Perceptions About the Geography of Religious Sites in the Kathmandu Valley

Robert H. Stoddard*

What are some of the spatial characteristics of sacred sites? This question can be answered by considering the nature of geography, the perceptual aspects of sacred space, and the geographic characteristics of certain cosmologies. These comments are followed by some rather specific information about the spatial arrangements of selected sacred sites in the Kathmandu Valley and about perceptions of those sites.

Nature of Geography

The question about perceptions of religious sites is answered here from the particular perspective of geography, which is the discipline that deals with phenomena on the earth in terms of their locations. Geography is concerned especially with cueries about why certain phenomena are located where they are and with the implications of those locations on human behaviour. To understand the distinctive viewpoint of geography, it might be helpful to consider briefly a geographical problem that is unrelated to this specific study.

The location of wheat production, for instance, may be understood in terms of (1) physical features (i.e., site characteristics such as climate, terrain, and soils),

^{*} Dr. Robert H. Stooddard is an Associate Professor at Department of Geography, University of Nebraska, Lincoln, Nebraska, USA.

(2) economic conditions (e.g., accessibility to market, production costs, and demands), and (3) the cultural environment within which persons decide to produce Specialization within the discipline of geography tends to concentrate research within one of these broad divisions; thus some geographers explore the locational interrelationships among physical phenomena, others the spatial dimensions of economic activity, and still others the geographic impact of cultural conditions. A cultural geographer might consider how the natural environment is thought of, or perceived, by farmers rather than the measurable site characteristics. cultural geographer might examine how economic conditions are actually evaluated by wheat producers rather than assuming that so-called "Economic Man" is making rational -decisions based on perfect knowledge. Thus the cultural geographer assists in the task of explaining and predicting

the location of wheat production by clarifying ways farmers mentally view their physical and economic environments. Because agricultural decisions about producing wheat are based on the manner in which farmers view the world, the mental geographies they possess are critical to a full understanding of where wheat is produced.

To repeat, the distinctive aspect of geography is the concern with relationships that are <u>spatial</u> -- and not with a particular phenomenon itself. This brief illustration dealt with producing wheat, but the topic could just as well have involved soil types, landslides, linguistic regions, marriage patterns, or access to higher education. Furthermore, the geographic perspective is not limited to contemporary situations -- it may deal with past conditions or with predictions for future spatial arrangements. Geographers may also study visible

features on the landscape such as paddy fields or non-visible phenomena such as languages. In fact, one of the subfields of geography that has received considerable attention in recent decades is one that concerns an intangible phenomenon, specifically, the phenomenon of human perceptions of places.

This emphasis on perceptions might be clarified with two examples. One example involves what is sometimes called "mental maps", which are the ideas people have in their minds about the locations of specific places. For instance, a person might mentally think of (or, visualize) a map showing Kathmandu farther north than Delhi; but, in fact, the reverse is true so an accurate map shows Delhi farther north than Kathmandu. Nevertheless, when scholars attempt to understand this person's activities, they should realize that the belief (even if mistaken) about the two cities' relative locations may affect behaviour of that persons.

The ideas a shopkeeper has about the locations of prospective customers and their shopping behaviour is a second example. Suppose the shopkeeper buys some land at a particular site, then he builds a shop and stocks it with supplies. His investment is made on the basis on what he believes to be the place where people will go for buying things; however, it may not necessarily be where shoppers actually will go. Thus, for geographers to understand his decision about where to locate his shop, they must know something about the shopkeeper's perceptions of human behaviour -- rather than just about the actual patterns of shopping trips.

In summary, geographers are interested in <u>locational</u>

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or <u>spatial</u> aspects of phenomena. The phenomena may be any kind, both natural and manmade, tangible and intangible. Furthermore, geographic study concerns not just where phenomena are located but also why they are located at those places. Since the understanding of locations involves relationships among phenomena, geographic knowledge provides insight into the effects of locations on human activities. This insight often depends on noting both the observable facts about locations and the intangible perceptions people have about those locations.

Perceptions of Sacred Space

The geography of sacred space, by its very nature, involves human perceptions. Because phenomena are imbued with sanctity by human beliefs, the study of sacred places necessarily includes consideration of mental images about such places. However, in contrast to some other kinds of perceptual studies (e.g., perceptions of environmental hazards and individuals' mental maps), research into perceptions of sacred places has been limited. This paper expands on that topic by studying perceptions about religious sites within the specific context of the Kathmandu Valley of Nepal.

