

# Vedic texts and geometry

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Kane [29, p. 1224], Chapter XXXV  
Olivelle [43, pp. xxiii–xxiv]:

Although the earliest texts, such as the hymns of the Ṛgveda, were composed in verse, the liturgical works (*brāhmaṇa*) of the middle vedic period were composed in prose. This practice was continued in the literature of the expert traditions; most ancient works falling within the Vedic Supplements are in prose. Probably because instruction in the expert traditions was carried out orally and the pedagogy of these schools was based on first memorizing the basic texts and then delving into their meaning with the aid of the teacher, the basic texts came to be composed in an aphoristic style known as *sūtra*. A *sūtra* is a sentence from which most non-essential elements have been removed. Individual *sūtras* are often syntactically connected to the preceding, words of earlier *sūtras* being implicit in later ones, a convention technically called *anuvṛtti*. This convention makes the entire composition similar to a chain and each *sūtra* a link in that chain. It is this characteristic that probably gave it the name *sūtra* (lit., ‘thread’), the composition being compared to a thread on which each aphorism is strung like a pearl. Given the brevity of each *sūtra*, it is frequently impossible to understand the meaning without the benefit of either an oral explanation or a commentary.

Olivelle [43, p. 3]:

The Dharmasūtra forms part of the voluminous Kalpasūtra of Āpastamba containing thirty *praśnas* (lit., ‘questions’) or books. The first twenty-four comprise the Śrautasūtra. Books 25–6 contain the Mantrapāṭha or the collections of ritual formulas to be used in domestic rites, and book 27 contains the Gṛhyasūtra. The two books of our Dharmasūtra occupy books 28–9, and the final book contains the Śulvasūtra, a treatise on principles of geometry needed for the vedic sacrifice. Āpastamba belongs to the Taittirīya branch of the Black Yajurveda. Opinion is divided as to whether the entire Kalpasūtra was composed by a single individual (Kane 1962–75, i. 54). The Kalpasūtra

of Āpastamba has been preserved better than most probably because commentaries were written on it at a relatively early date.

Kane = P. V. Kane, *History of Dharmaśāstra*, 5 volumes.  
Olivelle [43, p. 127]:

The Dharmasūtra of Baudhāyana, as that of Āpastamba, forms part of the Kalpasūtra ascribed to this eponymous author and divided into *praśnas* (lit., ‘questions’) or books. Unlike Āpastamba’s, however, the ritual texts of Baudhāyana have been tampered with repeatedly and contain numerous additions and interpolations. The extent and structure of the entire Kalpasūtra are not altogether clear. It appears that the first twenty-nine books contain the Śrautasūtra and other ritual treatises; book 30 contains the Śulvasūtra (vedic geometry); and the next four books comprise the Gṛhyasūtra. The last four books are the Dharmasūtra.

In the introduction to his translation of the Baudhayana Srautasutra, Kashikar [30, p. xi] writes:

The Baudhāyana Śrautasūtra forms the initial and prominent part of the Baudhāyana corpus. This corpus comprises the Śrauta, Prāyaścitta, Śulba, Gṛhya, Piṭṛmedha, Pravara and Dharma Sūtras. Tradition ascribes all these sutras to Baudhāyana. While preparing his critical edition of the Baudhāyana Śrautasūtra (BaudhŚS), W. Caland examined all available manuscripts of the above-mentioned types of the Sūtra-texts ascribed to Baudhāyana, and formulated the order of the Baudhāyana corpus. In the printed edition of the Śrautasūtra the Śulbasūtra forms the Praśna XXX. The Pravarasūtra printed at the end is without the consecutive Praśna number.

Vitruvius, *De Architectura*, 1.6.4–9.  
Hyginus Gromaticus, Establishment 152.4–22  
Arthashastra 1.19.7,8; 2.20.10,41,42,39,40

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White Yajurveda [24, p. 50], VI, 36:

East, west, north, south, from every side to meet thee let the regions run.  
Fill him, O Mother, let the noble meet together.

Rigveda [21, p. 405], III, 1, 2:

East have we turned the rite; may the hymn aid it. With wood and worship shall they honour Agni.  
From heaven the synods of the wise have learnt it: e’en for the quick and strong they seek advancement.

