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Candi, space and landscape : a study on the distribution, orientation and spatial organization of Central Javanese temple remains

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CHAPTER 6

Temple Orientation

The aim of the present book is to address a theme – that of space – and to use temple remains as a means to determine how the dignitaries and the architects who erected the temples of Central Java structured the space around them, from a practical as well as from a conceptual point of view. In the previous chapters, I have mainly been looking at location of temples. I have, to some extent, managed to link temple distribution patterns with settlements, communication nodes and remote sacred places, drawing conclusions regarding the extent of the territory and its economical structure.

In the present chapter, though correlation with distribution patterns is still a concern, the introduction of data concerning temple orientation will lead us to address more specifically the question of the relationship between temple orientation, landscape markers, religious architectural traditions, and the conceptualized perception of space. So, we will focus on if – and how – orientation is used to strengthen the relation between individual temples and specific landscape markers (rivers, springs, hilltops, mountains), on the canons for temple orientation expressed in Hindu-Buddhist architectural and textual traditions, and on the perception of space at work behind temple orientation.

For the sake of clarity, I will first discuss the general orientation of the temple remains, while the exact deviation from geographical north will be approached at the end of the chapter. I will first present the data, consider possible correlations with distribution patterns and try to determine whether temple orientation was influenced by the relative position of rivers and mountains. Then, I will briefly discuss the Javanese situation in the light of other Hindu-Buddhist traditions and try to understand to what extent the specificities of Central Javanese architecture convey a local perception of space.

General Orientation of Central Javanese temple remains

Data regarding temple orientation

To begin with, I would like to underline the difficulty of carrying out a study on temple orientation. To analyze distribution patterns we can rely on a temple corpus of more than 200 shrines, but information concerning their orientation is far more scarce: given the poor state of preservation of many remains, orientation is known for only 59 sites. The consequence of the limited extent of the data is that drawing definitive conclusions is difficult – and can even be hazardous. A few useful observations and hypotheses may nevertheless be made.

As a general rule, temples are oriented in relation to the cardinal points.¹ Furthermore they are directed either to the east or to the west, and almost never face north or south (Table 19).² Contrary to what happens in most other Hindu-Buddhist

¹ The only exceptions are candi Mendut and Pawon, which face northwest.

² There is one possible exception, namely candi Argakusuma. This temple complex was located on the northern slope of Mt Ungaran, in the district of Kendal. Verbeek mentions that at least one shrine faced north (Verbeek 1891:88). Unfortunately, there is no information concerning the orientation of the other buildings. As the site was backed by Mount Ungaran, its northern orientation is most probably an adaptation to local topography. It is nevertheless unique in Central Java. At Gedong Songo, although located in a similar location on the southern slopes of Mount Ungaran, none of the shrines faces south.

architectural traditions, Central Javanese temples do not especially favour the east: out of 59 remains of which the orientation is known, 24 face east, while 35 face west. In the Yogyakarta-Klaten region, west-facing temples are almost twice as numerous as east-facing ones.³

Table 19: General orientation of Central Javanese temples

<i>Orientation</i>	<i>Number</i>	<i>Names of the sites</i>
East	24	Argapura, Bima, Borobudur, Bubah, Bumen, Butak Wetan, Cebongan, Dipan, Dukuh, Gebang, Gunung Wukir, Kalasan, Kedulan, Loro Jonggrang, Lumbung (Prambanan), Merak, Ngawen, Ngempon, Perot, Retno, Samberan, Sari, Selogriyo, Sewu.
West	35	Asu, Banon, Banyunibo, Barong, Dieng, ⁴ Gajah, Gana, Gampingan, Gedong Songo, ⁵ Gunung Sari, Ijo, Jetis (Cangkringan), Kadisoka, Kaliworo, Kalongan, Karangnongko, Lawang, Lumbung (Magelang), Mantup, Miri, Morangan, Ngampin, Palgading, Pendem, Plaosan Kidul, Plaosan Lor, Pringapus, Ratu Boko, Risan, Sambisari, Sentono, Singo, Sojiwan, Sumur Songo, Tinjon.

Temple orientation and distribution patterns

Distribution of east- and west-facing temple does not seem to answer to any patterns. Both orientations are found all over Java; west-facing temples predominate in southern Central Java though (Figure 24, Table 20). Nevertheless, there appears to be some – though limited - correlation between orientation and the different clusters of temples identified in the previous chapters. We have seen earlier indeed that, among Central Javanese temples, two main groups emerge: the first one is composed of shrines dispersed through the rich agricultural plains of southern Central Java – and probably directly linked to settlements, while the second group consists of a more limited number of temples, clustered in high, remote places. If we cross these distribution patterns with data on temple orientation, it appears that the first group counts almost as many west-facing temples as east-facing ones, but that in the second group westward orientation clearly prevails. It is noteworthy that, if topography may explain the orientation of temples located on the Pegat-Ijo hills and that of *candi* Asu, Lumbung, Pendem and Selogriyo, it can not account for the westward orientation of Dieng and Gedong Songo. At Gedong Songo, as well as at Dieng, temple orientation is not clearly related to any landscape marker. The Dieng plateau is literally encircled by mountains and the orientation of the temples only very loosely relates to the position of the volcanoes. At Gedong Songo the location of Mount Ungaran, to the north of the temple group, does not seem to have any influence on the orientation of the various shrines – all the main temples face west and no single mountain is visible to the east. This could suggest that west actually was the favoured orientation for temples located in high or remote areas, the direction of predilection unless topography did not allow it (as in the case of Selogriyo). This adds to the singularity of these shrines which, as we have seen, already distinguish themselves for not being related to settlements.

³ The numbers are 12 and 22 respectively.

⁴ Arjuna group, Dwarawati and Gatotkaca.

⁵ Main temples.

