Presented at ***Vaastu Kaushal: International Symposium on Science and Technology in Ancient Indian Monuments***, New Delhi, November 16-17, 2002.

# Space and Cosmology in the Hindu Temple

by Subhash Kak

According to the Sthapatya Veda (the Indian tradition of architecture), the temple and the town should mirror the cosmos. The temple architecture and the city plan are, therefore, related in their conception. Volwahsen (2001) has remarked on the continuity in the Indian architectural tradition. The Harappan cities have a grid plan, just as is recommended in the Vedic manuals. The square shape represents the heavens, with the four directions representing the cardinal directions as well as the two solstices and the equinoxes of the sun's orbit.

A late example of a city designed according to the Vedic precepts is Jaipur. Vidyadhara, who designed the plan of the city, used the pithapada mandala as the basis. In this mandala of nine squares that represents the universe, the central square is occupied by the earth. In the city, which consists of nine large squares, the central square is assigned to the royal palace. The astronomical monuments of Maharaja Jai Singh II may also be seen as embodiments of the Vedic altars (Volwahsen, 2001).

The monument that has been studied most extensively for its cosmological basis is the Angkor Wat temple. Although it is located in Cambodia, it was built according to the principles of Indian architecture and, therefore, we will describe it at some length. The connections between Angkor Wat and Vedic astronomy emerged out of my own work (Kak, 1999 and Millar and Kak, 1999).

The astronomy and cosmology underlying the design of the Angkor Wat temple was extensively researched in the 1970s and it is well summarized in the book by Eleanor Mannikka (1996). Basically, it was found that the temple served as a practical observatory where the rising sun was aligned on the equinox and solstice days with the western entrance of the temple, and many sighting lines for seasonally observing the risings of the sun and the moon were identified.

This paper presents the basis of the Hindu temple design going back to the earliest period. We trace this design back to the fire altars of the Vedic period which were themselves designed to represent astronomical knowledge (Kak, 1995, 2000, 2002). An assumed equivalence between the outer and the inner cosmos is central to the conception of the temple. It is because of this equivalence that numbers such as 108 and 360 are important in the temple design.

The number 108 represents the distance from the earth to the sun and the moon in sun and moon diameters, respectively. The diameter of the sun is also 108 times the diameter of the earth, but that fact is not likely to have been known to the Vedic rishis. This number of dance poses (karanas) given in the Natya Shastra is also 108, as is the number

of beads in a rosary (japamala). The "distance" between the body and the inner sun is also taken to be 108, and the number of marmas in Ayurveda is 107. The total number of syllables in the Rigveda is taken to be 432,000, a number related to 108.

The number 360, the number of days in the civil year, is also taken to be the number of bones in the developing foetus, a number that fuses later into the 206 bones of the adult. The centrality of this number in Vedic ritual is stressed in the Shatapatha Brahmana.

The primary Vedic number is three, representing the tripartite division of the physical world into the earth, the atmosphere, and the sky and that of the person into the physical body, the pranas, and the inner sky.

The Hindu temple also represents the Meru mountain, the navel of the earth. The Brihat Samhita 56 lists the many design requirements that the temple building must satisfy. For example, it says "the height of the temple should be double its width, and the height of the foundation above the ground with the steps equal to a third of this height. The sanctum sanctorum should be half the width of the temple" and so on. It also lists twenty types of temples that range from one to twelve storeys in height.

**Figure 1**

We first summarize some relevant characteristics of the Angkor Wat temple that emphasize the relationship of the design to astronomy. This will be followed by sections on the Vedic antecedents of the temple and the medieval expression of the philosophy behind its design. We will also consider the question of the chaitya hall with its pointed arch as an alternate tradition within India that has been connected to the Lycian arch which may have influenced the design of the cathedral.

The most impressive aspect of the temple representation is that it occurs both at the level of the part as well as the whole in a recursive fashion, mirroring the Vedic idea of the microcosm symbolizes the macrocosm at various levels of expressions. This is done not only in the domain of numbers and directions, but also using appropriate mythological themes, and historical incidents. The mythological scenes skillfully use the oppositions and complementarities between the gods, goddesses, asuras, and humans defined over ordinary and sacred time and space.

