

Review

# Towards a “Positive Landscape”: An Integrated Theoretical Model of Landscape Preference Based on Cognitive Neuroscience

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**Abstract:** Landscape preference (LP) is often a critical interdisciplinary research topic that explores the interaction between human beings and their environments. Human preferences for landscape can have a profound influence on how the preservation, reconstruction, and restoration of the landscape is approached, both consciously and unconsciously. Theories of LP emerged in the 1960s and can be divided into three need categories: (1) the need for survival, (2) the need for affection, and (3) the need for cognition. However, these theories lack a unifying framework. The hypothesis presented herein is that LPs are derived from innate human needs. Based on cognitive neuroscience, positive psychology, and Maslow’s Hierarchy of Needs, an integrated theoretical model explaining the neural basis and mental processes that inform LPs is developed. The concept of “positive landscape” and the argument that landscape change could be a potential tool for regulating human LPs are proposed. Two regulatory strategies used to actively manipulate LPs in a way that benefits both the ecosystem and human wellbeing are described in this study.

**Keywords:** landscape preference; Maslow’s Hierarchy of Needs; positive landscape; scenic aesthetics; ecological aesthetics; cognitive neuroscience



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## 1. Introduction

As presented in the European Landscape Convention (ELC), a landscape is “an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors” [1]. The concept of landscape preference (LP) was first put forward by scholars in the late 1960s, and focuses on human perceptions, attitudes, and preferences regarding the landscape, as well as reasons why some landscapes are more favored than others [2–4]. LP stems from “the interaction of humans and the landscape” [5]. Humans rely on their senses to experience environments, on which their survival has been dependent throughout history [6–8]. LP is the subjective evaluation of the attraction to different types of landscapes based on psychological responses to different environmental stimuli [9]. Since it can define the degree of both direct and indirect land and landscapes use, and the adverse or beneficial interactions that impact human and ecological health [4], LP serves as an important tool for understanding how the interaction between humans and landscapes occur [6,7,10,11].

Ecological aesthetics, which also emerged in the late 1960s, provides a valuable perspective for the study of LP. Initial studies focused primarily on preferences for various types of wild landscapes [10,12,13]. Related theories can be found in landscape paintings and aesthetic theories of Europe in the seventeenth and eighteenth centuries, also referred to as “scenic aesthetics” by Gobster [14–17]. After World War II, the US went through a period of rapid cultural change, and this spawned new ways to tackle environmental issues. Scholars soon discovered that certain conflicts existed between aesthetic and ecological

values, and that ecologically important landscapes were often neglected simply because they were considered unattractive [18,19]. According to Rolston [20], beauty derives from respect for life, and the intrinsic and ecological values of the environment should be valued. Aldo Leopold [21] first referred to it as “land aesthetics” or “ecological aesthetics”.

Over time, basic psychological concepts, including the emotional experience and mental process, were gradually introduced into the study of LP. Emotional change accompanies aesthetic reproduction, or to be more precise, emotions and the aesthetic experience mutually affect each other [22]. Studies have demonstrated that positive emotions can produce more creative and diverse behaviors, and contribute to improved well-being and life satisfaction [23,24]. Therefore, understanding the positive emotions that humans create through their interactions with the landscape informs human needs, desires, emotions, and behaviors, and plays a vital role in how they shape landscapes that are favorable to the physical and mental health of humans, as well as the health of the ecosystem.

Academics have been trying to explain, predict, and even regulate people’s LPs through various hypotheses, models, theories, and methods [25–28]. Since the 1960s, the Habitat Selection Theory, Biophilia Hypothesis, Prospect-Refuge Theory, and Information Processing Theory have emerged as theories explaining human LPs (see Table 1 for an overview of previous theories). However, these different LP theories remain unincorporated into a single model of LP, which hampers the development of this field. By combining and analyzing these theories, we explore how a single model using Maslow’s Hierarchy of Needs can result.

Maslow proposed five needs that drive human behaviors in his book, *A Theory of Human Motivation* [29]. They are, from the foundation to the top of the hierarchy: physiological needs, safety needs, love and belonging needs, esteem needs, and self-actualization needs. Maslow’s Hierarchy of Needs has been widely recognized and adopted by many psychological studies [30–34]. Maslow later updated the theory after recognizing that self-transcendence is a part of the hierarchy of needs, and suggested that self-actualization and self-transcendence are distinct needs [35–38]. Resultantly, Maslow revised his five-level model to include self-transcendence as a motivational step beyond the self-actualization [35]. At the level of self-transcendence, people come to identify with something greater than the individual self in favor of service to others and some higher force or cause [39,40]. Therefore, this paper proposes a new conceptual framework based on Maslow’s six levels of needs to explain the deep-seated reasons for the differences in human LPs.