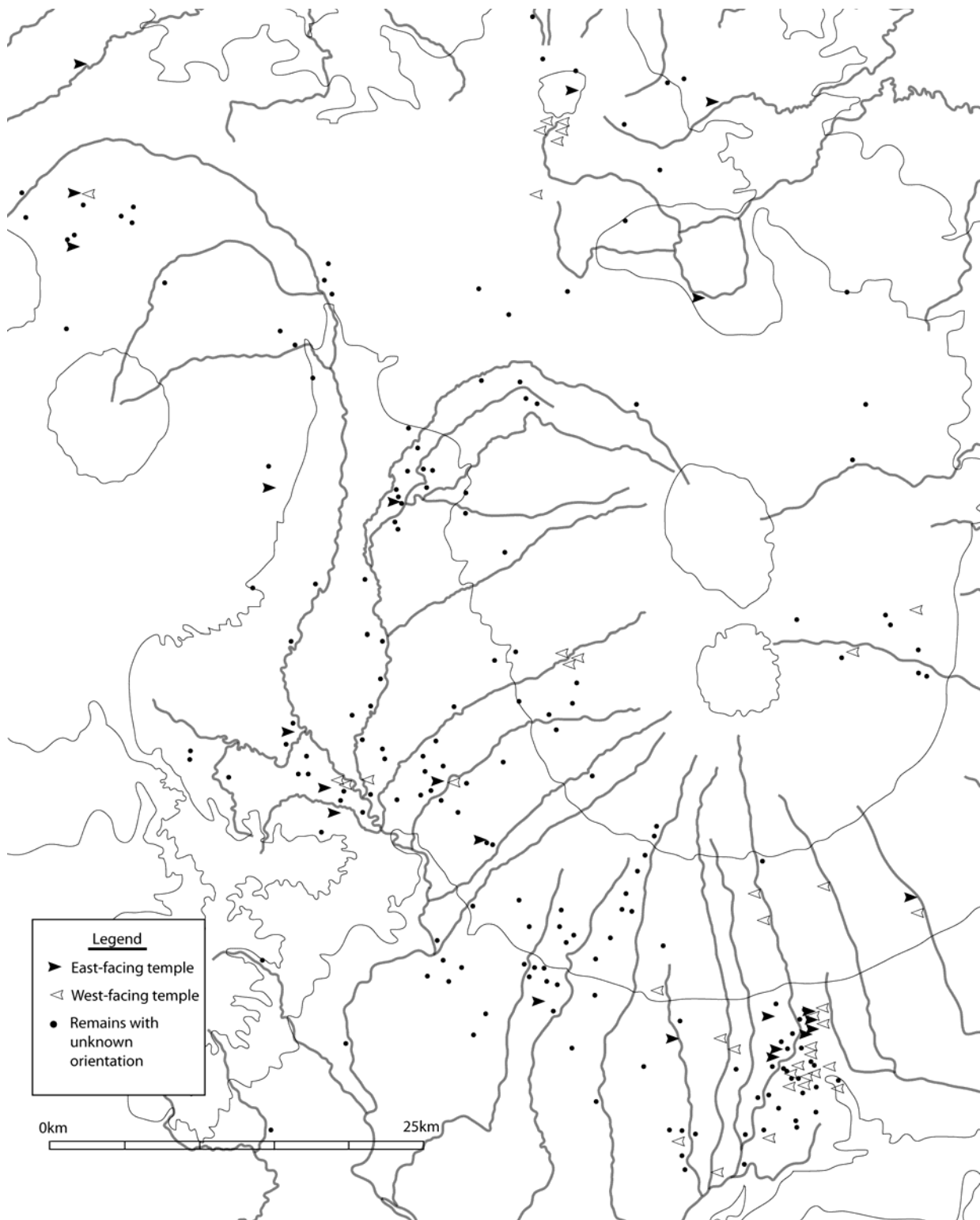


Figure 24: Temple remains, general orientation

Table 20: General orientation and region

<i>Orientation</i>	<i>Region</i>	<i>Number</i>	<i>Sites</i>
East	North	9	Argapura, Batur, Bima, Bumen, Butak Wetan, Dukuh, Ngempon, Perot, Retno.
	Centre	6	Borobudur, Dipan, Gunung Wukir, Ngawen, Samberan, Selogriyo.
	South	11	Bubrah, Cebongan, Gebang, Kalasan, Kedulan, Lumbung, Loro Jonggrang, Merak, Sari, Sewu.
West	North	4	Dieng, Gedong Songo, Ngampin, Pringapus.
	Centre	4	Asu, Banon, Lumbung, Pendem.
	South	23	Banyunibo, Barong, Gajah, Gampingan, Gana, Ijo, Jetis (Cangkringan), Kadisoka, Kaliworo, Kalongan, Karangnongko, Mantup, Miri, Morangan, Palgading, Plaosan Kidul, Plaosan Lor, Ratu Boko, Risan, Sambisari, Sentono, Sojiwan, Tinjon.

The influence of natural environment upon temple orientation

Let us now try to find if there is some correlation between temple orientation and natural surroundings. In East Java and Bali, it has long been acknowledged that many temples were oriented towards a distant mountain peak (Patt 1979:60).⁶ So, it is possible that, in Central Java as well, natural features, and especially topography, have played an important role in the choice of orientation.

It is quite obvious, as noted above, that topography influenced the orientation of several temples located in high or remote areas. This is clear in the Prambanan area: almost all the temples located on the northern tip of Gunung Kidul – and a great part of those dotting the Sorogeduk plain – face west.⁷ In this area, the hills form a sort of crescent encircling the eastern half of the Sorogeduk plain. Furthermore, the eastern façade of Gunung Kidul appears as a steep cliff that offers no natural passage, while the hills naturally slope down to the west. On the east-west axis, the only access to the hills dominated by Mount Pegat-Ijo is *via* the west, following the natural slope of the hills.⁸ For topographical reasons, temple compounds could only be approached from the west and it is no surprise that they face this direction.

Whatever the role of natural elements, this does not mean that such an orientation was without symbolic value. First of all, although knowing that temples built there would have to face west, Javanese architects still considered the site suitable. This can mean that in their perspective east and west were both auspicious. It may also be the case that physical settings had more influence than other prescriptions; temples were deliberately oriented so as to have their backs against the mountain. As a matter of fact, temples are not built on the summit but due west of it, so that the devotee praying in front of the temple is actually facing the mountain. Similarly, Selogriyo, Asu, Lumbung, Pendem and Perot are built quite high and in the vicinity of volcanic peaks,

⁶ Unfortunately, she does not list buildings that are mountain-oriented. The only example she gives is *candi* Sanggariti, the main axis of which is more or less in line with the peak of Mount Arjuna (Patt 1979:59).

⁷ West-facing temples of the area of Mount Pegat-Ijo and of the Sorogeduk plain are Arca Ganeca, Banyunibo, Barong, Gajah, Ijo, Miri, Ratu Boko, Sentono, Singo and Tinjon. The information is unknown for the following remains: Abang, Grebyangan, Keblak, Krapyak, Ngaglik, Polangan, Polengan, Sawo and Watugudig. No east-facing temple has ever been reported in the area.

⁸ Small paths climbing the hills also exist to the north and south of the Ratu Boko plateau, perpendicular to the general slope of the terrain. As a northward or southward orientation was however apparently not considered suitable for temple, the choice was limited to east and west.

opening toward the valley and turning their backs on the mountain – though not exactly on its peak.

Outside the area of the Sorogeduk plain, Mount Pegat-Ijo and the few shrines mentioned above, temple orientation is not as homogeneous and does not show any clear interference of topographical features. Could the orientation of temples situated in plains be influenced by other elements? Although no absolute rule transpires, it appears that rivers could well have influenced temple orientation. If one excludes temples of the Sorogeduk valley and those built on the Mount Pegat-Ijo hills, and compares temple orientation with the relative position of the rivers, it seems that, at least in southern Central Java, temples and rivers entertain some kind of relationship. In this region, whatever the temple orientation (east or west), in 18 out of 23 remains, the river is located at the rear of the building. In only 5 cases, the temple faces the river⁹ (Table 21). It is of course quite logical that temples built directly near a river would not face the water, since they are more easily approached through dry lands than *via* a bridge. Nevertheless, one has to wonder whether the location of the river at the rear of the temple did not have another significance, going beyond its pragmatic origin. As a temple backed by a mountain could indicate a certain form of mountain worship, then the placing of a religious building in front of a river could suggest that the river played a more significant role than that of a mere ablution tank. However, we have to note that in areas where rivers do not flow from north to south, temples do not turn their back to rivers.

In other parts of Central Java, data are scarcer and the temple-river relationship appears less obvious. The 17 temple remains for which we know orientation are located near rivers. Among those, 5 are located along rivers running east-west (or reverse) and hence do not face to or away from a waterway. In the remaining 12 sites, the river is located at the rear of the temple in 8 cases and at the front in 5 cases (Table 22).

Table 21: Temple orientation and rivers in southern Central Java

Orientation	River position	Back	Sites	Amount
East	East		Gebang, Kalasan, Merak, Sari.	4
East	West	X	Bubrah, Gampingan, Jetis (Cangkring), Kedulan, Loro Jonggrang, Lumbung, Sewu.	7
West	West		Sambisari.	1
West	East	X	Jetis (Ngemplak), Kadisoka, Kaliworo, Kalongan, Karangnongko, Mantup, Morangan, Palgading, Plaosan Kidul, Plaosan Lor, Sojiwan.	11

Table 22: Temple orientation and rivers in the Progo valley and peripheral areas

Orientation	River position	Back	Sites	Amount
East	East		Ngawen, Samberan.	2
East	West	X	Gunung Wukir, Retno.	3
East	Other		Ngempon (S), Selogriyo (NW).	2
West	West		Mendut, Ngampin.	2
West	East	X	Banon, Gunung Sari, Lumbung, Pawon, Sumur Songo.	5
West	Other		Asu (N), Lawang (N), Pendem (N).	3

⁹ Among those five temples, Gebang is a peculiar case, given that, although the nearest river is located east of the temple (thus in front of it), the site is close to a confluence, so that there is also a river to the west (back).

We can tentatively conclude from these observations that, although the location of rivers probably played a role in the orientation of certain temples, it was, in general, less essential than the east-west orientation. In that part of the landscape where rivers run east-west, temple orientation was never adapted, so the building would turn its back to the river. Only in areas where waterways follow a north-south course do they influence temple orientation.

The influence of other factors on temple orientation is striking at Gedong Songo. Although the site was obviously chosen for its impressive natural settings, neither the peak of Mount Ungaran to the north nor the sulphurous springs that flow in the small canyon right in the middle of the temple complex seems to have had an impact on temple orientation. The main buildings all face west, that is to say half of them overlook the canyon while the other half turn their backs to the spring.