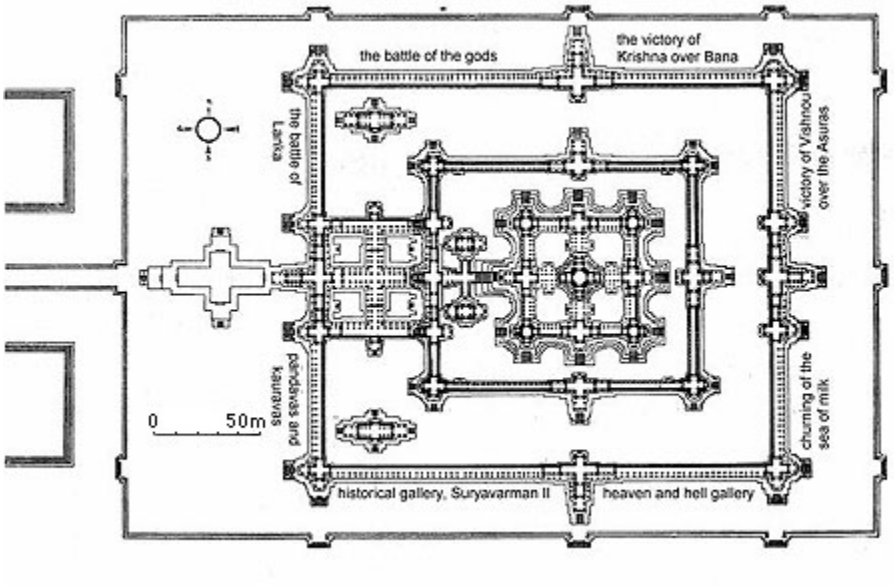


**Figure 2**

Speaking just of numbers, the various lengths and circumferences of units representing the motion of the moon may equal 27, 28, 29 (nakshatras or days of the month), 354 (days of the lunar year), or 360 (tithis of the lunar year). Other lengths represent the solar year (360, 365, or 366) or larger time cycles. For example, the west-east axis represents the periods of the yugas. The width of the moat is 439.78 cubit; the distance from the first step of the western entrance gateway to balustrade wall at the end of causeway is 867.03 cubit; the distance from the first step of the western entrance gateway to the first step of the central tower is 1,296.07 cubit; and the distance from the first step of bridge to the geographic center of the temple is 1,734.41 cubit. These correspond to the periods of 432,000; 864,000; 1,296,000; 1,728,000 years for the Kali, Dvapara, Treta, and Krita yuga, respectively. It has been suggested that the very slight discrepancy in the equations might be due to human error or erosion or sinking of the structure.

In the central tower, the topmost elevation has external axial dimensions of 189.00 cubit east-west, and 176.37 cubit north-south, with the sum of 365.37. This division of the almost exact length of the solar year into unequal halves remained a mystery for some time until it was found to be connected with the Shatapatha Brahmana numbers for the asymmetric motion of the sun.

Over the half-millenia of Khmer rule, the city of Angkor became a great pilgrimage destination because of the notion of Devaraja, that has been explained by Lokesh Chandra as a coronation icon. Jayavarman II (802-850) was the first to use this royal icon. According to Lokesh Chandra (1995), "Devaraja means `King of the Gods' and not `God-King'. He is Indra and refers to the highly efficacious aindra mahabhisheka of the Rigvedic rajasuya tradition as elaborated in the Aitareya-brahmana. It was not a simple but a great coronation, a mahabhisheka. It was of extraordinary significance that Jayavarman II performed a Rigvedic rite, which lent him charismatic authority."

The increasingly larger temples built by the Khmer kings continued to function as the locus of the devotion to the Devaraja, and were at the same time earthly and symbolic representations of mythical Mt. Meru, the cosmological home of the Hindu gods and the axis of the world-system. The symbol of the king's divine authority was the sign (linga) of Shiva within the temple's inner sanctuary, which represented both the axes of the physical and the psychological worlds. The worship of Shiva and Vishnu separately, and together as Harihara, had been popular for considerable time in southeast Asia; Jayavarman's chief innovation was to use ancient Vedic mahabhisheka to define the symbol of government.

To quote Lokesh Chandra further, "The icon used by Jayavarman II for his aindra mahabhisheka, his Devaraja = Indra (icon), became the symbol of the Cambodian state, as the sacred and secular sovereignty denoted by Prajapatishvara/Brahma, as the continuity of the vital flow of the universal (jagat) into the stability of the terrestrial kingdom (raja = rajya}). As the founder of the new Kambuja state, he contributed a national palladium under its Cambodian appellation kamraten jagat ta raja/rajya. Whenever the capital was transferred by his successors, it was taken to the new nagara, for it had to be constantly in the capital."

Angkor Wat is the supreme masterpiece of Khmer art. The descriptions of the temple fall far short of communicating the great size, the perfect proportions, and the astoundingly beautiful sculpture that everywhere presents itself to the viewer. Its architecture is majestic and its representation of form and movement from Indian mythology has astonishing grace and power. The inner galleries of the temple have depiction of the battle of Kurukshetra, procession of King Suryavarman and his ministers, scenes from heavens and hells, churning of the sea of milk, the battle of Vishnu and the asuras, victory of Krishna over Bana, battle of the devas and asuras, Ravana shaking Kailasa with Shiva and Parvati atop, and the battle of Lanka between Rama and Ravana. These and other scenes are drawn with great artistic beauty. No wonder, the temple ranks amongst the greatest creations of human imagination.

