

## CHAPTER THREE

### **FENG SHUI AND CONTEMPORARY ENVIRONMENTAL DESIGN PRINCIPLES**

This part of the dissertation reviews feng shui theories, its applications, and contemporary environmental design principles. It also compares feng shui to contemporary environmental design principles. Finally, it outlines the major environmental factors that should be considered in site analysis.

Environmental design principles in architecture have drawn increasing attention, as evidenced by the plethora of publications and research that consider environmental integration issues and design approaches. Since the 1950s, concerns about both industrial pollution and energy supplies have been reflected by increasing interest in the life cycle of nature and renewable resources. Environmental design approaches, such as those defined and analyzed by Olgyay, McHarg, and other researchers, emphasize western principles for studying basic aspects of the natural environment, including climate, physiography, hydrology, vegetation, and characteristics and habits of the inhabitants. Feng shui, an ancient wisdom that examines the sites of cities and determines the desirable layouts of buildings, offers both an alternative and complement to contemporary environmental design methods (Figure 3-1).

Recently, combinations of eastern and western approaches have become more apparent. For example, contemporary architects in New York and Washington DC have consulted feng shui experts for their input on architectural and interior designs. However, the comparison and possible incorporation of contemporary and traditional environmental principles has received less attention. In this chapter, comparisons are made between contemporary environmental design principles and feng shui, focusing on several aspects of this relationship, including their epistemological backgrounds, analysis methods, and

evaluation criteria. Finally, this chapter identifies the essential environmental design factors that are applicable to both approaches. These factors become major components of the proposed decision-making framework, and have been implemented into a computer program. This is described in further detail in the fourth chapter.

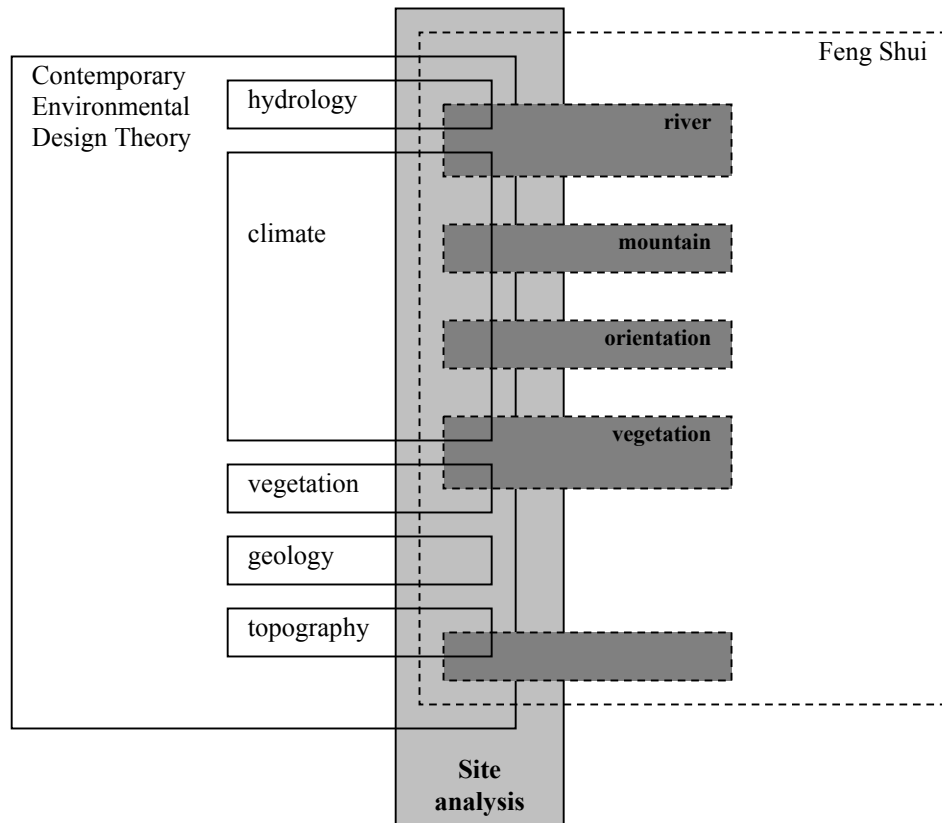


Figure 3-1 Comparison between feng shui and contemporary environmental design theory

### 3.1 Feng Shui Theory and Applications

Feng shui is an ancient discipline that examines the sites of cities and buildings, and determines the desirable arrangement of interior space. The Chinese have used it since the Western Zhou dynasty (1100 B.C. - 771 B.C.). Following the simple observation that environment influences the decline or rise of civilizations, the ancient Chinese concluded that the energy or force of nature, *feng shui*, creates mountains and rivers, nurtures plants and animals, and is essential to human life. Therefore, they argued, the selection of land for a city

or a house should follow the principles of feng shui. They developed feng shui as a comprehensive environmental evaluation system that examined issues related to astronomy, climate, geology, topography, ecology, and landscape. They used this system to select sites for cities and to determine desirable layouts for buildings and tombs. Feng shui also delineates certain taboos and incorporates various symbols that it uses to identify favorable environments for site selection, building construction, and interior design.

Over the years, feng shui studies have developed into two schools: one, the form school, is based on the land forms and the chi (*Qi*), a Chinese term describes the energy flow related to these forms. The other, the compass school, is based on orientations, astronomical changes, and calculations that are made with a feng shui compass. Most feng shui experts blend both methods in practice, although in general, the form school relates to landscape design and the compass school relates to architecture and urban planning. There are two fields of feng shui: *yang* house feng shui, which is for buildings, towns, and cities, and *yin* house feng shui, which applies to tombs (Figure 3-2).