General temple orientation in Hindu-Buddhist building traditions

Neither regional trends nor landscape features can explain completely satisfactorily the orientation, but what could then be the significance of a west- or eastward orientation; and is the situation in Central Java comparable to what we know from other Hindu-Buddhist countries?

Actually, variance in temple orientation is not unique to Java. In India, although east is predominant, some buildings do face west,¹⁰ and others even north.¹¹ Early Khmer and Cham buildings do not systematically face east either. The most ancient temple group of My-Son (My-Son E1), for example, faces west. Similarly, several pre-Angkorian buildings face west (such as *prasat* Ta Nien Kang Leach at Phnom Bayang, or *prasat* Punriy in Kompong Chnang) or north (such as Phnom Da and Ashram Maha Rosei). In Khmer architecture, however, it seems that from the Sambor Prei Kuk style onwards, temple orientation was standardized and east became the favoured direction, with almost all the main temples facing the rising sun.¹²

In India, as well as in mainland Southeast Asia, west-facing buildings were thus less numerous than east-facing ones.¹³ Central Javanese architectural traditions show on the contrary no singular preference for east over west at any point of its history, since east and west facing temples are found in its early as well as late period.¹⁴ In

¹⁰ West-facing temples are found in both north and south Indian architectural traditions. Here are some examples of west-facing Indian temples from the 5th to the 8th centuries: Pārvaṭī temple (Nacnā), Śiva temple (Sākōr), Rudra-Narasimha temple (Rāmtēk), Khimēśvara Mahādeva temple (Khimēśvara), Vindhyavāsinī temple (Śrinagar), Indal temple (Kharōd), Pāraśurāmēśvara, Śatrughnēśvara and Uttarēśvara temples (Bhuvanēśvara), Paśabhadra and Huccimalli temples (Aihole), Kailāsa temple (Ēllōrā), Pinākapāni temple (Mahākūṭa), Mahānandīśvara temple (Mahānandī), Draupadī ratha, Arjuna ratha, Dharmarāja ratha and Olakkannēśvara temple (Mahābalipuram), Vālīśvara temple and Vaikuṇṭha-perumāl (Kāñcīpuram) and the Veṭuvaṅkōvil temple (Kaḷugumalai) (See Dhaky, Meister 1983-1998).

¹¹ The Maniyār Maṭh temple at Rājgir (c.500 A.D.), the temple n° 1 at Mākangañj (625-650 A.D.), the temple n° 6 at Khimēśvara and the Śiva temple at Dhōbinī, for example, all face north (see Dhaky, Meister 1983-1998).

¹² Well-known exceptions are Angkor Wat, facing west, and Phimai, facing south.

¹³ There is, to my knowledge, no specific study on the orientation of Indian temples. To arrive at this conclusion, I have compiled data from published plans and temple description, using as a base the Encyclopaedia of Indian Temple Architecture.

¹⁴ For the early period, candi Arjuna, on the Dieng plateau, faces west, while Borobudur is oriented eastward. Among more recent buildings, Loro Jonggrang faces east while Plaosan faces west. As Borobudur and Plaosan are both Buddhist and Dieng and Loro Jonggrang Hindu, it is not very likely that the preference for east or west is also linked to the religious affiliation.

other words, even though west-facing temples occur in other regions of the Hindu-Buddhist world, the high proportion of such buildings is probably typical to Java.

This state of affairs, though, is not in contradiction with the written tradition inherited from India: Indian treatises on architecture do not say that a sanctuary should face east. According to these treatises, numerous factors may influence the orientation of a temple, among others the position of the building within the settlement, or the god to whom the temple is dedicated. The Indian texts offer a large variety of opinions, and no standard orientation emerges from them.

The *Bhaviṣya-purāṇa* (chap. VIII), for example, recommends that the temple face east, but that, if this is not possible, west is also a good choice (Arora 1972:192). The *Bṛhat-saṃhitā* (*Bṛhat-saṃhitā* LVI, 10) states it even more blankly, stating that “the central or main gate would be auspicious if situated in one of the four cardinal directions” (Ramakrishna 1981:538).

According to the *Mānasāra*, the temple of Viṣṇu should face the village, while that of Narasiṃha should have its back to the village. The temple of Śiva should face outward, except if it is built in the east or west, in which case it should face the village. As for the temples of the other gods, they may face any direction (*Mānasāra* IX).

For the *Mayamata*, the temple of Īśa may face either east or west, as long as it is turned outwards. The temple of Viṣṇu may face any direction and that of Śiva must face west (*Mayamata* IX: 84-85a).

In the *Agni-purāṇa* (XLI: 36), one reads that “the door of the temple at the centre of the village or on the eastern part should face west (...). In the southern, northern and western parts (the door) should face the east” (Gangadharan 1984:113).

Indian treatises on architecture, or at least a good number of them, thus give much freedom to the architect in the choice of orientation, but Central Javanese temples face only east or west, never north or south. The reason for this may be sought in the fact that only part of the Indian tradition reached Java: the principles established in the *Agni-purāṇa* would have been known, while the traditions expressed in the *Mānasāra* or in the *Mayamata*, for example, would not. The first text shows indeed a preference for east and west, while the two later ones consider also the possibility of north and south facing buildings. It does not however explain why Central Javanese architects did not interpret the texts as their Indian colleagues, i.e. in giving the preference to the east, direction of the rising sun.

The sun and the axes: space in Central Javanese inscriptions

Whatever tradition was received, Javanese temples most certainly reflect the way Javanese people structured the space around them. In the case of temple orientation, inscriptions may enlighten our understanding of architecture and provide us with a good starting point from which to explore the concept of space in ancient Java. The Indian conception of space relies on a movement, that of the *pradakṣiṇapatha* (clockwise circumambulation), which is an essential element of Hindu-Buddhist worship. In India, devotees have to turn clockwise around temples and idols, leaving them to the right. *Pradakṣiṇapatha* is the path of the sun and, therefore, the movement of life. It is best started in the east, to replicate the course of the sun from sunrise to sunset. Hence the numerous east-facing temples found in India. However, the essence of the *pradakṣiṇapatha* is the movement itself rather than its starting point. The opposite of *pradakṣiṇa* is *prasavya*, the counter clockwise circumambulation, which is associated with destruction and funerary rituals.

Pradakṣiṇapatha was also part of Hindu and Buddhist rituals in Central Java, as testified by reliefs¹⁵ and epigraphic data. The earliest inscription referring to the *pradakṣiṇapatha* is the inscription of Gaṇḍasuli II (810?). It states that “throughout all the kingdom, hither and yon, to the east, south, west and north, all about, everyone praises the good works of the *dang karayan* Partapan” (Wisseman Christie 2002-2004: n° 15). The cardinal points are here enumerated in a clockwise order, suggesting the movement of the *pradakṣiṇapatha*.

From the mid 9th century onwards, numerous inscriptions end with a curse formula, in which gods are invoked to protect the new *sīma*. The directions are mentioned clockwise in the following inscriptions (Table 23): Kañcana (860 A.D.), Poh Dulur (890 A.D.), Kubukubu (905 A.D.), Mantyaṣiḥ I (907 A.D.), Wukajana (908-910 A.D.), Kuṭi (898-910 A.D.), Sangguran (928 A.D.), Kampak (928 A.D.) and Air Kali (928-929 A.D.).¹⁶ In all these inscriptions, the enumeration starts from the east, and the terms used for the various directions are of Sanskrit origin (Klokke 1995:82): *pūrwwa* (east), *dakṣiṇa* (south), *paścima* (west) and *uttara* (north). In the inscriptions of Kañcana, Wuatan Tija (880 A.D.), Poh Dulur, Rukam (907 A.D.), Sugih Manek (915 A.D.), Gilikan (923 A.D.), Sangguran and Kampak,¹⁷ the *pradakṣiṇa* is also suggested by the names of the gods of the four directions: *Yama* (south), *Waruṇa* (west), *Kuvera* (north) and *Waśawa* (east).¹⁸

Furthermore, when the boundaries of the *sīma* are mentioned in inscriptions, they are most of the time described in *pradakṣiṇa* order, from east to north (inscriptions of Waharu I, 873 A.D.; Haliwangbang, 877 A.D.; Taji, 901 A.D.; Kuṭi, 898-910 A.D.; Pupus, 910-915 A.D.), or from northeast to northwest (inscription of Kañcana, 860 A.D.).¹⁹ The circumambulation of the territory transferred was part of the *sīma* ritual, as stated in the inscription of Air Kali: “(...) and they circumambulated the boundary, marking out the *sīma*” (Wisseman Christie 2002-2004: n° 206).