This paper adopts a narrative review model to explore the history and key examples of LP studies from a psychological perspective. Based on interactions between humans and landscapes, and with references to cognitive neuropsychology and positive psychology, including the emotion theory and Maslow’s Hierarchy of Needs, we propose an integrated theoretical framework of LP that incorporates previous independent theories of LP into a single model. Under this framework, we hold that LP is an emotional process induced by people’s needs, which can be categorized within the framework of Maslow’s Hierarchy of Needs. Although there are numerous landscape preference research results, no scholars have yet proposed the hypothesis that landscape preference comes from human needs in current research. Therefore, we believe that the landscape preference model we propose herein has the potential to be an important tool to protect the environment and improve human physical and mental health. These integrated LP theories can be employed as important tools in the decision-making process to actively and consciously regulate LP and promote the reconstruction of landscapes to benefit both the ecosystem and human physical and mental health.

## 2. Materials and Methods

In order to have a clear picture of the background of LP studies, as well as integrating the theories and practices of LP across disciplines, a narrative review has been adopted. This approach is commonly used in the research area of restorative environments to substantiate important research findings and support conclusions [34,41–43].

The Web of Science (WOS) core collection database is recognized as the most authoritative data source for research papers [44]. Apart from WOS, Google Scholar was also adopted for supplementary searches to increase validity. The date of publication was a limiting factor for peer-reviewed scientific literature. Other genres of writing, including theses, dissertations, and studies published on platforms other than scientific publications, were excluded. The keywords used for collecting the literature were as follows: landscape preference, landscape perception, landscape aesthetic preference, visual landscape preference, landscape aesthetic value, ecological aesthetic, and scenic aesthetic.

An iterative process was employed in the literature search, and after filtering for key words, 714 hits were identified in the Web of Science (WOS) Core Collections database. The literature review revealed that the earliest documents on LP appeared in 1968. As such, we focused on the period from 1968 to 2022 as the publication time span for Google Scholar searches. On Google Scholar, 16,600 relevant results were found, too many for a qualitative analysis, so these results were only used to supplement the WOS database search results. We further filtered the 714 retrieved documents by selecting those with psychology in their titles and abstracts or keywords, and finally returned 68 documents with the highest relevance. Recognizing the limitations of journal indexing within electronic databases, we conducted another manual search, using a forward snowball reverse snowball, as the efficiency of the snowball search is comparable to that of the database search [45,46]. These two methods were used on the 68 articles retrieved by WOS, and 36 highly relevant articles were identified. Finally, content keywords analysis was conducted to discover the drivers, focus, motivation, and trends of LP research. After the collection of all relevant data, we attempted to summarize the development of LP theories and discuss the neural basis of LP formation. Our aim is to provide a convenient reference point for related theoretical as well as practical research.

### 3. Development of Landscape Preference Theories

The 1970s and 1980s saw an explosive development of LP theories. Scholars put forward constructive theories from their disciplines and tried to create a LP model to analyze the factors determining people's LPs [5,26,47] and the mental process by which LPs are generated, with Kaplan, Appleton, Wilson, and Zube as examples (Table 1) [27,48–50].

#### 3.1. *The Need for Survival*

Survival is the most basic human need. The Prospect-Refuge Theory developed by Appleton [51], a British geographer, reveals that humans have a tendency to prefer particular conditions of landscapes/views and vantage points known as prospects (unobstructed open visual access) and refuges (enclosed spaces and areas of concealment). Examples of this include savannah, open forest, and river and lake landscapes. The theory of Habitat Selection proposed by Orians [52] assumes that as humans evolved from the African savannah, they genetically developed a preference for habitats or environments that offer advantages for survival. To date, people living in different environmental contexts seem to have a universal preference for this type of natural landscape over any other type of landscape [53]. They tend to produce positive psychological responses to potentially suitable habitats and negative responses to those not suitable to live in [54]. Similarly, E.O. Wilson [55], an American sociobiologist, believed that humans, in the lengthy process of biological evolution, developed a genetic preference for natural environments that can improve their chances of survival by avoiding danger and acquiring food. This became known as the Biophilia Hypothesis. It has been found from previous studies that landscape elements can influence landscape preferences and that human preferences for landscape elements that contribute to survival are more pronounced [56]. Dai et al. [57] also argued that the preference for landscape elements has a strong correlation with psychological effects. For example, natural landscapes such as flowing water, abundant vegetation, and a blue sky will alleviate people's negative emotions. Therefore, prioritizing these landscape elements in landscape design can facilitate landscape architecture projects.