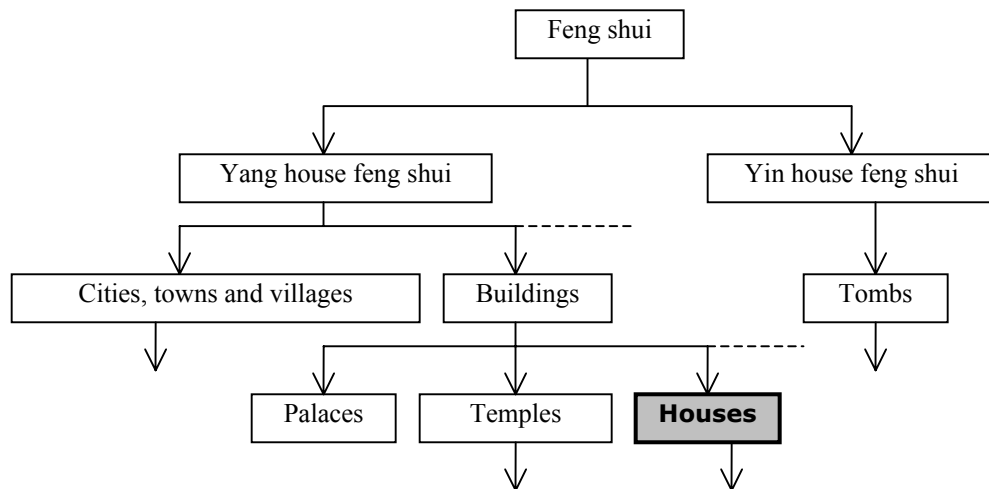


Figure 3-2 The applications of feng shui (this research will focus on the its application on houses)

The basics of feng shui include the *yin yang*, the chi, the five-element, and the eight-trigram concepts. Each of these is highly related to the others. It is vitally important to understand the interpretation of each characteristic in order to understand how it interacts with other factors. Thus, after introducing each concept, this section will summarize its application rules.

### 3.1.1 Yin Yang Concept

Based on the observation of the universal energy of the earth, the ancient Chinese believed that everything in the universe was produced by changes, which resulted from the balancing of *yin* and *yang* (Figure 3-3). *Yin* (--) symbolizes the moon, femininity, darkness, and stillness. Conversely, *yang* (—) symbolizes the sun, masculinity, brightness, and motion. Yin and yang have a complementary relationship. The presence of yin and yang in an object depends on its context. For example, water is yang when it compares with mountain, which is still and can be presented as yin. However, water is yin when it compares with fire. In ancient literature, feng shui practitioners analyzed landscape by considering the relationship between *yin* and *yang*. As Xu (1990) translates:

Mountain is [*yin*], while water is [*yang*]... the sharp rising land is [*yin*], while the flat land is [*yang*]; the tip is [*yin*] and the whole is [*yang*]; the still one is [*yin*] while the moving one is [*yang*] and the solid is [*yin*] while the void is [*yang*] (p.31).

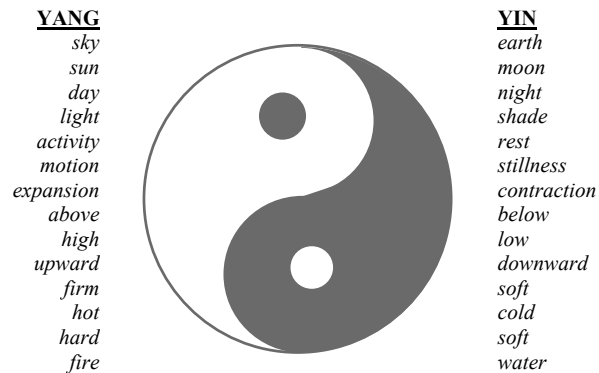


Figure 3-3 Yin and yang

A favorable site should have a balance between *yin* and *yang*. For example, surrounding hills (*yin*) and a meandering river (*yang*) suggest an ideal location. In feng shui, the *yin yang* theory is a fundamental principle that is also presented in the theories of chi, the five elements, and the eight trigrams.

### 3.1.2 Chi

The term chi (*Qi*) can be translated as “vital energy flow,” or the “breath of nature.” Chi can be split into two groups: *yin* chi or *yang* chi. Xie pointed out that:

When chi rises from earth to sky, it becomes cloud. This is called [*yang*] chi. When chi falls from sky to earth, it becomes rain. This is called [*yin*] chi. The exchange of [*yin*] chi and [*yang*] chi produces everything<sup>1</sup>.

Chi exists in every aspect of life. In the human body, chi is the energy that flows through acupuncture points. On the earth, chi is the energy carried by wind and water. In housing design, when chi is abundant, the site will bring health and strength to those who live there. In site selection, when *yang* chi accumulates around the area, the housing site benefits those who live there.

There are two types of chi: living chi and dead chi. Table 3-1 summarizes the separation between living chi and dead chi for different natural elements (Yi, Yu, and Hong, 1996). Although little research has been performed to test the accumulated chi surrounding given sites or buildings, researchers have obtained positive results in the fields of medicine and biology. For example, chi has been observed in the practice of Qigong, a natural science that has been utilized to achieve health, happiness, and longevity for thousands of years (Lu, 1994).

*Table 3-1 Living chi and dead chi*

	mountain	river	soil	vegetation	air
living chi	smooth	clean, slow, meander	thick, rich	green, flourish	warm, clean, dry
dead chi	steep	turbid, swift, straight	damp	barren	cold, stale, moist

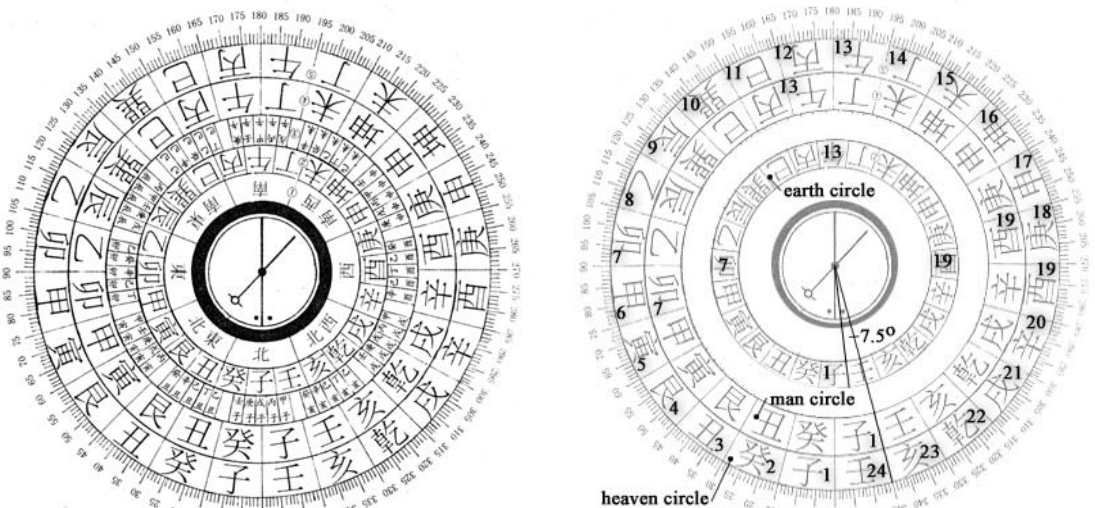
Chi is the most important concept in feng shui, as well as in other traditional Chinese disciplines that deal with culture and science. Literally, feng shui means wind and water. These two intersect in various ways. Perhaps the most important is in their relationships to chi. The term of chi came from the observation that chi could be “dispersed by the wind” and be “gathered by the water” (Gu, 1995). The simplest concept in feng shui is chi arrangement. Chi could be influenced by orientation, landform, wind, water, and the surrounding environment of the site. Feng shui masters examine and arrange chi by analyzing the land form and using a feng shui compass (Figure 3-4a).