However, boundaries are not always mentioned in *pradakṣiṇa* order (Table 23). In the inscriptions of Mamali (878 A.D.) and Taragal (881 A.D.),²⁰ they are even listed in *prasavya* order (from east to south for Mamali and from north to east for Taragal). In the inscriptions of Śrī Manggala II (874 A.D.) and Jurungan (876 A.D.),²¹ the lengths of only two boundaries are given, respectively the southern and eastern boundaries for Śrī Manggala II and the eastern and northern ones for Jurungan.

From the last four inscriptions, it can be deduced that, although *pradakṣiṇa* order was a well-known and important order regulating various activities, it was not automatically applied in every circumstance: directions could be listed in other ways, even in *prasavya* order. It is clear that counter clockwise circumambulation was not especially related to funerary rituals, nor to death and destruction, for establishing a *sīma* is not linked to funerals. The inscriptions of Haliwangbang, Mamali and Taragal,²² for example, belong to the same series of charters. The three inscriptions commemorate *sīma* made for the benefit of the same temple (Gunung Hyang). However, in Haliwangbang, the *sīma* boundaries are given in *pradakṣiṇa*, while in the

¹⁵ Narrative reliefs of Borobudur and Prambanan must be read clockwise.

¹⁶ See Sarkar 1971-1972: n° 12, 70, 72, 96; Wisseman Christie 2002-2004: n° 64, 126, 147, 206, 211.

¹⁷ See Sarkar 1971-1972: n° 46, 84, 96, 104; Wisseman Christie 2002-2004: n° 64, 126, 158, 211.

¹⁸ Waśawa is one of Indra's names (Krom 1925b:205).

¹⁹ See Sarkar 1971-1972: n° 12, 31, 61; Wisseman Christie 2002-2004: n° 64, 90, 180.

²⁰ See Wisseman Christie 2002-2004: n° 96, 109.

²¹ See Sarkar 1971-1972: n° 32; Wisseman Christie 2002-2004: n° 89.

²² See Wisseman Christie 2002-2004: n° 90, 96, 109.

Table 23: Lists of cardinal points in Central Javanese inscriptions

<i>List</i>	<i>Order</i>	<i>Inscriptions</i>
E, S, W, N	Clockwise	Gaṇḍasuli, Kañcana, Waharu, Haliwangbang, Poh Dulur, Taji, Kubukubu, Mantyaśih I, Wukajana, Kuṭi, Pupus, Sangguran, Kampak and Air Kali.
S, W, N, E ²³	Clockwise	Kañcana, Wuatan Tija, Poh Dulur, Rukam, Sugih Manek, Gilikan, Sangguran and Kampak.
E, N, W, S	Counter-clockwise	Mamali.
N, W, S, E	Counter-clockwise	Taragal.
N-S, W-E	In pairs	Wuatan Tija, Wanua Tengah III, Sugih Manek, Lintakan, Gilikan, Sangguran and Kampak.

other inscriptions, they are given in *prasavya* order. It is therefore not possible to consider *pradakṣiṇa* and *prasavya* as two methods of circumambulation relating to different types of temples.

The explanation might be that the Indian idea of *pradakṣiṇapatha* was challenged by a local concept of space and directions. The clockwise circumambulation, though part of numerous rituals, was perhaps not totally integrated into Javanese culture and was therefore somewhat inconsistent (hence the use of *prasavya* order in two inscriptions). Actually, there are already traces, in Central Javanese inscriptions, of the dualistic vision of the world that marks East Javanese art and society. Those traces are visible in the inscriptions of Wuatan Tija, Wanua Tengah III (908 A.D.), Sugih Manek, Lintakan (919 A.D.), Gilikan, Sangguran and Kampak. In the inscription of Wanua Tengah III, one can read that “the extent of the *sawah* was: going eastwards along the north side, 182 *dpa*; going eastwards along the south side, 162 *dpa*; going northwards along the east side, 160 *dpa*; and going southwards along the west side, 162 *dpa sihwā*” (Wissemann Christie 2002-2004: nr 161). Boundaries are listed in opposing pairs, north-south on the one hand, east-west on the other hand.

A similar formulation is found in the curse formulae of the other above-mentioned inscriptions, where spirits of the directions are mentioned in pairs: north and south, west and east.²⁴ The terms used are not of Sanskrit origin, as when the directions are listed in *pradakṣiṇa* order; they clearly are Javanese words: *lor* (north), *kidul* (south), *kuluan* (west), *wetan* (east) (Klokke 1995:82).

Conceptions of space defined in pairs of complementary elements are well known in present day Indonesia, and are found all over the archipelago. They can be composed of separate pairs, or of one main axis crossed by a secondary axis. In East Sumba and among the Ngaju Dayak (Table 24), for example, one pair is composed by “downstream-upstream” while the second axis is defined either according to the sun (sunrise-sunset, in the case of Borneo) or according to the shape of the island (head-tail, in the case of Sumba) (Schärer 1963:66; Forth 1981:52). On the contrary, in Roti and Ende (Flores), the main axis (east-west in Roti, sea-land in Flores) determines the secondary axis, the latter being expressed in terms of left and right (Waterson 1990:93). A system of orientation based on pairs has survived in Bali, showing that it is rooted deeply enough in the Austronesian way of thinking to coexist with Hinduism. Balinese determine the directions in terms of mountain-sea and east-west (Hupré 1993:174-175).

²³ Yama, Waruṇa, Kuwera, Waśawa.

²⁴ The inscriptions of Sangguran, Kampak, Sugih Manek, Gilikan and Wuatan Tija give them also (but earlier in the text) in *pradakṣiṇa* (east, south, west, north and/or Yama, Waruṇa, Kuwera, Waśawa). See above, p.112.

Table 24: Examples of systems of orientation by pairs in the Indonesian archipelago

	<i>Main axis</i>	<i>Secondary axis</i>
East Sumba	Upstream – Downstream	Head – Tail
Ngaju Dayak	Upstream – Downstream	Sunrise – Sunset
Roti	Sunrise – Sunset	Left – Right
Flores	Sea – Land	Left – Right
Bali	Mountain – Sea	East – West

Linguistic studies have further concluded that the Javanese directional system evolved from a geography-related binary (inland *versus* sea) to a fixed system of cardinal points. Lor, the Javanese for “north”, comes indeed from the Proto-Austronesian *laSud, meaning “toward the sea” (Adelaar 1997: 64).

We may conclude that, as early as the second half of the 9th century, two perceptions of space were challenging one another among the elite of Central Javanese society. One was the imported *pradakṣiṇa* concept, which relates space, time and sun. The other was of Javanese origin, probably ancient, and conceived a dualistic world. The reticence about *pradakṣiṇapatha* might come, as suggested elsewhere by Klokke, from the fact that the path of the sun is not as straightforward in Java as it is in India (Klokke 1995:76). Java is located in the southern hemisphere but near the equator. This means that for two thirds of the year the sun is travelling from east to west *via* the north (and not *via* the south as in the *pradakṣiṇapatha*). Hence, the association between the *pradakṣiṇa* movement and the path of the sun loses its foundations and becomes meaningless during most of the year (Klokke 1995:76).

Given its changing character, it is thus probable that the path of the sun did not play such a prominent role in Java as it did in India. Furthermore, as inscriptions suggest the existence of a local concept of space, it is not surprising that Javanese architects interpreted the Hindu-Buddhist tradition differently from their Indian colleagues. As a result, Javanese architects favoured an axis (east-west) rather than a single direction (west).

Besides, the practical implementation of these spatial principles might have been quite different in India and in Java. In Indian texts, temples should face an auspicious direction and, although the treatises on architecture do not agree with one another, in practice, it has often been understood that temples should face east. That the rising sun shines upon the image in the *cella* is thought to benefit the temple (Klokke 1995:75; Kramrisch 1946:235, 304).

However, in traditional Indonesian societies, although east is an auspicious direction, this is not necessarily translated into east-facing buildings. For example, in most Balinese housing compounds, the family temple is located to the northeast (the most auspicious direction in southern Bali). The altar itself faces west or even southwest, but people praying in front of it thereby face the auspicious direction (see Hurpré 1993:179).

