestation of Sanskrit comes from around the beginning of the present era. The first extensive inscription is that of the ruler Rudradāman c. AD 150 at Girnar in western India; the first extant manuscripts, found in central Asia, date from about the same period.

The writing system found in most of the early inscriptions is Brāhmī (another, less widespread system, Kharoṣṭhī, an adaptation of Aramaic, is found in the northwest, already in the Aśokan edicts). Brāhmī seems to have been adapted from a Semitic writing system, though the exact details are unclear, as is the date of its introduction into India, a subject of much controversy. Brāhmī is the ancestor of most of the writing systems used in India.

Until the advent of printing and the regular publication of Sanskrit texts, Sanskrit manuscripts were written in various local scripts. Now Sanskrit is almost exclusively printed in a script known as Nāgarī or Devanāgarī, a medieval offshoot of Brāhmī, and perfectly adapted to the writing of Sanskrit, with a one-to-one correspondence between sound and symbol. The conventional transcription of Devanāgarī into Roman characters was established finally at the Tenth Congress of Orientalists, 1894. Transliterations in works published before often show deviations from the modern norm.

The system can be considered a modified or pseudo-syllabary in that each consonantal symbol represents a consonant with following short a-vowel (the commonest vowel in the language), for example, क = ka, ख = kha, ग = ga, घ = gha (not k, kh, g, gh); see Table 26.1. However, unlike “pure” syllabaries, a different symbol is not necessary to represent consonants followed by other vowels (e.g., का, कि, कृ, etc.). Instead, a set of universally applicable diacritics can be used to cancel the inherent short a and substitute a different following vowel: thus, का = kā, कि = ki, कृ = ku, and so forth. There are also separate signs for independent vowels, for example, अ = a, ए = e.

Another drawback of some syllabaries, the inability to represent consonant clusters unambiguously, is overcome by the system of ligatures. Portions of each consonant in a cluster are combined into a single conventional sign, for example, त (ta) + क (ka) = तक (tka). Final consonants can also be represented, by a stroke (virāma) under the sign, which cancels the short a; thus त = ta, but त = t. Thus, the system combines the flexibility of an alphabet with some of the spatial economy of a syllabary.

Devanāgarī writing of Sanskrit lacks word divisions. Each linguistic string, regardless of morphosyntactic structure, is treated as a sequence of syllables (aksaras) consisting of onset
consonant(s) (if present) plus vowel. Thus, a string like *tad etad rūpam, with word divisions as given in transliteration, would obligatorily appear in Devanāgarī as *ta de ta drū pa m (though without spaces between the characters).

### 3. PHONOLOGY

#### 3.1 Diachronic overview

From the point of view of reconstructed Proto-Indo-European, the most important phonological development in Sanskrit (and indeed in Indo-Iranian) is vowel-merger: short *e, *o, and *a all merge as a; long *ē, *ō, *ā (and short *ō under certain conditions) merge as ā. Since much of Proto-Indo-European morphology was based on alternations of vowels with *e-timbre and those with *o-timbre (qualitative ablaut), these mergers had major effects on the morphological system.

On the other hand, Sanskrit maintained the Proto-Indo-European consonantal system with some fidelity, only enlarging its inventory. The three series of stops – voiceless (T), voiced (D), and voiced aspirated (Dh) – traditionally reconstructed remain in Sanskrit, and
a fourth was added, voiceless aspirated (Th). As in other satem languages the labiovelars merged with the plain velars. There was secondary palatalization of the resulting segments, reflected in thoroughgoing synchronic alternations within Sanskrit (see §3.4.2.2). Otherwise, the inventory of places of articulation was increased by the creation of a series of retroflex dental stops. For the comparatist an especially important retention in Sanskrit is the preservation of *γ, *ω, and *ς intervocally, thus avoiding the loss of morphological clarity attendant on vowel contraction that bedevils the historical linguist in languages like Greek.

3.2 Vowels

The cardinal vowels i, u, a distinguish length; in addition, short a is a closer vowel than ā, equivalent to schwa. The mid vowels ē and ō, as monophthongizations of the Indo-Iranian diphthongs *ai and *au (preserved in Iranian), are inherently long and are so marked in the phonological sections of this work, though they are not usually so transcribed. The true diphthongs āi and āu (usually now transcribed simply ai and au) also count as long. The vocalic liquid r represents a merger of PIE (Proto-Indo-European) *r and *l. However, long ṭ is an invention of the system and found in a few analogically generated morphological categories; PIE *ṛ has different, biphonemic outcomes in Sanskrit, as we will see. Vocalic l is even more limited, found in only one morpheme.

(1) Sanskrit vowel phonemes

<table>
<thead>
<tr>
<th>Monophthongs</th>
<th>Diphthongs</th>
<th>Vocalic Liquids</th>
</tr>
</thead>
<tbody>
<tr>
<td>i / ī</td>
<td>āi</td>
<td>r/r̥</td>
</tr>
<tr>
<td>u / ū</td>
<td>āu</td>
<td>́</td>
</tr>
<tr>
<td>ē</td>
<td>̄e</td>
<td></td>
</tr>
<tr>
<td>ō</td>
<td>̄o</td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>̄a</td>
<td></td>
</tr>
</tbody>
</table>

3.3 Consonants

The consonantal inventory of Sanskrit is presented in Table 2.2:

<table>
<thead>
<tr>
<th>Table 2.2 The consonantal phonemes of Sanskrit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place of articulation</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Stops and affricates</td>
</tr>
<tr>
<td>Voiceless</td>
</tr>
<tr>
<td>Voiceless aspirated</td>
</tr>
<tr>
<td>Voiced</td>
</tr>
<tr>
<td>Voiced aspirated</td>
</tr>
<tr>
<td>Nasals</td>
</tr>
<tr>
<td>anuvāra (see below)</td>
</tr>
<tr>
<td>Fricatives</td>
</tr>
<tr>
<td>Voiceless</td>
</tr>
<tr>
<td>Voiced</td>
</tr>
<tr>
<td>Liquids</td>
</tr>
<tr>
<td>Glides</td>
</tr>
</tbody>
</table>
The apparent symmetry of this consonantal system conceals some failures of parallelism in distribution, often the results of historical changes:

1. The voiceless aspirated series is an addition to the system and significantly rarer than the other three. It is often found in etymologically obscure words.
2. The retroflex sibilant $\varsigma$ is the automatic product of dental $s$ following $i$, $u$, $r$, and $k$ (mnemonically “ruki”), a process also found not only in Iranian but in part in Balto-Slavic.
3. The series of retroflex stops was a creation of Indic, in most cases as a conditioned result of regressive assimilation to rukified $\varsigma$ and therefore distributionally limited; in particular, initial retroflexes are almost never found. The retroflex nasal is ordinarily the automatic product of dental nasal when the word contains a preceding $r$ (subject to some conditions). Thus, all the retroflexes are in origin conditioned alternants of dentals, though from the beginning of the language they have a qualified independence.
4. The palatals are affricates, not stops. In the palatal row the voiced aspirate $jh$ is a new and extremely rare phoneme; the phoneme patterning with the palatals as the voiced aspirate for morphophonemic purposes is glottal $h$ (see §3.4.2.1).
5. The palatal nasal is a conditioned variant of $n$ occurring next to palatal obstruents; the velar nasal is also ordinarily a conditioned product of $n$, found before velar stops, but further phonological developments (loss of final or cluster-internal velar stop) can allow the velar nasal an independent if marginal existence. Anusvāra is a conditioned alternant of postvocalic nasals, under certain sandhi conditions.
6. Visarga is a word-final (sometimes morpheme-final) conditioned alternant of $s$ and $r$ under certain sandhi conditions.
7. The glides and liquids regularly alternate with vowels: $i \approx y$; $u \approx v$ ([w]); $r \approx r$; $l \approx l$ (under conditions discussed below).

### 3.4 Phonological alternations

Sanskrit is characterized by a pervasive series of phonological alternations occurring on several different linguistic levels and displaying varying degrees of transparency. We begin with the most transparent.

#### 3.4.1 External sandhi

The surface form of any linguistic string is subject to phonological rules of combination (*sandhi* or “putting together”). In other words, phenomena of the English *gonna* (from *going* + *to*) type apply to any two words in contact within a sentence, and even between sentences in a discourse. Most sandhi rules involve regressive assimilation, especially in voicing: for example, (with underlying *tad*) *tad bhavati* but *tat phalam*. Assimilation in manner of articulation is also met with (e.g., *tan manas*). Like vowels coalesce into a single long vowel (e.g., *vada + agne* ⇒ *vadāgne*), and unlike vowels undergo diphthongization or glide-formation (e.g., *vada oṣadhe* ⇒ *vadausadhe*; *asti agnih* ⇒ *asty agnih*). Despite the simplicity of the principles, the details of sandhi rules are sometimes opaque. For example, though the change of final *-as* to *-o* before voiced sounds historically involves regressive voicing assimilation, this process is not synchronically transparent. The rules of external sandhi ordinarily apply also at compound seams, and many but not all of the same rules at morpheme boundaries.
External sandhi in Vedic is more variable than in Classical Sanskrit, not only in the form of the rules but also in their application (or nonapplication). Sandhi in Middle Indic occurs only under conditions of close syntactic nexus. Given these facts, it seems likely that the pervasive system of obligatory sandhi characteristic of Classical Sanskrit involved an artificial imposition of an originally more flexible set of processes linking words within syntactically defined phrases.

