

Retraction

Retracted: Application of Computer 3D Modeling Technology in Modern Garden Ecological Landscape Simulation Design

Security and Communication Networks

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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- [1] P. Gong and J. Li, "Application of Computer 3D Modeling Technology in Modern Garden Ecological Landscape Simulation Design," *Security and Communication Networks*, vol. 2022, Article ID 7646452, 8 pages, 2022.

Research Article

Application of Computer 3D Modeling Technology in Modern Garden Ecological Landscape Simulation Design

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The use of digital technology (DT) to systematically plan and design UL can further progress the urban environment. Digital landscape as a new vector of landscape planning and design is oriented to DT. The promotion of DT improves the science and accuracy of UL planning and designs and promotes sustainable development. A city in the south was used as an example to reconstruct and restore the historical appearance of the city from four aspects: virtual process, reconstruction method, digital construction, and virtual interactive roaming technology, and a new way was found for the application of digital landscape in urban construction. The scientific and creative nature of UL is becoming increasingly prominent as the digital era progresses, and UL is no longer just an exterior manifestation of artistic configuration but also a humanized spatial combination guided by data analysis.

1. Introduction

As cities have grown in size and population, so has their stimulus. At the same time, the city is being empowered with unprecedented politics, experiences, and technologies [1]. It is at the heart of a globalized, service-based society, and its duties are changing [2]. The city has become the most important space for human life and development [3]. The cities we live in today are facing serious ecological pollution, consumption of various nonrenewable resources, rapid population growth, and other problems [4, 5]. Therefore, we need to think rationally and be able to manage our living and developing space in a more intelligent way [6]. After former U.S. Vice President Al Gore proposed the concept of “Digital Earth” in the 1990s, China also launched the “Digital China” and “Digital City” projects. The concept of “digital city” has triggered an upsurge in the research and construction of digital city [7]. To lead the innovative development of cities through informationization, to comprehensively promote the deep integration of new generation

information and communication technology and urban development strategy, and to improve the ability of urban governance and modernization, it is a new concept and a new stage [8, 9]. In such a realistic background, the intelligent and efficient data landscape, the use of various digital technologies for planning and design, and the application in urban construction can enhance the digitalization process of cities [10].

The interactive, scientific, and intelligent nature of digital landscape complements the new smart city boom [11, 12]. The following is a chart of the academic trend of digital landscape. It can be concluded from the following chart that the research results of digital landscape have gradually increased in recent years, UL is a part of urban construction, and the rise of data landscape is bound to promote urban construction [13]. The above-mentioned problems of land use and water environment exist in urban construction [14]. Through the construction of digital landscape, the problems of urban ecological fragility and water pollution can be improved. For example, the land space utilization of UL in urban construction, through DT analysis, optimize the

utilization of landscape land space and promote the rational utilization of land in urban construction, which is of practical significance to urban construction [15, 16]. In theory, the discussion of digital landscape is lagging behind the social practice, and the discussion of the theory in this regard should be accelerated [17].

This paper is organized as follows.

Section 2 states the complete landscape planning in the United States. Section 3 discusses the VRT on the spatial planning and design of natural landscape architecture. With the passage of time and place, the natural landscape changes in real time. Section 4 analyzes the VRT applied to architectural planning and design methods. Section 5 collects the different datasets and then applies the experiment design. Section 6 ends the article.

2. Related Works

From the 1960s, when computers were used to complete landscape planning in the United States, new technologies in the field of landscape architecture began to be applied to research, and the world's frontier forces gradually shifted with the emergence of digital software and tools [18]. The use of computer-aided landscape planning and design projects led to the emergence of geographic information system (GIS) software [19]. Visualization software and forest service systems in the United States are still in use today [20]. In the early 1980s, the emergence of the Commodore machine and the IBM microcomputer was a new field of computer graphics, along with the development of computers. In the 1990s, visualization technology was pushed to a climax, and many visualization-related research results appeared [21].

With the wide application and practice of DT in architecture and urban planning, research on DT in UL planning and design is also leaping forward. Using the theory of spatial syntax, we have started the work in the field of landscape planning with the help of DT, including the analysis of Chinese classical gardens; the use of AMAP to determine the basic model of plant structure and simulate the height and size of plant growth over several years and static results; the acquisition of social and human conditions based on the data of SOLOMO; the analysis of the impact of drainage waste heat on the environment through Flunet and Ponenics, respectively; the analysis of environmental simulation; and the use of DT to realize the virtual city scenario roaming, the physical city roaming, and the environmental simulation [22, 23].