Information available about the geography of religious sites can be summarized by classifying various types of sacred places. One type consists of places that become sanctified after secular decisions are made about locations. Christian and Muslim cemeteries may be set aside for burial grounds originally in much the same way as other land areas are established. It is only after the areas have been used for burials that the space becomes sacred territory.

A second type includes places that <u>become</u> holy following a specific event which believers regard as manifesting the divine. The birth places of religious leaders and the sites of major religious events typify this class of sacred places.

A third type of sacred sites includes those locations that are assigned sanctity because of certain kinds to topographic features. Mountain tops, the confluences of streams, and hot springs are examples of features that are regarded as holy by many different religious groups.

A fourth type of location that may be sacred originates with cosmoligical concepts. That is, holy places of this type are not the result of unique events nor are they evidenced by distinct earth features. They occur because the arrangement of sanctified space corresponds to a perceived spatial organization — or cosmology — of the universe. It is this type that is examined in this particular study.

Geographic Characteristics of Some Cosmologies

Several scholars have discussed the modeling of settlements according to a plan that duplicates a divine cosmology. An important publication that deals with this topic is the one by Mircea Eliade, The Sacred and the Profane, in which he discussed how various peoples in many parts of the world through the ages have organized their settlements according to a plan that imitates a divine cosmology. Persons settling in a region estalished a temple or sacred structure at the center of their land, a position representing the center of the

102 CNAS Journal, Vol. VII, No. 1 & 2 (Dec.'79 & Jun.'80) world, and then delineated the edge of their lands from the chaotic areas of the profane world.

This same general theme has been examined somewhat by at least two American geographers. Paul Wheatley in The Pivot of the Four Quarters stated:

Before territory could be inhabited, it had to be cosmized. Its consecration signified its "reality" and, therefore, sanctioned its habitation; but its establishment as an imitation of a celestial achetype required its delineation and orientation as a sacred territory within the continuum of profane space.

Also, Yi-Fu Tuan wrote:

Cosmologies have more than aesthetic or intellectual interest. They are not simply fantasies of the mind floating about the hard realities of day-to-day living. They derive from lived experiences and at the same time give them meaning and direction. Among agricultural societies, in particular, cosmologies exist that are closely integrated with the calendars of work, with seasonal festivals and rituals. Cosmologies also find visible expression in sacred architecture....

Likewise, publications on town planning and architecture have reported on these same concepts about arranging buildings in South Asia. 4

The major inspiration for this study, though, was the work of Niels Gutschow, which is summarized partly by the following statements:

One of the models Hinduism employs for the sanctification of space is configurations of shrines or temples dedicated to a particular, systematic group of gods or goddesses. Such shrines cannot be fully understood unless interpreted with reference to the entire system of which they form a part.

Systems of this type very often are eightfold. In such cases shrines are located in the four cardinal and the four intermediate points of the compass. Probably such patterns are to be understood as extensions of the old <u>dikpala</u> idea: the Eight Regions or Quarters are guarded each by a particular god. No doubt the new gods were also installed to protect the Quarters and thus assumed the function of the old Guardians; yet it is fairly certain that their function was not exhausted with this.

Such systems had to be imposed onto a town that existed already. Hence, the sites of temples or <u>piths</u> are of course conditioned to factors of topography: we do not find the ideal, symmetrical pattern of a well-ex
cuted <u>yantra</u> or <u>mandala</u>. The variations that actual locations will show do not, however, justify doubt in the principles underlying the spatial arrangement.

Matrikas are one of the most essential, and indeed most frequent, devices for the sanctification of Nepalese towns. Preferably they are arranged so as to surround settlements ... Hence... the eight Matrikas are used to define space.

The <u>pithapuja</u> consists of 24 shrines of <u>Matrikas</u> being visited. ... The 24 shrines are arranged in three sets of eight <u>Matrikas</u> each. ... The first of these circles, by and large surrounds the city of Kathmandu, the second the entire valley, and the third at times transcends the boundaries of the valley proper to include places traditionally under the spiritual -- and at most time also secular -- demination of Newar kings.

It is apparent from Gutschow, Eliade, and others that the geographic distribution of certain sacred sites results from concepts about a divine plan for the arrangement of sacred space. Interest focuses, therefore, on the ways residents of such religiously delimited areas perceive the spatial relationships among sets of holy places.

