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Image-Building and Place Perception of the Subway Station's Cultural Landscape: A Case Study in Xi'an, China

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Abstract: In the new phase of urbanization in China, the collective cultural landscapes of subway stations in many metropolises are flourishing, providing a powerful way to coordinate urban cultural development and display the image and identity of the city. This study focuses on the image-building cultural landscapes of subway stations. In the theoretical analysis section, it clarifies the construction logic with supporting theory, highlighting the key concepts involved: environmental design, cultural image perception and place perception, and setting out a structural framework of hypotheses concerning the relationships between these three concepts. In the empirical section, six stations in the urban historical center of Xi'an city were selected as the objects, and evaluation indexes of the three variables based on the perspective of the individual were constructed. Using a questionnaire and a combination of factor analysis and structural equation modeling methods, the data from 480 samples were then analyzed. The results were as follows: the cultural image and place perception presented by the environmental design of subway stations are universal to different categories of people; the structural model results showed that environmental design positively affects cultural image perception and place perception; the mediating effect results showed that environmental design affects place perception through cultural image perception. The empirical results confirmed the necessity and rationality of building the image of the cultural landscape of subway stations. Finally, the study makes suggestions for the optimization of current subway landscape development practices. The contribution of this study lies in the construction of a vertical analysis framework from "encoding: construction" to "decoding: perception", which could provide a reference for the integration of theory and practice for the cultural landscapes of subway stations in Chinese metropolises. However, the innovative definitions and methods used to examine some of the concepts also have a certain subjectivity and therefore require further evidence-based investigation.

Keywords: cultural landscape; subway station; environmental design; image-building; cultural image perception; place perception

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1. Introduction

As arteries of modern cities, subways are comprehensive symbols representing the hard power of infrastructure and the soft power of culture. They are not only boosters for the urban economy, but also platforms to showcase the image and cultural attributes of the city [1]. Since the emergence of the subway, attention to the visual form of the stations has brought together urban culture and art. Many cities created subway stations as urban "landmarks", conforming to the aesthetic and trends of the era through cutting-edge architecture and art [2]. As times change, the subway system has generated a large number of urban cultural landscapes with unique historical and artistic values. To date, some early subway facilities have become very important parts of the cultural heritage and cityscape, and they are increasingly linked with symbols of the urban memory that represent the city's identity [3]. For example, the Guimard-style Metro pavilions bear witness to the Art Nouveau movement led by Paris at the beginning of the last century, and they are also Parisian symbols that narrate its century-old metropolitan identity [4]. The underground

palace of the Moscow subway built to the standards of "Stalin's Aesthetics", is a record that demonstrates the will of the state in the historical socialist system of that period [5]. To sum up, subway cultural landscapes have helped to expand urban cultural capital and make unique contributions to the establishment of the image of a city.

In the contemporary context, many metropolises are committed to continuously extending the cultural landscapes of their subway systems in order to achieve collaborative participation in the construction of city identity and marketing of the city's image. As the driving force of cultural factors is strengthened in the competitive urban environment, culture-led urban regeneration has paid increasing attention to the overall promotion of the urban cultural landscape and atmosphere [6], seeking to enhance its attractiveness to the public by creating an "imaginative difference" [7]. In addition, with advances in the planning practice of "station–city integration", the linkage between subway nodes and urban public activity centers is accelerating, and this has transformed the subway station area into a "micro city" and "social container", which deeply affects the perceptions of citizens based on the advantages of the subway, such as the daily scene, extensive audience, etc. [8,9]. From the "node" perspective, the subway station cultural landscape establishes the identity of "place" through geo-information symbols in the station media space, which represent its spiritual connection with the surrounding environment and highlight the cultural image of the station [10,11]. From the "axis" perspective, the "node–axis" linkage mechanism of the subway helps to construct an overall subway cultural landscape system with multiple geo-cultural narratives relying on traffic corridors, which promote the macroscopic expression of urban cultural images [12]. Therefore, the subway system has created an important collaborative path for the interpretation of the historical context and image of the city as well as the marketing of its brand [13].

In the past two decades, the scale of urban rail transit construction in China has increased rapidly. At the 14th Five Year Plan stage, its development focus has shifted from "increasing quantity" to "improving quality", and more attention will be paid to improving the urban service levels of rail transit. Against this background, many cities have systematically planned their subway cultural landscapes, consciously applying environmental image, architectural semiology, place and location and other theories in the design process, resulting in an evolution from a "technical function" model to a regional "cultural image-building" model [14], which pays more attention to the humanistic needs of the subway station space and its function to display regional culture. The collective practices pursued in the cultural landscapes of subways in Chinese metropolises provide support for the development of urban and regional culture, and also show similar characteristics in their building logic and social influences. From the image-building perspective, the cultural landscapes of subways transform the "geo" cultural resources around the station into visual symbols, using color graphics, material texture, modeling scale, etc., and these symbols are projected into the media spaces of the station, such as entrance buildings, public art works, spatial interfaces etc., thus creating a distinctive scene and "place" identity for the station [15]. From the perspective of its psychological influence on individuals, the cultural image presented by the station landscapes and the "geo" meaning released by information can help individuals to identify the characteristics and orientation of the station, as well as to acquire a positive appreciation of their local cultural identity [16].

With the trend for a collective approach to the construction of the cultural landscapes of subways in China, existing studies have carried out a certain degree of narrative demonstration concerning the construction requirements and design strategy for image-building-led subway landscapes combining relevant theories and practical experience. However, there is a lack of vertical research deconstructing the environmental design factors of the cultural image of subway landscapes and demonstrating the perception of the cultural image and its positive effect through quantitative analysis. Therefore, this study focused on two key issues. First, it examined the image-building logic of subway station cultural landscapes, including: (1) in terms of symbol-encoding, deconstructing the environmental design aspects and their meaning expression via the subway station media space led by cultural

image-building; (2) in terms of symbol-decoding, analyzing the relationship between the image-building and the place-indicating function of the station. Second, it demonstrated the construction rationality and necessity of subway station cultural landscapes from the perspective of individual perception.

The structure of this paper is as follows. First of all, based on the existing literature, we analyzed the generation logic of the transformation between the "image" and "meaning" of subway landscapes led by cultural image-building; performed a theoretical analysis of the three concepts involved: environmental design, cultural image perception and place perception; and proposed a relationship hypotheses for the three concepts. Secondly, we established evaluation indexes for the three core concepts, and elaborated the study design for empirical analysis, including the introduction of sample stations, research methods, questionnaire content and data collection. Thirdly, we analyzed the empirical results of the relationships between the three concepts related to subway station cultural landscapes using factor analysis and structural equation modeling. Finally, we made suggestions for the optimization of the cultural landscape of subway stations based on the empirical results and current practices.

