A Study on the Innovation Mechanism of Ecological Connotation Based on Soundscape Perception

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Abstract: Under the background of "double take" planning reform, aiming at the ecological connotation that is limited to visual aesthetic and ecological function, introducing the theory of acoustic landscape and to extract the sound from the dimension of awareness "subjective listening", "subjective perception" and "subjective listening derivative" triple awareness in the process of evolution of thinking iteration of the ecological value. Then as a theoretical basis to build based on the above the physical form of visual and ecological function of ecological connotation of the innovation mechanism, namely: the field of innovation mechanism, personality innovation mechanism, the artistic dimension innovation mechanism. In order to provide a reference for the construction of ecological quality under "urban double repair". Under the background of "double take" planning reform, in view of the limited to the visual aesthetic and ecological connotation of ecological function first, introducing the theory of acoustic landscape and to extract the sound from the dimension of awareness "subjective listening", "subjective perception" and "subjective listening derivative" triple awareness in the process of evolution of thinking iteration of the ecological value. Then as a theoretical basis to build based on the above the physical form of visual and ecological function of ecological connotation of the innovation mechanism, namely: the field of innovation mechanism, personality innovation mechanism, the artistic dimension innovation mechanism. In order to provide a reference for the construction of ecological quality under "urban double repair".
***Keywords*:** soundscape perception; ecological connotation; ecological value; innovation mechanism

1. Introduction

In 2016, Vice Minister Huang Yan of the Ministry of Housing and Urban-Rural Development proposed regarding the planning reform of "Urban Renovation and Ecological Restoration": "It is necessary to transform the extensive expansion-oriented planning into planning that improves the connotative quality of cities"[1]. This proposition has pushed the construction of ecological connotations to a new height. As an emerging field in environmental acoustics, soundscape research focuses on emotional recreation based on auditory perception — built upon visual forms and physical functions — with dual unity of time and space. It not only serves as an innovative approach to addressing the homogenization problem caused by extensive urban expansion but also provides a new strategic direction for ecological connotation construction under the "Urban Renovation and Ecological Restoration" initiative. Looking back on the practical course of ecological connotation construction, from Ian McHarg's "Design with Nature" to the development of theories like "Landscape Urbanism" and "Sponge City", although clear practical methods have been provided for the restoration of natural landscapes such as plants, mountains, and rivers, as well as ecological functional issues like urban waterlogging, runoff pollution, and water resource shortage, most efforts still focus on single - dimensional ecological space reconstruction prioritizing visual forms and functions. This has led to homogeneous and unfamiliar ecological landscapes across cities. In China, only a few scholars led by Professor Yu Kongjian have integrated the emotional connotation of "local culture" into urban ecological restoration and carried out preliminary practices[2]. Therefore, addressing the research gap and urgent need for ecological connotations, this paper takes soundscape perception as the research object, uses interdisciplinary research methods to extract soundscape perception characteristics that stimulate emotional and cognitive evolution, and explores its ecological value. The goal is to construct an innovative mechanism for ecological connotations based on visual aesthetics and ecological functions, thereby enhancing ecological aesthetic connotations and ecological value.

2. Basic Connotations and Soundscape Boundaries

2.1 Analysis of Ecological Connotations

Mr. Wang Nuo believes that "ecological connotations" include at least four aspects: "First, taking the overall interests of the ecosystem as the highest value; second, exploring the social roots of ecological crises; third, examining and expressing

the relationship between nature and humans; fourth, expressing the ideal of harmonious coexistence between humans and all natural things, and predicting the future of mankind"[3]. The first two aspects can be summarized as physical ecological connotations constructed by limited forms, spaces, and functions. The latter two tend to incorporate human social factors into the ecosystem and attempt to build an ecological connotation mechanism based on physical visual forms and ecological functions through reasonable organizational forms, using this as a link to balance the relationship between humans and nature. This paper mainly defines the scope of ecological connotation construction as the latter.