The difference between the Indian interpretation – that the temple itself should face east – and that of the Balinese – that it is actually the devotee who should look in an auspicious direction – might partly explain why west-facing temples are so numerous in Java (far more numerous than in India or mainland Southeast Asia). The co-existence of two ways of thinking about space allowed Javanese architects to choose an orientation more freely and to adapt it to topography, hydrography or the position of human settlements.

That a local interpretation may lead to an inversion of Indian principles of spatial organization is illustrated by the repartition of *buddha* sculptures at Borobudur and

candi Sewu. According to the Indian tradition, each *buddha* is associated with a precise direction:

Buddha in <i>bhūmisparśa-mudrā</i>	East
Buddha in <i>varada-mudrā</i>	South
Buddha in <i>dhyāna-mudrā</i>	West
Buddha in <i>abhaya-mudrā</i>	North

The locations of the Buddha sculptures of *candi* Borobudur fit with the above scheme. In *candi* Sewu, however, only the sculptures from the first, second and fourth rows of shrines follow a similar pattern. Sculptures found in the third row (the only row where the shrines are turned inward) show an inverted picture: Buddhas in *bhūmisparśa-mudrā* are to the west, *varada-mudrā* to the north, *dhyāna-mudrā* to the east and *abhaya-mudrā* to the south (IJzerman 1891: fig.153). As regents of the directions, the *jina* rule over the cardinal points, i.e. they face the corresponding direction.

To summarize, the orientation of Central Javanese temples distinguishes itself from the building traditions of India and mainland Southeast Asia by the absence of preponderance of east over west. This peculiarity – which is not in contradiction with the Indian treatises on architecture – apparently resulted from the coexistence of two different perceptions of space – a dualistic one and a solar based one – and possibly from a different approach to sacred space – according to which both direction and location could be determinant factors in the planning of a temple. Central Javanese architects were therefore more inclined to build west-facing temples than Indian architects and thus to adapt temple orientation in relation to external parameters. Nevertheless, the fact that it was apparently an obligation for a shrine to have its door along the east-west axis shows that adaptation to exterior criteria had its limits and that there was a rather strict concept of space underlying the construction. No parameter was strong enough to make the architect depart from this rule and adopt a northward or southward orientation.

Temple orientation and religious affiliation

In the Javanese perception of space, temples had to be orientated to the east or to the west, both directions being apparently equally acceptable. But what further parameters could have influenced the choice for the one or the other? We have seen that regional trends, topography and rivers had probably an impact – though limited – on temple orientation. Indian treatises on architecture already suggest that two other elements might have influence on orientation: religious affiliation and position in relation with settlement.

The religious history of Central Java is not well-known and, as long as religious affiliation is concerned, we can only distinguish Buddhism from Hinduism. With the exception of a few cases, the exact name of the deity worshipped in the still visible temple remains is unknown – but the vast majority of Hindu temples were obviously dedicated to Śiwa, as suggested by the numerous *lingga*.

In a 1995 article, M.J. Klokke has suggested that temple orientation might be linked to the its affiliation to Buddhism or Hinduism:

While most Buddhist *caṇḍi* such as Kalasan, Sari, Sewu, Ngawen and Borobudur face east according to the Indian model, most Hindu temples, including the Arjuna group at Dieng, Pringapus, the Gedong Songo group, Ijo, Morangan and Asu, Pendem and Lumbung near Muntilan, are oriented towards the west. [...] It is striking, however, that in Central Java the west has been favoured systematically as the side for the entrance of Hindu temples. The only exception is the Loro Jonggrang complex, which faces east. (Klokke 1995:77)

Table 25: Orientation and religious affiliation

Direction	Religion	Number	Names of the sites
East	Buddhist	8	Borobudur, Bubrah, Gampingan, Kalasan, Lumbung (Prambanan), Ngawen, Sari, Sewu.
	Hindu	15	Argapura, Batur, Bima, Cebongan, Dukuh, Gebang, Gunung Wukir, Kedulan, Loro Jonggrang, Merak, Ngempon, Perot, Retno, Samberan, Selogriyo.
West	Buddhist	10	Banyunibo, Gana, Kalongan, Mendut, Palgading, Pawon, Plaosan Kidul, Plaosan Lor, Risan, ²⁵ Sojiwan.
	Hindu	21	Arca Ganesa, Asu, Banon, Barong, Dieng, ²⁶ Gajah, Gedong Songo, ²⁷ Gunung Sari, Ijo, Jetis (Cangkringan), Kaliworo, Lawang, Lumbung (Magelang), Mantup, Miri, Morangan, Pendem, Pringapus, ²⁸ Sambisari, Sentono, Singo, Sumur Songo.

However, now that we have gathered more data and can take into consideration a larger number of remains, we have to recognize that these observations were based on insufficient data. Orientation is known for 18 Buddhist temples and, out of these, 10 face west. There is thus no specific tendency to orientate Buddhist shrines towards the east. Furthermore, even though it is true that the majority of Hindu remains face west (21 out of 35), Loro Jonggrang is not the only east-facing Hindu sanctuary (Table 25). The choice of orientation must have been based on other criteria than a Hindu or Buddhist affiliation.

It can be argued, as was done in earlier times for Angkor Wat (Cœdès 1933; Przyluski 1933),²⁹ that west-facing temples had a funerary function, while east-facing shrines were dedicated the gods. It is indeed commonly admitted that west, being the direction of the setting sun, is related to death. Nevertheless, in ancient Indian Hindu-Buddhist thought, it seems that west is not automatically associated with death or funerary rituals. Furthermore, as will be shown later, the epigraphic and archaeological records do not suggest that such an association was common in Central Java.

Nevertheless, it is clear from Indian treatises on architecture that, in India, west-facing temples existed and had no special connections whatsoever with funerary rituals.³⁰ I do not want to re-open here the old debate regarding the function of the Javanese *candi*. It has been satisfactorily closed by R. Soekmono in his thesis (Soekmono 1995). Central Javanese shrines are not tombs, they are temples: the supposed funerary urns found in the temple pits were not remains of dead kings. They were ritual deposits, as described in Indian treatises on architecture, and were similar to the *peripih*, receptacles for the god's essence, still found buried under Balinese shrines and altars (Soekmono 1995; Ślaczka 2007).

²⁵ The religious affiliation of candi Risan is uncertain, since its association with Buddhism is based on the discovery of a single statue, identified as the bodhisattwa Awalokiteśwara (Verbeek 1891:168; Hoepermans 1913:218; Bosch 1915:25; *Laporan Peninjauan situs Semin, Playen dan Karangmojo* 1981; *Daftar peninggalan benda DIY* 1985:37-39).

²⁶ Arjuna group, Gatotkaca and Dwarawati.

²⁷ Main temples.

²⁸ Candi Pringapus might actually be the secondary shrine of candi Perot.

²⁹ The opinion that Angkor Wat had a funerary character was based on three main arguments: 1) reliefs that are not composed around a central motif must be read from left to right, 2) the order of the reliefs seems to follow a *apasavya* rather than a *pradakṣiṇa* movement, 3) the temple faces west (Cœdès 1933; Przyluski 1933). Cœdès already objected to the reading of the reliefs in *apasavya* direction (Cœdès 1933). This was recently contested by E. Mannikka (Mannikka 1996).

³⁰ See above, p.111.

What is specific about Javanese shrines is that at least some of them were related to the worship of former kings. The practice is well-known in East Java where texts tell us, for example, that king Anūṣapati was enshrined at *candi* Kidal and king Wiṣṇuwardhana at *candi* Jago.³¹ After their deaths, East Javanese kings united with their favoured god and, in that case, a statue of the god was placed in a *candi*. The temple would then become a place for the worship of the deceased king. Similarly, some inscriptions³² suggest that certain Central Javanese *candi* were linked to deceased kings.