2. Conceptual Framework

The ground environment contains a lot of historical and cultural information, which also has the image-shaping function as the "region" and "landmark" elements. Individuals often associate with the corresponding location names, nodes or landmarks on the ground above the station through the subway station's name and its thematic spatial visual information. The subway station cultural landscape can transform it from a homogenized "traffic node" to a perceptible "urban place" [17], which means, the integration of the original and similar station space with the interpretive and readable symbols that represent the "place" spirit of the station area would help the underground space to realize the "regeneration" and "reproduction" to the ground environmental information. Moreover, in terms of shaping urban images, the subway line, as a kind of linear facility, has the similar structural functions with the aboveground path [13]. The cultural landscape corridor relying on the subway line can cohere, reconstruct and display intensively the cultural gene fragments along the line in the form of an invisible link, which could make the originally hidden geo-cultural information be more accessible, and also improve the construction and demonstration of the urban cultural identity based on the symbols' mapping from underground space.

The cultural image-building-led landscapes of subway stations aim to condense the geo-cultural information of the subway station area into highly recognizable visual symbols [15], that is, using the "image" in material form to present the "meaning" in spiritual form. Cultural image-building encompasses a bilateral interaction process of "encoding" the station's geo-cultural information and "decoding" the cultural symbols to perceive their "meaning". The "encoding" is dominated by the designer; its fundamental idea is to establish the spiritual connection of the "station" with the surrounding environment through semantic analysis of the geo-context of the station area and creation of the unique cultural image. The "decoding" is based on the perspective of the user, and it can help individuals to identify the "place" by comprehending the "geo" information attached to the symbols in the station landscape, orientating themselves and completing way-finding tasks more efficiently, at the same time satisfying them emotionally via recognition of environmental information [18,19].

2.1. Transforming "Meaning" to "Image": Cultural-Image-Building and Environmental Design

Compared with the environmental image, Lynch defined the physical environment as the independent variable [20]. In the cultural landscapes of subway stations, the continuous physical spaces above and below ground are the "image-building" media, and it is through the sorting, analyzing, understanding, summarizing, arranging, organizing and abstracting of the environmental information around the station area, that the cultural image of the

station is finally transformed from "meaning" to "image" in the form of legible visual symbols, which fully display the historical heritage, regional characteristics, environmental image and cultural atmosphere of the station area and even the city as a whole [15,21]. In the process of message reception, cultural images are generated from individuals' overall perception of the subway station landscape and its surrounding environment. Visual information concerning the symbols is not only received by the individual's mind, but also links to with their memory of past experiences [20]. Therefore, the environmental design of the cultural landscape of subway stations is a controllable independent variable, and the cultural image is a dependent variable affected by the former.

Based on the examination of existing literature and practical cases, this study deconstructed the environmental design factors involved in the cultural image-building of subway station landscapes into five main elements. These are presented in diverse ways, but on the whole, they create "images" that are appropriate to their own physical media attributes and take different recognizable forms. They express the "meaning" contained in geo-cultural resources around the subway station area, through the editing and organization of structural syntax elements such as colors, graphics, scales, materials, etc., and together represent an ordered and unified semantics of place. As shown in Figure 1, they include:

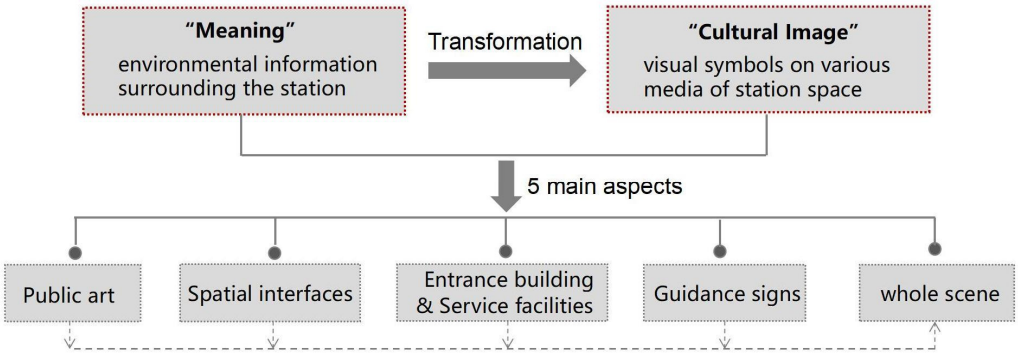


Figure 1. Transforming "meaning" into "image".

1. Public art: presenting the "meaning" of the theme and representing its essence. This refers to relatively independent public art works such as murals and sculptures in the station. The "image-building" of public art can respond to the geo-cultural information in and around the station in both intuitive and concrete ways [22,23], and puts the finishing touches to the station's theme.
2. Spatial interfaces: depicting "meaning" through the configuration of elements. Relevant media include various interfaces of the station space, such as ceilings, walls, pavements, columns, fences, etc. Its "image-building" imitates the characteristic form of the ground environment by organizing form, color, material, pattern and other elements [10,24], which represent a metaphor and continuation of the station environmental context.
3. Entrance building and service facilities: showing the "meaning" through landscaping the objects. These two elements create visual features by integrating functional noumena with artistic forms. The design of the entrance building attempts to coordinate with the existing aboveground landscape by adjusting its scale, color, texture, etc., whereas the service facilities focus on the human and aesthetic experience by integrating geo-semantics into landscaping treatments [25,26].
4. Guidance signs: interpreting "meaning" through graphic and literal symbols. These refer to the text of the station name and the graphic signage representing the time–space characteristics of the station. The former often use regional and traditional calligraphy fonts to shape the image of the station's character, whereas the latter transform the station name or its location information into an intuitive, abstract and simpli-

fied symbolic graphic language [27,28]. Both clearly indicate the "meaning" of the station location.

5. The whole scene: narrating the "meaning" through diachronically organizing all images. The comprehensive "meaning" of the subway station cultural landscapes implies a certain order, in which the semantic texts presented by different image media are connected in series through the time axis [29,30], so that individuals can dynamically experience the entire scene and understand its overall meaning while moving through it.

2.2. Understanding "Meaning" through "Image": Cultural Image Perception and Place Perception

The cultural-image-building of the subway station landscapes establish the space–time connection between the aboveground and underground spaces through the translation and expression of geo-cultural information, and also construct a recognizable "place" distinguishable from the original homogeneous station. In terms of generation logic, the motivation to create a cultural image is consistent with the shaping of sensations concerning "place" [31], and aims to guide individuals so that they can distinguish the characteristics of the station and perceive its location clearly from the symbolic information attached to cultural images, and also to arouse their memory of past experiences and cultural identity by recognizing the meaning of those symbols. Extending to the perspective of individual psychological perception, the cultural images of the subway station landscapes realize four aspects of place indication functions: station legibility, orientation awareness, space–time connection and cultural cognition, which in turn affect the individual's sensation of the "place", that is, their sense of identification, orientation and security of the station's geo-environment, as well as their sense of belonging and identity to the cultural environment of the station. The details are shown in Figure 2 below.