### 3.2. *The Need for Affection*

Humans are also significantly influenced by emotions. Research on the brain demonstrates that “emotion is a primitive system” that allows humans to quickly respond, despite having little information about conditions that matter to survival and well-being [58]. Yi-Fu Tuan, a Chinese-American geographer, developed the concept of “Topophilia” in 1974, from the perspective of human geography. Although Tuan did not declare his research field as belonging to LP, the concept of topophilia enriched the methods of studying landscape from the viewpoint of human geography.

Ulrich was an architecture professor who sought to explain “the psychological basis of affective responses to landscapes” by putting forward a psychological model based on the psycho-evolutionary theory [26,59]. He concluded that affects are regarded as “products of thought”. He also concluded that if this viewpoint is adopted to explain “aesthetic and affective responses to the natural environment”, the general perspective can be interpreted in the following way: “an observer’s affects are post-cognitive phenomena resulting from a process of cognitive evaluation or appraisal of a scene” [54]. Later, Ulrich [50] summarized “aesthetic, emotional and physiological response to visual landscapes” and highlighted “aesthetic preferences for views containing trees and other vegetation”. In this study, he suggested that aesthetic preference is critical to the “thoughts, conscious experience and behavior” of a landscape observer.

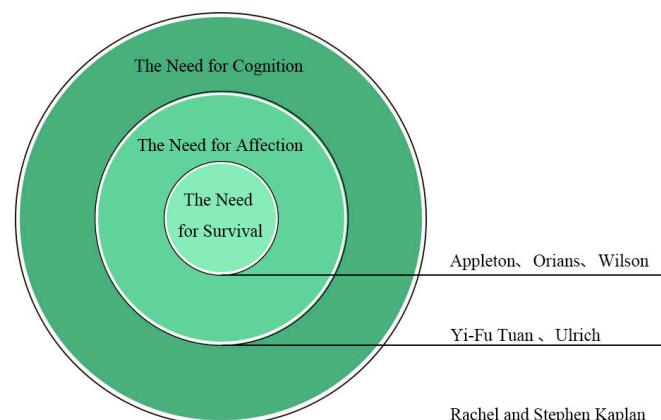
**Table 1.** Theories related to landscape preference.

Subject	Scholar	Discipline	Theory	Psychological Implications	References
The Need for Survival	Appleton	Geographer	Prospect-Refuge Theory	From the perspective of evolutionary survival needs, the theory of Prospect-Refuge attempts to explain why certain environments give a sense of security and thus satisfy a basic human psychological need. Environments that satisfy this need often provide people with the ability to observe (prospect) without being seen (refuge). During human evolution, human beings have focused on their own survival and environmental experience, and it is believed that evolutionary heritage is the basis for a consistent preference for natural environmental stimuli. Humans have evolved in concert with nature over millions of years, so LP most probably have a genetic basis. This results in an innate need and affection for nature, reflected in a tendency to pay attention to and connect with nature and other life forms.	Appleton (1975), Cai et al. (2022) [51,56]
	Orians	Biologist	Habitat Selection Theory		Orians (1980) [52]
	Wilson	Biologist	Biophilia Hypothesis		Wilson (1984) [55]
The Need for Affection	Yi-Fu Tuan	Geographer	Topophilia	Our physical surroundings play an essential role in establishing a meaningful and orderly life, which frequently provides a sense of comfort and security. It is a positive affective bond between an individual and a particular place, with the key trait being the individual's proclivity to maintain a close relationship with that place. When people see a landscape, they act to approach it or stay away from it on the basis of the affective response of liking or disliking the landscape. This mechanism is common to all people, and the response is rapid and based on limited information. If an individual is stressed, exposure to non-threatening natural environments will usually have a stress-reducing or restorative effect, including many positive changes in mental state, physiological system activity levels, behavior, or function.	Yi-Fu Tuan (1974), Chang et al. (2023) [60,61]
	Ulrich	Architecture	Affective Response Stress Reduction Theory		Ulrich (1977, 1983) [26,59] Ulrich (1991), Dai et al. (2023) [57,62]
The Need for Cognition	Rachel and Stephen Kaplan	Psychologist	Information Processing Theory Attention Restoration Theory	When engaging with the natural environment, humans require access to information to understand the environment and evaluate surroundings on the basis of their potential for exploration. On this basis, the Kaplans created a preference matrix with four informative elements that influence LP: coherence, complication, legibility, and mystery. Natural environments automatically attract attention, and contact with nature can facilitate/support recovery from directed attention fatigue. Landscape environments that enable directed attention recovery tend to have four main properties: being away, fascination, extent, and compatibility.	Kaplan R and Kaplan S (1989) [2] Kaplan (1995), Li and Zhang (2022) [63,64]