### 3.4.2 Internal consonantal alternations

The rest of this section presupposes the concept of the root and the canonical structure of the Sanskrit word presented in §4.1.

#### 3.4.2.1 Voicing and aspiration

The voiceless, voiced, and voiced aspirated obstruents of a positional series regularly alternate with each other ($ p \approx b \approx bh; t \approx d \approx dh$, etc.; note, however, $ c \approx j \approx h $), such that, for example, a morpheme with an underlying voiced aspirate final may show alternants with all three stops under differing internal sandhi conditions: thus, $ \sqrt{budh} \ \text{“be aware”} – \sqrt{budh}-yate$, $\sqrt{budh}-dha-$, $\sqrt{bholt}-syate$.

Clusters containing unaspirated stops show regressive assimilation (e.g., $chi-ti-$ from $^*chilid + ti-$). But in those containing voiced aspirates the resulting cluster is both voiced and aspirated whatever the position of the aspirate in the underlying cluster (hence buddha-from $buddha$-ta) – the change known as Bartholomae’s Law. In summary,

\[
\begin{align*}
\text{A.} & \quad T + T \\
\text{B.} & \quad T + D \\
\text{C.} & \quad Dh + T \\
\text{D.} & \quad D + T \\
\text{⇒} & \quad T-T \\
\text{⇒} & \quad D-D \\
\text{⇒} & \quad Dh + D \\
\text{⇒} & \quad D-Dh \\
\end{align*}
\]

Before s all stops become voiceless; hence bholt-syate above. This same form illustrates another, sporadic alternation: when roots with underlying final aspirates lose that aspiration, the initial consonant often acquires aspiration (hence buddha-from $buddha$-ta) – the change known as Grassmann’s Law, whereby di-aspirate roots dissimilated the first aspirated stop.

#### 3.4.2.2 Velars and palatals

The velar series ($k, g, gh$) regularly alternates with the palatal series ($c, j, h$). In particular, velar-initial roots reduplicate with palatales (e.g., $\sqrt{kr: ca-kara; gag: ja-gama}$); and preobstruent velars alternate with palatales in other phonological positions (e.g., $\sqrt{muc: muk-ta, but muc-yate}$). This alternation is the historical result of a pan-Indo-Iranian palatalization of velars by following front vowels (and $y$), the conditioning of which was obscured by the subsequent merger of $^*e$ with $^*a$ and $^*o$ noted above.

#### 3.4.2.3 Palatales and retroflexes

The structural position of the palatal series was further complicated by a different merger. Though Sanskrit $c$ can only be the product of an old palatalized velar ($^*k^{w}e$, etc.), both $j$ and $h$ have two sources: (i) not only palatalized velars ($^*g^{w}e$, $^*gh^{w}e$, etc.); (ii) but also PIE palatal stops ($^*g$ and $^*gh$), whose voiceless equivalent ($^*k$) yields Sanskrit $s$. These underlying palatales enter into a set of synchronic alternations different from that of the old velars: palatales followed by dentals produce a retroflex cluster, for example, $\sqrt{srj \ \text{“emit”}: srj + ta \Rightarrow srs-ta}$. Thus, though the phonetic inventory of the language contains only a single palatal series, morphological alternations define two morphophonemically distinct series: (3A) $s, j, h$; and (3B) $c, j, h$. 
The Ancient Languages of Asia and the Americas

(3)  A. palatals (∼ retroflexes)  B. palatalized velars (∼ velars)
    ū (e.g., viš : viš-ṭa)  c (e.g., muc: muk-ṭa)
    j (e.g., srj : srṣ-ṭa)  j̥ (e.g., bhaj: bhak-ṭa)
    h (e.g., ruh : rū-ḍha)  h (e.g., snih: snig-ḍha)

(By Bartholomae’s Law, a compensatorily lengthened vowel plus retroflex ḍh is the regular outcome in rūḍha.)

The distinction between these two series is neutralized before s, where both series (and all three manners) show k: for example, both ruruk-ṣati (√ruh) and sisnik-ṣati (√snih).

3.4.3 Internal vocalic alternations

The Sanskrit morphological system is pervaded by vocalic alternations, conveniently considered as the “strengthening” of an underlying vocalic element by two successive additions of the vowel a (V / a + V / a + aV). The preconsonantal versions of these strengthenings are known by the indigenous terms guṇa and ēṛddhi, but it is useful to consider these in conjunction with their prevocalic alternants as well. In terms familiar from Indo-European descriptive grammars, the unstrengthened state corresponds to zero-grade, guṇa to full-(or normal-) grade, and ēṛddhi to extended- (or lengthened-) grade. Though Proto-Indo-European qualitative ablaut essentially disappeared in Indo-Iranian with the merger of *e and *o, quantitative ablaut is transparently continued by the Sanskrit system of vowel strengthening. Alternations between zero-grade and full-grade are prominent in the morphological system; ēṛddhi is especially important in the derivation of adjectives of origin and appurtenance (ēṛddhi derivatives).

The alternations between consonantal and vocalic versions of glides and liquids are also relevant here, and the system is in fact clearest with these segments, especially ṛ, where the successive additions of a are easily discerned (N.B. for ease of exposition, i and ũ are not included here, but will be discussed below):

(4)  

<table>
<thead>
<tr>
<th>Vowel</th>
<th>Zero-grade</th>
<th>Full-grade</th>
<th>Extended-grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PreC. PreV.</td>
<td>PreC. (guṇa) PreV.</td>
<td>PreC. (ēṛddhi) PreV.</td>
</tr>
<tr>
<td>ṛ</td>
<td>ṛ r r ar ar ār ār</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>i y ē ay āi āy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>u</td>
<td>u v ō av āu āv</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>a a a a a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ā</td>
<td>ā ā ā ā ā</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As can be seen, with the simple vowels a and ā, the progressive addition of a is not so clear; moreover, prevocalic position is subject to complications.

Though Sanskrit does not have surface syllabic nasals (nThe and Ṇn) as reconstructed for Proto-Indo-European, the parallelism of morphological alternations compels us to posit such underlying vowels, which fit into the vowel gradation system as follows:

(5)  

<table>
<thead>
<tr>
<th>Vowel</th>
<th>Zero-grade</th>
<th>Full-grade</th>
<th>Extended-grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PreC. PreV.</td>
<td>PreC. (guṇa) PreV.</td>
<td>PreC. (ēṛddhi) PreV.</td>
</tr>
<tr>
<td>Ṇn</td>
<td>a m am am ām ām</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ṇn</td>
<td>a n an an ān ān</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The following chart gives an example of a root with each vocalism (save for the \(a\)-vowels), with representative forms from the various categories:

<table>
<thead>
<tr>
<th></th>
<th>(r)</th>
<th>(i)</th>
<th>(u)</th>
<th>(\eta)</th>
<th>(\eta)</th>
</tr>
</thead>
<tbody>
<tr>
<td>kṛ</td>
<td>ji</td>
<td>su</td>
<td>gam</td>
<td>han</td>
<td></td>
</tr>
<tr>
<td>&quot;do, make&quot;</td>
<td>&quot;conquer&quot;</td>
<td>&quot;press&quot;</td>
<td>&quot;go&quot;</td>
<td>&quot;smash&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**3.5 Syllable structure and phonotaxis**

There are few constraints on syllable structure. Syllables may both begin and end with vowels, single consonants, or consonant clusters; and internal vowels may be of any weight, even before coda consonants. In Vedic, however, some traces of phonological processes (Sievers–Edgerton Law) seemingly function to avoid overlong syllables: some suffixes containing \(y\) or \(v\) must be read as \(iy\) and \(uv\) after heavy syllables, but \(y\) and \(v\) after light syllables. But this is a morphologically limited phenomenon, not a pervasive phonological rule.

There are constraints on word-final consonants, which apply before external sandhi rules operate. Final clusters are not allowed (though monomorphemic \(r +\) obstruent is rarely retained), and certain classes of sounds, such as aspirates and palatals, are not permitted finally.

**3.6 Accent**

Vedic Sanskrit has a pitch accent system, described also by Pāṇini, but accent has disappeared in Classical Sanskrit. The Vedic accent can fall anywhere in the word and, as it is not phonologically predictable, the position of the accent often conveys morphological and syntactic information.