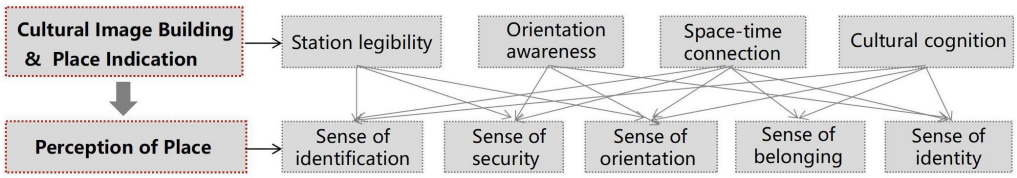


Figure 2. Understanding "image" through "meaning".

2.2.1. Station Legibility

Environmental images usually comprise three elements: structure, identity and imageability [20]. As a homogeneous "traffic node", the original similarity of "structure and identity" limited the legibility of each subway station, therefore, strengthening the "imageability" became the key to highlight its distinctiveness. Schultz replaced the concept of "space" with the concept of "place", precisely because the latter implied a more recognizable cultural character related to the human habitation environment [32]. The station's cultural landscapes project the aboveground geographic information downward in the form of symbols, creating a new frame of geographic references and memory points, which make the subway station and its associated environment more legible and easier to identify, thus giving users a certain sense of emotional security [33,34].

2.2.2. Orientation Awareness

The underground space of the station is usually isolated from the ground reference system, which creates geographical uncertainty for users when judging their location in the process of way-finding. The familiar geo-information released by the cultural images enables users to capture a "sense of place" [32,35], helping them make correct judgments on the relationship between the station, the environment and themselves. By controlling orientation awareness, it also strengthens individuals' sense of security and identity [36].

2.2.3. Space–Time Connection

The overall image-building achieved by integrating aboveground and underground spaces resolves the "separation" between the station and its surrounding environment from a spiritual perspective [10] and connects the two as a unified time–space place. In addition, in the process of harmoniously integrating into the urban context of time and history, the subway station transcends its existence as a functional space, avoiding the fragmentation of the urban cultural field at the psychological level, and enabling people to obtain a sense of security and identity in a stable and familiar time–space environment [37–39].

2.2.4. Cultural Cognition

Individuals always have an emotional affiliation with their familiar living environment, which is referred to as "place attachment" [40]. As a kind of regenerated geographical symbol, the cultural image projected by subway station landscapes establishes an interactive relationship between the mind, imagination and environment of the individual, which evokes their memory of past experiences in relation to shared culture, and is consistent with their "horizon of expectation". This type of place experience positively affects people's sense of identity with and belonging to the urban and regional cultural environment [15,36,41].

2.3. Hypotheses of Influence Relationships of the Main Concepts

To sum up, the cultural landscapes of subway stations present a "cultural image" by various forms of environmental design, and the geo-information attached to the "cultural image" may further affect the perception of place by individuals from a practical and emotional perspective. From our discussion above, this study presents the following hypotheses concerning the influence relationships between the three main related concepts: environmental design, cultural image perception and place perception, which are also illustrated in Figure 3:

Hypothesis 1 (H1). *Environmental design will positively affect cultural image perception.*

Hypothesis 2 (H2). *Environmental design will positively affect place perception.*

Hypothesis 3 (H3). *Cultural image perception will positively affect place perception.*

Hypothesis 4 (H4). *Cultural image perception will act as a mediator in the relationship of environmental design with place perception.*

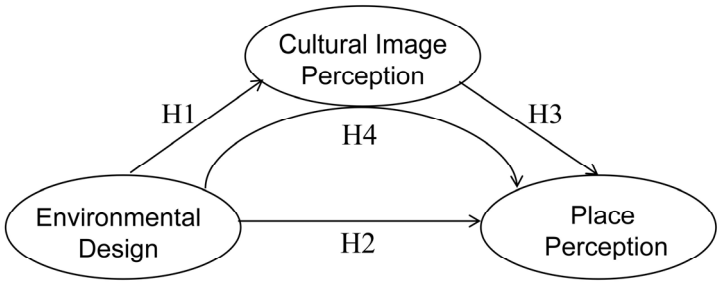


Figure 3. Hypothesis model of the three concepts.

3. Empirical Study Design

3.1. Illustration of the Methodological Path

The empirical study is purposed to objectively demonstrate the hypotheses of influence relationships between environmental design, cultural image perception and place perception. To achieve this purpose, three methodological steps are taken and the corresponding approaches and analysis tools are adopted. Firstly, an empirical theoretical framework is constructed, which is the final deduction result (Figure 3) of the Conceptual

Framework as mentioned above, with 34 pieces of literature selected to support the theoretical framework. In most of them, the cultural landscapes of subway stations are taken as the research object, and they are common in mentioning the causal effect of cultural image-building (from the perspective of encoding) and perception of place (from the perspective of decoding). Furthermore, the details about the three core concepts mentioned in different literature are classified. Secondly, empirical design and adjustment are carried out. In order to describe and measure the three core concepts under the empirical framework, they are subdivided in this paper into the indicators that can be observed and quantified according to the literature and existing research. Additionally, the sample stations in Xi'an, which is a city with relatively well-developed subway cultural landscapes, are selected to design the questionnaire by taking into account the evaluation indicators. Lastly, empirical data are processed. In this paper, the comprehensive methods of statistical analysis, including EFA, CFA and SEM, are selected. Sections 3.4 and 3.5 explain why these methods are adopted and how the pretreatment of questionnaire data is carried out (Table 1).

Table 1. Methodological process and approaches to empirical study.

Methodological process	Approaches and analysis tools
Establishment of the empirical theoretical framework	Literature analysis—the derivation of causal relationship between three core concepts based on supporting documents
Empirical design and adjustment	Questionnaire surveys—the core concepts are indexed, and the indicators are adjusted based on the current state of cultural landscapes in the sample stations
Empirical data processing	EFA+ CFA+ SEM

3.2. Overview of the Samples

Six subway stations in the historical center of Xi'an city were selected as study objects. Xi'an is known as the "Natural History Museum", having the longest history as the ancient capital and having experienced the largest number of dynasties in China. The center of Xi'an's old capital is surrounded by the ancient Ming Dynasty city wall, whose the original structure determined its circular growth mode consisting of one core area with multiple rings extending outward. Inside the ancient city wall, the Bell Tower is located in the center, with the east, west, south and north streets serving as the main axes, respectively. Xi'an city has preserved the complete city wall, city river, surrounding parks and ring roads. The area enclosed by the second ring road is of secondary historical and cultural importance, and significantly overlaps with Chang'an City of the Tang Dynasty [42].

Under the overall planning guidance to protect the city's heritage and culture, Xi'an attached great importance to coordinating the construction of subway cultural landscapes with urban cultural development. Subway lines 1, 2 and 4 pass through the historic center of the city, so the cultural planning and design of the subway system paid particular attention to the stations belonging to these three lines. This study selected six stations, Anyuanmen Station, Bell Tower Station, Sajinqiao Station, Yuxiangmen Station, Nanshaomen Station and Daming Palace Station as sample stations. The first four stations are located in and around the core area of the Ming Dynasty city wall, and adjacent to important historical districts and landmarks. The last two stations are located in Tangcheng District within the second ring road, adjacent to the Small Wild Goose Pagoda historic district and the Daming Palace National Heritage Park, respectively (Figure 4, Table 2).