### 3.3. The Need for Cognition

Rachel Kaplan is a professor of environmental psychology whose research interest mainly focuses on environmental preference, the role of the surrounding natural environment, and the participation of its citizens [65]. Stephen Kaplan, a professor of Psychology as well as Computer Science and Engineering, specializes in the field of “cognitive approaches to human-environment compatibility, psychological properties of natural environments, and evolutionary factors in human information processing” [65]. In the 1970s, Rachel and Stephen Kaplan began to explore the relationship between the natural environment and human psychological characteristics. They pointed out that preference is directly associated with people’s psychological responses, and also people’s experiences, emotions, evolution, and other factors closely related to the level of LP [66]. The Information Processing Theory proposed by Rachel and Stephen Kaplan [2] is considered one of the most influential psychological theories [67]. The theory advocates that the need for understanding and exploring a landscape was critical for human evolution. On this basis, Kaplans created a preference matrix with four informative elements that influence LP: coherence (immediate understanding), complexity (immediate exploration), legibility (inferential comprehension), and mystery (inferential exploration) [65].

Finally, human cognition, excluding biological instinctive responses, may be influenced by factors such as age, experience, and culture. Van den Berg et al. [68] found that an individual’s environmental preference is related to his or her ability to derive restorative benefits from the environment. Ulrich [62] and Kaplan [63] put forward the Stress Reduction and Attention Restoration theories, respectively, both of which explain the restorative effects of natural environments from a psychological mechanism perspective. Based on the Psycho-Evolutionary Theory, the Stress Reduction Theory believes that people produce “positively toned feelings” when observing natural environments [69,70]. Some scholars found that when individuals are under stress or anxiety, the level of sophistication of their preferences will decrease [71,72]. The Attention Restoration Theory is established around the concept of “Directed Attention” [73] derived from modern neuroscience, and focuses on the potential cognitive benefits of the interactions between humans and natural environments [2,63,74]. Research on environmental psychology indicates that experiences of direct perception (i.e., visual sense) of natural scenes and elements, especially vegetation and water features, can have a positive impact on individuals by enhancing stress reduction [62] and promoting spiritual recovery from fatigue [63,74]. Figure 1 below presents the classification of LP theories.

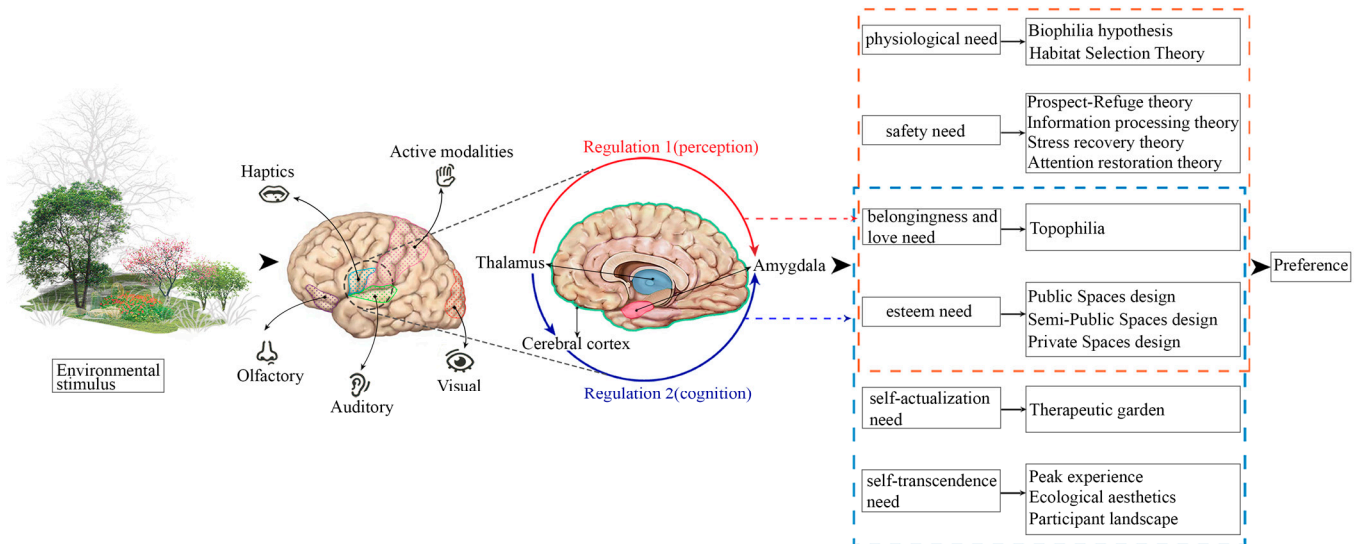


**Figure 1.** Theories of Landscape Preference can be divided into three categories: (1) the need for survival [51,52,55], (2) the need for affection [59,60], and (3) the need for cognition [2].