**Numbers at Angkor Wat**

The temple has 1300-m north-south axis and 1500-m west-east axis. The temple faces toward the west because that situates it to the east with respect to the worshiper, the appropriate direction for Vishnu who is a solar deity. At the heart of the temple are three rising, concentric galleries. Bordering these is further space, and a rectangular moat. About 40 m in from the moat is a laterite wall, 4.5 m high, with large single entrances from the east, north, and south, and five entrances on the west.

Mannikka has suggested that the Vastupurusha mandala at Angkor Wat forms a grid of 49, rather than the standard of 64 or 81.

Various numbers from the Vedic astronomy are encountered at Angkor Wat as simple counts, or measurements in cubits, or phyeam = 4 cubits. Some of these represent just the basic constants of the system, while others provide specific information related to the orientation of the temple related to the nakshatras and the positions of the planets. For an example of the latter, consider that the length of the north-south axis, door to door, in the sanctuary is 13.41 cubits, which according to Mannikka represents the fact that the north celestial pole is 13.43 degrees above the northern horizon at Angkor. This number is also basic to the second gallery, devoted to Brahma who is ``situated'' at the north celestial pole.

The order in which the planets rose over the eastern horizon at the end of July 1131 is represented in the bas-relief of the northwest corner pavilion: Saturn (Agni), Jupiter (Indra), Venus (Kubera), Mars (Skanda), and Mercury (Varuna).

According to Mannikka, the design of the temple can be seen in three architectural units:

1. Central sanctuary: Mount Meru, with 45 gods, the north celestial pole, the centre of the mandala, the spring equinox, the axis of the earth, Vishnu, Brahma, and King Suryavarman

2 Circumferences: the ecliptic, the moon and lunar periodicity, the constellations, the planets, the celestial year, the krita yuga, the grid of the
mandala, the history of King Suryavarman

3 Axes: the building blocks of time (60, 108), the yuga cycles, the solar year, the lunar year, historical dates in Suryavarman's reign, the mandala and its transformation of time, and, finally, the solar year and lunar time cycles from the vantage point of Mount Meru.

Some basic numbers that we encounter frequently in the architectural plan are given below. For more examples see the book by Mannikka which, however, does not recognize the special place of the altar numbers 78 and 261. Neither does it know the correct significance of the number 108.

21 The earth number shows up as the number of steps to the libraries.

27/28 This count of nakshatras is represented at numerous places; the total inner axes of the sanctuary.

32/33 This represents the number of devas and it is found as the number of pillars, windows and various lengths.

44/45 The number of divinities of the Vastupurusha mandala are shown in the total number of steps, main entrance and flanking Central Western entrances. As 450 cubits, various axial entrances and circumference of gallery.

54 As half of the distance in sun- or moon-diameters to the sun or the moon, 54 cubits or 54 phyeam are encountered several places on the Western bridge and the outer enclosure.

78 The atmosphere number is found in the central cruciform, inner axes as 20.08 phyeam, which equals 80.32 cubits. The 20 steps in several of the stairways to the libraries may also represent the same number divided by 4. Further evidence for that comes from the distance of 19.42 phyeam = 77.68 cubits each library, west-east outer axis. Since books represent the `atmosphere' in reaching the `sky' of knowledge, its use in the context of library is very appropriate.

108 In-and-out circumambulation of four corner towers together; circumambulation of the central Vishnu image from three axial entrances; inner axes of all four corner towers without images; full vertical distance above and below central sanctuary.

130.5/261 As half of the sky number 261, we find it in the circumambulation path to north end chamber, each end gateway. The number is 32.74 phyeam which equals 130.96 cubits.

354 The length of the lunar year in days, it is the distance between naga balustrade and first step at end of walkway to upper elevation.

360 In phyeam, the circumambulation path around the Cruciform Terrace.

366 Solar axes of gallery from walkway on west to bases on each side.

371 This is the solar year in tithis, and it is found in an in-and-out circumambulation of all four corner towers.

**Solar and lunar measurements; Temple Antecedents**

The solar and lunar numbers that show up in the design of the Angkor Wat temple are the number of nakshatras, the number of months in the year, the days in the lunar month, the days of the solar month, and so on. Lunar observations appear to have been made from the causeway.