Rigveda [23, p. 277], VIII, 54:

Though, Indria, though art called by men from east and west, from  
north and south,  
Come hither quickly with fleet steeds;

Sankhayana Grihyasutra [41, pp. 22–24], Adhyaya 1, Khandas 7:

1. When assent has been declared (by the girl's father, the bridegroom) sacrifices.
2. He besmears a quadrangular space with cow-dung.
3. (Let him consider in the ceremonies to be performed,) of the two eastern intermediate directions, the southern one as that to which (the rites) should be directed, if the rites belong to the Manes,
4. The northern one, if the rites belong to the gods,
5. Or rather the east (itself) according to some (teachers).
6. He draws in the middle (of the sacrificial ground) a line from south to north,
7. Upwards from this, turned upwards, to the south one line, in the middle one, to the north one.
8. These he sprinkles (with water),
9. Carries forward the fire with the verse, 'I carry forward Agni with genial mind; may he be the assembler of goods. Do no harm to us, to the old nor to the young; be a saviour to us, to men and animals,'
10. Or (he carries it forward) silently,
11. Then he wipes with his wet hand three times around the fire, turning his right side to it. This they call Samûhana (sweeping together).
12. Once, turning his left side to it, in the rites belonging to the Manes.

Hiranyakesin Grihyasutra [42, pp. 141–142], Prasna 1, Patala 1, Section 2:

1. And lays the (three) pegs round (the fire).
2. On the west side (of the fire) he places the middle (peg), with its broad end to the north,
3. On the south side (of the fire the second peg), so that it touches the middle one, with its broad end to the east,
4. On the north side (of the fire the third peg), so that it touches the middle one, with its broad end to the east.
5. To the west of the fire (the teacher who is going to initiate the student), sits down with his face turned towards the east.

6. To the south (of the teacher) the boy, wearing the sacrificial cord over his left shoulder, having sipped water, sits down and touches (the teacher).
7. Then (the teacher) sprinkles water round the fire (in the following way):
8. On the south side (of the fire he sprinkles water) from west to east with (the words), ‘Aditi! Give thy consent!’–
9. On the west side, from south to north, with (the words), ‘Anumati! Give thy consent!’ On the north side, from west to east, with (the words), ‘Sarasvati! Give thy consent!’–
10. On all sides, so as to keep his right side turned towards (the fire), with (the Mantra), ‘God Savitri! Give thy impulse!’ (Taitt. Samh. I, 7, 7, 1).

Asvalayana Grihyasutra [42, p. 212], Prasna 1, Patala 1, Section 2:

1. Now he should examine the ground in the following ways.
2. He should dig a pit knee-deep and fill it again with the same earth (which he has taken out of it).
3. If (the earth) reaches out (of the pit, the ground is) excellent; if it is level, (it is) of middle quality; if it does not fill (the pit, it is) to be rejected.
4. After sunset he should fill (the pit) with water and leave it so through the night.
5. If (in the morning) there is water in it, (the ground is) excellent; if it is moist, (it is) of middle quality; if it is dry, (it is) to be rejected.
6. White (ground), of sweet taste, with sand on the surface, (should be elected) by a Brahmana. 7. Red (ground) for a Kshatriya.
8. Yellow (ground) for a Vaisya.
9. He should draw a thousand furrows on it and should have it measured off as quadrangular, with equal sides to each (of the four) directions;
10. Or as an oblong quadrangle.

Seidenberg [50]

Taittiriya Samhita [31, p. 119], I,8,7,c:

The gods that sit in the east, led by Agni; that sit in the south, led by Yama; that sit in the west, led by Savitr; that sit in the north, led by Varuna; that sit above, led by Brhaspati; that slay the Rakṣases; may they protect us, may they help us; to them homage; to them hail!

Taittiriya Samhita [32, p. 506], VI,2,4:

All this earth is the Vedit, but they measure off and sacrifice on so much as they deem they can use. The back cross-line is thirty feet, the eastern line is thirty-six feet, the front cross-line is twenty-four feet.

Staal [54, p. ]

Staal [54, p. ]

Dominik Wujastyk, Mathematics and Medicine in Sanskrit  
Satapatha Brahmana [13, pp. 62–63], I,2,5,14:

‘Let is (the altar) measure a fathom across on the west side,’ they say: that, namely, is the size of a man, and it (the altar) should be of (the) man’s size. ‘Three cubits long (should be) the “easterly line,” for threefold is the sacrifice,’ (so they say, but) in this there is no (fixed) measure: let him make it as long as he thinks fit in his own mind!

fathom=vyâma, distance between ends of outstretched arms, namely the size of a man.

*Śatapatha Brāhmaṇa* [14, pp. 111–112], third kāṇḍa, fifth adhyāya, first brāhmaṇa:

1. From that post which is the largest on the east side (of the hall) he now strides three steps forwards (to the east), and there drives in a peg,—this is the intermediate (peg).
2. From that middle peg he strides fifteen steps to the right, and there drives in a peg,—this is the right hip.
3. From that middle peg he strides fifteen steps northwards, and there drives in a peg,—this is the left hip.
4. From that middle peg he strides thirty-six steps eastwards, and there drives in a peg,—this is the fore-part.
5. From that middle peg (in front) he strides twelve steps to the right, and there drives in a peg,— this is the right shoulder.
6. From that middle peg he strides twelve steps to the north, and there drives in a peg,—this is the left shoulder. This is the measure of the altar.