2.2 Soundscape Boundaries in Ecological Connotation Construction

The term "Sound Scape" was first proposed by Canadian composer R. Murray Schafer in the late 1960s and early 1970s, defined as: "A sound environment that emphasizes the way individuals or societies perceive and understand"[4]. As an emerging field of environmental acoustics, soundscape differs from environmental acoustics, which has long been committed to quantifying the physical characteristics of sound to evaluate the quality of the sound environment. Instead, it focuses on the subjective perception qualified by the integration of social factors to qualitatively evaluate the sound environment. This definition coincides with the essential meaning of incorporating social factors into the ecological service mechanism in "ecological connotations". Soundscape design is not a "superior" or "external" design, but an "inner" design[5], emphasizing a perceptual balance system based on vision rather than physical quantification of sound. This convergence point defines the soundscape boundaries in the construction of ecological connotations in this paper.

3. Ecological Value Orientation of Soundscape Perception

Based on the construction goal of incorporating subjective perceptual factors into the recreation of ecological connotations, the term "soundscape" emphasizes the characteristics of individual or social perception and understanding above visual and physical functions[4], providing a new value orientation for ecological connotation construction. This can be specifically extracted from the three perceptual attributes of soundscape: subjective auditory sensation, subjective auditory understanding, and subjective auditory derivation.

3.1 Subjective Auditory Sensation: Unity of "Subject" and "Object"

The perceptual characteristics of soundscape emphasize using sound as a medium to induce the evolution of human thinking perception, achieving a good dialogue between humans and the environment. "Subjective auditory sensation" refers to the first perceptual response of humans to physical sound, undoubtedly constituting the primary gateway to the evolution of soundscape thinking perception. Carles et al. conducted relevant research on the first perceptual response under the interaction of images and sound, concluding that when sound and images are consistent, people's aesthetic experience can be significantly enhanced[6]. Li Guoqi also showed through similar experiments that the higher the harmony between landscape and sound, the easier it is for audio-visual perception interaction to produce resonance, and the higher the aesthetic evaluation [5]. Numerous studies have shown that when the sound subject is consistent with the sound image mapped by humans' first perception, it creates a more expected soundscape dialogue space. Therefore, the "subject-object" unity in subjective auditory sensation constitutes the construction standard for the aesthetic connotations of soundscape. Similarly, the ecological aesthetic recreation emphasized in ecological connotation construction — above visual forms — is perceptual creation above form. When the sound subject is integrated into the ecological environment, ensuring that the visual forms and physical functional objects that once dominated landscape aesthetics maintain unity with the first perceptual mapping image (sound image) of humans, ecological landscape aesthetics will no longer be based on visual forms supremacy but on the "subject-object" unity degree of subjective auditory sensation.

3.2 Subjective Auditory Understanding: Transformability from "Substance" to "Quality"

"Subjective auditory understanding" is the evolutionary processing of the first perceptual thinking of subjective auditory sensation, a process of sound transforming from physical quantification to qualitative change. When physical characteristics such as sound source types, sound levels, and frequency spectra in the soundscape are converted into perceived information by people, the perceptual characteristic of subjective auditory understanding continuously stimulates the association and memory of the perceiving crowd. This perceptual thinking evolution process promotes the transformation of soundscape connotations from "substance" to "quality". In promoting urban ecological restoration, in December 2013, General Secretary Xi proposed the ecological construction standard of "seeing mountains, viewing waters, and remembering nostalgia" at the Central Urbanization Work Conference. At the beginning of promoting the Sponge City, Professor Yu Kongjian of Peking University proposed ecological reform paths such as the "Big Foot Revolution" and "Nostalgic Memory". Perceptual attributes full of emotional colors, such as "association", "memory", and "nostalgia", have endowed urban ecological con-

struction with new connotations. As an effective driving force for soundscape aesthetics to transform from physical forms to emotional connotations, the perceptual characteristic of "subjective auditory understanding" in soundscape provides a new value orientation for ecological connotation construction above physical forms and functional quantification—especially endowing the homogeneous and indifferent cities under extensive expansion with new emotional memories and vitality.