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The Spatial Arrangement of Selected Sacred Sites in the Kathmandu Valley

An arrangement of sites that resembles the geometric configuration of a mandala or yantra does occur repeatedly in the Kathmandu Valley. In the ideal form, sets of sacred places are situated around a central position in the same pattern as geometric figures surround the center of a mandala. The configuration of sacred space analogizes

the arrangement of a cosmological model because, like the mandala, it consists of an inner cosmmcized area surrounded by a line or zone of divine protectors who guard against external dangers. This cosmological mandala is attached geographically to a specific area by being oriented with the earth's directional grid. Consequently, settlement areas may be delimited by eight sites, which are positioned at the four cardinal and the four intermediate directions, with each site occupied by a protecting deity.

This model of sacred places occurs at various scales within the Valley. At the scale of a single residence, it governs the construction and architecture of most Newar houses?. At the scale of a town, it is manifested in the locations of the <u>Ashta Matrikas</u> that surround each of the major cities of Kathmandu, Patan, and Bhaktapur.

At the scale of the entire Kathmandu Valley, the cosmological pattern seems to apply to the geography of sacred sites also; but the correspondence between the conceptual model and sacred places is less apparent than for towns and individual homes. Furthermore, very little has been written about sacred places that constitute sets for the entire Valley. Thus, the research goal for this

study was to learn about such sacred sites by answering the following three questions:

- (1) Are there sets of sacred sites that apply to the Valley; that is, are there several places that constitute parts of an over-all unit of sacred space? If "yes", then:
- (2) Are the sacred sites located in a geometric pattern; that is, does each place in a set have spatial significance in terms of an over-all religious design? If "yes;" then:
- (3) Do most persons living in the Valley perceive specific sacred places as parts of a set which has meaning for the Valley as a whole?

To answer the first two questions, the author consulted several experts and relevant publications. The experts were local persons who have studied the ancient religious texts and have specialized in understanding Hindu-Buddhist Tantricism; the publications were ones readily available in Kathmandu and written in English.

According to these sources, the answer to the first question seems clearly to be that, indeed, several religious sites do exist as sets. The experts and various publications generally agreed with what was recently summarized in the monumental inventory of cultural features in the Valley (i.e., the <u>Protective Inventory</u>). The <u>Protective Inventory</u> lists several religious sets such as the Char Ganesh, Char Narayan, Char Yogini, Ashta Matrika, Ashta Bhairab, Ashta Nag, and so forth. The Study that is reported here deals with only three sets, namely, the Char Ganesh, the Char Narayan, and the Ashta

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Matrikas.

The answer to the second question about whether the sets of sites form a meaningful pattern is not a clear-cut "yes". The lack of an unequivocal affirmation is partly because there is not complete agreement about which Ganesh and Narayan shrines are members of the set of four. The Ganesh shrines and their locations according to one page in the Protective Inventory are Surya Vinayak south of Bhaktapur, Jal Vinayak at the Chobar gorge, Rakta or Chandra Vinayak in Chabahil, and Karya Vinayak close to Bungamati (Figure 1). 10 However, elsewhere in the same publication, Ashok Vinayak in Maru Tole of Kathmandu-replaces Karya Vinayak. 11 And. in one of Gutschow's publications he listed a Ganesh shrine in Sankhu instead of Rakta Vinayak. 12 Likewise, the four Narayans are usually, but not always, given as Changu Narayan southwest of Sankhu, Ichangu Narayan near Holchok, Sekh Narayan near Pharping, and Bisankhu Narayan midway between Lubhu and Godavari. As exceptions, one publication states that Buddha Milkantha is even more important than these other four Vishnu temples; 13 and Gustchow and Auer included a sixth one at Macchegaon. 14

With this diversity in enumerating which places actually constitute the set, it becomes a little difficult to discern whether either set forms a regular pattern which conforms to a Valley-size mandala. Generally the sources that commented on the geography of religious sites did agree with the Gutchow thesis: that sets of sites are theoretically positioned in the Valley in the four cardinal directions. Nevertheless, they recognized that topographic and settlement features have modified a perfect north-south and east-west orientation, and these

locational modifications from the ideal make it difficult to determine visually which of the conflicting sites are most likely members of the set. There was greater unamimity about the four Narayan temples; and when Buddha Nilkantha and Macchegaon are omitted, the remaining four do display spatial regularity within the Valley. Detecting regularity in the location of the Ganesh shrines is more difficult, partly because the experts differed about whether Ashok, Rakta, or Karya Vinayak belongs to the set of four. Depending on which four are included, either Ashok Vinayak or Rakta Vinayak represents the northern position, and Jal Vinayak is either the western or southern temple. Thus, except for agreement that Surya Vinayak is the eastern member, uncertainty remains about a regular and purposeful orientation of the Ganesh shrines.

