

# *Sustainable Urban Community Construction Based on Affordance Theory*

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**Abstract**—Aiming at the discordance between human behavior and community environment existing in the urban community construction under the current paradigm of computational psychology, and the disorderly development of the community under the functional analysis method, this paper analyzes the ecological connotation of the affordance theory, and puts forward the development modes of sustainable urban community construction based on affordance theory by using the research method of ecology. These modes are constructing the ecological communities with embodiment fitness, constructing urban community environment with the integral open interactivity, and constructing a self-organizing urban community. It concludes that the affordance theory can provide the realization path and ecological method for sustainable community construction. The innovation of this paper is to introduce the ecological connotation of affordance theory into sustainable urban community construction, and propose ecological development ideas and methodological mechanisms.

**Keywords**—Affordance; Ecological; Sustainable; Community

## I. INTRODUCTION

Gibson's most innovative idea is to interpret the relationship between the behavior of life entity and their environment based on the concept of natural evolution. In the traditional research on the relationship between human beings and the artificial environment, it is generally believed that "the relationship between human beings and the environment is different from the relationship between general animals and their living environment".<sup>[1][27]</sup> In other words, human beings are in a higher status than animals, and human perception mode is attributed to learn, while animal perception mode is attributed to instinct, ignoring the role of human instinct. Gibson's affordance theory contains an ecological design thought, which equates human instinct with animal instinct. It is shown as the relationship between human being and objects returns to the natural ecological relationship, and the ecological pattern is designed from the ecological niche of people, so as to build a sustainable ecological system.

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Therefore, the affordance theory plays an important role and significance for the construction of sustainable urban communities.

## II. AFFORDANCE THEORY AND ITS ECOLOGICAL CONNOTATION

The theory of affordance is from the eighth chapter in Gibson's book *The Ecological Approach to Visual Perception*. "Affordance" is the term Gibson created to describe the mutually beneficial relationship between organisms and the environment, the affordance that affords the possibility for biological behavior. Its core idea can be summarized as the following aspects:

### A. Embodied Ecological Scale is the Basis of Understanding Environment-Behavior

Gibson's affordance theory emphasizes the relationship between body scale and environment. From the beginning of the affordance theory, Gibson redefined the concept of "environment" and emphasized that the environment he studied is an ecological one, not a physical one described by Descartes, so that the scale of the physical scale is meaningless to humans. People perceive the ecological scale, such as a table, people perceive the table that we can eat on it, learn it, put things on it, rather than the length, width and height." These characteristics should be measured in an animal-related way, since they are supportive of the affordance of an animal,<sup>[1] 27</sup> Gibson said. This kind of measurement includes the body scale and the action scale, namely the ecological scale. The environment with the ecological scale contains the embodied relationship with people, and the embodied relationship is the basis of design implementation. The scale ratio relation of embodiment is the condition of behavior, the object that corresponds to the size of the hand provides the grip, and the plane that corresponds to the body provides the trip. The embodied ecological scale environment is consistent with human behavior and has active attraction to behavior.

### *B. Affordance Describes the Biological and Environmental Integrity*

Gibson believes that the ecological relationship between biology and environment is a mutually beneficial relationship in which animals live in harmony with the natural environment in the most instinctive way in the long-term evolution process with nature. The relationship between people and the artificial environment is not independent of the ecological relationship, but should be based on the ecological relationship between people and nature. Gibson also included human beings in the ecological system of biology and environment. He believed that human beings and nature are an interactive whole and human beings are the product of natural evolution. Human beings cannot live without the natural environment and live alone. The complexity of the human cognitive system comes from the construction in interaction with the environment, and the motivation of cognitive evolution points to survival and reproduction. Human beings have changed the nature through their own development, by using technology to reclaim land, build houses and change the natural environment into an artificial environment. The traditional view of artificial nature view that artificial nature has completely different characteristics from natural nature. Gibson points out that the artificial environment is not a new environment, not completely different from the natural environment. The artificial environment is still the old environment that has been changed by human beings.<sup>[1][129]</sup> The relationship between human and artificial environment is still equal to the integral relationship of the interaction between human and nature, and the design of artificial environment should follow the overall reciprocal relationship.

### *C. The niche is the set of affordance that affords compatible nesting relationships*

Gibson, who developed the concept of the niche in the affordance theory, notes that "a particular group of animals exploits or occupies a particular niche in the environment."<sup>[1][128]</sup> Gibson emphasizes "an animal" and "specific". For example, grassland is a niche for sheep, which provides food supply and habitat for the sheep. For people, the urban is a niche for them to live in. Animals determine their specific "niches", and the concept of niches determines how animals live in it. It constitutes the "symbiosis" of animals and niches. At the same time, the different biological niche occupy their position in the environment, small habitat nested in larger habitat, constitutes the hierarchical relationships of environment, So that the environment has a systematic ecological structure. Gibson describes the different concepts of environment and niche, a niche is a set of affordance, which are the nested relations of environmental scale. Small artifacts nest in large artificial environments, and large artificial environments nest in natural environments.