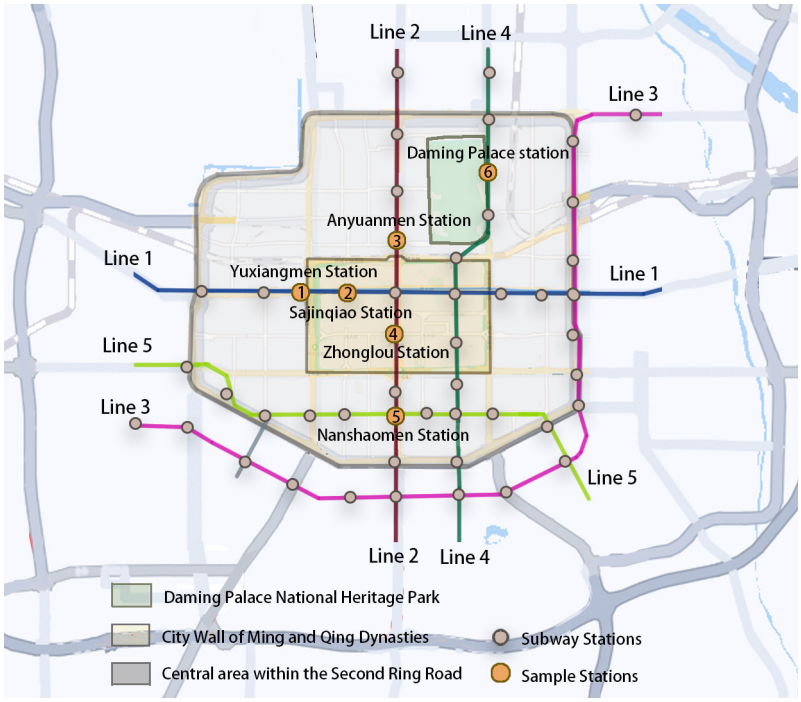


Figure 4. Location of the six sample subway stations in Xi'an City.

Table 2. Location information of the six sample subway stations in Xi'an City.

Subway Station	Affiliated Line	Adjacent Historic District and Cultural Facilities	Environmental Characteristics Around Station Area
Anyuanmen Station	Line 2	North part of Ming Dynasty City Wall	Located on the north–south axis of Xi'an City, the north gate of Xi'an Ming City Wall
Bell Tower Station	Line 2, line 6	Beiyuanmen historic district, Bell Tower historical site, Drum Tower historical site	Located at the intersection of four streets in the urban center, the landmark building is the Bell Tower
Sajinqiao Station	Line 1	Beiyuanmen historic district, Lianhu park	Located in the historic business district where many ethnic groups gather, Lianhu park is the landmark
Daming Palace Station	Line 4	Daming Palace National Heritage Park	Located in the east of Daming Palace National Park, Daming Palace historical site is the landmark
Nanshaomen Station	Line 2, line 5	Small Wild Goose Pagoda historic district	Located on Chang'an North Road, Small Wild Goose Pagoda historical site is the landmark
Yuxiangmen Station	Line 1	West part of Ming Dynasty City Wall, Beiyuanmen historic district	Located in the northwest of Xi'an City Wall, Yuxiang Gate is the landmark, which was built in memory of General Feng Yuxiang's rescue of Xi'an

3.3. Evaluation Index Construction

The three concepts (environmental design, cultural image perception and place perception) related to this study of the cultural landscapes of subway stations exist objectively and have been mentioned in some literature, but they are abstract and cannot be directly observed, and no mature evaluation scales have been created to describe them. Based on the examination of existing literature and the theoretical framework, our study created a

tentative evaluation index system for the three variables of environmental design, cultural image perception and place perception.

1. Evaluation of cultural image perception. Cultural image is the individual's abstract and comprehensive perception of the landscape and surrounding environment of the subway station. In order to observe and evaluate the perception of the cultural image in multiple dimensions, the indexes cover four aspects: manifesting historical heritage; reflecting regional characteristics; shaping urban cultural image; and improving and promoting cultural atmosphere (Table 3).
2. Evaluation index of environmental design. These indexes are based on the five environmental design aspects related to the image-building of the subway station's cultural landscapes, totaling 18 items, which are shown in Table 4.
3. Evaluation of place perception. Environmental design and cultural image building may further affect the individual's sense of place. The evaluation indexes for place perception consist of eight items: the ability to distinguish the station's characteristics; the impression of the station's image; awareness of the station's environmental information; awareness of its geographic orientation; willingness to remain in the place; emotional resonance of the geographic memory; cultural identification and cultural pride stimulated by the place (Table 5).

Table 3. Evaluation indexes of cultural image perception.

Cultural image Perception	Evaluation Items
Cultural landscapes of the station and its surrounding environment	Manifesting historical inheritance of the aboveground environment (CIP1) Reflecting urban regional characteristics (CIP2) Shaping and strengthening urban cultural image (CIP3) Improving and promoting cultural atmosphere (CIP4)

Table 4. Evaluation indexes of environmental design.

Environmental Design	Evaluation Items
Station building and entrance spaces	Suitability of contour scale of the building (ED1) Suitability of color and material of the building (ED2) Suitability of detailed decorative patterns of the building (ED3) Suitability of connection between entrance space and public open space (ED4) Suitability of configuration of the subsidiary site furniture (ED5)
Station hall, platform and other interior spaces	Suitability of theme selection of the public art (ED6) Suitability of the form of expression of the public art (ED7) Suitability of the modeling style of the wall and column interfaces (ED8) Suitability of decorative details of the wall and column interfaces (ED9) Suitability of the modeling style of the ceiling interfaces (ED10) Suitability of decorative details of the ceiling interfaces (ED11) Suitability of the modeling style of the pavement and stair interfaces (ED12) Suitability of decorative details of the pavement and stair interfaces (ED13)
Station overall spaces	Suitability of the decorative style of the auxiliary facilities (ED14) Suitability of the image design of the station's name text sign (ED15) Suitability of the image design of the station's graphic sign (ED16) Suitability of the linkage between the theme atmosphere and the surrounding environment (ED17) Continuity and richness of the whole scene experience(ED18)

Table 5. Evaluation indexes of place perception.

Place Perception	Evaluation Items
Cultural landscapes of the station and its surrounding environment	Ability to distinguish the station's characteristics (PP1) Impression of the station's image (PP2) Awareness of the station's environmental information (PP3) Awareness of the station's geographic orientation (PP4) Willingness to stay in the place (PP5) Emotional resonance of the geographical memory (PP6) Sense of cultural identification stimulated by the place (PP7) Sense of cultural pride stimulated by the place (PP8)

3.4. Quantitative Analysis Methods

Our study took structural equation modeling (SEM) as its core method. This is a multivariate statistical research technology that integrates measurement and analysis. It can analyze latent variables that cannot be directly measured by considering some observable variables, and analyzes the complex causal relationships between the multivariable [43]. The study set the three concepts, environmental design, cultural image perception and place perception as potential variables, and primarily used SEM to verify the hypothesized relationships between them.