The division of the year into the two halves of 189 and 176.37 was recently explained by the author as being derived from the Shatapatha Brahmana. In layer 5 of the altar described in the Shatapatha, a division of the year into the two halves in the proportion 15:14 is given (Kak, 1998, 2000). This proportion corresponds to the numbers 189 and 176.4 used at Angkor Wat, where in the central tower the topmost elevation has dimensions of 189 east-west and 176.37 north-south.

The elliptical orbit of the earth together with the fact that the sun is at a slight offset is behind the asymmetry in the sun's orbit. The period from the autumnal equinox to the vernal equinox is smaller than the opposite circuit. The interval between successive perihelia, the anomalistic year, is 365.25964 days which is 0.01845 days longer than the tropical year on which our calendar is based. In 1000 calendar years, the date of the perihelion advances about 18 days. The perihelion was roughly on December 18 during the time of the construction of Angkor Wat; and it was on October 27 during early 2nd millennium BC, the most likely period of the composition of the Shatapatha Brahmana. In all these cases the perihelion occurs during the autumn/winter period, and so by Kepler's 2nd law we know that the speed of the sun in its orbit around the earth is greater during the months autumn and winter than in spring and summer.

During the time of the Shatapatha Brahmana, the apogee was about midway through the spring season, which was then somewhat more than 94 days. The extra brick in the spring quadrant may symbolically reflect the discovery that this quarter had more days in it, a discovery made at a time when a satisfactory formula had not yet been developed for the progress of the sun on the ecliptic.

It is possible that the period from the spring equinox to the fall equinox was taken to be about 189 days by doubling the period of the spring season; 176 days became the period of the reverse circuit.

Why not assume that there was no more to these numbers than a division into the proportions 15:14 derived from some numerological considerations? First, we have the evidence from the Shatapatha Brahmana that expressly informs us that the count of days from the winter to the summer solstice was different, and shorter, than the count in the reverse order. Second, the altar design is explicitly about the sun's circuit around the earth and so the proportion of 15:14 must be converted into the appropriate count with respect to the length of the year. Furthermore, the many astronomical alignments of the Angkor Wat impress on us the fairly elaborate system of naked-eye observations that were the basis of the temple astronomy.

But since precisely the same numbers were used in Angkor Wat as were mentioned much earlier in the Shatapatha Brahmana, one would presume that
these numbers were used as a part of ancient sacred lore. The count between the solstices has been changing much faster than the count between the equinoxes because the perigee has been, in the past two thousand years somewhere between the autumn and the winter months. Because of its relative constancy, the count between the equinoxes became one of the primary `constants' of Vedic/Puranic astronomy.

The equinoctial half-years are currently about 186 and 179, respectively; and were not much different when Angkor Wat temple was constructed. Given that the length of the year was known to considerable precision there is no reason to assume that these counts were not known. But it appears that a `normative' division according to the ancient proportion was used.

As it was known that the solar year was about 365.25 days, the old proportion of 15:14 would give the distribution 188.92 and 176.33, and that is very much the Angkor Wat numbers of 189 and 176.37 within human error. In other words, the choice of these `constants' may have been determined by the use of the ancient proportion of 15:14.

**Astronomy of Altars and Temples**

We now present the Vedic astronomical tradition at the basis of Angkor Wat and the other Indian Hindu temples. In a series of publications I have shown (Kak, 1992, 1993, 1995, 2000) that the Vedic altars had an astronomical basis related to the reconciliation of the lunar and solar years. The fire altars symbolized the universe and there were three types of altars representing the earth, the space and the sky. The altar for the earth was drawn as circular, whereas the sky (or heaven) altar was drawn as square. The geometric problems of circulature of a square and that of squaring a circle are a result of equating the earth and the sky altars.

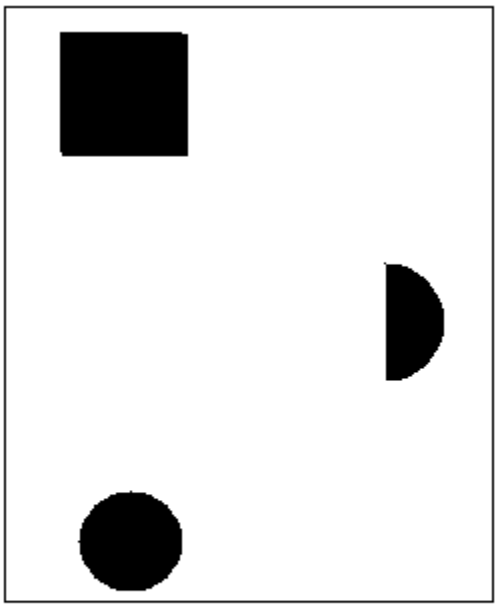

**Figure 3:** The three Vedic altars

The fire altars were surrounded by 360 enclosing stones, of these 21 were around the earth altar, 78 around the space altar and 261 around the sky altar.