## 4. A Theoretical Model of Landscape Preference Based on Cognitive Neuroscience

In view of the theories mentioned above, we have developed a conceptual framework to describe the physiological and psychological process of LP from the perspective of

Maslow's Hierarchy of Needs Theory (Figure 2). Our discussion will be carried out from two primary aspects: first the psychological process, and second, the evaluation mechanism. Our framework is only a preliminary exploration of the reasons behind LP, and further research will be conducted based on this framework.



**Figure 2.** Drawing on Maslow's hierarchy of needs theory [75], the evaluation of landscape preference is divided into five parts: survival, security, love and belonging, esteem, and self-actualization and self-transcendence needs, which correspond to the theories related to landscape preference proposed by previous scholars.

#### 4.1. The Neural Basis of Landscape Preference Evaluation

The human brain consists of approximately 100 billion neurons which perform multiple tasks, and to a certain extent, “our thoughts, feelings, and behaviors depend on neural communication”, that is, “the electrochemical action of neurons” [58]. Neurons are the fundamental cells of the nervous system that “communicate with one another to perform information-processing tasks” [58]. They are responsible for receiving, evaluating, and transmitting information, and their “electrical and chemical activities” are the fundamental start for all behavior, thought, and emotion” [58,76]. According to the deduction of Ramón y Cajal and other researchers of his time, neurons work in a pattern that they “receive information”, then “make a ‘decision’ about it following some relatively simple rules” before finally sending the electrical signals to other neurons “by changes in their activity levels” [76].

The thalamus is the part of the brain that receives all incoming sensory information, with the exception of smell, passing on messages to the cerebral cortex [58]. The cerebral cortex is the highest level of the brain, and it is responsible for the most complex functions in cognition, emotion, movement, and thought [77]. It has two symmetric hemispheres, each of which is composed of “large sheets of (mostly) layered neurons” [76]. After the cortex finishes processing information, a signal will be sent to the amygdala [58]. Norman Geschwind [78] found that the sensory information processed by other areas of the brain must work together with the amygdala in order to properly associate the information with “affective and motivational labels”. The amygdala is considered to be a part of the limbic system, and plays a critical role in generating emotion and memory as well as making evaluations [58,79].

#### 4.2. The Nerve Conduction Path of Environmental Information

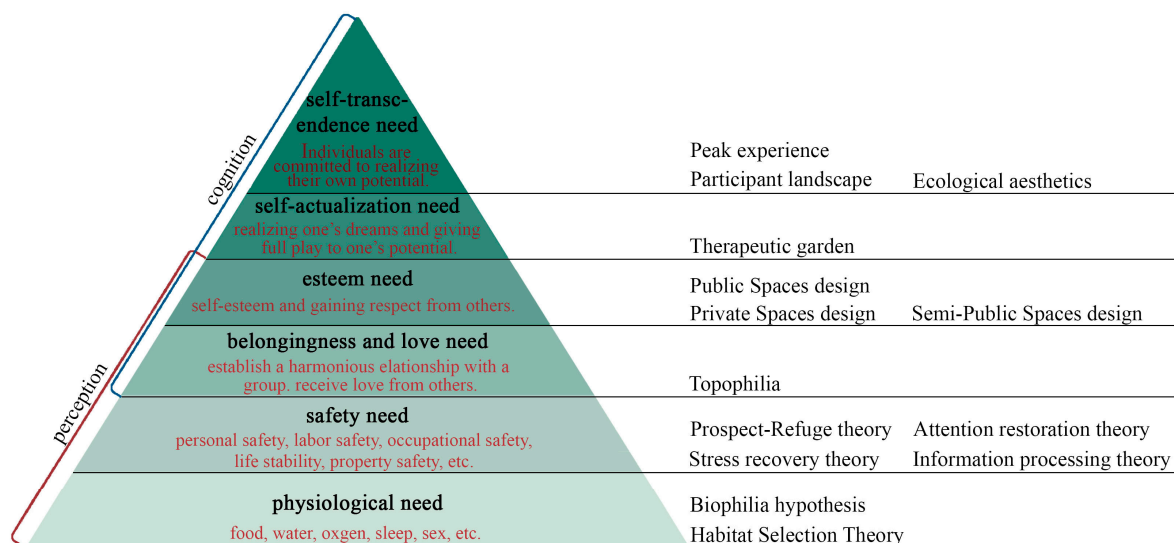
A psychologist, LeDoux [80], mapped the pathways through which stimulus information travels around the brain. He discovered that there are two amygdala pathways in the