Before conducting SEM, we also introduced exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). EFA is used to condense several closely related measurement items into a few core factors (F1, F2... FN) and discover the potential structure of the evaluation scale [44]. CFA forms part of SEM, aiming to test whether the relationship between factors and corresponding measurement items works in the way expected, and further revise the measurement model between latent variables and the items involved [45].

3.5. Questionnaire Design and Data Processing

The questionnaire was designed in four parts. The first part covered the demographic characteristics, including gender, age, education level and occupation. The second part was the evaluation scale for cultural image perception, the third part was the evaluation scale for environmental design, and the fourth part was the evaluation scale for place perception. The items in these three parts corresponded to the evaluation indexes shown in Tables 2–4, respectively, and the 5-point Likert scale was used to distinguish the perception level.

As SEM is applicable to the statistical analysis of large samples, it is preferable to have more than 200 test samples and at least 10 samples for each observation variable [46]. Therefore, the study collected 80 valid questionnaires from each sample station, with 480 questionnaires constituting the total sample data. In order to avoid the final structural model being overdependent on the sample data, it needed to be improved by interactive verification [47].Therefore, we randomly divided the 80 samples from each of the six stations into two groups, with 40 in each group, and randomly selected one group of data from the two to combine with data from 240 samples specifically for EFA, and the total 480 samples were imported into AMOS for CFA and then analysis using SEM.

4. Results of Empirical Study

4.1. Demographic Characteristics and Reliability Analysis

Using SPSS software to analyze the demographic characteristics of data from 480 questionnaires, the interviewees had a balanced gender ratio, a wide age distribution, and most of them were young and middle-aged people. Their occupations covered all fields, and most of them had received education at or above the middle level (Figure 5).

The reliability test results showed that the Cronbach's α value of the overall evaluation scale was 0.888. The Cronbach's α values of the environmental design, cultural image perception and place perception evaluation scale were 0.887, 0.856 and 0.859, respectively; and the Cronbach's α value of the overall evaluation scale of each of the 6 sample stations were between 0.857 and 0.922, all above the 0.7 threshold value (Table 6). To sum up, the sample data had a good internal consistency and reliability, and it was reasonable to base the study on the six stations as a whole.

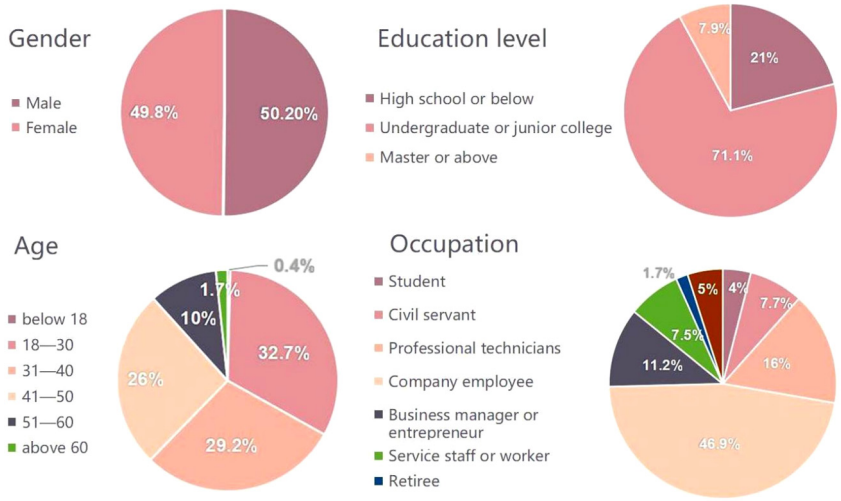


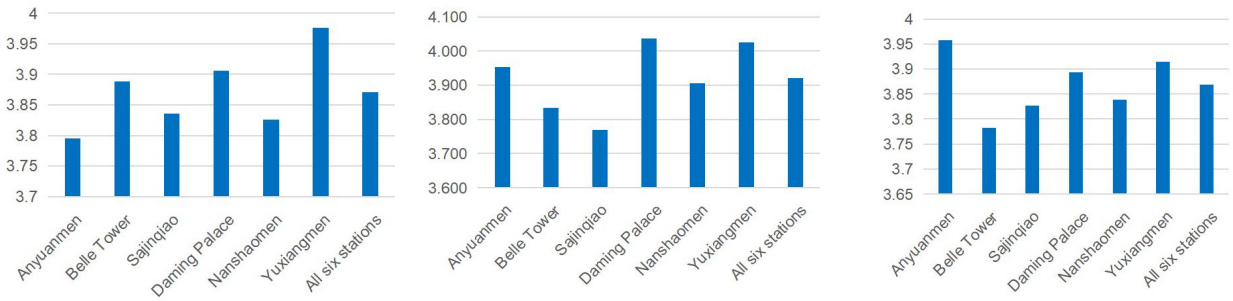
Figure 5. Results of demographic statistics.

Table 6. Results of reliability tests of the evaluation scale for the six sample stations and all six combined.

Scale	Item Quantity	All 6 Stations	Anyuanmen	Bell Tower	Sajinqiao	Daming Palace	Nanshaomen	Yuxiangmen
Whole scale	30	0.888	0.891	0.902	0.863	0.922	0.873	0.857
Environmental design	18	0.887	0.885	0.883	0.873	0.909	0.895	0.869
Cultural image Perception	4	0.856	0.863	0.884	0.888	0.816	0.822	0.791
Place perception	8	0.859	0.868	0.914	0.836	0.897	0.836	0.812

4.2. Analysis of Evaluation Results

The average evaluation score for environmental design from the overall data was 3.871, close to the "good" level. Comparing the six stations, Yuxiangmen Station > Daming Palace Station > Bell Tower Station > Sajinqiao Station > Nanshaomen Station > Anyuanmen Station, and their average evaluation scores were 3.976, 3.906, 3.889, 3.836, 3.826 and 3.795, respectively, as shown in Figure 6a.



(**a**) (**b**) (**c**)

Figure 6. Evaluation results for environmental design, cultural image perception and place perception. (**a**) Environmental design, (**b**) Cultural image perception, (**c**) Place perception.

The average score for cultural image perception from the overall data was 3.921, close to the "good" level. Comparing the six stations, Daming Palace Station > Yuxiangmen Station > Anyuanmen Station > Nanshaomen Station > Bell Tower Station > Sajinqiao Station, and their average evaluation scores were 4.038, 4.025, 3.953, 3.906, 3.843 and 3.769, respectively, as shown in Figure 6b.

The average score for place perception from the overall data was 3.869, close to the "good" level. Comparing the six stations, Anyuanmen Station > Yuxiangmen Station > Daming Palace Station > Nanshaomen Station > Sajinqiao Station > Bell Tower Station, and

their average evaluation scores were 3.958, 3.914, 3.894, 3.839, 3.827 and 3.783, respectively, as shown in Figure 6c.