When the question about whether a set of eight sites form a meaningful pattern is applied to the Ashta Matrkas, the answer seems to be mostly negative. This conclusion results primarily because of very limited knowledge about any set that pertains to the Valley as a whole. Only one of the published references referred to such a Valley as a whole. Only one of the published references referred to such a Valley set; 15 and several of the interviewed experts stated that no set of sacred sites exists for the entire Valley. Thus, even though it is well known that Ashta Matrikas surround each of the three major cities, knowledge about a set that protects the entire Kathmandu Valley is very rare.

The answer to the second question about the spatial regularity of sacred sites in the Valley, therefore, seems to be a conditional "yes". There is general agreement about the specific members of the Narayan set, and their locations within the Valley do appear to form a regular

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locations within the Valley do appear to form a regular pattern. There is less agreement about which four of five major Ganesh shrines constitute the true set, and mone of the potential sets forms a pattern which appears obviously regular to an outsider. Although the eight Matrika sites may form a well-oriented pattern (as shown by the small map published by Gutschow and Bajracharya), this information is apparently very esoteric.

Perceptions of Sacred Sites

The third research question deals with how inhabitants perceive the geography of sacred sites in the Valley. Information about perceptions was acquired by asking selected villagers and townspeople about the major Ganesh and Narayan shrines and about sites of the Ashta Matrikas. The author and his assistant went to more than a dozen villages scattered throughout the Valley and to the three main cities during a month's period to interview 121 lay persons. 17 Respondents were asked to name the four main Ganesh and Narayan sites, to describe the locations of those sites, and to show their locations on a large-scale map. Then they were asked why the sites are located as they are. Also, persons were asked about the existence of Matrikas, piths, and Dikpalas for the Valley and for their own locality.

The characteristics of the selected respondents are given in Table 1. A heterogeneous sample of persons was contacted with the respondents representing a variety of ages and schooling levels (and occupations). The number of times a particular site was named by respondents is listed in Table 2. It appears that respondents (like the experts) were uncertain about which of five Ganesh shrines

constitute the set of four that belong together. This uncertainty is evidenced in Table 2 by the gradual decrease from 93 to 49 in the frequency that the top five places were named; that is, the difference between the fourth and rifth (63 - 49 = 14) is no larger than between the second and third most frequently named places (86 - 72 = 14). Respondents were more certain which four Narayan sites form a distinct set, though, because the difference between the fourth and fifth most frequently named places (83 - 27 = 56) is much larger than between any of the first four places listed in Table 2.

Since even the experts are uncertain about the existence of Ashta Matrikas for the Valley, it came as no surprise that respondents also said they did not know about such. In a few villages, persons identified a particular place which did, in fact, correspond with one of the Valley Matrikas listed by Gutschow and Bajracharya; but the respondents invariably considered the pith as primarily a place of importance for the immediate

locality and not as one member of a set for the entire Valley. On the basis of the answers provided, one can only conclude that there is no common perception among the residents of the Kathmandu Valley about the existence of a set of Matrikas protecting the entire Valley.

Table 3 summarizes the replies to the interview question concerned with reasons for the locations of sacred sites. Only two persons pointed out the fact that the sites were located in the four directions; two others regarded the shrines as protectors for the Valley; and three interviewees specified that the four shrines were situated to serve the entire Valley. Four persons declared that the position of Surya Vinayak in the east

110 CNAS Journal, Vol. VII, No. 1 & 2 (Dec.'79 & Jun.'80) was significant, but they did not mention the other three as having similar locational importance. Evidently most respondents did not consciously consider the cosmological model as an explanation for the spatial distribution of sacred sites.

These data may be in error or misleading, though, for various reasons, three of which are the following.