Satapatha Brahmana [15, p. 199], VI,3,1,30:

On the right (south) side is the Âhavanîya fire, and on the left (north) lies that spade; for the Âhavanîya (m.) is a male, and the spade (abhri, f.) a female, and the male lies on the right side of the female. [It lies] at a cubit's distance, for at a cubit's distance the male lies by the female.

Satapatha Brahmana [15, pp. 327–329], VII,2,2:

9. On the right (south) side of the fire-altar, he ploughs first a furrow eastwards inside the enclosing-stones, ...
10. Then on the hindpart (he ploughs a furrow) northwards, ...
11. Then on the left (north) side (he ploughs a furrow) eastwards, ...
12. Then on the forepart (he ploughs a furrow) southwards, .... He first ploughs thus (south-west to south-east), then thus (south-west to north-west), then thus (north-west to north-east), then thus (north-east to south-east): that is (sunwise), for thus it is with the gods.

Satapatha Brahmana [15, pp. 372–373], VII,4,1,35:

Behind the altar (he offers) while seated with his face towards the east; then on the left (north) side (looking) to the south; then in front (looking) to the west; then going round behind (he offers) on the right (south) side while sitting with his face towards the north. Thus (he moves) to the right, for that (leads) to the gods. Thereupon, going back, (he offers) while sitting behind, with his face towards the east; and in this way that performance of his takes place towards the east.

Satapatha Brahmana [16, p. 139], VIII,7,3,5:

The body (of the altar) he covers first, for of (a bird) that is produced, the body is the first to be produced; then the right wing, then the tail, then the left wing: that is in the rightward (sunwise) way, for this is (the way) with the gods.

Satapatha Brahmana [16, p. 147], VIII,7,4,10:

First (he scatters them) at the back whilst standing with his face towards the east; then on the left (north) side towards the south; then in front whilst facing the west; then, having gone round the back, from the south whilst facing the north: this is from left to right (sunwise), for that is (the way) with the gods. Then, having gone round, (he scatters chips) at the back whilst standing with his face to the east, for in this way that performance of him took place.

Satapatha Brahmana [16, pp. 299–300], X,2,1:

1. Pragapati was desirous of going up to the world of heaven; but Pragapati, indeed, is all the (sacrificial) animals—man, horse, bull, ram, and he goat:—by means of these forms he could not do so. He saw this bird-like body, the fire-altar, and constructed it. He attempted to fly up, without contracting and expanding (the wings), but could not do so. By contracting and expanding (the wings) he did fly up: whence even to this day birds can only fly up when they contract their wings and spread their feathers.

2. He measures it (the fire-altar) by finger-breadths; for the sacrifice being a man, it is by means of him that everything is measured here. [“The sacrifice, being the substitute of (the sacrificing) man, is represented as identical with the Sacrificer...”] Now these, to wit, the fingers, are his lowest measure: he thus secures for him (the sacrificial man) that lowest measure of his, and therewith he thus measures him.

3. He measures the twenty-four finger-breadths,— the Gayatri (verse) consists of twenty-four syllables, and Agni is of Gayatra nature: as great as Agni is, as great is his measure, by so much he thus measures him.

Satapatha Brahmana [16, pp. 310–311], X,2,3:

8. He now measures off a cord thirty-six steps (yards) long, and folds it up into seven (equal) parts: of this he covers (the space of) the three front (eastern) parts (with bricks), and leaves four (parts) free.

9. He then measures (a cord) thirty steps long, and lays it sevenfold: of this he covers three parts (with bricks) behind, and leaves four (parts) free.

10. He then measures (a cord) twenty-four steps long, and lays it sevenfold: of this he covers three parts in front (with bricks), and leaves four (parts) free. This, then, is the measuring out of the Vedi.

Yano [66, pp. 145–146]:

When we read the *śulbasūtras* we have an impression that what has been transmitted by the text is only a part of the whole instruction. The rest of the instruction must have been transmitted by so-called *guruśiṣyaparamparā*, ‘uninterrupted succession from teacher (*guru*) to student (*śiṣya*)’, and it was not open to the general public, or even kept secret.