Most Vedic words possess one accent. A few loosely bound compounds keep accent on both members, and a number of linguistic forms lack accent: some particles, some pronouns, and, most interestingly, noninitial vocatives and noninitial finite verbs in main (but not subordinate) clauses.

For ease of exposition, accent will in many instances not be marked in the ensuing discussions.

**3.7 Diachronic developments**

As in most early Indo-European languages, the loss of the so-called laryngeal consonants (cover-symbol \(\text{H}\)) of Proto-Indo-European had major effects on Sanskrit phonology and morphology. The phonological alternations originally caused by these segments have been morphologized in various ways, especially visible in the variant forms of roots.

1. **set vs. anit roots**: In many obstruent-final roots, an \(i\) (from vocalized \(\text{H}\)) surfaces in preconsonantal position, with no counterpart prevocally. Such roots are known as **set** ("with an \(i\)"), and contrast with apparently parallel **anit** ("without an \(i\)") roots. Compare examples of identical morphological categories:
Because the distinction is neutralized in prevocalic position and because the interposition of the i helps to avoid the often awkward sandhi of consonant clusters, this i spreads beyond its original historical boundaries. Indeed, many suffixes and endings are reinterpreted as having an initial i (or at least an alternate form with initial i).

2. Roots in ∗RH: Sonorants (or resonants; i.e., i, u, r, l; ∗η, ∗η) followed by a laryngeal in Proto-Indo-European yield so-called long sonorants, having root-final alternation patterns as follows:

<table>
<thead>
<tr>
<th>Vowel</th>
<th>PreC.</th>
<th>PreV.</th>
<th>PreC. (guṇa)</th>
<th>PreV. (ṛddhi)</th>
<th>PreV.</th>
</tr>
</thead>
<tbody>
<tr>
<td>∗ṛH</td>
<td>ir/ūr</td>
<td>ir/ur</td>
<td>ari</td>
<td>ar</td>
<td>āri</td>
</tr>
<tr>
<td>∗iH</td>
<td>i</td>
<td>(i)y</td>
<td>ayi (&gt; ē)</td>
<td>ay</td>
<td>āyi</td>
</tr>
<tr>
<td>∗uH</td>
<td>ū</td>
<td>(u)v</td>
<td>avi</td>
<td>av</td>
<td>āvi</td>
</tr>
<tr>
<td>∗ṛH</td>
<td>ām</td>
<td>(a)m</td>
<td>ami</td>
<td>am</td>
<td>āmi</td>
</tr>
<tr>
<td>∗ṛH</td>
<td>ā</td>
<td>(a)n</td>
<td>an</td>
<td>ān</td>
<td>ān</td>
</tr>
</tbody>
</table>

Consider the following examples:

<table>
<thead>
<tr>
<th>Vowel</th>
<th>PreC.</th>
<th>PreV.</th>
<th>PreC. (guṇa)</th>
<th>PreV. (ṛddhi)</th>
<th>PreV.</th>
</tr>
</thead>
<tbody>
<tr>
<td>∗ṛH</td>
<td>tir-ṇa</td>
<td>nī-ta</td>
<td>bhū-ta</td>
<td>krām-ta</td>
<td>jā-ta</td>
</tr>
<tr>
<td>∗iH</td>
<td>nin(i)y-ur</td>
<td>bhuv-āni</td>
<td>cakram-ur</td>
<td>jajn-ur</td>
<td></td>
</tr>
<tr>
<td>∗uH</td>
<td>tari-ṣyati</td>
<td>nayi-tum</td>
<td>bhavi-tum</td>
<td>krami-ṣyati</td>
<td>jani-tum</td>
</tr>
<tr>
<td>∗ṇH</td>
<td>tar-ati</td>
<td>nay-ati</td>
<td>bhav-ati</td>
<td>kram-ate</td>
<td>jan-ati</td>
</tr>
</tbody>
</table>

The distribution of ir/ūr and ir/ur forms in ∗ṛh roots was originally conditioned by the quality of the preceding consonant, with u-forms following labials (e.g., √pṛ “fill,” with pūrṇa).

3. Roots in ā: Such roots show an extremely anomalous set of alternations in comparison with the patterns set by other root types. As was first recognized by F. de Saussure in the 1870s, the anomalies can be explained by positing the same structure and alternations as in set roots; in other words, by rewriting (in modern terms) ā as ∗VH and its unstrengthened form as ∗H, yielding i before consonant and zero before vowel:

<table>
<thead>
<tr>
<th>Vowel</th>
<th>PreC.</th>
<th>PreV.</th>
<th>PreC. (guṇa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>∗VH</td>
<td>ā</td>
<td>∅</td>
<td>ā</td>
</tr>
</tbody>
</table>

for example, sthā “stand” sthī-ta tasth-ur asthā-t
4. MORPHOLOGY

4.1 Word formation

The basis of Sanskrit morphology is the root, a morpheme bearing lexical meaning. Through the vowel-gradation processes described above and through the addition of affixes, verbal and nominal stems are derived from this root. The grammatical and syntactic identity of a stem in context is then fixed by the addition of an ending. In other words, the three major formal elements of the morphology are (i) root, (ii) affix, and (iii) ending; and they are roughly responsible for (i) lexical meaning, (ii) derivation, and (iii) inflection respectively. A (noncompound) word ordinarily contains only one root and one ending, but may have a theoretically unlimited number of affixes. Both ending and affix may also be represented as zero. The canonical structure of a Sanskrit word is thus:

(11) Root – Affix 0-n – Ending 0-1

Numerous examples of roots and their alternants were given above. There are some phonological constraints on root structure, the most important being that no root can end in short a, though affixes and endings commonly do, and all roots are monosyllabic (not counting the i of set roots; see §3.7). There are also some restrictions on co-occurrence of consonants: for example, roots do not contain two aspirates (the historical result of Grassmann’s Law) or stops from the same positional series in onset and coda.

Affixes are almost entirely suffixes. There is one infix, alternating -na/n- found in a single verbal present class, and one clear prefix, the so-called augment, an a- prefixed to past tense verb forms in the imperfect and aorist tenses. In addition, the class of preverbs mimic prefixes, because they precede a verb (and its nominal derivatives) and modify it semantically (e.g., ud “up,” pra “forth”). In the earliest language, however, the status of these elements is not clear, or rather it fluctuates, as both their position and their accentuation show. In the Rig-veda preverbs regularly occur in tmesis, in other words, separated from the finite verb. Even when immediately preceding the verb, they maintain their own accent, except in subordinate clauses. This last context is the only one in which they clearly form a part of the phonological word of the finite verb. Preverbs always precede the one undeniable prefix, the augment. With nonfinite forms of the verb and with nominal derivatives thereof, preverbs show much clearer univerbation in Vedic, both by position and by accent, and by Classical Sanskrit tmesis is no longer possible even with finite forms.

In nominal morphology three elements, a(n)- “un,” su- “well,” and dus- “ill,” function like prefixes, though technically forming compounds, both determinative and possessive.

Besides these few exceptions, suffixes are the rule in affixation. Though there are few absolute phonological constraints on suffixes, most are monosyllabic (though sometimes with the old laryngeal i attached, see above) and have relatively simple structure: CV is a common shape. The same is true of endings.

Reduplication is a common morphological process in the verbal system. Although the details cannot be examined, several of the phonological alternation processes discussed above are exemplified in reduplication: dissimilation of aspirates (√dhā: da-dhā-), alternation of palatals and velars (√kṛ: ca-kr-).

Some words do not conform to the canonical structure. A few forms lack both inflection and root and do not ordinarily serve as derivational bases: for example, the negatives n´a and m´¯a, particles of various functions like s´u and h´ı, and conjunctions like ca and v¯a (some are tonic, some not). Preverbs can be classified here at least originally.
Moreover, a much larger number of words are inflected (and can enter into derivation) but lack a recognizable root. These include many terms of basic vocabulary – kinship terms (e.g., mātār- “mother”), body parts (e.g., nas- “nose”), flora and fauna (e.g., śvān- “dog”) – but are not limited to such semantic categories. Pronouns might be usefully classified here. Numerals also lack roots; some are inflected, some not.

Sanskrit morphology is conveniently divided into two fundamental categories, namely nominal forms and verbal forms, formally distinguished by the types of endings they take and the grammatical categories these endings mark. Adjectives and participles derived from verbs are not formally distinct from nouns; pronouns share the same grammatical categories with nouns, though they may deviate somewhat in inflection. “Adverbs” are usually frozen case forms of adjectives, and nonfinite verbal forms such as infinitives and gerunds also clearly show frozen nominal case endings.