In addition, with the cross-disciplinary development, research results from other fields are cited in the discipline of landscape architecture, which has also become a popular research direction at present [24]. For example, Chae et al. proposed a study on landscape planning and design strategies based on a nonlinear view of thinking, which explores the nonlinear thinking constructs of landscape planning and design and landscape urbanism methodology, as well as landscape planning and design strategies under a nonlinear view of thinking [25]. These kinds of studies are critical to the advancement of the contemporary UL discipline.

3. Impact of VRT on the Spatial Planning and Design of Natural Landscape Architecture

In this section, we discuss the VRT. VRT has good interactive and immersive characteristics, and it is more realistic than traditional CAD natural landscape architectural design methods, with built-in motion modeling, physical modeling, and auditory modeling that are more adaptable to current virtual sensory requirements. VRT has advantages over traditional design models, such as motion qualities, acoustic properties, and optical properties.

3.1. Overview of VRT. The concept of virtual reality was first introduced by Jaron Lanier in the United States. The meaning of virtual reality consists of 3 aspects: it can realize the interactive movement of human senses and natural environment; it can complete human-computer interaction through 3D devices; and virtual reality is generated by computer. Among them, virtual reality has three basic characteristics: immersion, interaction, and conception, which make the sensory experience of human-computer interaction with VRT very realistic depending on the level of immersion and interaction desired. At present, domestic and foreign virtual reality performance technologies mainly include VRML technology, FLASH technology, Viewpoint technology, JAVA technology, and Cult3D technology; these technologies and multimedia combination can show a variety of forms of virtual scenes.

3.2. The Impact of VRT Characteristics. VRT has good interactive and immersive characteristics, and compared with the traditional CAD natural landscape architectural design methods, VRT is more realistic, and its built-in motion modeling, physical modeling, and auditory modeling are more adaptable to the current virtual sensory requirements. The accompanying sound and brightness changes of dynamic objects, water, and wind in the virtual world represent these benefits. VRT, as opposed to 3D animation technology, allows for real-time rendering and optimal solution design, whereas 3D technology is inefficient and has poor interaction performance.

3.2.1. Embodying Landscape Gardening Mood. The use of VRT to simulate landscape gardens has the advantage of integrating the object of appreciation, the subject of appreciation, and the landscape garden with each other. Garden lines, colours, senses, etc. can be set to reflect the contextual beauty of landscape gardens.

3.2.2. Reflecting the Timeliness of Landscape Gardening. The natural landscape is changing in real time with the change of time and space. When using VRT simulation, attention needs to be paid to updating the image information of the natural landscape with the continuation of time. VRT, as opposed to 3D animation technology, allows for real-time

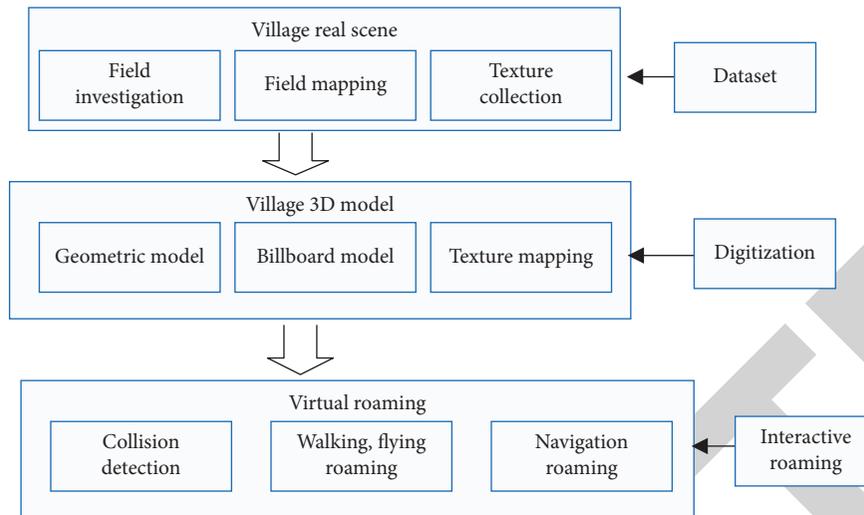


FIGURE 1: Village virtual process.

rendering and optimal solution design, whereas 3D technology is inefficient and has poor interaction performance.