Can we then postulate that temples linked to ancestor worship were oriented towards the west and that other kinds were oriented towards the east? Or the other way round? Unfortunately, Central Javanese inscriptions referring to known temples are too scarce to give a definitive answer to that question. Nevertheless, on the one hand, the inscription of Gunung Wukir, associated with *candi* Gunung Wukir (an east-facing temple) does not refer to ancestor worship, but commemorates the erection of *lingga* by (the then living) king Sañjaya in a “wonderful place dedicated to Śambhu” (Śiwa) (Sarkar 1971-1972: I, n° 3). On the other hand, the Śiwagrha inscription,³³ which is usually linked to the east-facing *candi* Loro Jonggrang (Casparis 1956: 280-330) is said to refer to the memorial temple of *rake* Pikatan.³⁴ We thus have two temples with the same orientation (east), one of them possibly linked to ancestor worship, the other probably not. It seems therefore unlikely that the dedication of a temple to ancestor worship automatically induced a specific orientation.

Exact orientation: deviation from geographical north

Until now, I have used the terms “east” and “west” without much precision, but a problem arises here: Central Javanese temples rarely face due east or due west. Most of the time, their axes deviate from geographical north. This observation raises a question: is this a mistake resulting from the technique of orientation used or was it done on purpose?

Data accuracy

First of all, a word must be said about data accuracy. Exact orientation is not easy to measure and, most often, mistakes cannot be avoided; the very nature of

³¹ According to the Pararaton and the Nāgarakṛtāgama. See Brandes 1897:16, 18; Robson 1995: 54. For the association between names mentioned in the texts and the actual *candi* Kidal and Jago, see for example Krom 1923, II:55, 95.

³² The inscription of Lanḍa (879 A.D.), for example, mentions a sang dewata ing pacaṇḍdyan i Kwak, which Wisseman Christie translates as a “deified ancestor buried in the *candi* at Kwak. Similarly, she reads, in the inscription of Tēlang I (904 A.D.), haji dewata lumāh ing śataśṛngga as “the deified ruler who is buried at Śataśṛngga”. In the inscription of Poh (905 A.D.), sang hyang caitya mahaywa silunglung sang dewata sang lumāh i pastika is “the holy funerary monument of the ancestor-spirit who is buried at Pastika” (Wisseman Christie 2002-2004: n° 100, 141 and 146). Many of these translations are tentative. It is nevertheless clear that some sort of ancestor worship occurred: it is indeed the only way to understand the inscription of Mantyaśih I (907 A.D.), which, after invoking all kinds of spirits, invokes the “holy spirits who have gone before” followed by the names of 8 kings of Matarām (Wisseman Christie 2002-2004: n° 152).

³³ For a transcription and translation of the Śiwagrha inscription, see Casparis 1956:280-330 and Wisseman Christie 2002-2004: n° 53.

³⁴ The inscription describes the funerary temple of the previous king. The title of the reigning king is dyaḥ Lokapāla, who, given the date of the inscription (856 A.D.), is without much doubt rake Kayuwangi dyaḥ Lokapāla. His predecessor on the throne was rake Pikatan dyaḥ Salaḍū, as we know from the Wanua Tengah III inscription (Wisseman Christie 2001:).

archaeological sites lowers the accuracy. Most temples were discovered in a poor state of preservation; the area being subject to earthquakes, landslides and floods. Ancient stonewalls are often found in a toppled state at a slight remove moved from their original locations. This process is amplified by the lack of deep foundations that characterizes ancient Javanese architecture. Foundations are indeed rarely more than two or three stone layers deep, so they can also be disturbed by natural events.

The situation is not always better when temples are found still partly standing. Movements of stones from their primary positions are frequently noted, so that it is very difficult to determine which stone is the least disturbed. Therefore, depending on the stones chosen as points of reference, results may vary and mistakes thereby occur in the measurement of orientation.

Another problem comes from the fact that numerous structures underwent thorough restoration. They were often dismantled to the ground before being completely rebuilt. This is the case, i.a., with *candi* Banyunibo, Barong, Borobudur, Gebang, Ijo, Pawon, Plaosan, Pringapus, Ratu Boko, Sewu and Sojiwan. In such circumstances, there is no guarantee that the rebuilding preserved the exact orientation of the original structure (especially when this original orientation was already difficult to estimate).

The conclusion from all this is that we should keep in mind that the numbers, although given with apparent precision, cannot be regarded as an exact picture of the past reality and that any study requiring a too high measurement of orientation should be treated with caution and suspicion.

To illustrate the problem posed by data accuracy, I would like to compare the orientation of two important temples, namely *candi* Mendut and *candi* Gunung Wukir, as measured by E.L. Hapsoro and B. Siswoyo (Hapsoro 1986:60-61; Siswoyo 1996:5):³⁵

Mendut:	Hapsoro:	303° 06'22.51"
	Siswoyo:	287° 59'
Gunung Wukir:	Hapsoro:	109° 24'03.77"
	Siswoyo:	101° 25'

We can see here that differences may be considerable. Although I would have liked to do so, I have not had the occasion to make my own measurements.³⁶ Nevertheless, it is probable that in many cases they would have given a third result, not necessarily more faithful to the original orientation than those of E.L. Hapsoro and B. Siswoyo.

If one accepts an error margin of more or less 5°, it is still possible to roughly divide temples into three groups, according to the importance of their deviation from geographical north.³⁷ 15 temples have an orientation very close to the cardinal points (Table 25, Group Ia), 4 are clearly far away from the main points of the compass

³⁵ Although both archaeologists were working with a theodolite, their methods differed. E.L. Hapsoro based himself on the measurement of the position of two corners of the same wall (Hapsoro 1986:49), while B. Siswoyo used an average taking into account the position of two parallel walls (Siswoyo 1996:3).

³⁶ I used a simple water compass to determine whether temples face due east/west or not, but the method is not precise enough to determine exact orientation. The use of a theodolite would have required me to hire instruments and topographers from the Suaka Purbakala, which was not possible given my budget.

³⁷ Mendut and Pawon are actually the only temples for which my compass-made estimates differed strikingly from the measurements of B. Siswoyo.

Table 26: Temple orientation, deviation from true north

	<i>Deviation</i> ³⁸	<i>Sites</i>	<i>Number</i>
Group Ia	0° - 3°	Asu, Banyunibo, Barong, Borobudur, Bubrah, Gedong Songo I, Ijo, Loro Jonggrang, Lumbung (Magelang), Ngempon, Plaosan Kidul, Sambisari, Sari, Sewu, Sojiwan.	15
Group Ib	4° - 8°	Arjuna, Dwarawati, Gatotkaca, Gedong Songo II, Kalasan, Lumbung, Plaosan Lor, Selogriyo.	8
Group II	11° - 16°	Bima, Gebang, Gedong Songo III, Gedong Songo IV, Gedong Songo VI, Gunung Wukir, Merak, Retno. ³⁹	8
Group III	17° - 30°	Mendut, ⁴⁰ Ngawen, Pawon, ⁴¹ Pendem.	4

(Table 26, Group III), and the rest, i.e. 16 sanctuaries, are in between (Table 26, Group Ib and II).

These variations of orientation raise many questions: are they related to religious affiliation, regional traditions or chronology? Do they have a meaning or are they the results of imperfect orientation methods? Unfortunately, the scope of this study has not allowed me to resolve these variations, and I hope that high quality astronomical methods will in the future be applied to the resolution of this question.

It is nevertheless possible to shatter one pre-conceived idea: that Central Javanese temples would be perfectly oriented around the cardinal points (contrary to East Javanese temples). In her thesis, J. Patt has argued that the orientation of Sanggariti (45° to the NE) is “strikingly in contrast to the exact east-west, north-south compass alignments of closely contemporary Central Javanese monuments of the eighth and ninth centuries” (Patt 1979:60). This argument has also been put forward by Klokke in a more recent article, where she emphasises that Central Javanese temples are oriented to the four cardinal points, whereas in East Java, “the principle of a holy centre accurately oriented to the cardinal points is lost”, for East Javanese temples face west-north-west rather than true west (Klokke 1995:76-77). Even though it is true that no Central Javanese temple faces NE like Sanggariti, and that both Borobudur and Loro Jonggrang (almost) face due east, one can hardly say that Central Javanese temples are always accurately aligned with the cardinal points: the deviation from true north oscillates between 0° 09’ (Sari) and 30° (Mendut) (Siswoyo 1996).

We can add that deviation from true north shows no correlation with religious affiliation or regional trends. Buddhist shrines are not more accurately oriented than Hindu ones (Table 27) and the deviation is not smaller in southern Central Java than in northern Central Java (Table 28).⁴² Furthermore, the temples that deviate the most from due north do not seem to be in a line with any mountain peak, close or distant, as appears to have often been the case for East Javanese shrines (Patt 1979:60).