- (1) Respondents were not selected by a statistically random procedure. That is, no prescribed method for using a sampling frame was employed, and thus the respondents cannot be regarded as an unbiased subset from the general Valley population. It is the opinion of the author that persons having more information about places other than their immediate vicinity were over-represented. For example, a higher percentage of school teachers were interviewed than their proportion of the total population. thus producing a sample of persons who undoubtedly leave their home village more frequently than do farmers. is probably safe to assume that those persons not chosen for interviewing were even less aware of religious places outside their immediate locality. Therefore, this possible source of error would not jeopardize a negative conclusion about perceptions of patterns in the locations of Valley sites.
- (2) Respondents may not have given correct information. Incorrect information can occur when interviewees choose deliberately to mislead an interviewer; certainly this is a universal weakness with any technique that depends on the cooperation of others. However, the percentage of persons who were willing to answer questions compares very favourably with other parts of the world, for instance with rural United States; this

willingness to answer indicates a positive attitude about giving valid answers.

Respondents may have given incorrect information unintentionally because of inability to remember names or places or use the map. Some persons knew where a Ganesh or Narayan temple was located but chuld not remember the name. Others knew a name but forgot the location. And, of course, asking persons to use the map had varying success. Those who had no idea about the relationship between the symbols on the cloth map lying before them and places they knew were excused from completing that portion of the interview. Although not checked statistically, responses seemed to reveal no correlation between the amount of schooling of the respondent and ability to use the map.

(3) Faulty communication may have distorted the recorded information. Under the best of conditions it is possible that an interviewer and interviewee misunderstand what the other person is trying to say. The possibility of such misunderstanding is increased if the information must be communicated through a third person, especially when the conversation must be translated into another language. Fortunately many of the questions and answers were fairly factual, so these data were probably communicated satisfactorily; but the attempt to learn about respondents' perceptions of regularity in religious sites undoubtedly was less successful.

Any one, of a combination, of these three conditions may have caused errors in the data. However, if the assumption is made that whatever errors did occur are not systematically large and of a single type, then the

112 CNAS Journal, Vol. VII, No. 1 & 2 (Dec.'79 & Jun.'80) results can be viewed as a satisfactory answer to the question about inhabitants' perceptions of sacred places.

Conclusions

The third question in the study was this: Do most persons living in the Valley perceive specific sacred places as parts of a set which has meaning for the Valley as a whole? The answer seems to be mostly negative.

In the case of the Matrikas, this conclusion may result from at least two characteristics of Tantricism. One characteristic is its secretive nature, which deliberately limits a wide diffusion of knowledge about beliefs and practices. Another characteristic is the manner in which knowledge is passed from guru to disciple rather. than through well-publicized doctrines, which means that certain sites may have meaning for one group of believers but not the same significance for followers of another teacher. Therefore, it is safe to conclude that the arrangement of any religious sites which may be associated with the eight Matrikas is not commonly perceived as representing a Valley-wide yantra or similar representation of a cosmic design.

For the Ganesh and Narayan sites, the conclusion is partly "yes" but mostly "no". On the positive side, most respondents did consider four specific shrines as belonging to a set (i.e., one set for Ganesh and one for Narayan), and each set was identified as distinct from other shrines in the Valley dedicated to Ganesh and Narayan. Further evidence that the four shrines are regarded as members of a unique set was acquired when several respondents reported they had taken a one-day

pilgrimage to the four shrines. (These pilgrimages involve walking the 35 to 45 kilometers in a prescribed sequence to worship at each of the four, but only these four, shrines.)

On the negative side is the fact that, although respondents may view the various shrines as belonging together in one of the two sets, very few respondents gave any reason for the locations of the shrines. contrast to the experts, who usually related the positions of the shrines to the cardinal directions in the Valley, the lay persons seldom mentioned any over-all Many respondents did answer queries about local shrines around their own village or town in terms of protective positions, but they rarely applied this same kind of locational model to the sets of Valley shrines. Consequently, it seems safe to conclude that, although inhabitants regard spatial regularity as very important in the sacred space of their local vicinity, they do not necessarily perceive a similar geography of sacred sites at the scale of the entire Kathmandu Valley.