3.3. Application of VR in the Overall Scheme Design Stage.

In the overall scheme design stage, the implementation steps of VRT are determined according to the requirements of the design task book. First, determine the basic path of the garden according to the real-life roaming system and the real landscape; create natural landscape architectural space according to the actual visual characteristics. In the determination of the best tour path, it can be set according to different principles such as topography and landscape, water bodies, and dynamic characteristics of people. According to the topography, we need to pay attention to the extension, visibility, and viewability of the road landscape. According to the water body, we should pay attention to whether the waterscape and the height ratio of rocks give people a comfortable and friendly feeling. According to the dynamic characteristics of human body, we need to pay attention to the difference of different road types on human senses.

The best roaming path based on VRT is realized by pilot animation interaction technology, and the design should take into account the influence of the real-time state of the road and the form of determining the best path, which includes three forms of optimal distance, optimal time, and optimal time distance. In the definite design, multiple visual points can be set between the 2 locations, and Floyd algorithm is stored into the 3D information array S , and the response pilot button can be determined by binding the visual points according to the information of array S .

3.4. Modeling. To build a good virtual reality scene, we need to strictly control the scene size, units, node editing, texture size format, and other elements. Among them, the scene size scale should be modeled according to the CAD drawing; textures should be obtained by stretching and rotating the relevant pictures; the material ball should be cleared to avoid renaming or failing to export; MAX material ball should be

adjusted by UVW modifier to adjust the number of mapping; light baking can show the real light effect; lens setting should be set in the PATH file to set the coordinate points for roaming. The path is fixed in the PATH file.

Plant 3D modeling is an important aspect of landscape garden design. The 3D representation of vegetation is achieved by applying photo effects directly to closed polygons. Determining the proportion of the tree image, building the tree's branch structure, checking the proportionate size and vertical construction plane, and producing the tree image material are the specific procedures.

4. VRT Applied to Architectural Planning and Design Methods

4.1. Virtual Process and Reconstruction Method. VRT is also widely used in the field of architectural planning and design. In this paper, a city in the south is used as the basic model for the construction of virtual reality scenes. The virtual scene building process of the city is shown in Figure 1.

VRT bundle has powerful computing and graphics processing capabilities. Its biggest feature is to be able to detach from the original object and its visual, auditory, and other specific performance.

This technology enables the creation of special construction sites, machinery and equipment, structural components, etc. in a virtual environment, forming a three-dimensional model with dynamic performance. The model is then subjected to a virtual simulation, so that the specifics of the complex construction plan can be observed and the unreasonable areas can be modified.

4.2. The Style Migration Network. The style migration network employed is taken from the CycleGAN network structure in the standard GAN, which consists of a generator and a discriminator, with the generator aiming to generate more realistic animated costumes and the discriminator determining the animated costumes' authenticity, and the two play against each other to achieve a dynamic