Before discussing nominal and verbal forms separately, we should note certain features and processes they share. Perhaps the most important is the distinction in each between thematic and athematic inflection. Any stem, nominal or verbal, that ends in short a (i.e., ends with a suffix consisting of or containing short a as final vowel) is thematic. All thematic stems show fixed form throughout their inflection, modified only by the addition of endings. There are no stem alternants and there is no accent shift in the paradigm. Any stem not ending in short a is athematic and ordinarily will show stem alternants (as generated by the vowel strengthening patterns discussed above) and often movable accent. For example, the noun stem deva- “god” is thematic and maintains this form throughout, whereas rājān- “king” is thematic, with the following stem alternants: “strong” rājān- (/rājā-), “middle” rājan-, “weak” rājīn- (/rājā-). Similarly in verbs, a nonalternating thematic present stem like bhava- “become” contrasts with athematic kṛnó- /kṛnu- (with accent shifted to the ending) “make.”

Given the relative simplicity of the former and the frequent morphophonemic complications of the latter, thematic inflection spreads at the expense of athematic inflection during the history of Sanskrit.

Two of the facts noted above – that affixes can be athematic (and alternating) as well as thematic, and that Sanskrit words can contain more than one affix – interact with each other. With very rare exceptions, only one element in any Sanskrit word will alternate within a single paradigm; all the rest will remain frozen in a nonalternating, usually weak form. Whenever a suffix (thematic or athematic) is added to a stem, all preceding elements become frozen. For example, the root √kṛ alternates within its root aorist paradigm: ākara-am “I have made” versus ākra-an “they have made.” However, when the present-stem alternating suffix -nó/nu- is added, the root syllable kṛ is fixed in zero-grade: kṛ-nó-/kṛ-nu-. In turn, with the optative suffix -yā/yī added to that, the present stem is frozen in weak form: kṛnu-yā-/kṛnu-yī.

4.2 Nominal morphology

The grammatical categories of Sanskrit nominal forms are gender, number, and case.

4.2.1 Gender

Three genders exist: masculine, neuter, and feminine. Nouns have inherent gender; personal pronouns have no gender, though demonstrative and anaphoric pronouns do. The formal expression is not parallel among the three genders. The feminine is primarily expressed by derivation: there are two important feminine-forming suffixes, -ā- and -ī-. By contrast, the difference between masculine and neuter is primarily inflectional. For the most part the
same suffixes form both masculine and neuter nouns, and different case endings signal the different genders. Most stems formally encode masculine versus neuter only in nominative and accusative. A few stem-types (especially i-stems) form feminines as well as masculines and neuters, where the feminine is distinguished by different case endings and by the form of modifying adjectives.

4.2.2 Number

Three numbers occur: singular, dual, and plural. The dual is a fully functioning category, used not merely for naturally paired objects, like eyes, but for any collection of two. Notable in Vedic is the “elliptical” dual, with a noun in the dual signalling a conventional paired opposition: for example, dyāvā, literally “the two heavens,” for “heaven and earth”; mātarā, literally “the two mothers,” for “mother and father.” Number is entirely an inflectional category, except in the personal pronoun.

4.2.3 Case

Sanskrit has eight cases: nominative, accusative, instrumental, dative, ablative, genitive, locative, vocative, though no stems make all eight distinctions in all three numbers. In all stems the dual shows only three distinctions: (i) nominative, accusative, and vocative merge; as do (ii) instrumental, dative, ablative; and (iii) genitive, locative. In all nominal stems the plural collapses nominative and vocative, as well as dative and ablative; only the personal pronouns distinguish dative and ablative in the plural. Even in the singular most stems conflate ablative and genitive; only one nominal stem-type (though the most common, the short a-stem) and the pronouns distinguish ablative and genitive singular. Thus, since pronouns lack vocatives, only one stem-type (a-stem) has eight distinct case forms in any number. Case function is discussed in §5.

Case is marked inflectionally, by endings, and by stem-form alternations. In alternating paradigms some cases regularly pattern together, in other words, show the same stem alternants. Normally (i) nominative/accusative singular, (ii) nominative/vocative plural and (iii) nominative/accusative/vocative dual (the so-called strong cases) operate in opposition to the other, weak cases (the terms direct versus oblique have almost the same range of reference, but are syntactic not formal designations; moreover, the accusative plural is also a direct case).

4.2.4 Nominal stem-classes

Unlike a language such as Latin or Greek, Sanskrit has no closed set of conventionally denoted noun declensions. Instead, there is a fairly large set of stem-types, some of which share features of patterning, as well as a sizable group of exceptional stems (not treated here). The first major division is between root nouns and derived nouns. As the name implies, root nouns combine the bare root, without suffixes, with endings, while derived nouns interpose suffix(es) between root and ending.

4.2.4.1 Vowel stems

The major division in derived nouns is between vowel stems and consonant stems, distinguished by the patterning of stem alternants and to some extent by endings. Among vowel stems we can differentiate three types:
1. The short a thematic type, the commonest stem-type in the language, forming masculines (e.g., *deva- "god") and neuters (e.g., *phala- "fruit"). Besides its invariant stem, it is distinguished by somewhat aberrant endings and by the fact that it alone has eight distinct forms in the singular.

2. The ā and ī feminine stems (e.g., *senā- "army," *devī- "goddess"). In addition to their gender, these stems share a distinctive set of endings in the singular oblique cases.

3. The stems in short i and u, forming nouns of all three genders (e.g., masc. *agni- "fire," fem. *mati- "thought," neut. *vāri- "water"); masc. *paśu- "cow," fem. *dhenu- "milk-cow," neut. *vasu- "wealth"). In early Vedic the inflection of all three genders is essentially the same (save for the neuter endings of the direct cases), with weak forms of the stem in the singular direct cases (*agni-) and strong forms in the singular oblique (*agnay-). Gradually all three genders develop separate singular oblique forms. The feminine stems become more like the stems of type 2.

4.2.4.2 Consonant stems

A number of varieties occur (*an-, *ar-, *ant-, *vas-, and *as-stems, among others), forming primarily masculine and neuter nouns. Most consonant stems share a general patterning tendency: strong forms of the stem occur in the "strong" cases, weak in the "weak" cases (e.g., *rājān- vs. *rājī-; *kartār- vs. *kartr̥-; *sānt- vs. *sat-, etc.), in direct opposition to the patterning of the short vowel stems just discussed. A few stem-types show no significant stem alternation (*in-stems, neuter *s-stems). Note also that *ar-stems are often classified as vowel stems (i.e., as /underring r-stems), and several of their cases have indeed adopted vowel-stem forms (especially acc. pl., gen. pl.). But the patterning of their stem alternants clearly classifies them with consonant stems, especially *an-stems.

4.2.5 Endings

Though no scheme of endings is applicable to all stems and all periods of the language, the following chart gives the most common patterns. When there are significant differences, both consonant and vowel-stem endings are given, as well as some feminine alternants.

(12)

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Nom.</td>
<td>ø</td>
<td>-s</td>
<td>ø</td>
<td>-s</td>
</tr>
<tr>
<td>Acc.</td>
<td>-am</td>
<td>-m</td>
<td>[=nom.]</td>
<td>-i</td>
</tr>
<tr>
<td>Instr.</td>
<td>-ā</td>
<td>-nā</td>
<td>-ā</td>
<td>-bhyām</td>
</tr>
<tr>
<td>Dat.</td>
<td>-ē</td>
<td>-ē</td>
<td>-āi</td>
<td>-bhyās</td>
</tr>
<tr>
<td>Abl.</td>
<td>-as</td>
<td>-s</td>
<td>-ās</td>
<td>[dat.]</td>
</tr>
<tr>
<td>Gen.</td>
<td>[=abl.]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loc.</td>
<td>-i</td>
<td>var.</td>
<td>-ām</td>
<td>[gen.]</td>
</tr>
<tr>
<td>Voc.</td>
<td>ø</td>
<td>var.</td>
<td>var.</td>
<td>[nom.]</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th></th>
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<th></th>
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<tbody>
<tr>
<td>Dual</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plural</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.2.6 Comparison of adjectives

There are two different patterns for producing comparatives and superlatives, one primary, that is, by direct attachment to the root, not to a derived adjective (comp. -īyas-, splv. -iṣṭha-); the other secondary, by attachment to an existing adjective (-tara-, -tama-). An example of each follows:
In Vedic the secondary suffixes are used rather freely, for example, in compounds like *somapātama- “most soma-drinking” (i.e., “best drinker of soma”); *vṛtrailantama- “most Vṛtra-smashing” (i.e., “best smasher of Vṛtra”).

4.2.7 Pronouns

The major division within this category is between (i) the personal pronouns of the first and second persons, unmarked for gender, and (ii) a larger number of gender-distinguishing demonstrative/deictic/anaphoric pronouns and adjectives.