A great variety of feng shui compasses exists, the simplest one has four concentric rings and the full geomantic one comes with thirty-six rings. Each ring has twenty-four

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<sup>1</sup> My translation from the Chinese text in Dili Tianji Huiyuan, Vol. 9.

orientations, which mainly come from the eight-trigram concept and are also related to the *yin yang* and the five-element concepts. Feng shui practitioners obtain information from the center magnetic needle and the three important rings: the earth, the man, and the heaven circles. The earth circle determines the direction where the chi enters a given site and the orientation of the building. The man circle helps to examine surrounding hills of a site. It inclines 7.5° counterclockwise to the earth circle. The heaven circle helps to analyze the flow of rivers. It inclines 7.5° clockwise to the earth circle (Figure 3-4b).



(a) *Compass (Chen and Kong, 1992, p.78)*

(b) 1:zi, 2:kui, 3:chou, 4:gen, 5:yin, 6:jia, 7:mao, 8: yi, 9:chen, 10:xun, 11:si, 12:bing, 13:wu, 14: ding, 15: wei, 16:kun, 17:shen, 18:geng, 19:you, 20:xin, 21:xu, 22:qian, 23:hai, 24:ren.

*Figure 3-4 Feng shui compass*

According to Zang Jing, one of the oldest books on feng shui, chi becomes clouds when it raises to sky, and it rains when chi falls to the earth. This characteristic of chi is very similar to the process of water evaporation and air circulation in western science. It suggests the scientific understanding of the ancient Chinese. However, chi cannot be evaluated through air movement or any other single element. This research considers wind, relation to bodies of water and the shape of bodies of water, soil types, slope, vegetation, and orientation when applied to chi and *yin yang* theories.

### 3.1.3 Five-element Concept

The five elements: wood, fire, earth, metal, and water, originated from observed natural phenomena, and represent different characteristics of the material world. The ancient Chinese believed that everything is composed of one or more of the five elements, and that these elements influence each other within both a creative order and a control order (Figure 3-5). The creative order is established through connections and interactions between these elements. For example, the ancient Chinese found that wood burns to produce fire and then becomes ash, a component of earth; metal comes from the veins of the earth and will melt to liquid like water; underground water nourishes trees and produces wood. On the other hand, the control order follows the observations that fire changes the attributes of metal, but will be stopped by water; tools made from metal can lop off branches; trees and other plants can break through the soil (earth); banks of the river (earth) block the flow of water.

Table 3-2 Five elements and their representations

	directions	colors	materials	shapes	seasons	numbers	planets	animals
<b>wood</b>	east	green	wood	straight line	spring	eight	Jupiter	dragon
<b>fire</b>	south	red	fire	sharp angle	summer	seven	Mars	raven
<b>earth</b>	middle	yellow	soil	rectangular	four seasons	five	Saturn	dragon
<b>metal</b>	west	white	metal	round	fall	nine	Venus	tiger
<b>water</b>	north	black	water	curve	winter	six	Mercury	tortoise

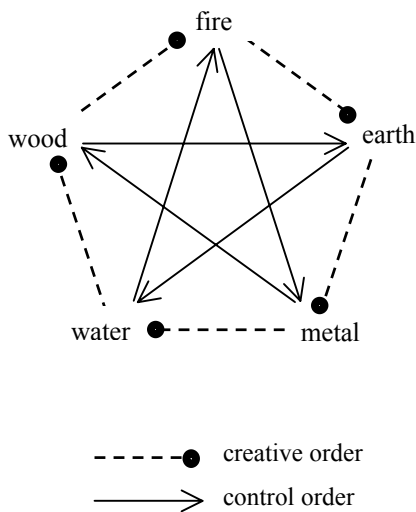


Figure 3-5 Creative order and control order of five elements

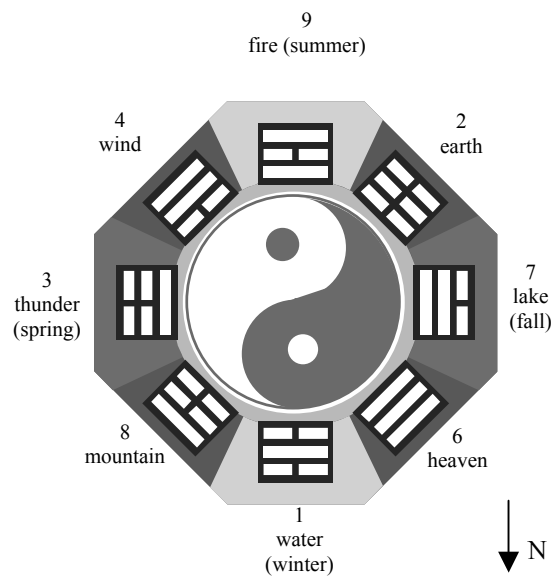


Figure 3-6 Yin yang and bagua

Directions, colors, materials, shapes, seasons, numbers, planets, and animals can be connected to one or more of the five elements (Table 3-2) (Yi, Yu, and Hong, 1996; Wang, 2000). The form school of feng shui practice interprets the five elements as a means of identifying desirable landscape and building forms.

#### **3.1.4 *Eight-trigram Concept***

The eight trigrams: heaven, water, mountain, thunder, wind, fire, earth, and lake, are derived from the changes of *yin* and *yang* (Figure 3-6). They also represent the eight directions, four seasons, and twelve times of the day. Figure 3-6 shows the *bagua*, a feng shui diagram made up of the eight trigrams, combined with feng shui numbers and eight directions. *Bagua* is the central part of the feng shui compass, and is the basis for both the form school and the compass school.