In other words, the earth, the space, and the sky are symbolically assigned the numbers 21, 78, and 261. Considering the earth/cosmos dichotomy, the two numbers are 21 and 339 since cosmos includes the space and the sky.

The main altar was built in five layers. The basic square shape was modified to several forms, such as falcon and turtle. These altars were built in five layers, of a thousand bricks of specified shapes. The construction of these altars required the solution to several geometric and algebraic problems.

Two different kinds of bricks were used: the special and the ordinary. The total number of the special bricks used was 396, explained as 360 days of the year and the additional 36 days of the intercalary month. Two kinds of day counts: the solar day, and tithi, whose mean value is the lunar year divided into 360 parts. Considering the altar by layers, the first has 98, the second has 41, the third has 71, the fourth has 47 and the fifth has 138. The sum of the bricks in the fourth and the fifth layers equals 186 tithis of the half-year. The number of bricks in the third and the fourth layers equals the integer nearest to one third the number of days in the lunar year, and the number of bricks in the third layer equals the integer nearest to one fifth of the number of days in the lunar year, and so on.

The number of ordinary bricks equals 10,800 which equals the number of muhurtas in a year (1 day = 30 muhurtas), or equivalently the number of days in 30 years. Of these 21 go into the garhapatya, 78 into the eight dhishnya hearths, and the rest go into the ahavaniya altar.

The main altar was an area of 7 1/2 units. This area was taken to be equivalent to the nominal year of 360 days. Each subsequent year, the shape was to be reproduced with the area increased by one unit.

Three different years were considered: (1) nakshatra, or a year of 324 days (sometimes 324 tithis) obtained by considering 12 months of 27 days each, where this 27 is the ideal number of days in a lunar month; (2) lunar, which is a fraction more than 354 days (360 tithis); and (3) solar, which is in excess of 365 days (between 371 and 372 tithis).

A well-known altar ritual says that altars should be constructed in a sequence of 95, with progressively increasing areas. The increase in the area, by one unit yearly, in building progressively larger fire altars is 48 tithis which is about equal to the intercalation required to make the nakshatra year in tithis equal to the solar year in tithis. But there is a residual excess which in 95 years adds up to 89 tithis; it appears that after this period such a correction was made. The 95 year cycle corresponds to the tropical year being equal to 365.24675 days. The cycles needed to harmonize various motions led to the concept of increasing periods and world ages.

The number of syllables in the Rigveda confirms the textual references that the book was to represent a symbolic altar. According to various early texts, the number of syllables in the Rigveda is 432,000, which is the number of muhurtas in forty years. In reality the syllable count is somewhat less because certain syllables are supposed to be left

unspoken. The verse count of the Rigveda can be viewed as the number of sky days in forty years or 261 x 40 = 10,440, and the verse count of all the Vedas is 261 x 78 = 20,358.

The Brahmanas and the Shulbasutras tell us about the altar of chhandas and meters, so we would expect that the total Rigvedic hymn count of 1017 and the group count of 216 have particular significance. Owing to the pervasive tripartite ideology of the Vedic books we choose to view the hymn number as 339 x 3. The tripartite ideology refers to the consideration of time in three divisions of past, present, and future and the consideration of space in the three divisions of the northern celestial hemisphere, the plane that is at right angle to the earth's axis, and the southern celestial hemisphere. The number 339 is simply the number of disks of the sun or the moon to measure the path across the sky: pi times 108 is approximately 339. The number 216 represents the distance to the sky, which was twice the distance of 108 to the sun. The Rigvedic code then expresses a fundamental connection between the numbers 339 and 108.

As mentioned before, the number 108 is actually the average distance that the sun is in terms of its own diameter from the earth; likewise, it is also the average distance that the moon is in terms of its own diameter from the earth. It is owing to this marvelous coincidence that the angular size of the sun and the moon, viewed from the earth, is about identical. It is easy to compute this number. The angular measurement of the sun can be obtained quite easily during an eclipse. The angular measurement of the moon can be made on any clear full moon night.

An easy check on this measurement would be to make a person hold a pole at a distance that is exactly 108 times its length and confirm that the angular measurement is the same. Nevertheless, the computation of this number would require careful observations. Note that 108 is an average and due to the ellipticity of the orbits of the earth and the moon the distances vary with the seasons. It is likely, therefore, that observations did not lead to the precise number 108, but it was chosen as the true value of the distance since it is equal to 27 x 4, because of the mapping of the sky into 27 nakshatras. In reality, the diameter of the sun is also about 108 times the diameter of the earth. But it is unlikely that the Vedic sages knew of this fact.