4.2.7.1 Personal pronouns

The cases of these pronouns were noted above, as was the occurrence of a different stem in each number. The number of stems is in fact still greater, in that the first singular and plural and the second plural use a different form for the nominative than for the rest of the paradigm:

<table>
<thead>
<tr>
<th></th>
<th>1st sg.</th>
<th>1st pl.</th>
<th>2nd pl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nom.</td>
<td>āhām</td>
<td>vayām</td>
<td>yūyām</td>
</tr>
<tr>
<td>Elsewhere</td>
<td>m-</td>
<td>asm-</td>
<td>yuṣm-</td>
</tr>
</tbody>
</table>

The other stem formants are 1st dual āv-, 2nd. sg. tu-, 2nd dual yuv-. There also exist enclitic oblique forms, often with yet a different stem (e.g., 1st. pl. nas, 2nd pl. vas). The endings of the personal pronouns are in part unique to them.

4.2.7.2 Gender-marking pronouns

Such pronouns are characterized by a number of different paradigms and partial paradigms, with different functions sometimes changing over time. Most can be used both as pronouns proper and as demonstrative adjectives. We will mention only the most important and widespread stems, beginning with the strong deictics, nearer *ayām “this here,” farther *asāu “that yonder.” Both have rather aberrant inflection, with an assortment of stems collected from different sources.

The most common pronominal stem is *sā/tām, with a wide range of uses. While it serves as the anaphoric pronominal par excellence, it also shows traces in early Vedic of deictic usage. Moreover, it is the closest element Sanskrit possesses to both a third-person pronoun and to a definite article. It is also sometimes used with both second- and first-person reference. Its inflection shows archaic inherited features, with initial s- in nominative singular (masc. sā and fem. sā), versus t- elsewhere (replicated by Greek masc. ho, fem. hē [with h- < *s-] but neut. tō; see WAL Ch. 24, §4.1.3.4), and with an endingless nominative singular masculine (under certain sandhi conditions).

This stem also shows some peculiarities of inflection, some of which are found also in the stems of the interrogative (*kā-), the relative (*yā-), and a class of “pronominal adjectives” such as “other” (*anyā-), “all” (*vīśva-, replaced by *sārva-), “one/some” (*ēka-).

4.3 Verbal morphology

Like nouns, verbs are either thematic or athematic. Athematic verbs regularly alternate strong (guna) forms in the active singular, weak in the rest of the inflection.
The grammatical categories of finite verbs are person, number, voice, tense/aspect, and mood. In general, person/number/voice are expressed by a portmanteau morpheme, the ending; tense/aspect by suffixes, morphological processes directly affecting the root, and/or endings; and mood by suffixes (or endings) following the tense/aspect markers. The canonical shape of a verb is thus:

(15) Root – (Tense/Aspect suffix) – (Mood suffix) – Per./Num./Voice ending

4.3.1 Person and number

These categories index the subject of the verb. There are three persons, first, second, and third (in Western grammatical terminology); and three numbers, singular, dual, and plural. As in the noun, the dual is fully functioning, not limited to subjects naturally occurring in pairs. The nine-member grid defined by these two parameters is the basic building block of the Sanskrit verbal system, the paradigm. Each person/number pair is marked by a separate ending.

4.3.2 Voice

The approach to this topic will differ depending on whether formal or functional aspects are emphasized. Formally, many Sanskrit nine-member paradigms come in matched pairs, in two different voices – with identical stems but different endings. The two voices are active and middle (or mediopassive), or, in the more perspicuous Sanskrit terms, parasmaipada “word for another” and ātmanepada “word for oneself.” A typical formal configuration, the endings of the present, active, and middle, is given below:

(16)

<table>
<thead>
<tr>
<th></th>
<th>Active</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Singular</td>
<td>Dual</td>
<td>Plural</td>
<td></td>
</tr>
<tr>
<td>1st</td>
<td>-mi</td>
<td>-vas</td>
<td>-mas</td>
<td></td>
</tr>
<tr>
<td>2nd</td>
<td>-si</td>
<td>-thas</td>
<td>-tha</td>
<td></td>
</tr>
<tr>
<td>3rd</td>
<td>-ti</td>
<td>-tantis</td>
<td>-anti</td>
<td></td>
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<table>
<thead>
<tr>
<th></th>
<th>Middle</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Singular</td>
<td>Dual</td>
<td>Plural</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-e</td>
<td>-vahe</td>
<td>-mahe</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-se</td>
<td>-āthe</td>
<td>-dhve</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-te</td>
<td>-āte</td>
<td>-ante</td>
<td></td>
</tr>
</tbody>
</table>

The function of the separate voices is harder to define. Though there exist contrasting pairs such as act. yajati “sacrifices (on another’s behalf)” : mid. yajate “sacrifices (for one’s own benefit),” which illustrate the Sanskrit terminology, there are other active : middle functional relations: for example, transitive : intransitive, act. vardhati “increases X” : mid. vardhate “X increases.” Some middles are simply passive in value, though lacking overt passive suffix, and an even greater number have no obvious functional correlate: for example, the numerous deponents (to use the Latin term) inflected only in the middle (e.g., āste “sits”). The distinction between active and middle is, in the main, a purely formal one synchronically; not surprisingly, the distinction becomes attenuated in the development of the language.

There is, however, an important functional distinction in voice, with various formal encodings: that between active and passive. As just noted, the formal middle sometimes functions as a passive. One particular present-stem type, the suffix-accented -yā-present with middle endings, also becomes specialized as a passive (e.g., ucyate “is spoken”); and the aorist system contains a third singular of peculiar formation (heavy root syllable and mysterious ending -i; type avāci “was spoken”), the so-called aorist passive. Passive value is also expressed by several verbal adjectives, the gerundive (“future passive participle”) in -ya- and -tavya-, and especially the past passive participle in -ta- (-na-). The latter often substitutes for a finite verb as sentential predicate.
4.3.3 Tense-aspect

The backbone of the tense-aspect system is the three-way contrast between the present system, the aorist system, and the perfect system. Each of these stems produces one or more tenses, as well as (in the early language) moods and participles. The present system has two tenses, the present and the imperfect. In post-Rig-vedic Sanskrit both the aorist and the perfect have only one, though in the Rig-veda there is a marginal pluperfect beside the perfect. All three systems can be inflected in either voice:

(17)  

<table>
<thead>
<tr>
<th>Stem</th>
<th>Tense</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>present</td>
</tr>
<tr>
<td></td>
<td>imperfect</td>
</tr>
<tr>
<td>aorist</td>
<td>aorist</td>
</tr>
<tr>
<td>perfect</td>
<td>perfect</td>
</tr>
<tr>
<td></td>
<td>(pluperfect)</td>
</tr>
</tbody>
</table>

Like voice, the tense-aspect system is an elaborate formal edifice whose functional motivations have essentially broken down. Though the system inherited from Proto-Indo-European was an aspectual one, aspect is no longer a clear category even in early Vedic, and only relics of the inherited system can be discerned in the Rig-veda. From the Sanskrit point of view, the salient functional distinction is tense: present (expressed by the present tense) versus past (expressed by three competing preterital forms, imperfect, aorist, and perfect, as well as by certain nonfinite forms used predicatively).

The old perfect was a stative present functionally; a few Vedic perfects maintain this function, but most already express simple past. The original distinction between the present and aorist systems was probably durative versus punctual, but this can no longer be discerned. Insofar as the aorist can be distinguished from the imperfect in Sanskrit, it expresses immediate past time. The loss of functional distinction among the three past tenses set the stage for the loss of those formal categories in later Indo-Aryan.

4.3.4 Perfect stem morphology

Formally, the perfect is characterized by special endings and, except for one widespread old form (veda “knows”), by reduplication. It is built directly to the root, without affixes, and shows ordinary strong/weak stem alternation (type cakār-ā/cakr-ū). There is only one type of perfect stem formation (except for the “periphrastic perfect” of derivative presents; see §4.3.6).

4.3.5 Primary and secondary endings

The formal distinction between present and aorist systems is less well marked. The endings of the imperfect tense and the aorist are identical (the so-called secondary endings), and the endings of the present tense (the primary endings) closely resemble these. Compare, for example, the primary and secondary endings of the active singular, and contrast them with the corresponding perfect endings:
Unlike the perfect both imperfect and aorist prefix the augment, regularly in Classical Sanskrit and optionally (but commonly) in Vedic. Moreover, several types of stem formation are common to both present and aorist.

