



ENVD Mandala: A Synthesis Model Applied in Environmental Design Education

Ping Xu

University of Colorado Boulder, U.S.A.

Abstract

To resolve the rising problems in the environment, we need synthesis approaches. This paper explores a synthesis model of environmental design education. Demonstrating ancient systems thoughts, the Tibetan cosmic model of the mandala had shaped the ancient built environments, interweaving architecture within its surrounding landscape and cultural significance. Inspired by this Tibetan mandala and elaborating on contemporary design disciplines, this paper explores a general model of environmental design (ENVD), the so-called ENVD mandala. As a synthesis model, the ENVD mandala provides a framework to integrate landscape planning, urban design, architecture, landscape design, and interior design, from large to small scales and from natural to the built environment. One space nests from other spaces. All spaces appear isomorphic, including landforms, urban settings, gardens, and architecture. In contrast to the conventional isolated and piling-up models, the ENVD mandala presents a new direction for environmental design education. As a synthesis model, ENVD mandala bridges gaps between different fields and delivers more efficient learning by applying systems theory. Finally, the ENVD mandala model, inspired by ancient systematic thought, promotes students' systems thinking, a fundamental philosophy in the contemporary world. As an efficient methodology and a new worldview, systems theory is changing design education and practice and leading toward a sustainable environment for our society.

Keywords: ENVD Mandala, Synthesis model, Isomorphic forms, Nesting spaces, Environmental design education

1. Introduction

Extreme weather patterns and frequent natural hazards in recent decades have made environmental issues one of the most critical concerns in daily life. Environmental design is the process of designing human-occupied spaces and their environment, including city and regional planning, urban planning and design, landscape planning and design, architecture, and interior design. These design fields have their expertise and are often isolated from each other. Design professionals and educators are facing challenges in resolving complex environmental issues. An isolated design approach rarely makes wise solutions for avoiding future disasters. Places severely impacted by natural hazards prove that urban designers and architects mistakenly selected sites. When a building is damaged by debris flow, a new building is erroneously restored in its exact location. A significant factor was ignored: the existing landform pattern poses a threat to residents [11]. Debris flow is one of the most natural hazards. It originates at higher elevations and descends, collecting more debris while gaining momentum and power [9].

Roughly 180 years ago, landscape design and architecture were divided into two practices. Since then, contemporary architecture has often appeared in isolation from the landscape. The lack of integration between the two fields is problematic in education and practice. Isolated perspectives create gaps between different design fields, not only impacting the site selection process but also design solutions. In contrast, historical design masterpieces appear as an integrative entirety. Unfortunately, some textbooks and courses often analyze the historical beauty as broken pieces of architecture, plant design, and topographic design.... Students have been trained to divide the environment into isolated parts. This approach is called the conventional model.



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Educators have realized the problems of isolated disciplines in design education and explored new methods. An experimental approach, dubbed by the author as the "piling up" model, has not been successful. In this approach, a large amount of specialized knowledge and methods have been added to curriculums, which can exhaust and overwhelm students. Some students complained it is difficult to grasp the essential concepts and design skills of professions. The issues of the built environment cannot be well resolved by simply "piling up" knowledge and disciplines of isolated specializations because the built environment contains the subsystems, including natural landscape, city, urban landscape, and buildings - which are interconnected. As Ervin Laszlo states, "*We need a synthesis model since the universe appears as an interconnected system of nature* [4]."

Synthesis models and systems theory would be new concepts for contemporary scholars but certainly not new in human history. According to Lazlo, systems philosophy can be traced to the roots of ancient thoughts, Western and Eastern [4]. As an excellent example, the cosmic mandala model structures the Tibetan Buddhist landscape above 3000 meters [10]. This paper, using this ancient model of the Tibetan mandala as a case study, explores a contemporary general model of Environmental Design (ENVD) --, as described by the author, the ENVD mandala, a framework integrating landscape, urban design, architecture, and interior design.