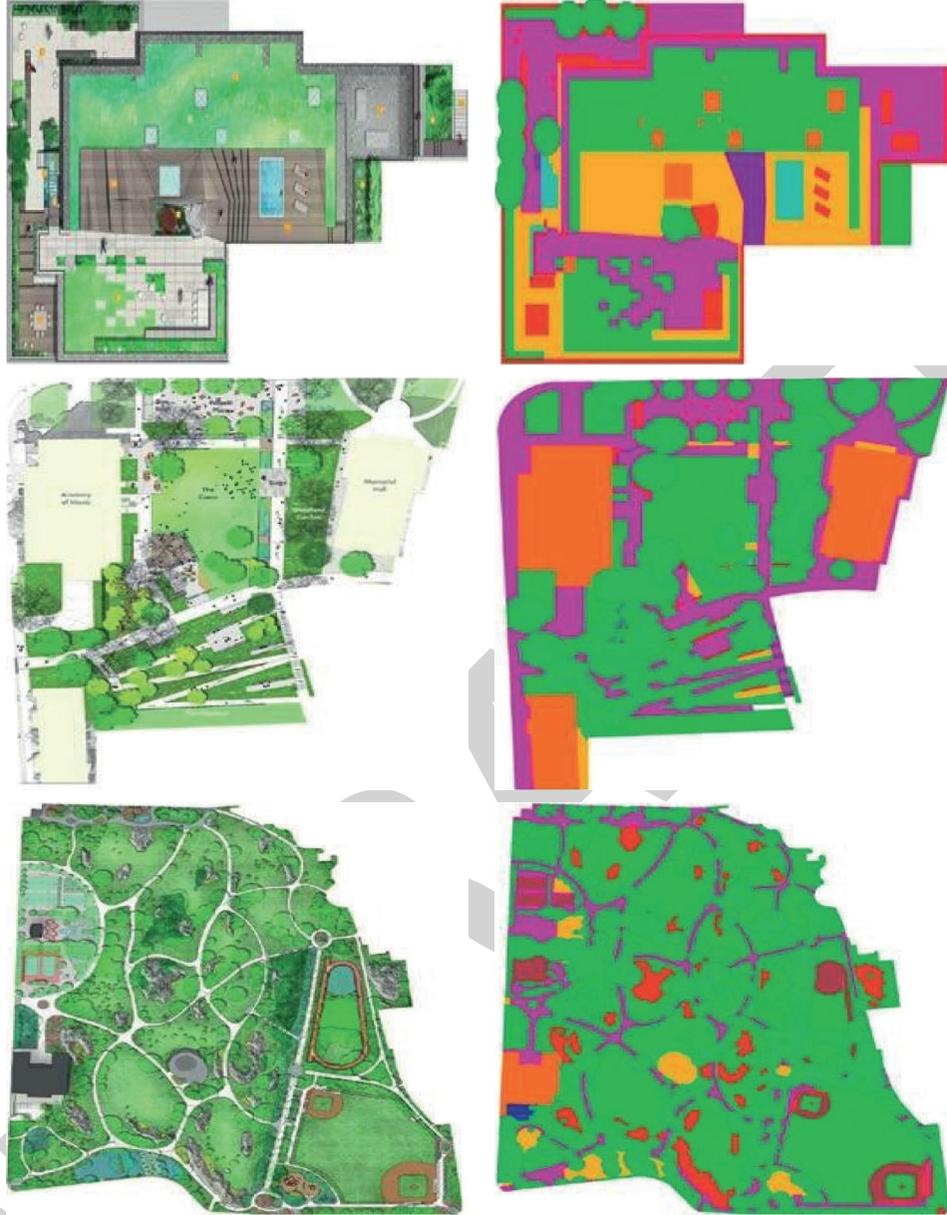


FIGURE 2: Dataset enumeration and label RGB rules (2-1 scheme cited from Tribeca Penthouse Gardens, HM White; 2-2 scheme cited from Pulaski Park, Stimson; 2-3 scheme cited from St. Mary's Park, Starr Whitehouse).

equilibrium, and the loss function of the GAN can be expressed formally as

$$L_{GAN}(f_{AB}, \mathbf{D}_B, \mathbf{A}, \mathbf{B}) = E_{b \sim B} [\ln \mathbf{D}_B(\mathbf{b})] + E_{a \sim A} [\ln(1 - \mathbf{D}_B(f_{AB}(\mathbf{a})))] \quad (1)$$

where A and B represent the two animation costume domains to be style migrated, a and b represent the animation costumes in the two domains, f_{AB} is the mapping function from domain A to domain B , \mathbf{D}_B is the discriminator, $E_{b \sim B}$ represents the probability that b belongs to domain B , and represents the expectation that b is taken from B . The purpose of the discriminator \mathbf{D}_B is to distinguish the animated costume b in domain B from the fake animated costume $f_{AB}(\mathbf{a})$ generated by the

generator, i.e., to make the value of $\mathbf{D}_B(\mathbf{b})$ in the first term converge to 1 and the value of $\mathbf{D}_B(f_{AB}(\mathbf{a}))$ in the second term converge to 0.

The task that CycleGAN wants to accomplish is to migrate the animation costume style in domain A to domain B . Two GANs are used:

$$L_{cyc}(f_{AB}, f_{BA}) = E_{a \sim A} [\|f_{BA}(f_{AB}(\mathbf{a})) - \mathbf{a}\|_1] + E_{b \sim B} [\|f_{AB}(f_{BA}(\mathbf{b})) - \mathbf{b}\|_1], \quad (2)$$

where 1 stands for 1 parity. The meaning of the first term of this loss function is that the animated costume a in domain A is generated by the generator GA as $f_{AB}(\mathbf{a})$, $f_{AB}(\mathbf{a})$ and then transformed to $f_{BA}(f_{AB}(\mathbf{a}))$ by the generator GB , which should be similar to the original

TABLE 1: Statistics on the number of parcels of land in the plan dataset by type.