3.3 Subjective Auditory Derivation: Derivativeness of "Quality"

The perceptual characteristic of "subjective auditory derivation" in soundscape is an emotional catalysis based on "subjective auditory understanding", with the function of evoking other perceptions and acquiring new thinking — it is the highest perceptual attribute in soundscape. "The chirping of cicadas makes the forest more silent; the singing of birds makes the mountain more secluded" is the artistic conception portrayal of poet Wang Ji's emotional sublimation under this perceptual characteristic: as physical sound sources in the soundscape, the chirping of cicadas and birds transform into the poet's personal memory emotions of the nature's "forest silence" and "mountain seclusion" in the evolutionary process of "subjective auditory sensation" and "subjective auditory understanding". "More silent" and "more secluded" reflect the emotional recreation under the perceptual characteristic of "subjective auditory derivation". The multi-dimensional artistic conception of "listening to natural sounds, the mind roams freely"[7] is derived from the multiple thoughts and emotions under the highest perceptual characteristic of soundscape. "Roaming freely" is interpreted as "thoughts can travel freely without being restricted by time and space", elevating the perceptual aesthetics of soundscape to the temporality of emotions. In ecological connotation construction, the ecological memory emotions endowed by soundscape are not limited to the static reproduction of memories of specific eras, regions, and groups but represent a dynamic deduction process of ecological memory. They bear the value burden of the dynamic development of ecological connotations in the form of an "ecological memory flow".

4. Innovative Mechanism of Ecological Connotations in Soundscape Perception

The extraction of ecological value from soundscape perception provides a solid theoretical foundation for the innovative mechanism of ecological connotations. It reveals the internal driving force of the three perceptual attributes of soundscape — "subjective auditory perception", "subjective auditory comprehension", and "subjective auditory derivation" — in the construction of ecological connotations. The construction of the innovative mechanism of ecological connotations is mainly reflected in the iterative evolution of subjective emotions and their objective evaluation by soundscape perception characteristics. When the ecological value generated in each emotional iteration stage and the ecological benefits constructed by the physical ecological space correspond to the ecological aesthetic standards of "subject-object" unity, "matter-quality" transformability, and "quality" derivativeness possessed by the three perceptual attributes of soundscape, new ecological connotations emerge. This refers to the field innovation, personality innovation, and artistic conception dimension innovation covered by the projection surface of the ecological connotation innovative mechanism (Figure 1).

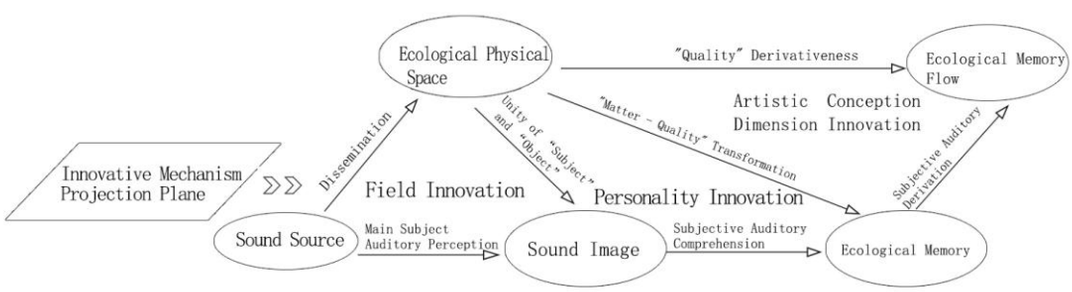

Figure 1. Projection Plane of the Innovative Mechanism for Ecological Connotations (Drawn by the Author)

4.1 Field Innovation: "Field Fit Degree"

The field does not solely refer to the physical environment, but also includes others' behaviors and many other related factors[8]. It is also understood as a conceptual "field", serving as a perceptual supplement to the incomplete and insufficient functions of physical space. The ecological field constructed in this paper is an organic body formed by the physical ecological space supplemented by soundscape perception, whose aesthetic connotation is manifested in the field fit degree based on the unity between the sound image subject mapped by "subjective auditory perception" and the physical ecological landscape object.