4.3. Exploratory Factor Analysis

4.3.1. EFA Result for Environmental Design

Firstly, this study investigated whether the environmental design evaluation scale was suitable for EFA. The Bartlett's test of sphericity result showed that the KMO value was 0.909 (>0.6), x^2 was 2033.114, with a p value of 0.000 (<0.01), indicating that the 18 items preliminarily selected were suitable for conducting the factor modeling. Based on the principal component extraction method and varimax-rotation analysis, with a factor load value greater than 0.5 as the extraction standard, the remaining items were rotated to three main factors, with an accumulative variance contribution of 58.276%, which constituted the three dimensions of the environmental design scale (Table 7).

The common factor F1 explained 26.197% of the total variance. Its content mainly referred to the theme selection and expression of public artworks, the decorative details and modeling styles of various visual interfaces, so this was named scene decoration.

The common factor F2 explained 17.914% of the total variance, and its content mainly pointed to the coordination between the subway station entrance building and the overall atmosphere of the surrounding environment, so it was named feature coordination.

The common factor F3 explained 14.164% of the total variance, and its content mainly referred to the visualization and artistic expression of guidance facilities and auxiliary facilities in the subway station, so it was named service facilities.

Table 7. EFA result for environmental design.

	Common Factor 1 Scene Decoration	**Common Factor 2 Feature Coordination**	**Common Factor 3 Service Facilities**
Cumulative contribution	26.197	44.112	58.276
Explained variance	26.197	17.914	14.164
Cronbach's α	0.904	0.83	0.808
Variable items and factor loading	ED11 0.796	ED18 0.794	ED4 0.735
	ED8 0.788	ED2 0.79	ED15 0.721
	ED9 0.787	ED1 0.776	ED14 0.697
	ED7 0.73	ED3 0.763	ED16 0.642
	ED10 0.726	ED17 0.618	
	ED13 0.718		
	ED6 0.675		

4.3.2. EFA Result for Place Perception

For the place perception evaluation scale, the Bartlett's test of sphericity result showed that the KMO value was 0.879 (>0.6), x^2 was 889.954, and the p value was 0.000 (<0.01), indicating that the 8 items preliminarily selected were also suitable for conducting factor modeling. Using the same common factor extraction method and standard as above, the items were rotated to two main factors, with an accumulative variance contribution of 69.321%, which constituted the two dimensions of the place perception scale (Table 8).

Table 8. EFA result for place perception.

	Common Factor 4 Place Recognition	**Common Factor 5 Place Identification**
Cumulative contribution	36.827	69.321
Explained variance	36.827	32.494
Cronbach's α	0.877	0.818
Variable items and factor loading	PP1 0.877	PP7 0.846
	PP2 0.825	PP8 0.754
	PP4 0.810	PP6 0.753
	PP3 0.785	PP5 0.739

The common factor F4 accounted for 36.827% of the variance contribution rate. Its content mainly referred to the individuals' perception of the characteristics of the station and its surrounding environment, and their sense of the geographical orientation, so it was named place recognition.

The common factor F5 accounted for 35.536% of the variance contribution rate. Its content mainly referred to the individuals' emotional resonance and their sense of identity to the station's geo-culture environment, so it was named place identification.

4.4. Confirmatory Factor Analysis

After the dimension reduction of the environmental design and place perception scales, the study clarified the relationship structure of multidimensional latent variables. The second-order latent variable environmental design (ED) consists of three first-order factors: F1 scene decoration, F2 feature coordination and F3 service facilities. The second-order latent variable place perception (PP) consists of two first-order factors: F4 place recognition and F5 place identification. Combining the above latent variables with the latent variable cultural image perception (CIP) to test the validity of the total sample data using CFA, the results were as follows:

(1) Convergent validity. This is usually assessed by examining the standardized factor loadings (Std.) and average variance extracted (AVE) for each item. According to Table 9, the factor loadings of each item and variable are greater than 0.6, with a significant p value ($p < 0.001$) [48], which means that the items and variables of each order are highly representative. In addition, the AVE of each latent construct is greater than 0.5, and the composite reliability CR of each latent construct is greater than 0.7, indicating that the convergent validity reached an ideal level [49,50].

Table 9. Convergent validity result of CFA.

Latent Variables	Observed Variables	Coef.	Std. Error	C.R.	*p*	Std. Estimate	CR	AVE
F1 Scene decoration	ED6	0.794	0.059	13.528	***	0.615	0.894	0.548
	ED11	0.886	0.052	17.061	***	0.754		
	ED10	0.917	0.058	15.915	***	0.710		
	ED9	1.000				0.774		
	ED8	0.993	0.056	17.601	***	0.774		
	ED7	0.912	0.054	17.009	***	0.752		
	ED13	0.977	0.054	17.974	***	0.788		
F2 Feature coordination	ED15	0.845	0.071	11.871	***	0.616	0.844	0.522
	ED4	1.087	0.078	13.894	***	0.740		
	ED14	1.080	0.076	14.168	***	0.761		
	ED16	1.000				0.714		
	ED15	0.845	0.071	11.871	***	0.616		
F3 Service facilities	ED15	0.845	0.071	11.871	***	0.616	0.802	0.504
	ED4	1.087	0.078	13.894	***	0.740		
	ED14	1.080	0.076	14.168	***	0.761		
	ED16	1.000				0.714		
F4 Place recognition	PP1	1.000				0.819	0.853	0.594
	PP4	0.969	0.052	18.632	***	0.806		
	PP2	0.988	0.054	18.402	***	0.797		
	PP3	0.792	0.055	14.417	***	0.647		
F5 Place identification	PP7	1.000				0.685	0.813	0.522
	PP6	0.942	0.075	12.545	***	0.667		
	PP5	1.071	0.076	14.091	***	0.773		
	PP8	1.062	0.076	13.916	***	0.759		
CIP Cultural image perception	CIP4	1.000				0.807	0.858	0.603
	CIP1	1.040	0.059	17.738	***	0.785		
	CIP3	1.015	0.055	18.366	***	0.813		
	CIP2	0.894	0.058	15.441	***	0.695		
ED Environmental design	F1	1.000				0.782	0.771	0.531
	F2	0.724	0.087	8.301	***	0.644		
	F3	0.780	0.092	8.503	***	0.753		
PP Place perception	F5	1.000				0.943	0.789	0.659
	F4	0.814	0.117	6.980	***	0.654		

Note: *** $p < 0.001$.

(2) Discriminant validity. This is executed by comparing the square root of the AVE values with the latent construct correlations. As shown in Table 10, there were significant correlations between the three latent variables ($p < 0.001$), and all latent constructs with the square root of AVE were greater than their correlation coefficients with the remaining latent constructs, which indicates that the discriminant validity of the scale is ideal [51].

Table 10. Discriminant validity result of CFA.

	CIP	ED	PP
CIP	0.776		
ED	0.298 ***	0.729	
PP	0.516 ***	0.308 ***	0.811

Note: *** $p < 0.001$.