Parcel type	RGB	Quantity/piece	Number of pictures/piece
Soft elements	Single tree	80,160.80	18614
	Grassland shrub	024040.00	21054
	Woods	206030.10	442
	Waterscape	0255255.30	713
	Pavement node	255190.00	2266
	Route	2550255.10	1344
Hard element	Steps	4900255.00	254
	Parking lot	168007.00	81
	Playing field	165257.05	80
	Outdoor installation	25500.03	12853
	Building construction	2551200.00	530

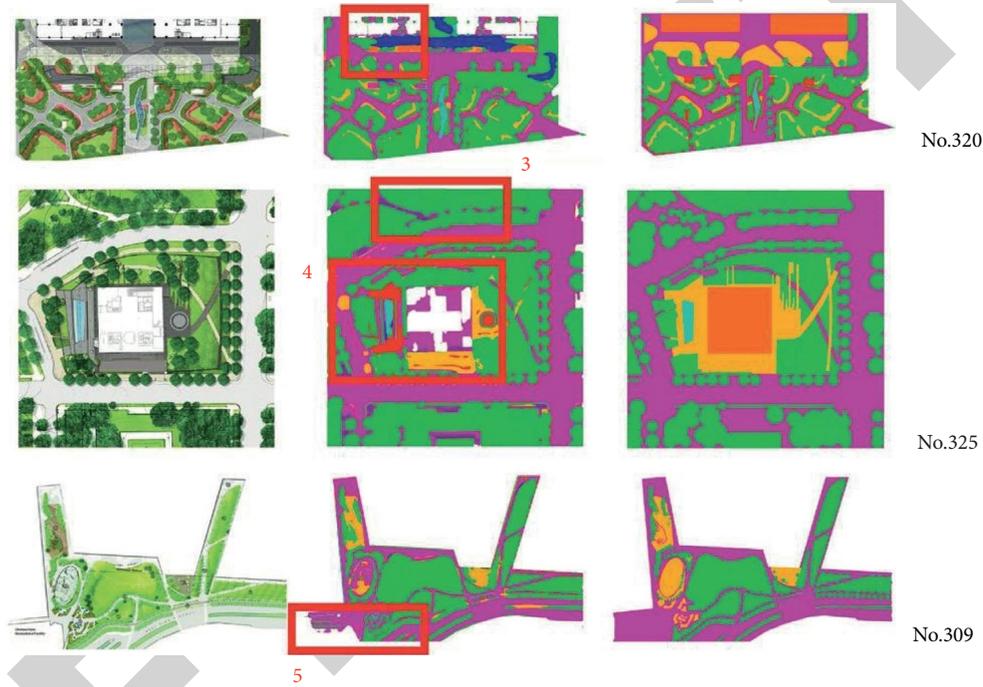


FIGURE 3: Results of CycleGAN identification of landscape garden plan site information (Scenario 3-1 cited from Gillespies Associates; Scenario 3-2 cited from Caddown website; Scenario 3-3 cited from GGN Associates; Scenario 3-4 cited from ASPECT Studios).

animated costume a . The second term of this loss function is that the animated costume b in domain B is generated by the generator GB and transformed to $f_{BA}(\mathbf{b})$ by the generator GA . The second term of the loss function is that the animated costume b in domain B should be similar to the original animated costume b after the action of generator GB to generate $f_{BA}(\mathbf{b})$, $f_{BA}(\mathbf{b})$ and the action of generator GA to $f_{AB}(f_{BA}(\mathbf{b}))$. This adds a constraint to establish a certain connection between the unpaired data [26–28].

The sum of these 3 loss functions is the loss function of CycleGAN, i.e.,

$$L_{\text{full}}(f_{AB}, f_{BA}, \mathbf{D}_A, \mathbf{D}_B) = L_{\text{GAN}}(f_{AB}, \mathbf{D}_B, \mathbf{A}, \mathbf{B}) + L_{\text{GAN}}(f_{BA}, \mathbf{D}_A, \mathbf{B}, \mathbf{A}) + \lambda L_{\text{cyc}}. \quad (3)$$

The parameter determines how important the two loss functions are in relation to one another.