The research methods include the following components:

1) Literature studies. Studying the systems philosophy of Bertalanffy and Laszlo provides a philosophical base for this research. Research on the Tibetan mandala demonstrates the case study of a general model. Also, journal articles on natural hazards and healthy living offer a wide range of scientific knowledge for this approach.

2) Field investigations. Investigations provide experiential study to examine theories. The analysis of the Tibetan mandala is based on field investigations in Tibetan temples and villages in China. Field investigations in debris flow impact areas in Colorado are also crucial in the practice of the ENVD mandala for climate adaptation and healthy living.

3) Comparative study. Comparing general characteristics among the Tibetan mandala model and contemporary professional practices leads to a synthesis model -- "ENVD mandala" for sustainable environmental design. Furthermore, this study also includes comparing the synthesis model with the conventional isolated model and an experimental model of "piling up" specializations.

4) The ENVD mandala model application. The practice of the ENVD mandala is utilized to examine its theory. Applying the ENVD mandala in teaching and learning to evaluate the natural and built environments furthers our understanding of the environment as an integrative system. To solve environmental problems, designers should explore a synthesis model to create a sustainable environment for the future.

2. Tibetan cosmic model of mandala

The mandala, a Buddhist cosmic model, shows the universe centered around Buddha's dwelling place [2]. This cosmic model is presented by both three-dimensional and two-dimensional mandalas. In various sizes, the three-dimensional mandala represents a geographical model of the Buddhist cosmos and Mount Meru. Two-dimensional mandalas are painted on cloth or leather or sprinkled on a flat surface with colored powder, demonstrating Mount Meru in a plan view. A mandala painting, "*Tan Cheng*," or literally "the altar city," is a symmetrical diagram built up of nesting squares surrounded by concentric circles, presenting the cosmic model in a plan view. The nesting squares represent the Buddha's dwelling, and the concentric circles represent the surrounding environment radiating from the Buddha Hall, an iron wall, mountains, and oceans to the infinite. Mandalas aid meditation, visualization, and liberation in ritual ceremonies and are integral to Tibetan daily life [10].

The author visited Tibet in 1998 and 2002. She extensively investigated Tibetan temples and villages outside Tibet in China's Gansu, Qinghai, Yunnan, Inner Mongolia, and Sichuan Provinces. These field investigations greatly enhanced her understanding that Tibetan architecture, landscape, and religious beliefs are woven together, forming a sacred realm. In the Tibetan cultural landscape, the mandala theme appeared everywhere she went, inspiring her to speculate that the mandala, as a spiritual vehicle and a general model, shaped Tibetan Buddhist architecture and landscape.



The mandala systematically structures the spatial organization of Tibetan temples and their surroundings at various scales, which adapt to the harsh climate above 3000 meters in altitude. These include stone landmarks, stupas, the Buddha Hall, the temple complex, the landscape setting, and the holy mountains. Following the mandala, the Tibetan built environment nests on a series of isomorphic levels, with concentric planes rising in elevation towards the center. The mandala model interweaves landscape with architecture, religious meanings, and human movements by unifying spatial structures. Insight into this integrative relationship enhances a general understanding of the continuity of architecture and landscape. The mandala, a cosmic model, presents ancient people's perception of their spaces.

3. Synthesis model – ENVD mandala

Ancient thoughts emphasized the concept of wholeness. Inspired by the Tibetan mandala, the author describes the structure of the built environment with the diagram of the Environmental Design mandala, called the ENVD mandala (Fig. 1). This ENVD mandala model would direct designers to conduct environmental analyses on large and small scales, from natural landscapes to city, urban, garden, building, and interior spaces. This approach considers the information input from other fields and provides feedback, applying specialized knowledge at every level. This approach follows the systems philosophy, a theory exploring "wholeness" to find common principles applied in the system. It differs from the conventional analytical method of dividing a system into pieces and examining the details [4].

Different cultures and geographical conditions produce various forms of architectural space. For example, Western houses are often open to their surroundings, while Eastern courtyard houses are open to the center and defined by buildings. The two models are utilized extensively in their built environments, including gardens, neighborhoods, campuses, and cities. Nevertheless, the Western and Eastern built environments can be described with the ENVD mandala. By considering each unit as an abstract concept and disregarding their unique characteristics, we can identify similarities in spatial patterns across different cultures, thereby enhancing integration between planning and design fields.