The temple is considered in the image of the Cosmic Purusha, on whose body is displayed all creation in its materiality and movement. Paradoxically, the space of the Purusha (Rigveda 10.90) is in the sanctuary only ten fingers wide, although he pervades the earth. The prototype of the temple is the Agnikshetra, the sacred ground on which the Vedic altars are built. The Agnikshetra is an oblong or trapezoidal area on which the fire altars are built. Tripathi (1990) has argued that the agnichayana sacred ground provides the prototype, because in it is installed a golden disc (rukma) with 21 knobs or hangings representing the sun with a golden image of the purusha on it. Tripathi shows that the detailed ritual includes components that would now be termed Shaivite, Vaishnava, or Shakta. In Nachiketa Agni, 21 bricks of gold are placed one top of the other in a form of shivalinga. The disk of the rukma, which is placed in the navel of the altar on a lotus leaf

is in correspondence to the lotus emanating from Vishnu's navel which holds the universe. Several bricks are named after goddesses, such as the seven krittikas.

The temple is the representation of the cosmos both at the level of the universe and the individual, making it possible for the devotee to get inspired to achieve his own spiritual transformation. The purusha placed within the brick structure of the altar represents the consciousness principle within the individual. It is like the relic within the stupa.

Complementing the tradition of the Vedic ritual was that of the munis and yogis who lived in caves and performed austerities. From this tradition arose the vihara, where the priests lived. The chaitya hall that also housed the stupa may be seen as a development out of the agnichayana tradition where within the brick structure of the altar were buried the rukma and the golden man (see Shatapatha Brahmana 7.4.1 for details; 7.4.2 describes how above the man is placed a perforated brick which encases it like a casket).

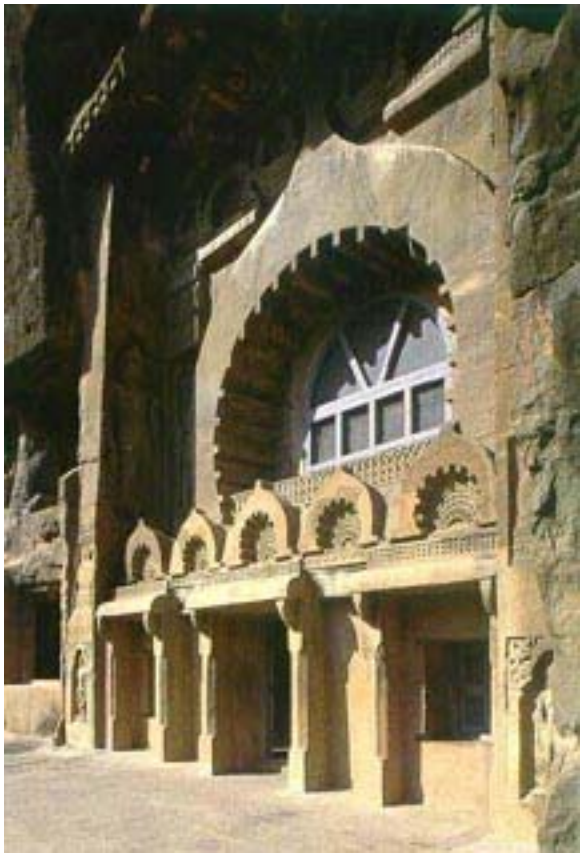

**Figure 4.** Chaitya cave 9 at Ajanta

The rock-cut chaityas represent a variant form of a tradition that was usually implemented using wood or brick. The evidence for that comes from the very nature of the structure with its beams. A conjectured wooden chaityagriha is shown in Figure 5. The mature temple is thus an organic development of the Vedic tradition. Further evidence for wooden structures is provided by a painting from Ajanta given in Figure 6.