Because the analysis process and results of the five-element and eight-trigram concepts are intangible, they are difficult to use directly in this research. Therefore, this research incorporates the concept of five elements and eight trigrams with other feng shui theories, and uses only the measurable factors.

#### **3.1.5 *Feng Shui Applications in Residential Buildings***

Feng shui originated from the observations and understanding of the natural environment that developed when ancient Chinese searched for desirable places to live. Over the years, rules and methods for selecting a housing site emerged; these techniques considered the major elements – rivers, mountains, sun, soil, underground water, and the surrounding environment of the site. The ancient Chinese believed that these major elements could influence the formation and circulation of chi. The ultimate goal of feng shui is to find a place where chi is abundant, so that the site can maximize its benefits for those who live there. Because feng shui is applied on a case-by-case basis, every factor should be considered in the context with others.

There are two major applications of feng shui: site selection of buildings and sites for human settlement (Figure 3-2). Whether the person searching for a site is an emperor or an ordinary person, the surrounding environment and its effects on housing are very important. This explains why *yang* house feng shui became a major component in practice and



literature. This school originally developed as a means of selecting housing sites in mountain areas, where the natural environmental impacts were primary factors. Detailed methods of *yang* house feng shui were developed for various locations. Most of these methods are still used with little adjustment since the original transcripts were written hundreds of years ago (Figure 3-7). In this research, the most commonly used texts are selected to support the interpretation. The literature also shows that the ancient Chinese summarized the basic feng shui principles into illustrated patterns. Figure 3-7 shows two patterns with the same content: a housing site that is between two parallel roads is not desirable. The one on the left was first published in the Ming dynasty (1368-1644) (Wang, 1985), and the one on the right is a later interpretation (Wang, 2000).

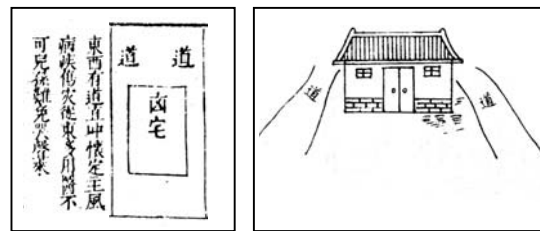


Figure 3-7 Two feng shui patterns

In general, the rules from the form school were widely applied to housing in mountain areas; on the other hand, when the surrounding factors were related to roads, buildings, and other structures, the principles of the compass school were used. The principles of *yang* house feng shui can also be differentiated into exterior layout and interior design. Four groups of principles further separate the traditional methods when applied to houses that are located in cities or suburban areas (Figure 3-8).

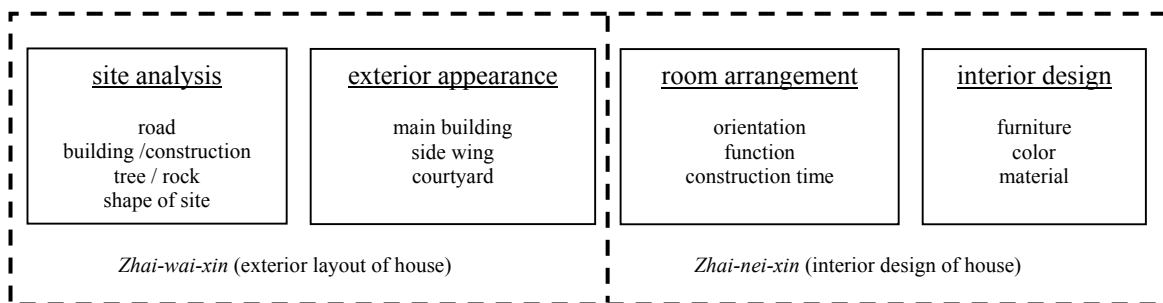


Figure 3-8 Four groups of feng shui

The first group interprets the methods with urban settings: roads can be evaluated as rivers and surrounding tall buildings or structures as mountains. The method illustrated in Figure 3-7 is in the first group. Considerations also include the position and type of trees and rocks, the shape of the site, and the functional uses of other buildings in the neighborhood. One poem in *Lu-ban-jing* says: "If the door of a granary is facing the house, one can be sure of bad luck and disaster. Falling sickness will raise its head time and again, for which no cure exists. But few people in the world are aware of this" (Ruitenbeek, 1993, p.78). Thus, feng shui finds urban analogs to the more traditional features of the rural landscape.

The second group consists of rules for the exterior appearance of the house. For example, the relation of the central building and side wings reflects the order of human society, so that a higher central hall is preferred.

The third group suggests the functional arrangement of rooms inside the house. Most principles in this process derive from the compass school. In some cases, accurate information about users and construction time are needed for better results.

The fourth group concerns the interior design of each room, including the colors and materials, and the placement of furniture. In ancient Chinese texts, rules regarding the first and second groups are normally listed under *Zhai-wai-xin* (exterior layout of houses); while those that influence the third and fourth groups appear under *Zhai-nei-xin* (interior design of houses).

The feng shui methods for the selection of housing sites in the countryside can be summarized in the following four principles:

1. The principle of systematic analysis is the foundation for other principles. Every factor within the environmental system is related to others. When applying feng shui, the goal is to find an optimized balance of all major factors.
2. The site should be supported by vital chi. For example, a favorable site should be surrounded by good hills and water. A topographic analysis of a specific site should be considered in addition to the regional information.
3. A favorable site should have a good orientation, such as facing south for those located in China.
4. Geologic and hydrologic data can provide more detailed information sets to perform the physiographic analysis.

Xu (1990) further summarizes the procedure of site selection and evaluation in feng shui practice into four steps. The first step is to look at the character of mountains in a large scale. For example, the mountain should begin at a peak, across many miles presenting at least three major peaks. The second step is to find an open space by judging the forms of the surrounding hills and the shape of nearby bodies of water. The third step is to find a suitable area within this open space. This step also includes examining soil, water quality, slope, and vegetation. The fourth step is to arrange chi by using a feng shui compass. This research analyzes the essential factors (wind, relation to bodies of water and the shape of water, soil type, slope, orientation, and vegetation), with the consideration of the above four principles and four steps.