4.3. *Animated Costume Matching.* Finally, the animated costumes after style migration are matched with the target objects in the semantically segmented labeled animated costumes and brought back to the original image to complete the whole experimental process. The matching process uses the Hadamard product of the animated costume matrix, i.e.,

$$\mathbf{R} = \mathbf{Y} \circ \mathbf{Z}. \quad (4)$$

5. Experimental Design

Here, we certify that the floor plan representation is both consistent and creative; the plan is primarily derived from

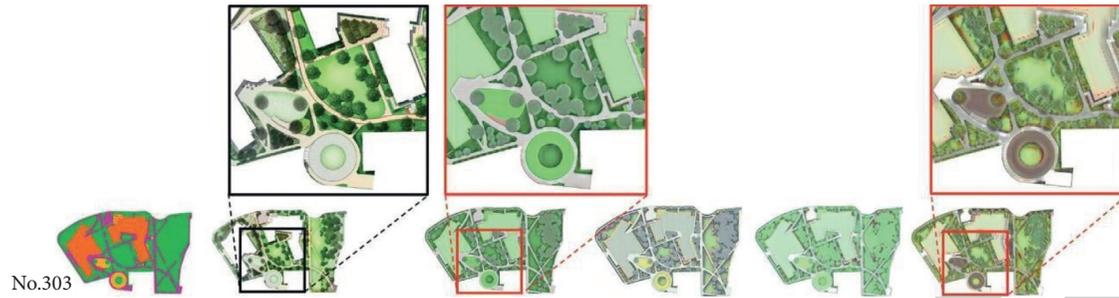


FIGURE 4: CycleGAN landscape garden plan generation training process (50–300 generations) (scheme cited from Ayers Saint Gross Associates).

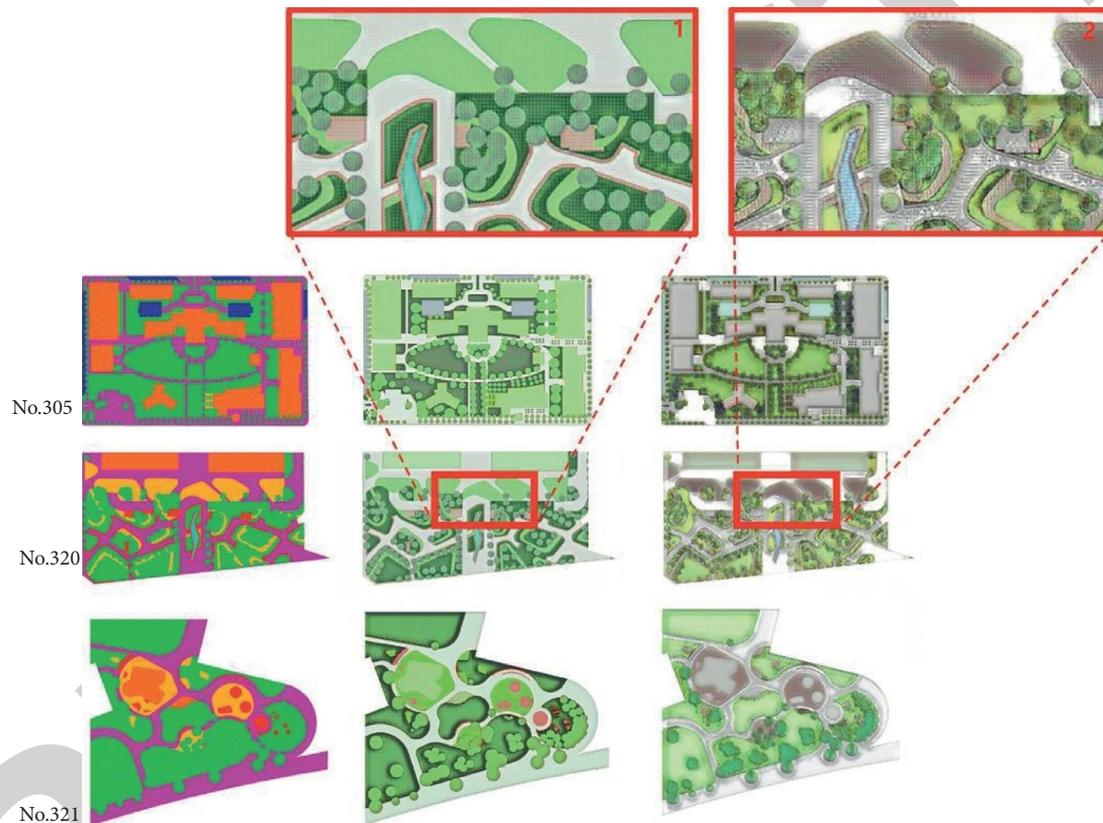


FIGURE 5: CycleGAN validation set for 50 generations (Epoch50).

well-known domestic and foreign firms and award-winning schemes.