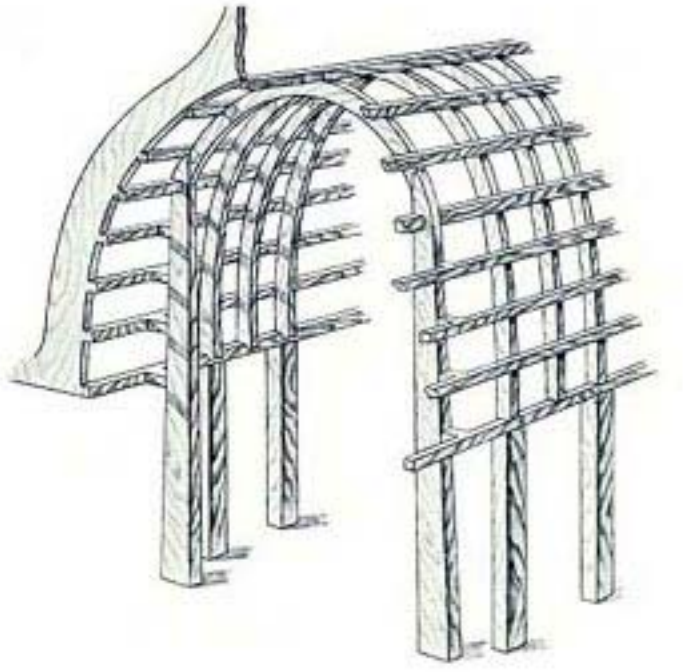

**Figure 5.** A conjectural reconstruction of a wooden chaityagriha (from Percy Brown's Indian Architecture, 1942)

**Figure 6.** Painting of a wooden house in Ajanta

**Figure 7.** Chaitya Cave in Karli (courtesy Takeo Kamiya)

The rock-cut temples preserve features of earlier structures that have not survived. For example, we see the pointed arch of the chaitya halls that is not seen in other monuments on the ground made of brick or stone until the 8th or 9th century. In the words of Susan Huntington (1985) regarding the Lomash Rishi cave: "The sophisticated woodworking techniques recorded in the cave makes it certain that ancient India had an elaborate and lengthy history of wooden architecture prior to the Maurya period, though some of the forms are only preserved then."

**Figure 8.** Lomash Rishi Cave

The temple construction begins with the Vastupurusha mandala, which is a yantra, mostly divided into 64 (8 x 8) or 81 (9 x 9) squares, which are the seats of 45 divinities. Brahma is at the centre, around him 12 squares represent the Adityas, and in the outer circle are

28 squares that represent the nakshatras (Figure 9). The Vastumandala with its border is the place where the motions of the sun and the moon and the planets are reconciled. It is the Vastu in which the decrepit, old Chyavana of the Rigveda 1.116.10 asks his sons to put him down so that he would become young again. Chyavana is the moon and Sukanya, whom he desires, is the sun.

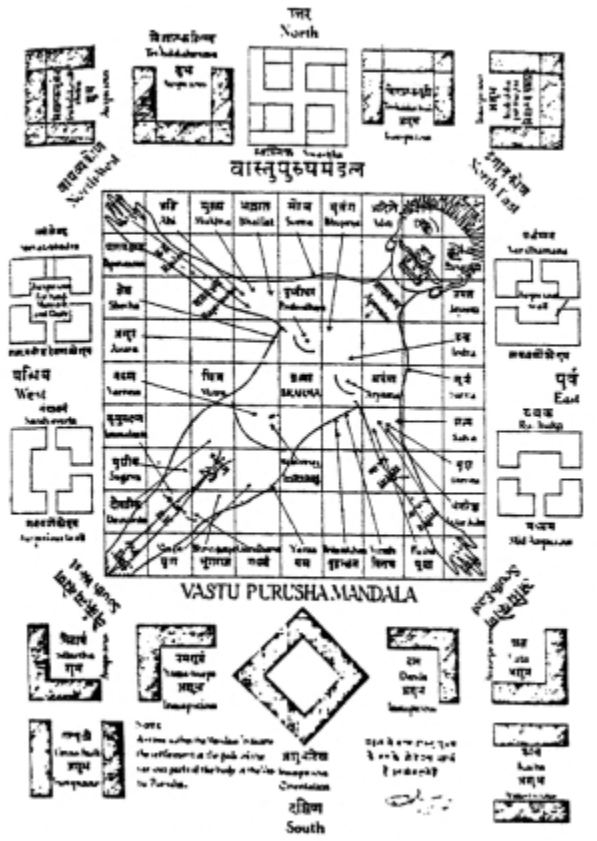


**Figure 9.**

In the basic Vedic scheme the circle represents the earth and the square represents the heavens or the deity. But the altar or the temple, as a representation of the dynamism of the universe, requires a breaking of the symmetry of the square. As seen clearly in the agnichayana and other altar constructions, this is done in a variety of ways. Although the main altar might be square or its derivative, the overall sacred area is taken to be a departure from this shape. In particular, the temples to the goddess are drawn on a rectangular plan. In Shiva or Vishnu temples, which are square, change is represented by a play of diagonal lines. These diagonals are essentially kinetic and are therefore representative of movement and stress. They embody the time-factor in a composition.

In the Shilpa Prakasha} 1.90-106, a 9th-12th century Orissan temple architecture text, Ramachandra Kaulachara describes the Yogini Yantra for the layout of the goddess temple. Alice Boner writes (in Kaulacara, 1966),

> [The Devi temples] represent the creative expanding forces, and therefore could not be logically be represented by a square, which is an eminently static form. While the immanent supreme principle is represented by the number ONE, the first stir of creation initiates duality, which is the number TWO, and is the producer of THREE and FOUR and all subsequent numbers up to the infinite.