Śrautasutras [30]

Pingree [46, pp. 4]:

The Śrautasutras containing Śulbasūtras are those of Baudhāyana, in which the Śulbasūtra is *praśna* 30; of Āpastamba, in which the Śulbasūtra is also *praśna* 30; of Varāha, whose Śulbasūtra is said to survive in a manuscript at Madras; of Manava, in which the Śulbasūtra is *adhyāya* 10 (a recension of this is entitled the Maitrāyaṇīyaśulbasūtra); of Varāha, whose Śulbasūtra survives in a manuscript at Mysore; and of Kātyāyana, in which the Śulbasūtra is *parīśiṣṭa* 7. The last of these belongs to the Śuklayajurveda (the Vājasaneyisaṃhitā), the first five to the Kṛṣṇayajurveda (Baudhāyana, Āpastamba, and Vādhula to the Taittirīyasaṃhitā, and Mānava and Varāha to the Maitrāyaṇīyasaṃhitā).

Precise dating of any of these texts is impossible. The earliest, that of Baudhāyana, was perhaps written before 500 B.C., and the remainder presumably antedate the Christian era. It was, indeed, during this period also, probably in the second century B.C., that the most striking *śyenaḥiti* of which remains survive was built in Kauśāmbī. The Āpastamba appears to be the second oldest of the major Śulbasūtras, and the Kātyāyana, which consists of a *sūtra* section (to a large extent repeating *sūtras* of the Āpastamba verbatim), followed by a verse section, is among the latest; the Mānava has apparently copied some verses from the Kātyāyana.

Each of the basic altars must be constructed with five layers of bricks, and there must be a fixed number of bricks in each layer; moreover, the bricks in the second and fourth layers must not be directly above or below those in the first, third, and fifth layers. And the surface covered by the altar, regardless of its shape, must cover an area of seven and one half square *puruṣas* or, for certain purposes, that area increased by specified numbers of square *puruṣas*, or it must be multiplied by a given factor. Finally, the altar must be correctly oriented with respect to the cardinal directions. The task faced by the authors of the Śulbasūtras was to prescribe rules for laying out these altars with only a rope (*rajju* or *śulba*) of determined length and posts or gnomons (*śaniku*). The geometrical problems that were solved by these altar-builders are indeed impressive, but it would be a mistake to see in their works the unique origin of geometry; others in India and elsewhere, whether in response to practical or theoretical problems, may well have advanced as far without their solutions having been committed to memory or eventually transcribed in manuscripts.

Winternitz [63, pp. 55–56]:

The expression “Veda” is justified only for this literature which is regarded as revealed. However, there is another class of works, which has the closest connection with the Vedic literature, but yet cannot be said to belong to the Veda. These are the so-called Kalpasūtras

(sometimes also called briefly “Sūtras”) or manuals on ritual, which are composed in a peculiar, aphoristic prose style. These include:

1. The Śrautasūtras, which contain the rules for the performance of the great sacrifices, which often lasted many days, at which many sacred fires had to burn and a great number of priests had to be employed.
2. The Gṛhyasūtras, which contain directions for the simple ceremonies and sacrificial acts of daily life (at birth, marriage, death, and so on).
3. The Dharmasūtras, books of instruction on spiritual and secular law—the oldest law-books of the Indians.

Like Brahmaṇas, Āraṇyakas and Upaniṣads, these works, too, are connected with one of the four Vedas ; and there are Śrauta, Gṛhya, and Dharmasūtras which belong to the Ṛgveda, others which belong to the Sāmaveda, to the Yajurveda, or the Atharvaveda. As a matter of fact, they originated in certain Vedic schools which set themselves the task of the study of a certain Veda. Yet all these books of instruction are regarded as human work, and no longer as divine revelation ; they do not belong to the Veda, but to the “Vedāṅgas,” the “limbs,” i.e. “the auxiliary sciences of the Veda.”

Parpola [45, p. 187]:

The Yajurvedic texts connect the *nakṣatras* and the full and new moon with specific “bricks” laid down in brick-built fire altars (*agniciti*), which are unknown in the Rigveda and belong to the archaic layer of Vedic rituals connected with the Atharvavedic tradition. The relatively late Vedic Śulvasūtras describe the elaborate geometry and rules of orientation used in the construction of these altars. This Śulvasūtra tradition probably goes back to the Indus people, who lived for a millenium in brick-built cities and needed solar time-reckoning, as did other agriculturally based riverine and urban early cultures, for example, in Mesopotamia and Egypt, in which astronomy and astrology invariably form an important part of religion.

Parpola [45, pp. 195–196]:

The Baudhāyana-Śulvasūtra (1,22–28) describes a method to construct an oriented square and thus to define the cardinal and intermediate directions by using a gnomon and a cord with marked midpoint. This produces a pattern of “intersecting circles,” which is an important motif on Early and Mature Harappan painted pottery, and also a favorite motif on Harappan bathroom floors and “bath tubs.” I suspect this motif relates to the necessity of leveling the ground for the gnomon by means of water. In later Indian astronomical texts water is recommended for making ground perfectly level.

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