4.3.6 Present stem morphology

The indigenous grammarians distinguish ten present classes, which can be conveniently divided into thematic and athematic types. Four thematic classes occur, with the following suffixes added to the root: -a- (Class I); -á- (VI); -ya- (IV); and -áya- (X). The six athematic classes are as follows: simple root presents (endings added directly to the alternating root, Class II); reduplicated presents (III); and four classes continuing (directly or indirectly) nasal affixes – nasal infix (VII), and suffixed -nó/nu- (V), -ó/u- (VIII), and -nā/nī- (IX). Examples of each follow; thematic forms (with nonalternating stems) are given in the third singular active present, athematic forms in both third singular and third plural active, to display both stem alternants:

(19) Sanskrit present tense classes

I  simple thematic  √bhū “become”  bhāva-ti
II  root  √as “be”  às-ti, s-ánti
III  reduplicated  √hu “pour”  juhó-ti, juhv-áti
IV  -ya-  √paś “see”  pāśya-ti
V  -nó/nu-  √su “press”  sunó-ti, sunv-ánti
VI  -á-  √viś “enter”  viśá-ti
VII  nasal-infix  √yuj “yoke”  yunák-ti, yunj-ánti
VIII  -ó/u-  √tan “spread”  tanó-ti, tanv-ánti
IX  -nā/nī-  √kri “buy”  krīná-ti, krīn-ánti
X  -áya-  √cint “think”  cintáya-ti

There is no longer any clear distinction in function among these various present classes, though again traces of prehistoric distinctions can occasionally be discerned.

Besides the above ten classes, several other formations are formally presents, but are classified separately because they have clear functional correlates.

The future is formed with the thematic suffix -syá- (or -iśyá- originally proper to set roots) (e.g., kariśyáti “will do”: √kṛ). There is also a periphrastic future, formed from a noun stem with the -tar- agent suffix.

The so-called secondary conjugations:

1. Passive, formed with accented -yá- and middle endings, for example, nīyáte “is led”: √nī “lead.” In Classical Sanskrit with the loss of accent the passive cannot be formally distinguished from a middle Class IV present.

2. Intensive, formed with heavy reduplication (sometimes disyllabic) and, in later Sanskrit, a -yā- suffix with middle endings. The intensive expresses repeated or intensively performed action, for example, mármarj-, marmṛjyáte “wipe repeatedly, groom”: √mrj “wipe.”
3. Desiderative, formed with reduplication in -i- and a -sa- suffix. The desiderative expresses action desired, intended, or about to take place, for example, pīpāsati “desires, intends, is about to drink”; √pā “drink.”

4. Causative, formed with a heavy root syllable and a suffix -āy-a-. Formally not distinguishable from Class X presents, except sometimes in the shape of the root syllable. In the earlier language the causative is ordinarily formed only to intransitive verbs, for example, pādāyati “cause to fall”: √pad “fall.”

In addition to present stems built to verbal roots, nouns and adjectives can form den ominative presents by the addition of the suffix -yā-, for example, āśva- “horse”: āśvayāti “seek horses.”

The above derivative present stems can form a secondary periphrastic perfect, with a feminine accusative singular generated to the present stem, plus the perfect of √kr (in the earlier language), √bhū or √as (in the later language), of the type pādayāṃ cakāra/āsa “caused to fall.” The periphrastic perfect is especially common with causatives.

4.3.7 Aorist stem morphology

The aorist shares certain stem-types with the present system. The root aorist (e.g., ābhūt: √bhū “become”) and thematic aorist (āvidat: √vid “find”) resemble Class II and VI presents. Class III presents somewhat resemble the reduplicated aorist, though the aorist has certain formal characteristics (heavy i- reduplication, thematic vowel) and a functional connection with the causative (type āpīpadat “caused to fall,” parallel to pādayati “causes to fall”) that set it apart.

Proper to the aorist, however, are a variety of sigmatic formations. The s-aorist and iṣ-aorist were originally identically built, with s-suffix, to anīt and set roots respectively. Especially notable in these formations is the consistent vṛddhi of the root in the entire active voice, an unusual distribution of grades (e.g., s-aor. ājai-s- “he conquered”; √ji “conquer”; āpāviṣ- “purified”: √pū “purify”). Analogic extensions of these two aorist types led to the creation of the marginal types, sīṣ-aorist and sa-aorist.

The passive aorist was noted in §4.3.2.

4.3.8 Mood

There are four clear moods in early Sanskrit: indicative, imperative, optative, and subjunctive. In addition, the so-called injunctive of early Vedic is considered a mood by some, and the preceptive, a subtype of the optative, develops in the course of Vedic. This system is reduced by Classical Sanskrit. One global change is the virtual restriction of nonindicative moods to the present stem; in Vedic, aorists and perfects displayed broader modality. Furthermore, the subjunctive is effectively lost, and the injunctive, insofar as it is a mood, becomes restricted in usage.

4.3.8.1 Indicative

The indicative is the unmarked mood, used for statements, questions, etc.

4.3.8.2 Imperative

The imperative expresses command and is marked by special endings on the appropriate tense stem. In Vedic the imperative has a defective paradigm, being found only in second and third persons, but as the subjunctive is lost as a functional category, its first-person
forms are incorporated into the imperative. The negative imperative (i.e., prohibitive) is expressed not by the formal imperative mood, but by the injunctive with a special form of the negative, namely mā (not nā).

There is also a rare second imperative formation, the so-called future imperative, made by adding -tāt to the tense stem, expressing a command to be executed after the action of an intervening verb. Its value is usually second singular.

4.3.8.3 Optative
The optative expresses possibility (“might,” “could”), necessity (“should,” “ought to”), and will/desire (“would”), and is marked by a suffix added to the tense stem. For athematic stems, the suffix is -yā- in the active, -i- in the middle, added to the weak stem form (e.g., s-yā- to root pres. as-ti, s-anti: √as, kṛṇu-yā-, kṛṇu-i- to kṛṇō-ti: √kṛ). For thematic stems, -ē- is substituted for the thematic vowel -a- throughout (e.g., bhāvē- to thematic pres. bhāva:- √bhū). Both suffixes take secondary endings, with some special details.

The precative is a supercharged optative, primarily expressing desire. It is formed by interposing an -s- between the optative suffix and the ending. Thus, the ordinary athematic optative first singular ends in -yām, that of the precative in -yāsam; that of the first plural optative in -yāma, the precative in -yāsma.

4.3.8.4 Subjunctive
This mood has disappeared (except for its formal representatives in the imperative) by Classical Sanskrit. It is formed by adding a suffix -a- (identical to the thematic vowel) to the tense stem; in thematic verbs this produces a contracted suffix -ā- (e.g., bhāva- to bhāva-ti). Athematic verbs add the -a- to their strong forms (e.g., ās-a- to ās-ti; kṛṇāv-a- to kṛṇā-ti). The subjunctive stem can take either primary or secondary endings (āsati, āsat, etc.); in addition, the typical final vowel of primary middle endings, -e, is usually strengthened to -āi after the Rig-vedic period.

The function of the subjunctive is difficult to define. It often seems to express the future, or volitional future, rather than the more strictly modal value its Western name implies. This interpretation fits well with the fact that the future tense is quite rare in early Vedic in finite forms; their place seems to be filled by the subjunctive.

4.3.8.5 Injunctive
Formally the term injunctive simply refers to unaugmented preterite forms (i.e., imperfects and aorists). Such forms are quite common in the Rig-veda in a variety of contexts, but only one usage persists into later Vedic and Classical Sanskrit: the conjoining of aorist injunctive and the particle mā to express prohibitions. Despite the best efforts of numerous distinguished scholars, a common functional core cannot be discerned in the other Rig-vedic contexts, and it seems best to regard these forms as not belonging to a unified modal category, but rather representing a period when the prefixation of the augment was still optional in the preterite.

4.3.9 Nonfinite verbals
Sanskrit possesses a large number of verbal nouns and verbal adjectives, of common occurrence. These ordinarily show verbal syntax (objects in the accusative, for example), and many can stand as the main verb in a clause. Some are built directly to the root, some to tense stems.
4.3.9.1  Infinitive

Classical Sanskrit has a single infinitive, built with the suffix -tum added directly to the root in guna form (type kar-tum: √kṛ), which is much rarer in textual usage than the infinitives of other early Indo-European languages. It continues the frozen accusative singular of a nominal stem with a tu-suffix, and indeed in Vedic other case forms of this stem appear in infinitival usage: dative -tave (/-tavāi), ablative-genitive -tos. In addition, other stem-types form infinitives or quasi-infinitives in Vedic, for example, datives to as-stems in -ase.

The line between an infinitive and a simple noun can be difficult to draw in the early language.

Infinitives appear as complements to verbs such as √śak “be able” and are used to express purpose. They are neutral as to voice and can express either active (“to X”) or passive (“to be Xed”) value, usually depending on the voice of the form to which they are complement.

4.3.9.2  Gerund

These frozen instrumentals, common in Sanskrit of all periods, are used to express an action prior to (or just simultaneous with) that of the main verb. Standard Classical Sanskrit has two formations, formally distributed: -tvā (also made to the tu-stem noted under the infinitive, §4.3.9.1) built to an uncompounded root; and -(t)ya built to preverb + root (thus the type kr-tvā vs. pra-kr-tya). This formal distribution is not always adhered to in the earlier language, and several other related suffixes are also employed.