Figure 1. SHRINES IN THE KATHMANDU VALLEY

Table 1. Characteristics of Respondents

<u>Sex</u>	<u>Number</u>	<u>Age</u> <u>N</u>	umber
Male	85	Less than 30 years	16
F'emale	36	31 - 60 years	82
		Over 60 years	23
	121		121

Schooling	<u>Number</u>
Illiterate	36
Read & write	35
Grades 4 = 9	15
10th Class & more	26
No data	9
	121

Table 2. Shrines Named and Mapped by Respondents

Ganesh Shrines

Place	Frequency <u>Named</u>	F'requency Mapped
Surya Vinayak	93	74
Ashok Vinayak	86	73,
Jal Vinayak	72	57
Rakta Vinayak	63	52
Karya Vinayak	49	39
Misc. others	28	8
No response	4	-

contd....

Narayan Shrines

Place	Frequency Named	Frequency Mapped
Changu	97	77
Ichangu	8 5	61
Sekh	83	64
Bisankhu	83	57
Budhanilkantha	27	15
Macchegaon	7	3
Misc. others	16	3
No response	5	-

Table 3. Reasons Given for the Locations of Shrines

Reason	Frequency
Protectors of the Valley	2
Placed in four directions	2
Spread throughout the Valley	3
Surya in the east	4
Specific story for one place	13
No reason known	106
No response	12
(Classes are not necessarily mutual)	ly exclusive)

Notes

- 1. Mircea Eliade, <u>The Sacred and the Profane</u> (New York: Harcourt, Brace, & World, 1957).
- 2. Paul Wheatley, <u>The Pivot of the Four Quarters</u> (Chicago: Aldine, 1971), p. 417.
- 3. Yi-Fu Tuan, <u>Man and Nature</u>, Commission on College Geography, Resource Paper No. 10 (Washington, D.C.: Association of American Geographers, 1971), p. 24.
- 4. B. B. Dutt, <u>Town Planning in Ancient India</u> (Calcutta: Thacker, Spink, 1925); Stella Kramrisch, <u>The Hindu Temple</u> (Calcutta: University of Calcutta, 1946); Jan Pieper, "Three Cities of Nepal," in Paul Oliver, ed., <u>Shelter. Sign & Symbol</u> (London: Barrie & Jenkins, 1973), pp. 52-69.
- 5. Niels Butschow and Bernhard Kolver, <u>Ordered Space</u>.

 <u>Concepts and Functions in a Town of Nepal</u>. Nepal
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 Steiner Verlay, 1975), p. 43.
- 6. Niels Gutschow and Manabajra Bajracharya, "Ritual as Mediator of Space in Kathmandu," <u>Journal of the Nepal Research Centre</u>, Vol. I (1977), P. 4.
- 7. Jay W. Vogt, "Sacred Space, Architectural Tradition, and the Contemporary Designer," The Himalayan Review, Vol. 9 (1977), pp. 41-53.
- 8. J. Tevere MacFadyen and Jay W. Vogt, "The City is a Mandala: Bhaktapur," <u>Ekistics</u>, Vol. 44 (1977), pp. 307-309; Niels Gutschow, "Ritual as Mediator of Space: Kathmandu," <u>Ekistics</u>, Vol. 44 (1977), pp. 309-312; Jan Pieper, op. cit.

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- 9. Carl Prusha, ed., <u>Kathmandu Valley</u>. <u>The Preservation of Physical Environment and Cultural Heritage</u>. <u>A Protective Inventory</u> (Vienna: Anton School & Co., 1975).
- 10. <u>Ibid</u>., p. 31
- 11. Ibid., p. 51.
- 12. Gerhard Auer and Niels Gutschow, <u>Bhaktapur</u>: <u>Gestalt</u>, <u>Functionen und Religiose Symbolik einer Nepalishchen Stadt im Vorindustrielien Entwicklungsstadium</u>
 (Darmstadt: Technische Hochschule, 1974), p. 17.
- 13. K. R. Pandey and Carl Prusha, eds., <u>The Physical</u>

 <u>Development Plan for the Kathmandu Valley</u> (Kathmandu: His Majesty's Government of Nepal, 1969), p. 50.
- 14. Auer and Gutschow, op. cit., p. 16.
- 15. Gutschow and Bajracharya, op. cit. (which is essentially repeated in the 1977 issue of Ekistics, op. cit.).
- 16. <u>Ibid</u>., p. 3 (and p. 311).
- 17. Gambhir Bahadur Hada from the Centre for Nepal and Asian Studies, Tribhuvan University, was the research assistant for this project.