The dynamism is expressed by a doubling of the square to a rectangle or the ratio 1:2, where the garbhagriha is now built in the geometrical centre. For a three-dimensional structure, the basic symmetry-breaking ratio is 1:2:4, which can be continued further to another doubling.

The constructions of the Harappan period (2600-1900 BC) appear to be according to the same principles. The dynamic ratio of 1:2:4 is the most commonly encountered size of rooms of houses, in the overall plan of houses and the construction of large public buildings. This ratio is also reflected in the overall plan of the large walled sector at Mohenjo-Daro called the citadel mound. It is even the most commonly encountered brick size.

There is evidence of temple structures in the Harappan period in addition to iconography that recalls the goddess. Structures dating to 2000 BC, built in the design of yantras, have been unearthed in northern Afghanistan. There is ample evidence for a continuity in the religious and artistic tradition of India from the Harappan times, if not earlier. These ideas and the astronomical basis continued in the architecture of the temples of the classical age. Kramrisch has argued that the number 25,920, the number of years in the precessional period of the earth, is also reflected in the plan of the temple.

As a representation of the macrocosm, change in the temple is described in terms of the motions of the heavenly bodies. According to Alice Boner (Kaulacara, 1966):

> But in asmuch as it incorporates in a single synthesis the unequal courses of the sun, the moon and the planets, it also symbolizes all recurrent time sequences: the day, the month, the year and the wider cycles marked by the recurrence of a complete cycle of eclipses, when the sun and the moon are readjusted in their original positions, a new cycle of creation begins.

The Hindu temple, as a conception of the astronomical frame of the universe, serves the same purpose as the Vedic altar, which reconciled the motions of the sun and the moon. The progressive complexity of the classical temple was inevitable given an attempt to bring in the cycles of the planets and other ideas of the yugas into the scheme.

**Concluding Remarks**

This paper has shown how the Hindu temple represents the outer and the inner cosmos. The outer cosmos is expressed in terms of various astronomical connections between the temple structure and the motions of the sun, the moon, and the planets. The inner cosmos is represented in terms of the consciousness at the womb of the temple and various levels

of the superstructure that correspond to the states of consciousness. The position of the gods in the vastupurushamandala within the temple is a symbolic representation of the spatial projections of the cosmic purusha in his own body.

The temple must be seen as a structure that gives us considerable information about the science and cosmology of its times. Regarding technology behind the constructions, one must look at each structure separately and see how it fits in the evolving techniques of design and artistic representation across the region.

**References**


Boner, A., 1962. Principles of Composition in Hindu Sculpture. E.J. Brill, Leiden, 1962, page 27.

Huntington, S., 1985. The Art of Ancient India. Weatherhill, New York.

Kak, S., 1992. ``Astronomy of the Vedic altars and the Rigveda", Mankind Quarterly, 33, 43-55.

Kak, S., 1993. ``Astronomy of the Vedic Altars," Vistas in Astronomy, 36, 117-140.

Kak, S., 1995. ``The astronomy of the age of geometric altars," Quarterly Journal of the Royal Astronomical Society, 36, 385-396.

Kak, S., 1998. ``The sun's orbit in the Brahmanas," Indian Journal of History of Science, 33, 175-191.

Kak, S., 1999. ``The solar equation in Angkor Wat," Indian Journal of History of Science, vol. 34, pp. 117-126.

Kak, S., 2000. The Astronomical Code of the Rgveda. Munshiram Manoharlal, New Delhi.

Kak, S., 2002. The Gods Within. Munshiram Manoharlal, New Delhi.

Kamiya, T. 2002. Lycian influence to Indian cave temples. http://www.ne.jp/asahi/arc/ind/lycia/liki_eng.htm

Kaulacara, R., 1966. Silpa Prakasa. Boner, A. and Rath Sarma, S. (eds.). E.J. Brill, Leiden, 1966.

Kramrisch, S., 1946. The Hindu Temple. The University of Calcutta, Calcutta, 1946; Motilal Banarsidass, Delhi, 1991, page 35-36.

Lokesh Chandra, 1995. ``Devaraja in Cambodian history", In Cultural Horizons of India. Aditya Prakashan, New Delhi.

Mannikka, Eleanor, 1996. Angkor Wat: Time, Space, and Kingship. Univ of Hawaii Press, Honolulu

Millar, F.G. and Kak, S., 1999. ``A Brahmanic fire altar explains a solar equation in Angkor Wat," Journal of the Royal Astronomical Society of Canada, vol. 93, pp. 216-220.

Tripathi, V., 1990. Agnicayana. Sampurnanand Sanskrit University, Varanasi.

Volwahsen, A., 2001. Cosmic Architecture in India. Prestel, New York, and Mapin Publishing, Ahmedabad.