brain working simultaneously to transmit information: the “fast pathway” goes from the thalamus to the amygdala, and the “slow pathway” goes from the thalamus to the cortex before reaching the amygdala. Remarkably, the fast pathway is similar to the process of cognition, whereas the slow pathway is similar to the process of perception. Thus, while the cortex is processing the information to analyze the identity and significance of the stimulus comprehensively, the amygdala is conducting very quick and simple decision-making based on the information coming directly from the thalamus. In other words, stimulus information is passed on synchronously to the amygdala which implements “a quick appraisal of the stimulus’s goodness or badness” and the cortex which performs “a slower and more comprehensive analysis of the stimulus” [58]. Sometimes, the amygdala may evoke an emotional experience first, followed by the cortex suppressing that emotion [9].

Aesthetics is a complex psychological process [81], involving multiple sub-processes such as perception, affection, memory, evaluation, and judgment [82]. During the aesthetic process, the observer will first visually analyze environmental stimuli and extract simple and basic visual elements [82]. Then, the brain will perform selective aesthetic reproduction on the received environmental information, and ultimately make aesthetic judgments, thereby generating an aesthetic experience [22]. The process of aesthetic reproduction is always accompanied by changes in emotions [22]. Emotions affect the aesthetic experience and vice versa. When the subject is undergoing an aesthetic experience, his or her emotional state plays an essential role in aesthetic activities, arousing the individual’s specific emotions or affective reactions in viewing aesthetic objects. Hence, the subject’s emotional state cannot be ignored when discussing aesthetic activities. Many previous studies have also demonstrated that emotional states are closely related to landscape preferences. For example, people with positive moods prefer open landscapes, while people with negative moods prefer element-rich landscapes [83,84].

#### 4.3. Evaluation Based on Maslow’s Hierarchy of Needs

In normal conditions, the appraisal happens quickly and unconsciously. However, it can sometimes be “slow, deliberate and conscious” in terms of “what is happening” [85]. A major characteristic of humans is that they are animals of desire with satisfaction lasting only a short period of time [29]. The presence of a motive or desire leads to people’s actions or responses, and satisfaction can be obtained through achieving goals [29]. Therefore, we hold that latent desire is the reason for the existence of human LP. Such desire can be discussed in conjunction with Maslow’s Hierarchy of Needs (Figure 3).



**Figure 3.** Maslow believed that people have six different levels of needs latent in them, and the urgency of the various needs expressed at different times is different [75].



#### 4.3.1. Physiological Needs

Several theories, including the Biophilia Hypothesis and the Habitat Selection Theory, propose that there is a biological basis for landscape preference [86]. These include needs such as food, water, sleep, and sex, the most basic needs for human beings. Only after these basic needs are met will people pursue higher-level needs.

#### 4.3.2. Safety Needs

Safety appears after physiological needs are met. Like physiological needs, safety needs also belong to the lower levels of human needs. The normal operation of the organism entails a relatively safe environment, including personal, labor, occupational, life stability, and property safety, etc. This is consistent with the Prospect-Refuge Theory, Information Processing Theory, Stress Reduction Theory, and Attention Restoration Theory.

#### 4.3.3. Love and Belonging Needs

When the two needs mentioned above are satisfied, the needs for love and belonging, which are also the social attributes, will emerge. This level of needs includes two aspects. One is to fit into a group and establish a harmonious relationship with it. The other is to receive love from others. This is also reflected in Topophilia.

#### 4.3.4. Esteem Needs

These are among the higher-level needs of human beings, and they are centered on self-esteem and gaining respect from others. However, when these needs are not met, it can cause a person to lose confidence and create feelings of incompetence, such as low self-esteem and vulnerability [75]. Therefore, the design of public spaces, semi-public spaces, and private spaces are closely associated with these needs.

#### 4.3.5. Self-Actualization Needs

Being regarded as growth needs, they concern the need of realizing one's dreams and aspirations to the greatest extent, and giving full play to one's potential. In this way, they are the driving force that enables people to realize their desires and values [75]. Self-actualization needs will not arise until the first four levels of needs are met. Self-actualized people are better able to perceive the natural world. They can understand the interdependence of humans and other creatures, and make connections with entities beyond themselves. "Therapeutic gardens" are closely associated with these needs.