The sound image and physical ecological space in the ecological field form a dialectical unity of contradictions, restricting and promoting each other. Therefore, seeking this unity of contradictions is the key to constructing a good field fit

degree. Compared with the physical ecological space object, the sound image is more uncertain. Divided by physical sound sources, sound images can be classified into natural sound images, artificial sound images, and living sound images, which are formed mainly through two paths: direct propagation and indirect propagation. The former refers to the sound source being perceived directly by people with normal hearing without any interference from objective entities, forming highly pure subjective intentional characteristics; the latter is the opposite — after the sound source acts on diversified spatial forms, its essential characteristics are changed through secondary refraction, reflection, or penetration, and then driven by subjective auditory perception, forming sound images with highly mixed characteristics. This alienation characteristic precisely reflects the restriction of physical ecological space on the formation of sound images. Meanwhile, once formed, sound images act back on the ecological environment, playing a positive role in promoting and guiding the remodeling of physical ecological space. On the one hand, as a perceptual innovation based on visual forms and physical ecological functions, sound images promote the formation of multi-dimensional perceptual experiences in ecological spaces. For example, natural sound images such as wind, rain, waves, and snow sounds add a cool perceptual experience to ecological functional spaces for microclimate regulation; bird, frog, and insect sounds create richer biodiversity spatial images for biological retention spaces. On the other hand, based on the landscape aesthetic evaluation standard of "subject-object" unity in soundscape's "subjective auditory perception" characteristics, the generation of sound images provides guiding significance for the secondary remodeling of ecological spaces. A sound image is a virtual image mapped under the drive of "subjective auditory perception" characteristics, presenting a virtual ideal vision in human consciousness, while physical ecological space is an objective result. The generation of this vision, like a design goal, drives the physical ecological space to form a more reasonable image, guiding the process of unifying the vision with the objective result.

Sound images and physical ecological spaces complement each other. Driven by the perceptual characteristics of soundscape's "subjective auditory perception" and taking "subject-object" unity as the aesthetic evaluation standard, they form an ecological field mechanism with a high fit degree (Figure 2), innovating the ecological aesthetic connotations beyond visual forms.

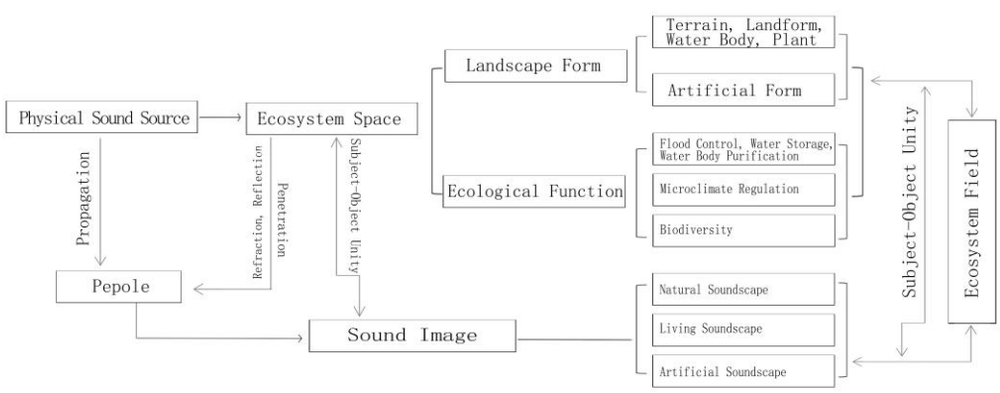

Figure 2. Innovative Mechanism of the Ecological Field (Drawn by the Author)

4.2 Personality Innovation: "Field-Memory"

In ecological design, mountains shape the ecological skeleton, rivers inject ecological blood, and cultural context builds the soul of the ecological field. Based on the research of many scholars who interpret this cultural context with words such as "local", "pioneering", "regional", and "indigenous", a series of specific perceptual words like "emotion" and "memory" have endowed "ecological cultural context" with personalized connotative labels.