4.3.9.3  Tense-stem participles

As with the moods, participles tend to become restricted to the present stem in later Sanskrit, although Vedic allows participles to be built to all three tense-aspect stems. Tense-stem participles distinguish voice. The active participle suffix for present and aorist is -ant-; the middle suffix for all three tense-aspect stems is -āna- for athematic verbs, -māna- for thematic. The active perfect participle is made with the suffix -vas-, of curious inflection. Though most nonpresent participles disappear by Classical Sanskrit, the perfect participle to vēda “knows,” vid-vās-, survives as an adjective meaning “knowing, wise.”

4.3.9.4  Past passive participle

This is an extremely common form, both as an attributive adjective and as a predicative verb substitute. It is built directly to the unstrengthened root with the suffixes -tā-, -itā- (originating in set roots and still largely found there), -nā-, and, rarely, -vā-: types kṛ-tā- “made, done”: √kṛ “make, do”; muṣitā- “stolen”: √muṣ(i) “steal”; san-nā “seated”: √sad “sit”; pakvā- “cooked, ripe”: √pac “cook.” Competing with the three finite past tense forms discussed above, the past passive participle is often the successful contestant, and is responsible for the preterites in a number of later Indo-Aryan languages.

4.3.9.5  Past active participle

Derived from the past passive participle by the addition of the possessive suffix -vant- (type kṛtvāvant- to kṛtā-), it is far less successful than its base.

4.3.9.6  Gerundive (or future passive participle)

The gerundive is another form with passive value, but with the additional component of obligation or necessity (“to be X-ed”), often the equivalent of a passive optative (type kartvya- “to be done”). It is formed directly to the root by the addition of one of several suffixes, the most common being -tvya- and -ya-.
4.4 Compounds

Sanskrit has an extremely well-developed system of nominal compounding; verbal compounding hardly exists. In Vedic, though all types of nominal compounds occur and are frequently encountered, individual compounds are usually limited to two or three members. In Classical Sanskrit, compounds of dozens of members are not infrequent, especially in philosophical texts: the compounding process comes to take the place of the independent syntactic arrangement of inflected words.

4.4.1 Verbal compounds

The verb shows two types of quasi-compounding: (i) the gradual incorporation of preverbs (and functionally equivalent elements) into a verbal complex (type √gam “go”: ā√gam “come”); (ii) the so-called cvī construction, which combines nouns and adjectives with both finite and nonfinite forms of the roots √k “make” and √bhū “become” (meaning “make/become X”). In such cases, the nominal first member substitutes invariant -ī- for a stem-vowel -a- or -ī-, -ū- for -u- (e.g., stambhī-bhavati “becomes a post”: stambha- “post”).

4.4.2 Nominal compounds

Formally, nominal compounding ordinarily involves the concatenation of uninflected words (i.e., stems), resulting in a unit with a single ending and a single accent. The stems may include nouns, adjectives (including participles), adverbs, and pronouns. Both the single ending and the single accent have exceptions in the early language. Inflected case forms may appear in prior compound members, as in rathe-śīthā- “standing on a chariot” (with the first member in the locative case). And paral compounds (dual dvandvas; see §4.4.2.1) with both members in the dual and both accented (e.g., mitrā-vāruṇā “Mitra [and] Varuṇa”) are a well-attested feature of Rig-vedic discourse.

There are three major types of nominal compounds: copulative, determinative, and possessive, known familiarly by their Sanskrit names as dvandva, tatpuruşa, and bahuvrīhi respectively.

4.4.2.1 Dvandvas

These copulative compounds conjoin two or more stems as parallel members of a series: \(X + Y + Z\ldots\) (the “lions and tigers and bears” type). Formally the compound may either take the gender of its final member and be inflected as dual or plural (as appropriate), or be treated as a neuter singular collective. In either case the final member is accented (in accented texts). On the Rig-vedic dual dvandvas, with double inflection and double accent, see §4.4.2.

4.4.2.2 Tatpuruşa

The prior member of this determinative compound limits the following member in some way. Two major subtypes can be distinguished according to the underlying case relations of the members: dependent (tatpuruşa proper) and descriptive (karmadhāraya). In the former the prior compound member would be in a different case from that one which follows. A typical relation is genitive + head, as in nr-pāti-, literally “man-lord,” that is “lord of men”; but other relations are common, especially the limiting of a final past passive participle by an underlying instrumental agent – type agni-taptā-, literally “fire-heated,” that is, “heated by fire.” In karmadhārayas the prior member is either a qualifier in the same underlying
case as that member which it limits (typically an adjective, i.e., the “black-bird” type) or an adverbial element (su- “well,” dus- “ill,” and a(n)- “un-” are especially common). The accentual facts of determinatives are complex, but in general the accent falls on the final syllable or the final member.

4.4.2.3 Bahuvrīhi

This possessive compound may be based on any of the preceding types, but adds to the concatenation the semantic feature of possession: the formal sequence X + Y means not simply “X-Y” but “possessing X-Y.” English has similar compounds; compare red-head and Bluebeard.

An important formal consequence of the addition of this semantic feature is that the compound, whose final member is a noun, must be transformed into an adjective, capable of inflection in all genders (hence the common designation “secondary adjective compound”). Sometimes the gender switch can be accomplished silently, as it were, as when neuter nouns in -a- simply take masculine endings in the nominative and accusative. Sometimes the adjustment simply requires lengthening or shortening the stem-vowel, as when masculine or neuter nouns in -a- become feminized as ā-stems or, vice versa, a feminine long ā-or ī-stem is inflected as a short a- or i-stem in the masculine or neuter. At other times more complex processes must be employed. These possessive adjectives are then often resubstantivized; bahuvrīhis are a rich source for proper names in Indic and other Indo-European languages (as Bluebeard demonstrates).

As with determinatives, the accentual facts are complex, but the accent generally falls on the first member. In accented texts it is thus easy to distinguish determinative compounds from bahuvrīhis, but in later Sanskrit this is not formally possible unless the bahuvrīhi has undergone gender shift.

We might note here that Sanskrit nominal morphology engages in a kind of conspiracy to express the semantic feature “possessing.” When a bahuvrīhi cannot be formed, because the notion being expressed is not a compound, a variety of suffixes may be utilized, especially -vant- (-mant-) and -in-, and in early Vedic simple accent shift is possible (e.g., brāhmaṇ- “formulation” gives brahmāṇ- “possessing a formulation,” “priest”).

4.5 Numerals

The cardinals from 1 to 10, 20, 100, and 1,000 are:

| (20) | 1 | ēka- |
|     | 2 | dvā- |
|     | 3 | trí- |
|     | 4 | catūr- |
|     | 5 | pāṇca |
|     | 6 | śaś |
|     | 7 | saptā |
|     | 8 | aṣṭā |
|     | 9 | nāva |
|     | 10 | dāśa |
|     | 20 | viṃśatī |
|     | 100 | ṣatā |
|     | 1,000 | sahāsra |

The relation of most of these to numerals in other Indo-European languages should be obvious.
There are some unusual inflectional details. *Dvá*—“two” is inflected regularly as a dual in all three genders (masc. nom./acc. *dváu*; fem., neut. *dvé*, etc.). Both *trí*—“three” and *cattír*—“four” display some archaic inflectional features, especially the feminine formant -sr- between stem and ending; thus nom./acc. pl. *tisrás* (with dissimilation < *tri-sr-as*), *cátasras*.

Ordinals are derived from cardinals with the suffixes -ma- (e.g., *pañcama*—“fifth”) and, rarely, -tha- (e.g., *sástha*—“sixth”). Irregular forms include

(21) first *prathama-*
second *dvitiya-*
third *tṛtiya-*
fourth *turiya-* Vedic (< *ktur-), also *caturtha-*

5. **SYNTAX**

Because of its elaborate morphology many traditionally “syntactic” phenomena take place on the level of morphosyntax in Sanskrit. In particular the case system allows the syntactic roles of nominals to be encoded without recourse to rigid word order or obligatory adpositions. Both prepositions and postpositions are rare in early Sanskrit; they become more common later, developing from old preverbs and from frozen case forms of nouns.

5.1 **Case usage**

Sanskrit cases and their uses are typical of an early Indo-European language: vocative (address); nominative (subject); accusative (direct object; goal of motion; a number of adverbial uses, notably duration of time); instrumental (accompaniment; instrument; agent of the passive; adverbial uses); dative (purpose; indirect object, though the genitive is more commonly used for the latter); ablative (source; cause; comparison); genitive (found in all varieties of adnominal usage; a genitive absolute is also occasionally found, cf. locative absolute); locative (location in both space and time; goal of motion). The locative is also the normal “absolute” case: a noun and modifying participle in the locative can express the time or attendant circumstances under which the action of the main clause occurs: for example, “(on) the sun having risen,” “(on) the enemy flee ing.”