In summary, these basic feng shui theories cannot be evaluated as thoroughly as any single element such as air movement or landform; feng shui embraces many fields of knowledge and integrates all related factors. Therefore, this research focuses on the applicability of feng shui and interprets its principles into quantifiable factors, including landform, wind, relation to bodies of water and the shape of bodies of water, soil type, slope, orientation, and vegetation.

The first concern is landform. Whether looking at the character of mountains or finding an open space, landform is essential concern for feng shui practice. Landform features include elevation, slope, and aspect (the orientation of slope). Differences of elevation determine the peak and the lower area in a region. Additionally, a steep slope is not favorable because water flows and the living chi slides off such a place. Flat land is also not acceptable because there is “no diversity of *yin* and *yang*.” Feng shui also considers the aspect, or orientation, of a slope. A favorable site should be located on a south-facing, gentle slope with an open space in the front. Moreover, in feng shui practice, the chi arrangement includes selecting the orientation for a house and evaluating the orientation of its surrounding mountains and water. The primary tool in this selection is the feng shui compass. The form school uses the compass with the observation of the land and associated compass diagrams. The compass school uses the eight trigrams and five elements in conjunction with the compass. This research uses the survey results of favorable sites that are mentioned in

Chinese feng shui literature (Tables 3-3 and 3-4), instead of directly analyzing sites using the compass.

*Table 3-3 Survey results of orientation (Xu, 1990)*

Orientation	S	E	SE	SW	W, N, NW, NE
Percentage	46%	20%	13%	7%	<=5%

*Table 3-4 Survey results of orientation of the gates of building complexes and main buildings (Translated from Cheng and Kong, 1992, p.84)*

	Gate	Front Building	Main Building	Back Building
Nanhai Temple, Guangzhou	SE 7°	S 0°	SW 2°	SW 3°
Zhang Temple, Yongding			SW 18°	
Han Temple, Chaozhou			WS 8°	
Kaiyuan Temple, Chaozhou	SW 6°	SW 5°	S 0°	SE 3°
Xu House, Chaozhou			SE 8°	SE 6°
Yue King Temple, Hangzhou			SW 25°	
Baoen Temple, Suzhou	SE 10°	SE 5° (Pagoda)	SE 5°	SE 10°
Xiyuan Temple, Suzhou		SW 3°	S 0°	
Xia Huayan Temple, Datong	ES 6°	ES 4°	ES 4°	

The second concern is wind speed and direction. According to the famous feng shui master Yang Junsong, it is crucial for a favorable place to avoid wind because the wind scatters chi. Therefore, a strong breeze is considered as one of the most harmful factors in site selection. A site should be protected from the winter wind and welcome a gentle summer breeze.

The third concern is the relationship between a site and a body of water. Because chi can be kept and accumulated by water, locating near a body of water becomes a basic criterion for site selection. A favorable site might feature a body of water forming a lake or joining a stream. In addition, a curved stream is preferable to a straight one. Also, the site location should be inside the bend of a river, in the confluence of two streams, or on an island, because these places are less likely flood areas. Furthermore, feng shui emphasizes water quality. A site should avoid muddy areas, stagnant water, and wetlands.

The fourth concern is the type and characteristics of the soil. Zang Jing stated that rich and thick soil suggests flourishing, living chi. The weight of soil also suggests soil quality – the heavier the better. In addition, Xu’s translation from the ancient text to English clearly indicate the criteria for examining soil: “soil should not be too wet or too dry; the

color should be fresh and the fiber should not be too rough or too loose” (Xu, 1990, p.78). In practice, analyzing soil includes examining its size, texture, wetness, weight, and color. Soil in a favorable place should have fine particles, good drainage, and a high special gravity (SG) value.

The final concern is vegetation. The feng shui literature characterizes vegetation as the hair of the earth. Green trees, blossoming flowers, and prosperous vegetation are visual indication of living chi. A favorable site should have the above features. In addition, different types of vegetation provide accurate information about the type, drainage conditions, and mineral composition of the soil.

John Michell says "Feng-shui is the art of perceiving the subtle energies that animate nature and the landscape, and the science of reconciling the best interests of the living earth with those of all inhabitants" (Eitel, 1993). The above analysis of the applications of feng shui in buildings and human settlements intends to connect the “art” and “science” with the focal point of environmental issues. In the fourth chapter, the proposed framework uses the essential factors identified here in the development of its environmental models.

The potential benefits of feng shui have been recognized by westerners since the mid 19<sup>th</sup> century (Yates, 1868; Eitel, 1993; Dukes, 1914; Needham, 1962; Rossbach, 2000). Since the first Christian Missionary went to China, differences between western models of site selection and feng shui in dealing with the environment were noticeable. For example, in the late 19th century and early 20th century, the architectural activities of Christian missionaries, such as Gothic churches, were rejected by the Chinese people, because these buildings were not in harmony with their surroundings and were not consistent with feng shui. Mining of metals and coal was prohibited in the hopes of maintaining the chi vein (Yu, 1994).

### **3.2 Contemporary Environmental Design Principles**

After the industrial revolution, western approaches to environmental integration became, in many ways, similar to the eastern tradition of feng shui. Since the 1940s, industrial and chemical processes, such as depletion of the ozone layer and global warming, have caused irreversible damage to natural resources. With this awareness, effective environmental control and improvement methods become one of the most urgent tasks for

scholars and professionals in every field. Consequently, several environmentally conscious approaches to architecture have developed, as demonstrated by various projects and publications. During the 1940s and 1950s, Buckminster Fuller created the *Dymaxion*, an object that can perform at “the greatest possible efficiency with the most current technology.” The result was the Dymaxion house. In the 1960s, Paolo Soleri invented the term Arcology to integrate architecture and ecology. A prototype arcology for 5000 people named Arcosanti was constructed near Phoenix, Arizona. In its West and East Housing, passive solar strategies are used to make the indoor space comfortable; while the structure of the foreground, named the Foundry, is designed to respond to changes in the sun angle and to control the amount of shade. After the oil crisis of 1973, many pioneers also began to design houses, such as the “integral urban house” of Ken Baer and Sim van der Ryn, which uses solar energy and other alternative energy sources. Meanwhile, books and publications, including Rachel Carson’s *Silent Spring* (1962), E. R. Schumacher’s *Small is Beautiful* (1976), and David Pearson’s *The Natural House Book* (1989), helped to raise awareness of environmental issues.