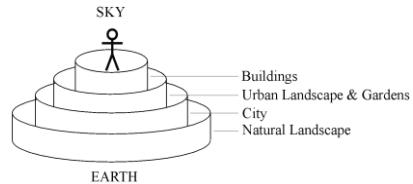
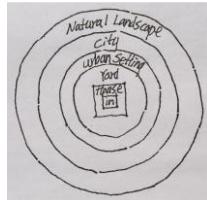


Fig. 1. Diagram of the ENVD mandala. **Fig. 2.** Environmental system contains nesting spaces.

The ENVD mandala emphasizes the spatial relationship in the environment consisting of complex and varied forms. A building includes many subsystems and is subsequently a subsystem of the built environment. In a built environment, buildings are surrounded by gardens, city, and urban and natural landscapes; those spaces fit one inside another and form nesting spaces. Every large space consists of small spaces. The boundaries of these spaces can be ambiguous. These nesting spaces of the built environment are beneath the sky and based on the Earth (Fig. 2). Thus, the design at every level must consider the climate influences and geographic conditions. In this interconnected system, humans play a significant role. Influencing and relying on each other's designs and studies, architects, landscape architects, urban designers, and city and regional planners work together to create a functional and meaningful space for the inhabitants. By emphasizing the relationship among varying spatial units, this approach is comparable with the methods of contemporary landscape ecology. The horizontal focus of the relationship among spatial units makes landscape ecology unique [3].

The Tibetan mandala model presents isomorphic patterns. It is these patterns that integrate architecture into cultural landscapes. Seeking correspondences, we also find isomorphic spatial patterns in contemporary environmental systems, from natural to built environments including city/urban places, gardens, and buildings. Richard Forman identifies natural landscapes that consist of corridors, patches, intersections, edges, and neighbors [3][8]. Kevin Lynch describes cities and urban spaces as roads,



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districts, and nodes, such as downtowns, plazas, boundaries, landmarks, and natural landscapes [6][8]. Inspired by the above scholars, the author describes isomorphic spatial patterns in campuses, gardens, and various architectural spaces.

Campus and garden designs have similar spatial patterns, with roads and paths, subdivisions, main gathering places, lakes, and walls defining their boundaries. Various types of buildings, such as hotels and libraries, have strong isomorphic spatial patterns. Each type of building has an entrance, exit, hallway, and gathering node of a lobby or atrium. The external wall defines the boundary, and a yard with landscape design surrounds the building. Various building types differ in their room districts, which depend on their functional requirements.

Understanding the general spatial patterns helps integrate the different specializations and enhances the general concept of an interconnected system. In addition, elaborating principles and models applying to systems would provide efficient teaching and learning with an interdisciplinary approach to sustainable environmental design. According to von Bertalanffy and Laszlo, the general systems theory emphasizes the correlation or isomorphism in certain general aspects of "systems." Elaborating principles and models applying to "systems" provides an interdisciplinary approach to integration between systems [1] [4].

4. Practicing ENVD mandala and new educational direction

Practice is an effective way to examine a theory. Applying the ENVD mandala model, the author, a professor of architecture and environmental design teaching an undergraduate program in Colorado, explores an approach to designing for healthy living. The professor draws the ENVD mandala diagram (Fig 1) on the whiteboard in each class and emphasizes it during desk critiques. The class conducted the evaluation matrix after literature studies and lectures on systems philosophy, mandalas, climate adaptations, relevant scientific research, and field investigations to understanding the large scale impacts are crucial [8]. Combining scientific knowledge, students evaluate their residences from the natural landscape, urban setting, landscape design, and architecture to furniture arrangement. Applying the ENVD mandala in a design curriculum to evaluate the environment boosts understanding of the environment as an integrative system. Students engage in their education, and the professor is not only the knowledge deliverer but also a facilitator.