Ecological memory records the imprints of the times in the development of the ecological environment under specific regional conditions, representing the sublimation of the emotional connotations of the physical ecological environment from universality to particularity. From the perspective of the evolution of the ecological environment, ecological memory can be divided into two types: spontaneous biographical[9] and social biographical[10]. The former emphasizes the physical imprints of the times formed by the long - term interaction between the natural climate and diverse species in the ecological environment. The latter has dual attributes of nature and society, and more importantly, emphasizes the social imprints of the times formed by the ways of behavior of social groups acting on specific regional environments in the process of historical evolution. Based on the research foundation of the ecological value of soundscape perception, the perceptual characteristic

of "subjective auditory comprehension" plays an important role in the qualitative change of ecological aesthetics from physical forms to the emotional connotations of memory. Spontaneous biographical ecological memory is a subjective phenomenon of further mental evolution under the action of the perceptual characteristic of "subjective auditory comprehension" on natural or artificial sound images, with the objectivity and stability of emotions. When natural or artificial sound images can objectively present a highly representative imprint of the times of a specific ecological environment, the perceptual characteristic of "subjective auditory comprehension" will spontaneously stimulate individual emotions to interpret the site, constructing the connotations of ecological personality with physical identity characteristics. For example, the natural sound images generated by frog sounds and the bubble sounds of mud pits can strongly stimulate emotional responses to the site memory of swamp wetlands. The artificial sound images of snow collapses and ice block explosions can also make people subconsciously reminisce about the site memory of ice and snow disasters. Compared with spontaneous biographical ecological memory, due to the different cultural experiences of different individuals in different time periods, the social biographical ecological memory formed under the perceptual characteristic of "subjective auditory comprehension" has more subjectivity and difference in emotions, further differentiating people's cognition of the ecological environment. Therefore, on the basis of a common regional identity in cognition, living sound images with time memories or artificial sound images imitating them, under the perceptual stimulation of "subjective auditory comprehension", provide more possibilities for enriching the connotations of ecological personality.

The perceptual characteristic of soundscape's "subjective auditory comprehension" is the internal driving force for the qualitative change of the ecological field from "field" to "memory". Based on acting on sound images that are highly representative of the imprints of the times, it activates the corresponding emotional ecological memories, providing personalized and innovative connotations for the homogeneous ecological styles formed by the continuous expansion of cities (Figure 3).

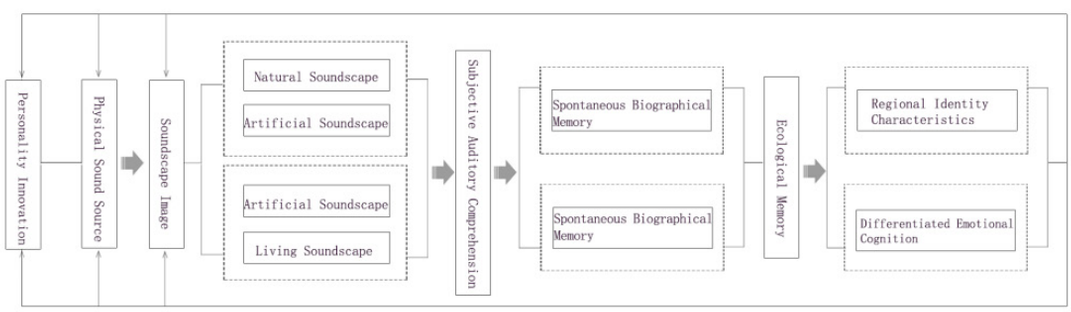

Figure 3. Innovative Mechanism of Ecological Personality (Drawn by the Author)

4.3 Innovation of Artistic Conception Dimension: "Ecological Memory Flow"

In an ecosystem, the intensity of the continuous exchange of matter, energy, and information between components and with the environment is usually quantitatively expressed in the form of "flow"[11]. "Ecological memory flow" refers to the multi-dimensional transmission and exchange of emotional information in ecological memory. It is mainly manifested as the process mechanism of ecological memory deriving from static temporality to dynamic spatiotemporality, and realizes the derivation of multi-dimensional artistic conceptions through the penetration of emotional time and space.