So far, we can only formulate negative conclusions. However, a better understanding of the relative chronology of Central Javanese monuments might lead to a different result. A list of the temples facing (almost) due east or west appears to include a majority of late sanctuaries (such as Loro Jonggrang or Ijo), with the

³⁸ On the basis of the measurements of B. Siswoyo, except stated otherwise (Siswoyo 1996).

³⁹ Nitihaminoto 1977: fig.14.

⁴⁰ My own estimates, taken with a water compass, using the western and eastern walls as references. These estimates (300°) correspond roughly with the measurements of E.L. Hapsoro (303° 06’ 22.51”) and D. Chihara (301°), but not with those of B. Siswoyo (287° 59’) (Hapsoro 1986; Siswoyo 1996).

⁴¹ My own estimates.

⁴² The four temples of group III, however, are found in the same region (Muntilan).

noticeable exception of Borobudur.⁴³ In contrast, among the four temples that deviate most from the cardinal points, at least two (Mendut and Pawon)⁴⁴ are usually ascribed to an early date.⁴⁵

Table 27: Deviation from true north and religious affiliation

	<i>Hindu</i>	<i>Sites</i>	<i>Buddhist</i>	<i>Sites</i>
Group Ia	8	Asu, Barong, Gedong Songo I, Ijo, Loro Jonggrang, Lumbung, Ngempon, Sambisari.	7	Banyunibo, Borobudur, Bubrah, Plaosan Kidul, Sari, Sewu, Sojiwan.
Group Ib	5	Arjuna, Dwarawati, Gatotkaca, Gedong Songo II, Selogriyo.	3	Kalasan, Lumbung, Plaosan Lor.
Group II	8	Bima, Gebang, Gedong Songo III, IV, VI, Gunung Wukir, Merak, Retno.	0	
Group III	1	Pendem	3	Mendut, Ngawen, Pawon.

Table 28: Deviation from true north and region

	N	Sites	C	Sites	S	Sites
Group Ia	2	Gedong Songo I, Ngempon.	3	Asu, Borobudur, Lumbung.	8	Banyunibo, Barong, Bubrah, Ijo, Loro Jonggrang, Plaosan Kidul, Sambisari, Sari, Sewu, Sojiwan.
Group Ib	4	Arjuna, Dwarawati, Gatotkaca, Gedong Songo II.	1	Selogriyo.	3	Kalasan, Lumbung, Plaosan Lor.
Group II	4	Bima, Gedong Songo III, IV and VI, Retno.	1	Gunung Wukir.	2	Gebang, Merak.
Group III	0		3	Mendut, Ngawen, Pawon, Pendem.	0	

N: northern zone; C: central zone; S: southern zone

Determining east and west: the Indian method

Even if it is true that over time there was an increasing general tendency to orientate buildings more and more accurately towards the cardinal points, we still do not know what this means. Is it due to improvements in orientation techniques? We should further ask ourselves specifically which techniques were used by Javanese architects, and what methods of orientation were known at what time. Unfortunately, Central Javanese inscriptions do not seem to contain any details referring to practical orientation matters.

⁴³ Asu, Barong, Loro Jonggrang, Lumbung (Muntilan) and Plaosan Kidul are dated after 830 A.D. Borobudur, Bubrah and Sewu are usually ascribed to a period before 830 (Vogler 1949; Soekmono 1979; Williams 1981; Dumarçay 1993; Chihara 1996). The construction dates of *candi* Banyunibo, Gedong Songo I, Ngempon, Sambisari and Sari are subject to controversy. As far as I am concerned, I consider Gedong Songo I to belong to the late period of Central Javanese architecture.

⁴⁴ One can probably add Pendem, which is most probably closer in date to Borobudur than to Loro Jonggrang (Klokke, Degroot 2006).

⁴⁵ Mendut and Pawon are dated before 830 A.D., and often even before 800 A.D. (Vogler 1949; Williams 1981; Dumarçay 1993; Chihara 1996). The same scholars do not agree concerning the dating of Ngawen, with dates varying between 770 and 850. Although Dumarçay suggests a date around 850 A.D. for *candi* Pendem (Dumarçay 1993), I follow M.J. Klokke and ascribe it to an early period (i.e. before 830 A.D.) (Klokke, Degroot 2006).

We do have, however, a rather complete description of the method possibly used by Indian architects.⁴⁶ The method is described in the *Mānasāra* and the *Mayamata* (Chap. VI). First of all, the ground should be levelled. Then a stick should be planted in its centre. With a cord, a circle should be drawn around the stick, its diameter measuring twice (Dagens 1970:68) or four times the length (Acharya 1934:24) of the stick. Then the architect should mark the points where the shadow of the gnomon touches the circle, in the morning and in the afternoon. Those points give the east-west direction. After that, the east-west axis should be reported to the centre.

From an astronomical point of view, this method is quite precise and the expected error in determining east and west should be around one degree (Cuypers 2002). However, another source of error is the fact that the text, as interpreted by Dagens, would suggest that the east-west line should be reported to the centre of the circle (Dagens, 1970:70), i.e. that it is not the original east-west axis that is used to draw the temple plan, but a line parallel to it and passing through the centre. Although reporting the line to the centre is source of error, it is not probable that this method would have introduced a global mistake of more than 10°. Therefore, it must be concluded that the temples of groups II and III, at least, were not built using this method.

Sunrise orientation

It is indeed possible that Central Javanese architects used another method to determine the orientation of their temples, based on the sun or on specific stars, even though this method is not described in Indian texts.

Using sunrise as reference for east is quite common, and simple. It can be done using either a pair of crossed-sticks or the early shadow of a gnomon. Because it is based on the position of the rising sun, the accuracy of this method in determining cardinal points varies all over the year, according to the sun declination. In Java, the sun apparent azimuth at sunrise is roughly estimated at lying between 66° (at the summer solstice) and 114° (at the winter solstice). This means that in June, the sun rises 24° north of true east, while in December, it rises 24° south of it. It is only around the equinoxes, in September and March, that the sun rises due east. With the exception of *candi* Mendut and Pawon, the orientation of all Central Javanese temples fall within this range. This means that, theoretically, they could have been oriented according to the sunrise position on a specific day.

It is tempting to follow B. Hapsoro and attempt to date a temple on the base of its orientation only (Hapsoro 1986). However, there is no such easy solution. Apart from the above-mentioned problem of estimating the original orientation of a temple, there are many unknown variables. We do not know for sure which method was used. If crossed-sticks can be used at sunrise, to the extent that the local landscape allows it, the shadow method needs the sun to be a bit higher in the sky; and the sun declination is not the same at sunrise or at 10 o'clock. Precision of sunrise orientation depends also on the elevation of the horizon, and the mountainous landscape of the Progo Valley would inevitably lead to additional errors, probably in the order of seconds (Gomperts 2004).

As the sun reaches a given azimuth two times a year (with the exception of the extreme azimuths, which are reached at solstices only), it would eventually be

⁴⁶ Although the method is described in Indian treatises on architecture – and therefore was certainly known in India – there is no evidence that may show that its use was widespread in India.

possible to determine roughly two possible building periods (of a few days) within one year. Nevertheless, as the sun follows the same path every year, it is impossible to determine the year without additional information.

It is expected that Javanese architects would have planned the building on an auspicious day. If we did possess a list of the auspicious days of the Javanese calendar and cross referenced this information with temple orientation, we would most probably be able to ascribe a temple to a specific day of a specific year.

Unfortunately, we do not know much about Central Javanese astrology. No specific month of the year or day of the week seems to have been considered auspicious on its own: inscriptions were indeed written at any time of the year and on any day.⁴⁷ It seems probable that the system was a complex one and that it actually was a conjunction of several factors that made a day auspicious.

In his study, Hapsoro suggests that the full moon was the determinant factor and that it was on full-moon days that the orientations of the temples were determined (Hapsoro 1986:64). Although I do not deny the importance of the moon in Hindu-Buddhist thought, as well as its impact on the Javanese calendar, I think Hapsoro's statement cannot be accepted without qualifications: there is no clear mention of the full moon as an overly auspicious phenomenon in any Central Javanese source. Actually, only a handful of inscriptions were written on a full-moon day,⁴⁸ which tends to show that other days could be considered auspicious as well. Nobody, I think, would build a temple or inaugurate a *sīma* on an inauspicious day. The conjunction of a full-moon day, a given sun declination and a temple azimuth cannot be held as valid criteria to date a temple, at least as long as a deeper study of the Central Javanese astrological system has not been carried out.