#### 4.3.6. Self-Transcendence Needs

Maslow pointed out that some people do manage to go beyond the level of self-actualization [39], so he introduced the concept of self-transcendence needs as the highest of the six levels of needs. Ecological aesthetics and participatory landscapes are examples of self-transcendence needs relevant to the LP theories.

### 5. Towards a "Positive Landscape": Application of the Landscape Preference Model

#### 5.1. The Definition of a "Positive Landscape"

Positive psychology is the study of the positive orientation of people's psychology, including research on positive psychological qualities, human health and well-being, and the harmonious development of society. Inspired by the definition of positive psychology, this paper proposed the concept of "a positive landscape" and defines it as a landscape that can promote ecological integrity, ensure the health and well-being of humans, and motivate the harmonious development of society. Stimulating positive emotions can create a more fulfilled feeling psychologically for humans and thereby improve people's well-being. A positive landscape can enrich people's affective experience, generate love and care for nature, encourage people to wholeheartedly enjoy nature and obtain real and immediate feelings and experiences, and promote people's physical and mental health and social harmony. Instead of putting people at the core, the landscape research should adopt a

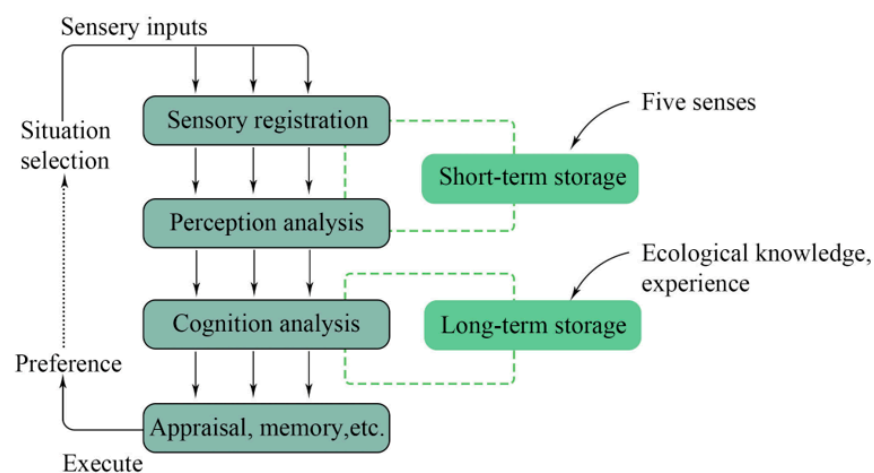
perspective of landscape sustainability, and focus on how humans and the environment can co-exist in mutually supportive ways to eventually achieve harmony between humans and nature [87].

### 5.2. Understanding Human Landscape Preferences Using the Integrated Landscape Preference Model

The integrated landscape preference model argues that people's needs are the major factor influencing LP. The model applies to existing LP theories and explains the underlying reasons for the differences in human LPs. Since different groups (demographic characteristics) have diverse needs, the model suggests that LP is driven by six needs. Firstly, the preferred landscape satisfies one's need for survival, such as fertile farmland, clean water, etc.; secondly, it meets safety needs, for instance, the landscape enables people to observe without being seen; thirdly, it meets love and belonging needs, such as the topophilia concept proposed by Yi-Fu Tuan; subsequently, it meets esteem needs, such as different spaces designed to meet all kinds of people; and finally, it meets the needs for self-actualization and self-transcendence, such as those espoused in ecological aesthetics.

### 5.3. Using the Integrated Model to Regulate Human Landscape Preferences: Ecological Landscape as an Example

Ecologists often understandably focus on the ecological value, rather than the aesthetic value of the environment [88,89]. Environment destruction threatens the survival of humankind, and changing human attitudes towards LPs is an essential step in the protection of the environment. Research indicates that ecological design and ecological knowledge-based approaches can lead to greater stakeholder acceptance of landscapes that have been considered unattractive [86]. Tribot, Deter, and Mouquet [90] demonstrate how knowledge and experience lead to a better understanding of ecological phenomena and help enhance our aesthetic experience, thus leading to a more aesthetically pleasing ecological landscape. Gobster et al. [86] proposed that ecological goals should be addressed while simultaneously satisfying people's LPs and needs. Based on this model and previous practices, two strategies are proposed in this paper to help regulate ecological LP, as shown in the image (Figure 4):



**Figure 4.** Drawing on Atkinson and Shiffrin's modal model of memory [91]. Information is obtained from sense organs and enters the information-processing system. The neurons in the hippocampus are plastic, our aesthetic experience could be enhanced by regulating people's perceptual and cognitive processes, thus leading to a more aesthetically pleasing ecological landscape.