5.1. Datasets and Labeling. A total of several hundred landscape plans, including squares, municipal parks, residential areas, and waterfront parks, were collected and divided into a training set and a validation set (the validation set was not involved in the training), all in 2000×2000 px JPEG format. In order to improve the accuracy of the data annotation and to ensure that the model can better learn the pixel texture of the planes, small and medium scale project planes smaller than the size of the planes were selected as

training samples, which have a larger scale and clearer image texture (Figure 2). The plan is mainly sourced from well-known domestic and international firms and award-winning schemes to ensure that the floor plan representation is both standardized and artistic [29, 30].

RGB colour differentiation is used for the labeling of the site plots on the plan, and the labels are all 2000×2000 px in PNG format. The labels are based on the common expressions of landscape plans, with soft and hard landscape elements marked and subdivided into 11 subcategories. The labels were vectorised by three landscape architects and exported as images to ensure strict alignment between the labels and the original drawings. To simplify future open-

source work on the dataset, the authors used pixel statistics to count the number of consecutive identical RGB colour blocks of each type in the plan and included them in Table 1. A total of approximately 58,000 site colour blocks were labeled, the precise procedure of which is not described here.

5.2. Evaluation of Floor Plan Identification Results. The results of the test set are shown in Figure 3 to demonstrate the training process of CycleGAN for recognising landscape garden site types and to analyze the performance of the CycleGAN final output (Epoch300) in recognising site types. Currently, manual visual interpretation is still the most operative way to evaluate recognition results. Firstly, the accuracy of CycleGAN recognition gradually improved as the number of training sessions increased, and the colour block segmentation gradually transformed from more scattered 50 generations (Epoch50) to a more complete image segmentation in the final output (Epoch300) [31, 32].

Overall, CycleGAN is able to identify the types of roads, paving nodes, and green spaces in landscape garden plans more accurately and can complete the task of extracting the proportion of the case plan site. It should be emphasised that the difference between the model recognition results and the manual annotation does not necessarily mean that the model is wrong. In practice, errors in manual annotation and appropriate simplification are inevitable. The advantage of the deep model is reflected in the meticulousness and comprehensiveness of recognition, and it is easier to find omissions in manual annotation: as shown in red box 3 in Figure 4, the annotator simplified the annotation of tree clusters when making labels, and there is a certain error in the scope of tree clusters, but the CycleGAN model can complete a more accurate tree cluster recognition.

5.3. Evaluation of Floor Plan Rendering Results. The results of each training generation from validation set number 303 are selected in Figure 4 to demonstrate the deepening of rendering detail throughout the training process of CycleGAN. Overall, the model's rendering strokes progressively deepen and detail increases as the number of training sessions increases. Zooming in on the details reveals that the model at generation 50 (Epoch50) has a flattened representation with weak strokes but is still able to clearly show the space's features, while after 300 training generations, the floor plan is rendered with more detail, creating a gradual, blended rendering stroke.

Figure 5 further selects some of the training results of the test set 50 generations (Epoch50) and the final output (Epoch300) to analyze the rendering results qualitatively and quantitatively in terms of three aspects: picture quality, normative representation, and colour artistry.

6. Conclusion

This paper firstly briefly introduces the basic situation of VRT from 3 perspectives: classification, technical characteristics, and application methods of VRT; secondly, it elaborates the application methods and methods of VRT

from two aspects: design principles and general scheme stage application of VRT in natural landscape architectural space; after that, it briefly introduces the construction process of virtual reality scenes: determining project type → model making → plant modeling in virtual scenes → virtual scene roaming; finally, it introduces the practical operation of VRT from 4 aspects: virtual process, reconstruction method, digital construction, and virtual interactive roaming technology. Finally, taking a city in the south as an example, VRT was implemented in four aspects: virtual process, reconstruction method, digital construction, and virtual interactive roaming technology, with the reconstruction restoring the city's historical appearance to assure cultural heritage inheritance and distribution. This will provide scientific decision and basis for the scientific and rational use of VRT to plan and design natural landscape and architectural space.

Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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