In summary, the structure relationship of latent variables of the theoretical model had a good internal fitting validity with the total sample data.

4.5. Difference in Demographic Variables

Using independent sample t-tests and one-way ANOVA, this section analyzed the differences in individual evaluation of each dimension scale in terms of demographic variables. As shown in Table 11, the *p* values for cultural image perception, environmental design, place perception and the other 5 subdimension scales for the different genders, ages, education levels and occupations were all greater than 0.05, and the differences were not significant. This showed that there were no obvious differences in the way that people of different genders, ages, education levels and occupations evaluated environmental design, cultural image perception, place perception and the other subdimensions, which further illustrated that the environmental design, cultural image perception and place perception related to the cultural landscapes of subway stations have a certain universal influence on all kinds of interviewees.

Table 11. Difference in demographic variables.

Latent Variable	Gender		Age		Education Level		Vocation	
	p	T	*p*	T	*p*	T	*p*	T
CIP	0.900	−0.991	0.077	2.001	0.689	0.372	0.101	1.726
PP	0.159	−1.107	0.261	1.303	0.602	0.509	0.234	1.33
ED	0.741	−0.784	0.252	1.325	0.986	0.014	0.159	1.518
F1	0.754	−0.014	0.608	0.722	0.926	0.077	0.183	1.45
F2	0.502	−0.748	0.165	1.577	0.955	0.046	0.228	1.343
F3	0.945	−1.142	0.353	1.111	0.894	0.112	0.856	0.47
F4	0.395	−1.513	0.616	0.71	0.735	0.308	0.36	1.103
F5	0.167	−0.386	0.189	1.498	0.622	0.476	0.101	1.726

4.6. Theoretical Model Verification

This study further used AMOS 26 to establish the structural model and measure the causal relationships between the three latent variables, environmental design, cultural image perception and place perception. Firstly, it examined the model fit, and the results of the fit indices for the structural model (Table 12) were as follows: the absolute fit measures, $\lambda^2/Df = 1.535$, RMSEA = 0.033, GFI = 0.93, all achieved the ideal standard; the incremental fit measures, NFI, IFI, TLI and CFI, also achieved the ideal standard; and all indices suggested a good fit, indicating that the model fitted the data well [52].

Table 12. Goodness-of-fit test for structural model.

Fitness Index	λ^2	df	λ^2/df	RMSEA	GFI	NFI	IFI	TLI	CFI
Reference Value	525.048	342	1.535	0.033	0.93	0.918	0.97	0.967	0.97
Model fit			<3	<0.08	>0.9	>0.9	>0.9	>0.9	>0.9

According to Figure 7 and Table 13, the causal paths result of the 3 main latent variables, cultural image perception, environmental design and place perception, verified the hypotheses about their relationships:

(1) H1 is valid. The environmental design of the Xi'an subway station landscapes positively affects their cultural image perception, with a path coefficient of 0.298 (p value < 0.001).
(2) H2 is valid. The environmental design of the Xi'an subway station landscapes positively affects their place perception, with a path coefficient of 0.169 (p value < 0.01).
(3) H3 is valid. The cultural image perception of the Xi'an subway station landscapes positively affects their place perception, with a path coefficient of 0.466 (p value < 0.001).

Table 13. Path coefficients and causality test for hypotheses.

Hypothesis	Path	Std.	S.E.	C.R.	p
H1	ED → CIP	0.298	0.069	4.887	***
H2	ED → PP	0.169	0.056	2.771	0.006
H3	CIP → PP	0.466	0.050	7.509	***

Note: *** p < 0.001.

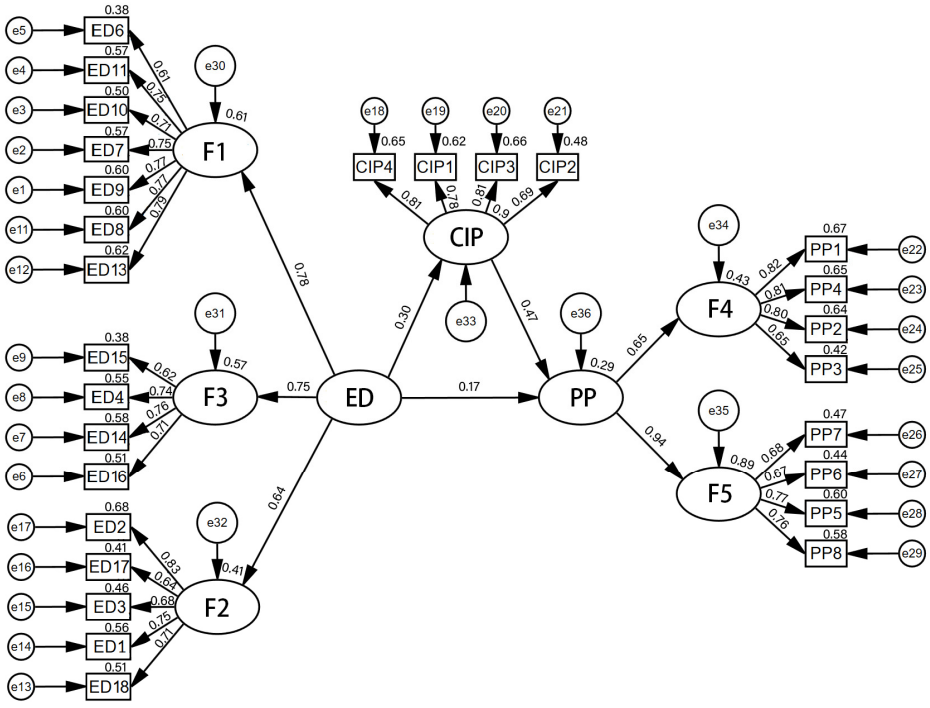


Figure 7. Structural model with path coefficients.

4.7. Mediation Analysis of Cultural Image Perception

The bootstrap method was adopted in the study to test the mediating effects. The bootstrap sample digits were set at 5000, with bias-corrected confidence intervals of 95%. If the bootstrap confidence interval does not contain 0, the mediation effect is proven to exist [53]. The test results in Table 14 indicated that at the 95% confidence level, the confidence interval for indirect effect was [0.072, 0.207], the confidence interval for direct

effect was [0.018, 0.311], and the confidence interval for total effects was [0.138, 0.452]. These results excluded 0, indicating the existence of the indirect effect and the proportion of indirect effects was 0.450. The result demonstrated that environmental design had an indirect effect on place perception via the impact of cultural image perception; therefore, the cultural image perception mediated the ED→CIP→PP path, which proved that H4 is valid.

Table 14. Results of the mediation effect.