The idea of nesting is interlinked with the mosaic pattern of ecology, the embedding pattern of social science, and the embodied nature of philosophy and cognitive science.

### III. MODEL CONSTRUCTION AND REALIZATION OF COMMUNITY SUSTAINABLE DEVELOPMENT

Gibson put the concept of affordance into the context of evolution to study the interaction between organisms and the environment in the state of equality and return to nature to study the natural interaction between organisms and the environment. The concept of affordance developed by Gibson has attracted extensive attention from the design circles. In 1988, Donald Arthur Norman first introduced the concept of affordance into the design circles. It has been applied in many fields in the design circles, such as interface design, environment design, robot design, etc., and achieved remarkable results. The research on the theory of Affordance Based Design is deepening in the Design field. The American scholar Jonathan r. a. Maier (2011) published the book *Affordance Based Design: Theoretical Foundations and Practical theories*; Ethiopian schola Sinkneh Eshetu Zeleke (2012) published the *Theoretical dance Based on Conceptual Framework for Landscape Architecture*, etc., which have achieved remarkable research results. Therefore, the above studies have laid a solid theoretical and practical foundation for the application of affordance theory in sustainable development of communities. The introduction of sustainable urban community design into the affordance theory will bring about innovation in design philosophy and transformation in design methodology.

#### *A. Construct the Ecological Communities with Embodiment fitness*

Urban community construction is the urban environment to serve the people and the social place the most closely associated with people's life. Urban community has the characteristics of population diversity and behavior diversity. Thus meeting the demand of people's behavior and realizing the harmonious interaction between human and objects are the first problem for constructing the sustainable urban community, and coordinated relations between people and community environment contains in the embodiment fitness.

Embodiment fitness refers to the anastomosis between the body, consciousness and the environment. The design of ecological community environment should conform to human's natural behavior and the environment-behavior rule formed in the evolution of natural environment, and the behavior rule contains in the embodiment relations between human and environment. Heidegger pointed out that people are not experiencing the existence that the objects separated from people. "the property of the overhand is that it seems to withdraw in the state of its hand, just for the overhand that can be true".<sup>[2]</sup> The sustainable urban community construction that should be considered from the affordance theory should conform to the relationship of embodiment fitness, which can bring people convenience and convenient community behavior environment, mainly reflected in the following aspects: (1)The distance within the community that fits the walk. The internal scale design of the community from the perspective of affordance theory needs to follow the human body scale and action scale. The traditional functional method of community construction only considers the scale design of the object,

lacks the connection with the human ecological scale, and creates a loose community. The structure forms a distance that people can hardly reach by walking, which greatly reduces the utilization of community space. (2) The construction of community facilities fits with embodiment scale. Facilities in the community mainly include fitness equipment, leisure seats, children's play areas and other aspects. The design of facilities should be consistent with the body scale of people. The corresponding scale relationship can explain the function and use of facilities, and the corresponding dynamic scale relationship can make the behavior between people and facilities smooth and comfortable. (3) Community space that fits the diversity of human behavior. Single function characteristics of the current community construction have the directional definiteness for people's behavior, and limit the diversification of people's behavior. Based on the affordance theory of community construction emphasizes the richness of features, such as the bench not be segmented not only provides the function of lying on it, but also we can sit on it. And children's playground sand block provides more types of games than modular slides.

The sustainable development of the community takes the basic comfortable behavioral needs of people as the primary task of design. The ecological community construction based on the embodiment fitness relation of the affordance theory provides a broader service basis for the sustainable community construction.

#### *B. Construct Urban Community Environment with the Integral Open Interactivity*

The design from the affordance theory emphasizes the integral monism. The design of the community includes that the people and the community environment are a mutually beneficial whole, and the relationship between the community and the natural environment also emphasizes the consideration of the whole. The structure of human behavior corresponds to the structure of the environment. The structure of the environment must be hierarchical because of the diversity of human behavior. Gibson's concept of niches and the nesting of niches are applied in community construction, which is the construction of an integrated and open community system based on people's perception and environment.