In the West, the environmental emphasis in housing design also has a long history. In the first treatise in architectural history, *Ten Books on Architecture*, Vitruvius emphasized the importance of climate:

[I]f our designs for private houses are to be correct, we must at the outset take note of the countries and climates in which they are built. One style of house seems appropriate to build in Egypt, another in Spain, a different kind in Pontus, one still different in Rome, and so on with lands and countries of other characteristics (p.170).

His outline hearkened back to an era when architecture evolved without architects before the eleventh century (Figure 3-9). The earliest existing structures were probably modeled by the forces of natural wind and water, even before humans walked the earth. Inspired by caves and animal dens, people learned how to use local materials and simple tools to build their houses.

Some traditional buildings are not only useful as artifacts for cultural preservation; they also offer good examples of ways for us to work in similar climates and culture conditions. One example is a traditional house at Baghdad, Iraq. In this vernacular and “oriental” house, family living areas are in the lower rooms on summer days, and in the courtyard or the roof terraces on summer nights; these activities moved into the rooms on



*Figure 3-9 Buildings reflected natural environment (Rudofsky, 1964)*

the second floor, constructed by light materials and glass, during the winter (Watson, 1979). Further examinations by Hassan Fathy (1986) show that the house also used a malgaf, a wind-catching device “rising high above the building with an opening facing the prevailing wind.” The malgaf improved the natural ventilation and also introduced cooler and faster wind into the building.

The abundant traditional solutions offer concepts that can be of use today, such as the ways that architectural design should respond to the climatic and social considerations as well as materials and structure. Thus, the field of vernacular architecture should be evaluated, modified, and then developed to be compatible with modern requirements.

Since the 1950s, Olgyay, McHarg, and other researchers have begun the study of design theories and methods focused on the relationships between architecture and the environment, including climate, physiography, hydrology, vegetation, and characteristics and habits of the inhabitants.

### **3.2.1 Bioclimatic Design**

Concentrating on the environment, Olgyay (1973) analyzed examples from around the world and documented his findings in *Design with Climate*. He notes that regional architectural characteristics could be found in response to certain climates, although in different geological locations and cultures. Olgyay investigates a series of steps to interpret climatic factors in relation to human comfort. Using these steps, designers can focus on specific issues of the synthesis model (Figure 3-10).

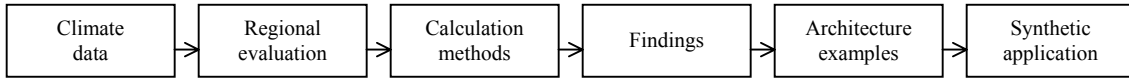


Figure 3-10 Bioclimatic design steps (Hyde, 2000)

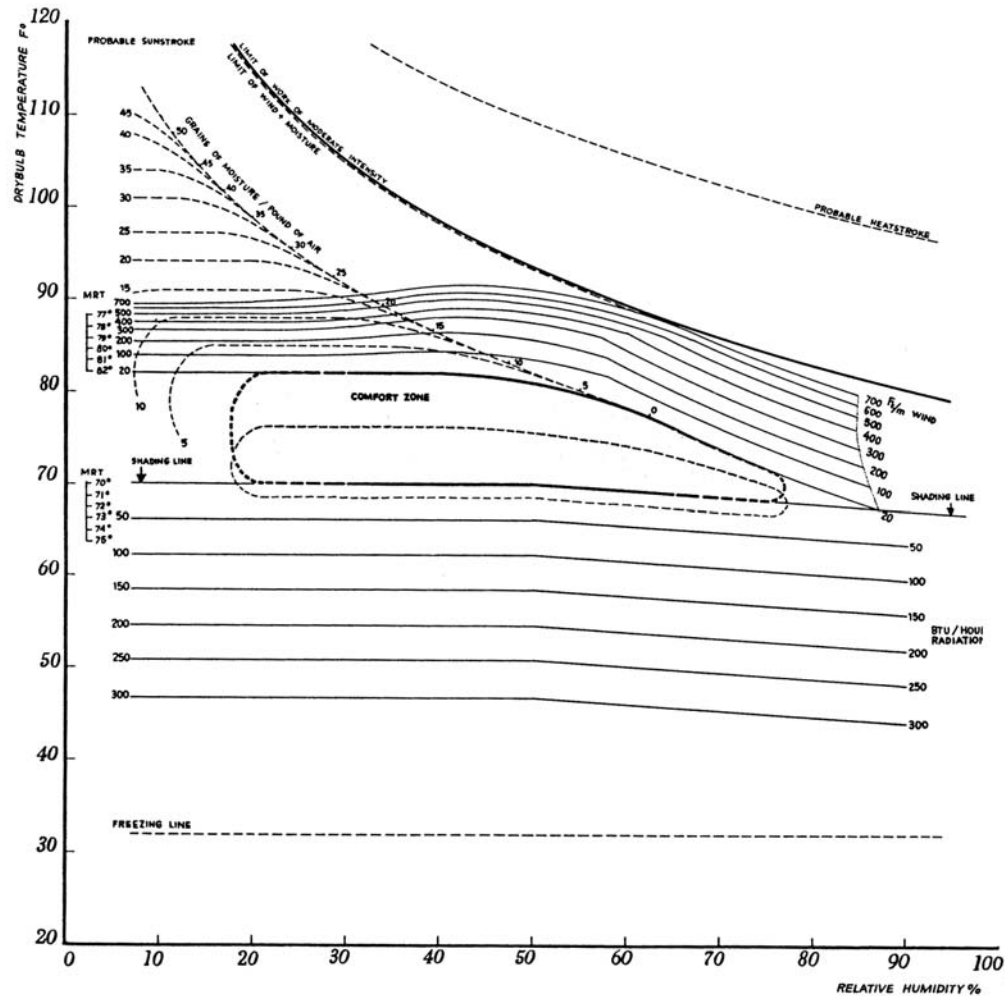


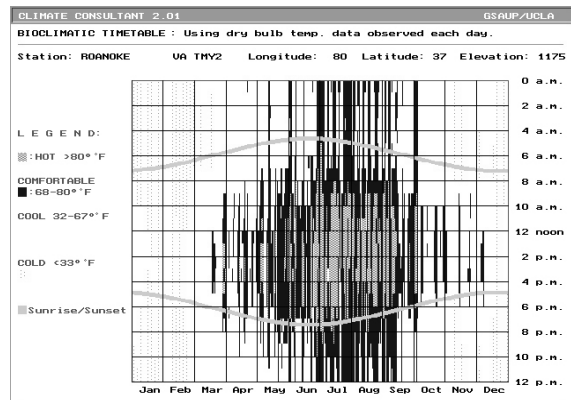
Figure 3-11 Bio-climatic chart for U.S. moderate zone inhabitants (Olgyay, 1973)