5.2 **Word order**

Although the case system obviates the need for rigid word order, the order of elements in a Sanskrit sentence is not entirely free. Ordinary prose is SOV (Subject–Object–Verb), with many of the standard typological features of this ordering, such as genitives preceding heads. Poetry and artful prose, however, exploit the opportunities that the syntactic clarity of the morphological system affords, by thoroughly scrambling the order of elements for expressive or discourse purposes. Even in the most extreme examples, however, it is usually possible to formulate principles of movement from a putative underlying order parallel to simple prose.

Overt marking of the subject is not necessary; the bare verb, with person/number markings, is sufficient. First- and second-person subject pronouns are used in addition to the verb only for emphatic or contrastive value. The third-person “pronoun” *sá* is more frequent with third-person verbs, but it ordinarily serves discourse functions: anaphoric to a noun previous in the discourse or coreferent with the relative pronoun in a subordinate clause.
Not only finite verb forms but also participles, especially the past passive participle, can fill the slot V. In this case the copula normally appears only in the first and second persons, and even in those circumstances the personal pronoun can serve instead:

(22) \( \text{gatō 'smi (with copula)} \quad \text{or} \quad \text{ahām gatāḥ (with pronoun)} \quad \text{“I went”} \)
\( \text{gatō 'si (with copula)} \quad \text{or} \quad \text{tvāṃ gatāḥ (with pronoun)} \quad \text{“you went”} \)
\( \text{but} \quad \text{gataḥ} \quad \text{“he [she/it] went”} \)

Also common are nominal sentences – that is, the predication of a noun (or adjective) to a noun (or pronoun) without an overt copula.

5.3 Cliticization

As in other early Indo-European languages, sentences frequently begin with a chain of clitics attached to the initial, accented word of the sentence, occupying “Wackernagel’s position.” Such a chain of clitics (and pseudo-clitics – some carry accent) consists of sentential particles (often several to the sentence), conjunctions, and pronouns fronted from their underlying position in the clause; their order is determined by both syntactic class and phonological shape. Word-level conjunctions and pronominal clitics may also appear elsewhere in the clause, the latter ordinarily attached to their head. In such positions the pronoun may either precede or follow the word it is attached to, but clause-initial proclitics are not permitted: all clauses (and their metrical equivalent, verse lines) begin with an accented word. Especially common initial hosts include coordinating and subordinating conjunctions, preverbs in tmesis, and tonic demonstrative and anaphoric pronouns. Much recent work on Sanskrit syntax has concentrated on the constituents of this initial chain and their functions.

5.4 Subordination

A fully inflected relative pronoun \( \text{yā-} \) and a number of subordinating conjunctions built to this stem (\( \text{yadā “when,” yādi “if,” etc.} \) mark subordinate clauses. These elements are normally fronted (\( \text{wh-movement} \) from wherever they originate in the clause, but as other elements (including entire constituents) can be topicalized around them, the fronting is sometimes not superficially obvious. Relative clauses either precede or follow the main clause (the former is more usual except in the case of relative clauses of purpose); there is almost no embedding.

In early Vedic, subordinate clauses are sometimes marked only by verbal accentuation, not by a subordinating conjunction; and some particles (notably \( \text{hī} \)) also induce verbal accentuation, presumably a mark of subordination.

Indirect discourse is quite rare, especially in Classical Sanskrit; such clauses are usually expressed by direct discourse marked by the clause-final quotative particle \( \text{iti} \). For example, “he thought that he would go” would be expressed as “he thought, ‘I will go.’”

Other, nonclausal types of subordination are quite common. For example, a series of gerunds with nominal complements is often completed by a single finite verb (type “having come, having asked the king for permission, having received it, he went away”). A notable feature of the syntax of the gerund is that its subject is the logical agent of the main clause, not necessarily the overt grammatical subject (type “having smashed [ger.] with a cudgel, the tiger [nom.] was killed by the man [instr.]”, where the subject of the gerund is “the man” in the instrumental).
Participles and possessive compounds often correspond to relative clauses in other languages. Noteworthy is the use of the present participle of the verb “to be” (sánt-) as a concessive marker (“although being X, . . . ”). Bahuvrīhis often serve as nonrestrictive relative clauses (type “Indra, [lit.] possessing slain Vṛtra”, i.e., “who had slain Vṛtra”).

Unlike some other early Indo-European languages, Sanskrit has no elaborate rules governing the succession of moods and tenses in conditional sentences.

5.5 Agreement

The usual agreement rules of early Indo-European languages hold for Sanskrit: subjects agree with their verbs in person and number; adjectives with the nouns they modify in number, gender, and case; relative pronouns with their antecedents in number and gender.

There are a few interesting exceptions. The well-known Ancient Greek rule, whereby a neuter plural subject takes a singular verb, is preserved only in a few Vedic relics; ordinarily a plural verb is used. Vedic prose has developed a subtype of defining relative clause (type: “. . . the X, which is Y”) in which the relative marker is always neuter singular yād, whatever the gender and number of X and Y. This usage is reminiscent of the Iranian izafe marker, which has developed from the same form, but it is not clear if the two constructions are directly related. In some other equational nominal clauses, by contrast, an anaphoric pronoun is attracted to the number and gender of its antecedent.

Though conjoined nominals ordinarily agree in case, an apparently inherited exception in Vedic involves the conjoining of vocatives by ca “and,” where the second underlying vocative appears instead in the nominative. This phenomenon is denominated the vāyav īnдраś ca construction after one of its principal examples (“o Vāyu [voc.] and Indra [nom.]”).

5.6 Stylistic syntactic developments

One may consider the history of Sanskrit a history of style, and style in turn is linked to textual genre. Although neither the grammar nor the syntax of Sanskrit shows any significant changes after the fixation of the language by the early grammarians, the usage of these fixed elements significantly alters its balance in the Classical period. The emphasis falls heavily on the nominal system, and the complex verbal system outlined above is exploited far less. We have already noted some of the features of this change in emphasis – the efflorescence of the compounding system, the employment of nominal formations built to verbal roots in preference to finite verbs, the expansion of the adnominal case, the genitive. Sanskrit works of “high” style, court literature and philosophical discourse, take these tendencies to remarkable extremes, while technical treatises, with an eye to verbal economy, arrive at a similar nominal style from a somewhat different angle.

6. LEXICON

A very large proportion of the Sanskrit vocabulary in all periods consists of transparent Indo-European inheritances. Examples need hardly be given; but the numerals given above (§4.5), as well as kinship terms like pitar “father,” māter, “mother,” sūnu “son,” duhitar “daughter” can serve as illustrations. Not surprisingly, however, even earliest Vedic has words without clear Indo-European correspondences. While some of these may nonetheless still continue Proto-Indo-European etyma, others doubtless were borrowed from languages with which
the Sanskrit speakers came in contact. The difficulty is determining the source languages, given the fact that we have no records of likely languages from remotely the same era. Though Sanskrit speakers no doubt encountered speakers of Dravidian language(s), no Dravidian language is attested until around the beginning of the present era, and then only in South India. We do not know what a northern Dravidian language would have looked like in the second millennium BC. Our knowledge of the Munḍa languages (belonging to the Austro-Asiatic family) comes only from the modern era. Many scholars have proposed Dravidian and Munḍa sources for Sanskrit words (and indeed phonemes, syntactic constructions, and so on). It is reasonable to accept the principle, but difficult to judge the plausibility of any particular suggestion. Even when a single etymon clearly reveals itself in Sanskrit and one or more Dravidian languages, for example, borrowing may have gone in the other direction, or both families may have borrowed from a third source. Later (i.e., post-Vedic) Dravidian borrowings into Sanskrit are less controversial.

In addition to borrowing from non-Indo-Aryan languages, Sanskrit also sometimes re-incorporates vocabulary showing Middle Indic phonological developments, often with some phonological hypercorrection.

### 7. Reading List

The standard synchronic grammar of Sanskrit in English is Whitney 1889, which, along with its supplement, Whitney 1885, is invaluable. The standard historical grammar is the multivolume but still unfinished (lacking the verb) Wackernagel and Debrunner 1896—. The first volume, reissued in 1957, has a detailed general introduction to the language by L. Renou. Many of Renou’s other works can be consulted with profit, including his short but elegant history of the language (1956). The classic work on syntax (but only of the Vedic period) is Delbrück 1888. Speijer 1886 treats the Classical language. The standard etymological dictionary is Mayrhofer 1956–1976, currently updated and significantly expanded in Mayrhofer 1986—. A general discussion of the language, though with personal views, is found in Burrow 1955. A short survey, along the same lines as this, is found in Cardona 1987. Both Bloch 1965 and Masica 1991, though concentrating on later Indo-Aryan, nonetheless treat many aspects of Sanskrit as starting points for later developments.

### Bibliography


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