Open interactivity refers to the space of better communication and exchange between people and environment and between environment and environment in the community space environment, which is different from the traditional behavior limited space of single function. "The reason why we emphasize openness instead of closure is mainly because the practice space is not an invariable region or a passive place that can be measured, but a value world with action force and social significance."<sup>[3]</sup> First of all, the community must be a multi-functional mixed urban space. The community construction understood from the ecological scale of affordance not only includes the scale of human body, but also includes the ecological scale of material in the community; the ecological scale among communities and the scale relationship between communities and natural environment. A good organization nesting relation is the structure nesting that forms trapezoid, And it is the scale relationship from human

body scale to the whole ecosystem. Secondly, sustainable urban community environment should form an open and dynamic interaction with the outside world. Urban community construction should not only consider the single community unit, but also consider the relationship among community units. The relationship among communities separated from each other is a functional and lifeless module. Therefore, the circulation relationship among community units is crucial. Better community relationship is a network of interlaced behaviors in the urban and the foundation of dynamic urban construction. Finally, the better interaction between the community and the natural environment is the foundation of the community construction, avoiding the formation of a closed and self-contained space.<sup>[4]</sup> Open spaces ensure a balance between the inputs and outputs of the community and the natural environment. At the same time the natural environment design is the essential condition for protecting human's healthy. "In an open space, one must not only satisfy one's natural instincts and one's behavioral function. But human beings also have different characteristics from animals; they yearn for beauty and order and have higher spiritual needs."<sup>[4]</sup>

The affordance theory avoids the dichotomy of man and environment resulting from the "central" paradigm, integrating man and community, community and community into an organic whole with ecological connections.

#### *C. Construct a Self-organizing Urban Community*

The affordance describes the mutually beneficial relationship between animals and the environment, which is the result of natural evolution. The affordance is coordination mechanism for the mutually beneficial relationship that makes the relationship between biology and environment from the evolution of automation. Sustainable urban community construction based on affordance theory is an automatic process under the coordination mechanism of affordance and an important way to realize the self-organizing urban community.

"Self-organizing is an open and complex fundamental attribute. The meaning of self-organizing theory is that if energy is injected into the system to make certain parameters reach a certain adjacent value, the system will automatically form a certain order and model. Popularly speaking, a system is said to be self-organizing when it has evolved to achieve a goal without any particular external interference, relying only on the coordination of its internal elements."<sup>[5]</sup> Self-organizing urban communities have the ability to coordinate with internal order and form a benign development of the community. The affordance theory studies the relationship between human beings and the environment from the context of natural evolution. The community construction from affordance is the self-organizing that "regenerates" the natural environment in the community environment with technical tools. The community design starting from the affordance theory is an urban environment design based on the interaction between the subject and the object, which can effectively organize the artificial environment construction composed of complex factors and effectively drive the organizational construction of the environment. At the same time, affordance is a regulatory mechanism between the subject and the object, which can

enhance the internal self-organizing structure and mechanism. "The appearance of complex structures in the process of self-organizing depends on a balance between order and disorder. In fact, the structure of evolution can be characterized as a delicate combination of order and disorder."<sup>[6]</sup> Sustainable community construction should be a self-organizing space in line with people's natural behavior, and a good order should be formed in the community.

The affordance theory provides the implementation path of self-organizing ability for the community's sustainable development. From researching the ecological relationship between human and nature, start with replicating the self-organizing to achieve sustainable urban community construction.

#### IV. CONCLUSION

The affordance theory provides the theory and methodology for sustainable urban community construction. "Affordance describes the potential behavior between two or more subsystems in a larger complex system of 'designer-artifact-user'. ... The occurrence of behavior depends on the relationship between the artifact and the user, and cannot be separated."<sup>[7]</sup> One of the purposes of the design is to make this connection reappear between artifact and people. Because the artifact created by human beings also need to reflect this kind of coordination relationship, artifact can be used more naturally, and people can survive healthier and more freely. It can also be called the appropriate directivity of

design. The sustainable urban community construction from the affordance theory is based on the ecological relationship between human and the natural environment, takes the interaction relationship between human and environment as the principle, takes the instinctive behavior of human in nature and the ecological pattern of community as the targets. The affordance method for sustainable urban community construction.

#### REFERENCES

- [1] Gibson J.J, *The Ecological Approach to Visual Perception*, Boston: Houghton Mifflin Company, 1979.
- [2] Heidegger. *Existence and time*, Jiaying Chen, Qingjie Wang translation, Beijing: life · reading · new knowledge Sanlian bookstore, 1987:86. In Chinese
- [3] Jun Wen, Rui Huang, Thought pedigree and ideal prospect of "space": construction of an open practice space, *Sociological research*,2012(2):35-59. In Chinese
- [4] Chenhui Cui, Tao Han, An analysis of the nature of place in urban open space, *Reform and opening up*, 2010(2):97-97. In Chinese
- [5] Yanguang Chen, Self-organization and self-organization city, *Urban planning*, 2003(10):17-22. In Chinese
- [6] White R, Engelen G , Uljee I, The use of constrained cellular automata for high-resolution modeling of urban-land dynamic, *Environment and Planning B:Planning and Design*, 1997(24):323-343.
- [7] Jonathan R. A. Maier, Georges M. Fadel, Affordance based design: a relational theory for design, *Res Eng Design*, 2009(20): 13 - 27.