Based on Olgyay’s research, four major climatic elements – air temperature, radiation, air movement, and humidity – influence human comfort. The bioclimatic chart not only assembles individual factors, but also shows the correlations between the various climatic elements in the context of the comfort zone (Figure 3-11). In addition, when the natural climatic data is not located within the comfort zone, several modification strategies

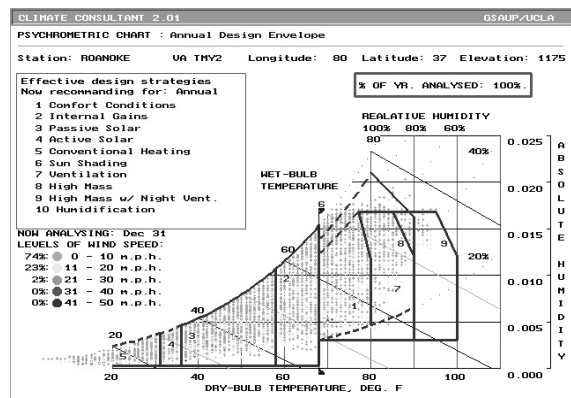


are suggested descriptively. Olgay also suggests that bioclimatic evaluation must be associated with regional climatic conditions. For example, four regions are selected to represent major climatic zones within the United States: Minneapolis, Minnesota represents a cool climate, the New York/New Jersey area represents a temperate climate, Phoenix, Arizona represents a hot/arid climate, and Miami, Florida represents a hot/humid climate.

Olgay's bioclimatic approach has had a profound influence among architects. Bioclimatic principles can be applied more practically using computer technology. Climate Consultant is a computer tool that delivers outlines of bioclimatic design to architects and researchers (Li and Milne, 1994). It also provides for psychrometric analysis that recommends the most appropriate environmental integration strategies, based on the passive design strategy as outlined by Givoni (1981) and Waston (Waston and Labs, 1992). Climate Consultant can graphically display climate data, including temperatures, wind velocity, sky coverage, timetable of bioclimatic needs, sun charts, and sundials (Figure 3-12).



a) Dry bulb temperature in Roanoke, VA



b) Psychrometric chart for annual design envelope in Roanoke, VA

Figure 3-12 Results generated from Climate Consultant

However, Olgyay's bioclimatic approach only emphasizes one factor of architectural design. Human society has developed into a world with diverse cultural and religious systems. Architectural regionalism addresses this by deconstructing not only traditional cultures, but also the new civilizations and great cultures.

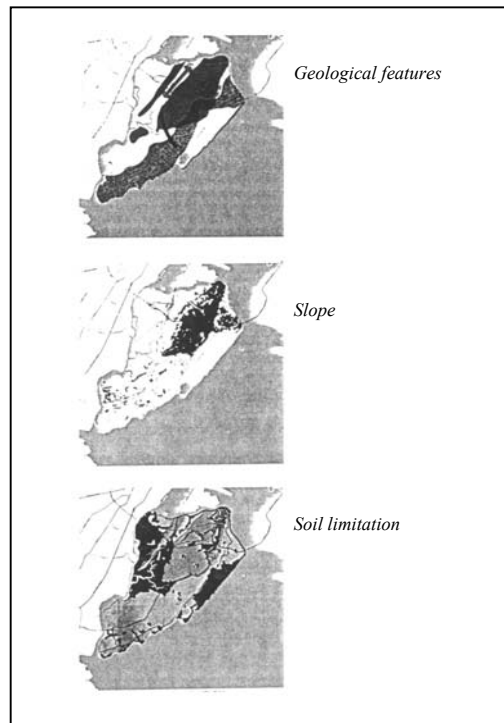
### ***3.2.2 Environmental Conscious Design Principles***

Industrial and chemical processes, such as depletion of the ozone layer and the increasing of global warming, have caused irreversible damage to numerous natural resources. With this awareness, effective control and improvement methods have become one of the most urgent tasks for scholars and professionals in every field. Alvin Toffler (1980) emphasizes that energy is "the precondition of any civilization, old or new." He specifies three civilizations in terms of energy usages: "First Wave societies drew their energies from 'living batteries' – human and animal muscle power – or from the sun, wind, and water... Second Wave societies, by contrast, began to draw their energy from coal, gas, and oil – from irreplaceable fossil fuels. This revolutionary shift ... meant that for the first time a civilization was eating into nature's capital rather than merely living off the interest it provided" (p.41). He further suggests that Third Wave civilization must and will draw on an amazing variety of energy sources – hydrogen, solar, geothermal, tidal, biomass, lighting discharges, as well as other energy sources not yet imagined.

There have been several major environmentally-conscious approaches to architecture since the 1940s, including plethora of projects and publications. Among them, Ian McHarg's *Design with Nature* (1969) is one of the most important books in the modern environmental movement in the field of architecture, landscape architecture, and urban planning.

In his book, McHarg establishes guidelines for choosing sites for development in various geographic locations, especially in metropolitan areas. By using mapping and measurement techniques, McHarg identifies eight natural processes related to land use. The basic information includes climate, geology, physiography, hydrology, pedology, vegetation, wildlife habitats, and land use. McHarg also considers over thirty factors under these eight categories. For example, in terms of residential development, the positive factors include features such as good soil and bedrock foundation conditions, as identified by geology and pedology studies; riparian land/water features, as identified by physiography study; and

historical and scenic value, which fall into the land use category. Negative factors include excessive slopes, poor drainage areas, susceptible flooding or erosion areas, and existing forests. As McHarg (1969) notes, more detailed criteria are also developed: “the land should have slopes of no greater than five per cent inclines; it must not be in the 50-year floodplain, nor in an important aquifer recharge area, nor in fog pockets or high and exposed elevations.” After analyzing individual factors, he demonstrates the results of each analysis in a transparency, which he attaches together to get a summary (Figure 3-13).