⁴⁷ There are about a hundred inscriptions from the Central Javanese period that contain complete information of the date on which they were written. All the months of the year are represented, even though less inscriptions were made during the months of Āsāḍha, Caitra and Māgha than during the other months. Similarly, all the days of the three weeks are present in a large variety of combinations. In the 6-day week, the days most frequently found in the inscriptions are Mawulu, Tunglai and Wurukung; in the 5-day week, they are Pahing and Wagai; in the 7-day week Soma/Candra. See below for the details.

Months in Central Javanese inscriptions:

Month	(a)	Month	(a)	Month	(a)
Caitra	2	Śrāwaṇa	12	Mārgaśīra	10
Waiśākha	9	Bhadrawāda	7	Poṣya	11
Jyeṣṭha	6	Asuḥi	8	Māgha	4
Āsāḍha	2	Kārttika	15	Phālguna	9

(a) Number of dated inscriptions written during that month

Days in Central Javanese inscriptions:

6-day week	(b)	5-day week	(b)	7-day week	(b)
Tunglai	23	Pahing	22	Āditya	8
Hariyang	12	Pon	17	Soma	28
Wurukung	21	Wagai	26	Anggāra	10
Paniruan	12	Kaliwuan	18	Budha	14
Was	11	Umanis	17	Wṛhaspati	18
Mawulu	21			Śukra	19
				Śanaīścara	4

(b) Number of dated inscriptions written on that day of the week

⁴⁸ Only the inscriptions of Mandang (843 A.D.), Pendem (881 A.D.), Watukura (902 A.D.), Wintang Mas B (919 A.D.) and Harinjing B (921 A.D.) mention in their date of writing "the 15th day of the waxing moon", which should correspond to the full moon. The inscription of Upit (866 A.D.) was written on the "15th day of the waning moon". Inscriptions were written on any day of the waning or waxing moon.

I would like to add that comparison of the orientations of Gunung Wukir, Sewu and Loro Jonggrang with the sun declination on the dates given in the corresponding inscriptions of Canggal,⁴⁹ Kēlurak⁵⁰ and Śiwagrha have not given positive results. These three sanctuaries are the only ones associated with precisely dated inscriptions (i.e. inscriptions mentioning a year, a month and a day). I introduced the longitude and latitude of the temples together with the data from the inscriptions in the online sunset/sunrise calculation software of the American National Oceanic and Atmospheric Administration,⁵¹ but the calculations were not in line with the orientation of the temples (Table 29). These variations may have multiple causes: inaccuracy of the archaeological data, mistaken association between a temple and an inscription, misinterpretation of an inscription⁵² and so on. Furthermore, three sets of data are far from sufficient to determine whether or not the buildings were not oriented towards the rising sun.

Orientation towards the sunrise is far from being the sole possible option. Ancient societies have used many other points of reference to orientate themselves and their buildings. As suggested to me by Amrit Gomperts, heliacal rising of important stars, such as Canopus (Agastya), may have served as reference to determine the orientation of Central Javanese temples (Gomperts 2004). The above mentioned accuracy problems with data, uncertainties concerning associations between temples and inscriptions (which would provide a good verifying tool) and my own limited knowledge of astronomy (in particular Indian astronomy) have prevented me from exploring these possibilities further. So, I leave the question open.

Although rivers and hilltops played a role in the general orientation of temple remains, the meaning of their exact orientation is still unknown. Perhaps the Central Javanese architects oriented their buildings toward the rising sun at a time considered auspicious, or perhaps temples were directed towards certain stars. But it might also be that they did not give great importance to the temples' precise orientations and that, in early times at least, precise methods of orientation were used only in the larger constructions, such as Borobudur. In present-day Yogyakarta, it is not unusual to hear people speak about Malioboro Street as a south-north axis linking the sultan's palace to the summit of Mount Merapi. However, although Malioboro Street does indeed head north from the palace, it never reaches Mount Merapi, as the volcano lies not to

⁴⁹ Although the location at which the inscription was found leaves few doubts about its association with Gunung Wukir (Soekmono 1979:462), the temple most probably underwent a thorough rebuilding at a later period (Dumarçay 1993:80). Whether the restoration was made while preserving the original plan and orientation is unknown.

⁵⁰ The association between the Kēlurak inscription and candi Sewu has been questioned by M. J. Klokke (Klokke 2006:57). The inscription, which was actually found close to candi Lumbung and Bubrah, has been associated with Sewu because the Kēlurak inscription refers to Mañjuśrī and Sewu was thought to be dedicated to Mañjuśrī. Nevertheless, the only evidence for a cult of Mañjuśrī at Sewu, the Mañjuśrīgrha inscription, was found near a secondary building, not in the direct neighbourhood of the main temple. Furthermore, the throne within the main cella suggests the presence of a sitting buddha rather than a Mañjuśrī (Klokke 2006:57). The whole association of Sewu with Mañjuśrī might not be right. As far as solar declination and orientation are concerned, however, an association with Lumbung or Bubrah does not give more convincing results. The orientation of the two latter temples deviates respectively by 5.58° and 2.1° from due east.

⁵¹ www.srrb.noaa.gov/highlights/sunrise/sunrise.html

⁵² None of the inscriptions relates directly to the laying of the ground plan. The inscription of Gunung Wukir commemorates the erection of a lingga and Kēlurak the installation of a statue of Mañjuśrī. The Śiwagrha inscription mentions the inauguration of a Śiwa image/lingga and the construction of a large temple complex.

the north, but rather to the north-northeast of the town. When one is aspiring for divine order, however, the crudities of everyday realities may have to be excluded from consideration.

Table 29: Temple orientation and solar declination

Temple	Coordinates	Date	Solar declination ⁵³	Temple deviation ⁵⁴
Gunung Wukir	07° 38' 03.5"	6.10.732 ⁵⁵	-4.77°	-11.42°
	110° 17' 48.7"			
Sewu	07° 44' 38.1"	26.09.782 ⁵⁶	-0.7 °	1.58°
	110° 29' 35.1"			
Loro Jonggrang	07° 45' 07.4"	12.11.856 ⁵⁷	-17.9 °	1.15 °
	110° 29' 29.2"			

Conclusion

While correlations between distribution patterns and natural environment have helped us to gain more insight into the physical structure of Central Javanese territory and the complex relationship between temples, mountains and rivers, this chapter has extended the discussion to conceptualized space. We have noticed that Javanese temples are always built around an east-west axis, but that, contrary to what happens in other Hindu-Buddhist traditions, there is no specific preference for the east. We have further shown that there are good reasons to believe that this state of affairs results from the existence of two conceptions of space: one miming the path of the sun, the other built around the existence of two axes. In such a context, west was apparently as auspicious as east.

The choice between one direction or the other was influenced, at least in the rich agricultural plains, by the relative location of temples and rivers, temples having a tendency to face away from rivers (and, possibly, to face settlements). Although there is, in the lower areas, no evidence that temple orientation was determined by religious affiliation (Buddhism or Hinduism) or by reference to ancestor worship, temples built in high, remote places (and not directly linked to settlement and economic activities) tend to favour west. It is thus possible, that, in these cases, temple orientation reflects a difference in religious practice and/or purpose, since some of these sites at least (Dieng, Ratu Boko) seems to have been related to ascetic practices.

In the following chapters, we will explore further the use of space at the temple level and show that there is indeed a link between the space implemented via the ground plan of a temple and its religious background.

⁵³ Calculated with the online software of the American NOAA. Positive values denote a northern declination, negative numbers a southern one. (www.srrb.noaa.gov/highlights/sunrise/sunrise.html)

⁵⁴ Based on the measurements of Siswoyo (1996).

⁵⁵ Inscription of Canggal. See Sarkar 1971-1972: nr 3.

⁵⁶ Inscription of Kêlurak. See Sarkar 1971-1972: nr 6.

⁵⁷ Inscription of Śiwagṛha. See Casparis 1956: 280-330.