The ENVD mandala can also be utilized with various themes, such as design with climate adaptation, which the author has practiced in her senior architectural studio. In addition, following the framework of the ENVD mandala, a history course in the built environment can replace several isolated history courses in city planning, urban design, landscape design, and architecture. Analyzing a historical design masterpiece would address multiple aspects, from climate to geographic conditions, from site selection to architecture, from gardens to buildings, from external form to interior arrangement, and from cultural traditions to political background. A synthesis approach provides efficient learning and enhances the understanding of excellent design with its natural, cultural, and social background, which is its original matrix.

Research on the ENVD mandala explores a new educational direction, synthesizing previously separate design majors. The synthesis approach presents more advantages than some methods currently practiced in academic institutions, such as the conventional and "piling up" models. Conventional architectural education has developed over centuries and established curriculums supporting professionals. However, this conventional approach has produced designs with isolated specializations, causing gaps between majors. While the "piling up" approach attempts to overcome isolations among planning and design fields, its method mixes up different specializations from various fields, failing to research integration between fields and weakening on training design skills. As a result, students complained they were overwhelmed with a tremendous amount of knowledge and did not get enough training in their design skills. Thus, using general models is critical to developing a synthesis approach. According to the systems philosophy, elaborating principles and models applying to "systems" provides an interdisciplinary approach to integration between systems [4].

5. Conclusions



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The Tibetan mandala demonstrates the ancient people's perception of their environment. Like Tibetans, ordinary people today perceive a strong image of their environment, which is intuitive and integrative, often different from what professionals have. As Kevin Lynch states, designers should understand and consider the way ordinary people perceive their environment, the image of which derives from the perceptions of the people who use the place [6]. The Tibetan mandala presents inhabitants' perceptions of the environment that people have lived in for thousands of years. The integrative nature of ancient thought provides excellent value for contemporary practices in environmental design. Unsurprisingly, students present great interest in and receive the integrative concept well. Thus, they skillfully apply the ENVD mandala to evaluate their living environment.

The Tibetan mandala presents an ancient systematic model of environmental design. The Tibetan mandala model structured the Buddhist landscapes adapting to harsh plateau climates above 3000 meters. Ancient people adopted natural laws based on thousands of years of experience to survive [7]. Vernacular design methods have tremendous value for sustaining civilizations [5]. Moreover, compared with contemporary design methods, the Tibetan model demonstrates different ways of thinking about the environment, organizing its elements, and ultimately perceiving built places within the surrounding landscape. Those areas often offer significant potential for further research toward a synthesis model of environmental design. Insight into ancient practices has inspired this ENVD mandala model.

The ENVD mandala shares common characteristics with the Tibetan mandala models. First, each model can structure integrative spaces at various levels, from city, urban landscapes, gardens, and buildings to interior spaces. In each space, human activities are significant. Second, dealing with an entire site as a spatial unit, these models emphasize the horizontal relationship between buildings, gardens, urban landscapes, the city, and natural landscapes. Third, these spatial units form nesting spaces. All places are beneath the sky and built on the Earth. Thus, the design at every level should consider the climate influences and geographic conditions. In this interconnected system, humans play a significant role. The ENVD mandala model provides a broad and integrative basis for environmental design. Finally, the ENVD mandala model allows designers to instill themes into various scales to create a meaningful and sustainable environment for the inhabitants.

Weaving in social and cultural values and adapting to the natural environment, the ENVD mandala model would shape cultural landscapes where architecture and landscape design are not separated. Architectural design can instill social and cultural attributes into people's perceptions of the landscape. The landscape, serving as a matrix, imbues architecture with meanings of time and space. In a cultural landscape, architecture is not only included but is a crucial element in generating meanings. The two design fields of architecture and landscape design share common principles, particularly in the design process.

The ENVD mandala model introduces a synthesis approach to environmental design education, bridging gaps in diverse fields. By applying systems theory, this model enhances learning efficiency. Rooted in ancient systematic thoughts and elaborating planning and design disciplines, the ENVD mandala model encourages students to cultivate systems thinking, an essential mindset in the contemporary world.

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