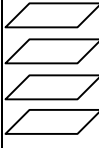
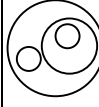


*Figure 3-13 Layered information structure used in McHarg's analysis*

### **3.3 Comparison of Feng Shui and Contemporary Approaches**

In this section, several aspects of feng shui and the western models are compared and analyzed in detail. The criteria for this comparison include research approaches, analysis method and structure, and criteria. Table 3-5 shows the simplified comparison results.

Table 3-5 Comparisons of three models

	RESEARCH APPROACHES	ANALYSIS METHODS		ANALYSIS STRUCTURE	ANALYSIS CRITERIA
Bioclimatic Model	Climatic factors: temperature, humidity, wind, radiation	Individual analysis and their correlation effects, psychometric chart, and comfort zone	tangible  in-tangible	 Frame structure	Human comfort
Environmentally Conscious Model	Nature process, including geology, physiography, hydrology, climate, vegetation, etc.	Identify values for different categories and select a better fit environment and adaptation		 Layer structure	Fitting environment for development
Feng Shui	chi and its relation with environment	Survey the mountain and water, find suitable area, and arrange chi		 From big system to small sub-system	Living chi should be abundant and harmonious with the surrounding

### 3.3.1 Research Approaches

During the process of investigation, it gradually becomes clear that both western models share a common epistemological background. This explains the similarity in their approaches and information sets. Since the seventh century, the task of exploring the foundations of physical science, which is symbolized by Newton's physics, turned the philosophers to the study of epistemology. As part of this trend, modern environmental studies seek to uncover the harmony of man and nature by analyzing the climate and other natural influences on human activities.

Olgay notices that when humans share an environment with other living species, they "must either adapt their physiology, through selection or mutation, or find other defenses against the impacts of environment." This builds on the widely-accepted notion that human physiology and cultural development have a close relationship to climate and environment. With his identification of four major elements in a climatic environment, Olgay presents clear and profound analytical results of their correlated impacts on human comfort. In his research, nature and human beings are different entities. The development of science and technology provides opportunities to thoroughly investigate each sub-system and the antagonistic relationships that it includes.

McHarg's approach is similar to that of Olgyay, although his model of design with nature consists of eight major factors, including climatic influences, and he criticizes traditional man-nature relationships. From his perspective, human beings are a part of nature. He believes that by understanding and considering the manifestation of natural processes and interactions, plans can be developed based on the intrinsic suitability and limitations of the land. In addition, McHarg notices that time may also become a major factor. Thus, the investigation of "surficial geology" or hydrology and soils can show geological and meteorological history.

In the view of feng shui, man is part of nature and is also a form of chi, like everything else in the universe. Chi is the holistic concept that includes natural phenomenon and human experiences, which cannot be simplified into or characterized by any individual scientific factor, such as energy and/or material. It is an entity of the earth and the stars, the divinities and the mortals, and human beings on the earth. In addition, the ancient Chinese believed that everything in the universe was produced by changes, the result of the balance between *yin* and *yang*. The concept of *yin* chi and *yang* chi describes the basic relationship, which feng shui uses to express the ideal that man and nature can be and should be in harmony. Thus, it is argued that design with feng shui principles follows natural law, and can help to accumulate a good energy field, and eventually improve the life cycle of nature.

The differences between the epistemological background and research approaches of these disciplines also reflect their various criteria. Human comfort is one of the fundamental goals of the bioclimatic model, and becomes its major criteria. In McHarg's model, the basic criterion is the fitness of environment for certain types of land development. The scientific understanding of the natural processes helps to select an appropriate plan. According to feng shui, living chi should be harmonious with the surroundings. The important criteria thus become the balance between *yin* chi and *yang* chi, and the accumulation of abundant living chi.

### **3.3.2 Analysis Methods**

The method of analysis and structure of the three approaches are very different. Bioclimatic design emphasizes the major results of climatic changes, such as temperature and humidity, and focuses on the correlations of these factors. Analytical results come from

quantifiable figures and numbers. The analysis structure of the bioclimatic model is a frame structure, while each factor has linear connections with other factors.

McHarg's model uses both tangible and intangible methods. For example, the thresholds of five phenomena ranking slope are defined as 2%, 5%, 10%, and 25%, while the results only show high or low ranking for air pollution, with no specific standard. This model of design with nature organizes its results into a layer structure. Factors of different categories are analyzed on separated layers and projected together; while factors within a major category are considered simultaneously.

Feng shui focuses on the observation and calculation of primordial causes, including the movements of planets and stars, and the balance of *yin* chi and *yang* chi. Because of its often-intangible combinations of forces, it is hard to use modern equipment and technology to implement feng shui's concepts. In terms of the analysis structure, the feng shui model considers every object or phenomena as a unit within a hierarchical-order system. For example, the site as a unit needs to have living chi. According to the feng shui literature, vegetation is considered as the hair of the earth, soil as the flesh, land forms as the bones, and water as the blood. Using this metaphor, feng shui intends to protect the vegetation and soil, to enhance landforms, and to clean and improve the circulation of water.

### **3.4 Conclusion**

In summary, the differences among the three models show a change in the degree of tangibility; this ranges from the most tangible bioclimatic model to the largely-intangible feng shui model. It is also worth noting the similar structure of the two contemporary models. Both analysis processes follow a sequential order, although in the model of design with nature, the factors within a category also form a parallel structure, such that the analysis sequences move from one unit to the other (Table 3-5). On the contrary, feng shui uses a different model that is based in a hierarchical order. The unit can be considered as a sub-system. The above analysis suggests an integrated approach, using a scientific research method and organic system, which has a hierarchical order in its main structure, and incorporates both sequential and parallel structures in its sub-structure.

The analysis also suggests the similarity with the environmental issues considered in the three models. These environmental factors include temperature, wind speed and direction, relative humidity, solar radiation, relation to bodies of water and the shape of bodies of water, flood area, soil type and quality, slope, aspect, and vegetation. These factors fall into five categories in the proposed framework, which is described in further detail in the following chapter.

Further, this integration with emphasis on environmental factors may lead to a better understanding of the relationships between humankind and the natural environment, and may create more harmonious living conditions. If the applications of feng shui can be effectively analyzed using contemporary environmental theory, its principles not only can be practiced as an alternative approach, but will also lead to a new field of environmental science.