Strategy 1: Changing the process of human perception of the ecological landscape

Landscape perception is a key factor when connecting people to ecological phenomena [92]. People rely on their own senses, namely sight, sound, touch, taste, and smell, to perceive the external environment. This induces emotional experiences and forms LPs.

Under the influence of LP, people consciously or unconsciously change the landscape, profoundly influencing ecological transformation. Emotional experience plays a vital role, as Gobster et al. [84] described, and visually attractive and healthy landscapes can inspire positive emotions and stimulate the desire to protect such landscapes. Emotional experiences affect people's personal values and LPs, which is later reflected on the design approaches that people adopt, and ultimately transform the landscape [93–95]. For example, people will actively protect the landscape when they feel positive emotions, while when they feel negative emotions, they show indifference to landscape change, and their people's personal values and LPs [96].

“Nature-deficit disorder” and “place attachment” are two examples that showcase the important impact that landscape perception has on people. Guo and Dong [97] proposed that staying away from nature during the critical stages of infancy and adolescence deprives people of their ability to experience and observe life, and can negatively affect their health. This phenomenon is called the nature-deficiency disorder. Due to the lack of interaction with nature, children's perception processes of nature are disrupted, resulting in indifference to ecological landscapes in their later stages of growth. Scenic aesthetics have a firm foundation in our culture. Those with nature-deficit disorders can hardly “experience and perceive” ecological beauty, or accept practices which make the landscape healthier and more diversified, but also potentially messier [14]. The relationship that humans have with the natural environment affects their feelings towards the environment [98]. The closer the relationship, the stronger the attachment that people have to the natural environment [99]. When people have stronger attachments, they show a greater willingness to protect the environment [100] and a lower tolerance for negative impacts on the environment, motivating them to address environmental issues [101]. Encouraging children and adults to experience and perceive nature and establish personal attachments to natural environments is a significant strategy for forming ecological LP, and rebuilding the relationship between people and nature.

Strategy 2: Changing the process of human cognition of the ecological landscape

The critical role that ecological knowledge plays in understanding and appreciating the landscape was emphasized by several scholars [102,103]. Experience influences how humans appreciate ecological environments, and through learning and cognition, they generate affection for the natural world [104], as well as a sense of identification with it. The complexity of human perceptual responses also suggests that perceptions can be altered by knowledge and cognitive processes [14,92,105]. In terms of “the ecological value of landscape”, it may bring joy to people who know how to understand relevant ecological phenomena [92,104]. Strengthening people's cognition is useful for aligning their aesthetic preferences with ecological goals [104,106]. Moreover, the relevant knowledge gained through this process can be utilized to improve landscape management and facilitate the transformation of ecological aesthetics that are based on ecological knowledge and guided by cognition [104,106]. Cognitive regulation may provide people with knowledge and experience [106], remind people of the less obvious and less noticed landscapes, and improve their aesthetic appreciation [88,92]. For example, a case study found that an unattractive but ecologically beneficial constructed wetland elicited more positive ecological aesthetic responses when nearby residents were educated about habitat and hydrological functions [92].

## 6. Conclusions

This study first reviews the development of LP theories. LP used to be divided into evolutionary theory and cultural theory. While the Evolutionary theory, based on the Habitat Selection Theory and Biophilia Hypothesis, is limited to the perceptual level, regarding LP as instinctual, cultural theory, represented by topophilia, views LP at the emotional level. In addition, contemporary ecological aesthetics brings an understanding of human LPs from the cognitive level. Then, the study proposes that people's preferences for landscape stem from their needs. Combined with the knowledge of cognitive neuroscience

and Maslow's Hierarchy of Needs of positive psychology, it analyzes the neural basis and psychological activities of LP evaluation and constructs an LP theory model. The model incorporates LP theories proposed by scholars since the 1960s and offers a more robust explanation behind various LPs. This study also puts forward the concept of a positive landscape. It is believed that this model has the potential to be an important tool to change humans' attitudes towards LPs. In addition, two strategies which aim to encourage people to take initiative to protect and transform the landscape for their physical and mental health and the sustainable development of the environment are presented.

Landscapes shape people and in turn, people influence and shape landscapes. This study argues that the research on LP should be integrated with cognitive neuroscience and positive psychology in order to change human's attitudes towards LPs from the perspectives of health, hope, and gratitude for the betterment of humankind and our living environment.

Since research on the interactions between human perception, cognition, emotion, aesthetics, cognitive neuropsychology, and positive psychology are still at the exploratory stage, the model constructed in this study is likely to evolve in the future. We encourage all researchers and practitioners to make concerted efforts to find the best ways to use their findings in positive psychology to enhance mental health and explore other positive environmental outcomes that may result from them.

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