Content	Effect Value	Product of Coefficient		Bootstrapping (*N* = 5000)		Proportion
		SE	Z	95% CI Lower	95% CI Upper	
Indirect effect	0.127	0.034	3.735	0.072	0.207	0.450
Direct effect	0.155	0.074	2.095	0.018	0.311	0.550
Total effect	0.282	0.079	3.570	0.138	0.452	

5. Discussions and Suggestions

Based on the empirical analysis, the following conclusions are worth emphasizing. Firstly, the cultural image perception and place perception presented through the environmental design related to the cultural landscapes of the subway stations are universal to all kinds of people, and perception of the three aspects by individuals is clear, positive and shared. Secondly, the cultural image presented by the landscape of the subway stations strengthened the place perception of individuals, which not only enhanced their sense of geo-orientation to the station's environment from a practicality perspective, but also strengthened their sense of cultural identity from the perspective of emotional experience. The above demonstrated that it is reasonable and necessary to construct the landscapes for urban subway stations with cultural image-building in mind. In addition, scene decoration, feature coordination and service facilities were the main factors in environmental design that influenced the creation of the station's cultural image, and designing all three together could create a multiplier effect. Therefore, combining the above conclusions and the current practices for creating subway cultural landscapes in China, the study offers some suggestions for optimizing subsequent programs.

5.1. Establishing an "Integrated" Design Process Framework

The cultural image-building design of the landscapes of subway stations involves systematic implementation, requiring the cooperation of multiple disciplines such as cultural planning, urban design, architectural design, decorative art design and engineering design. Although subway cultural landscape practices in many Chinese cities are prevalent, most of them have paid much more attention to interior design, and in particular public art, which led to problems such as the convergence of design dimensions. Therefore, it is necessary to introduce an "integrated design" strategy to systematically create cultural image-building-led subway landscapes [54]. The planning and design of subway landscapes should unify the three aspects of scene decoration, feature coordination and service facilities in a comprehensive vision, in order to improve the expression of the geo-information of the subway station area as a whole and enhance the efficacy of its cultural narrative. In addition, consideration should be given to a new mechanism or platform that could mobilize horizontal cooperation between artists, planners, architects, engineers, designers and even municipal administrators in relation to the work as a whole [55].

5.2. Strengthening the Scene Decoration of Subway Station Space

Scene decoration is the first influencing factor that controls the presentation of the cultural images of the subway station landscape, and it has both static and dynamic elements. Static scene decoration should focus on public art and visual interfaces. The expression of the former should directly point out and narrate the "geo-theme" that echoes the heritage, landmark buildings, station names and other environmental characteristics

around the station by introducing murals, sculptures and other types of art installation. The expression of the latter should encompass the overall conformation of multiple media, consisting of the ceilings, walls, pavements, steps and columns of the station spaces, extracting the visual symbols that map the surrounding environment to reproduce the aboveground style, and create an "anchor point" of geographical memory. For dynamic scene creation, the relevant design should focus on how to apply diachronic clues into scene narration, plotting static scenes along a certain time axis, so that individuals can obtain rich cultural information and experiences when they wander through the station [56].

5.3. Coordinating with the Environmental Features around the Subway Station

For subway station landscapes, the cultural images generated in the minds of individuals are closely related to their overall interpretation of the existing environment. Therefore, the environmental design methods that constitute feature coordination, in particular the urban and architectural design of the station entrance building, should follow the semantic context of its surrounding environment, organically integrating with the existing cityscape through the mining, refining and restructuring of the geo features and maintaining the authenticity and integrity of the original characteristics of the station area. The relevant design should pay attention to control the color, material, height, proportion, decorative patterns and other elements of the station building, so as to maintain visual consistency with the surrounding environment [57,58]. Taking Yuxiangmen station in Xi'an as example, the entrance buildings were designed with red columns, a bucket arch and other simplified traditional components, highlighting the classic meaning of historical buildings of the Tang Dynasty.

5.4. Improving the Humanized Experience of Service Facilities

Service facilities represent soft guidance for people finding their way around the station, and they are also invisible clues that unify the space above and below ground. Improving the humanized design of service facilities in station landscapes can further enhance the individual's perception of the cultural image and experience of the place [59]. To optimize the form and quantity of the many station facilities, the design should consider their visual decoration and use artistic symbols and aesthetic languages to bring them to life. First, some novel design methods can be used to change the traditional forms of service facilities and incorporate them within the integrated configuration of the station; for example, the lighting system of Daming Palace Station is embedded in the simplified Chinese style ceiling, which is in harmony with the interior scene of the station. Second, the guidance facilities should be designed vividly, and their symbol designs could use important buildings, landscapes or historical events as pictographic objects for the subway station [60].

6. Conclusions and Limitations

In the current phase of urban expansion and renewal, urban competitiveness increasingly inclines toward cultural empowerment, and the construction of cultural landscapes in subway systems has become a new contributory pathway in the development of urban culture. With the rapid growth of China's urban rail transit system, the collective construction practices for the cultural landscapes of subways in Chinese metropolises are becoming ever more ambitious. Against this background, this study focused on the cultural image-building-led landscapes of subway stations, establishing the building logic and conducting an empirical study to prove the construction rationality using a "theory–demonstration" structural framework.

In the theoretical section that established the building logic for the cultural image of subway station landscapes, the study summarized three concepts relating to the construction and perception processes and analyzed the influence relationships between them, which included the "encoding–decoding" interaction of cultural image symbols. In terms of "encoding: construction" of the landscape symbols, we deconstructed the environmental

design factors involved in the cultural image-building of stations into five aspects. In terms of the "decoding: perception", we analyzed the correlation between cultural image-building and the place-indicating function of the station and put forward a hypothesis model for the relationships between the three key concepts, environmental design, cultural image perception and place perception, from the perspective of an individual's sensations.

In the empirical section, the study took six subway stations in the historical center of Xi'an city as the objects, constructed evaluation indexes for the three concepts of environmental design, cultural image perception and place perception related to the cultural landscapes of the stations, and designed questionnaires with evaluation scales. Based on the data from 480 valid questionnaires, factor analysis and structural equation modeling methods were combined to analyze and verify the hypotheses. The results of this section of the study demonstrated that the environmental design of the landscapes and the cultural image they present can positively affect the individual's sense of the place both in terms of geo-orientation perception and emotional experience. Therefore, we consider that it is rational and necessary to construct cultural image-building-led landscapes for urban subway stations.

Finally, based on the empirical results and existing problems with current practices, the study made some suggestions for the optimization of the cultural landscapes of subway stations in Chinese metropolises.

Some limitations should be noted. The empirical study aims to verify the theoretical framework derived from the theoretical part—the influence relationships between environmental design, cultural image perception and place perception. It sorted and integrated the existing literature with literature analysis in a comprehensive way, which is innovative to some extent. However, it is worth noting that the indexing of the three core concepts remains based on the literature and existing research, which may be insufficient or inaccurate. Despite the literature supporting their use to rationalize the relevant potential variables, there is a certain subjectivity shown not only in some aspects of evaluation index construction, but also in the proposition and demonstration of the hypotheses of the relationship between the potential variables. It is necessary to adjust these quantitative indicators according to the actual practice of cultural landscapes construction within the sample subway stations in different cities. In addition, as this is an exploratory study design, it introduced structural equation modeling and factor analysis as the quantitative analysis methods, which needs to be further revised through the use of more evidence-based testing.

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