From the philosophical implication of "artistic conception", the so-called "artistic conception" is to go beyond specific and limited objects, scenes, and events, enter infinite time and space, and reflect a certain philosophical implication from a certain perspective, with inexhaustible aesthetic connotations. That is, the so-called "encompassing the universe in the mind, connecting thoughts to thousands of years of history", thus obtaining a philosophical feeling and understanding of the entire life, history, and universe [12]. The construction of ecological personality connotations by ecological memory is reflected in the retrieval of regional historical characteristics and the memories of social groups, emphasizing the reconstruction of limited objects, scenes, and events in a certain period of the past. The ecological memory flow, under the stimulation of the perceptual characteristic of "subjective auditory derivation" of soundscape, is a dynamic development process in which the emotions of ecological memory, in the form of "flowing" information transmission, break through the boundaries of specific time and space, thereby deriving new perceptions and new thoughts. Due to the diversity of auditory experiences of social groups, different groups have different perception views. Therefore, individuals' new perceptions and new thoughts reflected by a certain ecological memory, especially social biographical memory, also vary. This characteristic of difference provides basic conditions for the multi-dimensionality of the derivation of memory emotions. Meanwhile, once such multi-dimen-

sional perceptions and thoughts are formed, they will continue to feed back to the ecological memory space with a movement mechanism of self-supply and self-improvement until a stable and intangible artistic conception space with philosophical implications is formed. The so-called "listening to stones with the heart, one can hear the sounds of nature" and "the image beyond the image, the meaning beyond the words" all express the creation of artistic conception that transforms "physical images" into "vague images" under the continuous evolution of soundscape perception characteristics.

Therefore, compared with single-dimensional and static ecological memory, the ecological memory flow has multi-dimensional penetration of emotional time and space and dynamic deduction. "Penetration" reflects the cross-temporal and spatial interaction mode of "flowing" information, and "deduction" expresses the evolution process of the qualitative change of ecological memory emotions into artistic conceptions. Under the stimulation of the "subjective auditory derivation" of soundscape, they jointly realize the innovation of ecological connotations of multi-dimensional artistic conceptions (Figure 4).

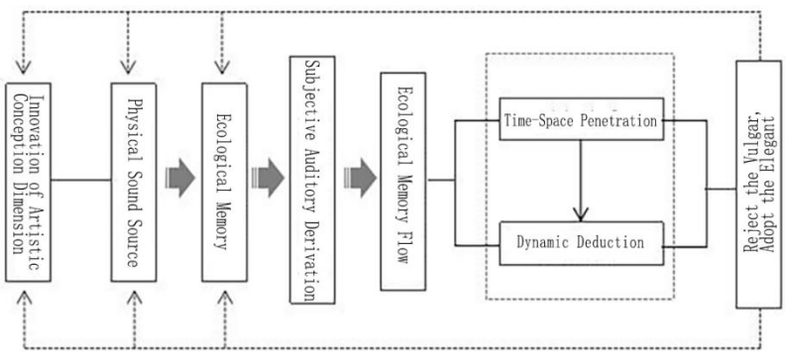

Figure 4. Innovative Mechanism of Artistic Conception Dimension (Drawn by the Author)

5. Conclusions and Prospects

Facing the ecological drawbacks left by the continuous extensive expansion of urbanization, this paper mainly defines the scope of "ecological connotations". Based on this theoretical gap and urgent need, taking soundscape perception as the entry point, it extracts the ecological values under the different perceptual characteristics of soundscape, namely "subjective auditory perception", "subjective auditory comprehension", and "subjective auditory derivation", so as to explore the construction of the innovative mechanism of ecological connotations. Soundscape perception is a dynamically developing organism. With the continuous iterative evolution of perceptual characteristics, ecological values of "sound image", "ecological memory", and "ecological memory flow" are formed accordingly. These three are interlinked and, under compliance with certain evaluation criteria, constitute the innovative mechanism of ecological connotations in terms of field, personality, and multi-dimensional artistic conception.

Since the object mapped by soundscape perception is not an objectively existing entity, but an objective phenomenon under the mapping of subjective thinking, it is difficult to control it qualitatively and quantitatively during the process of participating in the operation of the innovative mechanism of ecological connotations, resulting in a lack of certainty in the final result of ecological connotation construction. Therefore, it is necessary to further elaborate on the interrelationships and result orientation among the main and objective elements involved, so as to provide a more complete operation mechanism model for the universal construction of ecological connotations.

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