Design of Visual Landscape Garden Environment of Plant Landscape Based on CAD Software

Ren Wang

1Chongqing Vocational Institute of Engineering, Chongqing, China, 402260

*Corresponding author e-mail: wang_ren@cqvie.edu.cn

Abstract. Irregular scenes in nature are objects that often appear in the scene being drawn, and the simulation of plants and other objects has always been a research hotspot in computer graphics. To explore the holographic model technology of virtual garden trees, taking bird plum as an example, CAD software is used to edit the overall skeleton, branches, leaves and post-model effects with the CAD software taken the editing of the basic parameters of the tree as the principle. The results of the study show that the CAD software is used to create a tree model. Its high authenticity causes a dynamic effect, a fast rendering speed, and easy operation. In garden landscape design, it can effectively guide the expression of garden plant configuration effects, and provide a practical basis for garden plant species selection.

Keywords: Virtual Garden Trees, 3Dmax, Bird Plum, Garden, Landscape Design

1. Introduction

In recent years, irregular scenery in nature is an object that often appears in the scene being drawn. Simulation of plants and other objects has also been a research hotspot in computer graphics [1-4], and is widely used in various fields, whether it is education or teaching, whether it is industry, agriculture, or movie games, the virtual representation of plants has an important role, but there are still many problems in plant modeling in garden design. In the era of rapid development of computers, garden design methods are also leaping. Some scholars have applied virtual reality technology to landscapes. This is not just the progress of gardens. It is also extremely important for the sustainable development of the ecological environment. Ecological significance [5-8]. Virtual plant modeling has strong visibility. This technology is an emerging research field that has rapidly developed with the progress of information technology, and has become one of the research hotspots in the computer field [9]. Plant simulations account for a large proportion of natural landscape simulations. Rich plant landscape design is one of the distinguishing characteristics of landscape garden planning and design from city planning and architectural design. The massive data of plant models is precisely the bottleneck for the realization of virtual reality interactivity and immersion [10].

This article takes bird plum as an example, based on the principle of CAD software for editing basic parameters of trees, and edits its overall skeleton, branches, leaves and post-model effects, aiming to provide effective support for the configuration of garden plants.
2. Relevant content of plant visualization technology

Combining plant visualization technology with garden-aided design is an inevitable requirement for the continuous development of technology. Plant visualization technology is currently widely used in computer-aided design of gardens. From the drawings of the plant planting expressed in the planning and design drawings of the garden, and the plant expression of the general plan design, to the expression of the plant direction of the facade and section in the design drawings, the expression of the plant's visualization technology needs to be reflected. It enables the content of plant design to be expressed through computer visualization technology and is a tool for designers to communicate with readers. Therefore, the study of plant visualization technology is to better express the design information of plant direction, easy to modify, and easy to communicate (as shown in Figure 1).

![Classification of plant models](image)

**Figure 1.** Schematic diagram of plant model classification.

2.1. Application of virtual plant model in garden design

With the development of plant visualization technology, plant modeling technology has developed rapidly in recent years, and the scope of application has also been expanding. In view of the characteristics of the above-mentioned garden design, the application and location of plants in the garden are very important. Therefore, in the auxiliary design of landscape, whether it is graphic design or scene modeling, the types and three-dimensional models of virtual plants are higher. The application of virtual plants permeates every step of auxiliary design, such as planting design of plants, scene design of plants, design of garden renderings, etc., from which we can see the important position of virtual plants in auxiliary design.
2.2. Development of virtual plant models
Because the basis and methods of modeling are different, the model construction methods of virtual plants can be roughly divided into three categories: graphical models, dynamic structural models and static structural models. These three different construction methods can be compared, and the graphical model is more suitable for the construction research of virtual plants in garden landscape design, but the graphical model cannot fully express the comprehensive information of the plant that you want to express. In the process of exploring the virtual plant model of the garden, the construction method with topological structure, which conforms to the morphological characteristics of plants and their growth rules, is more pursued.

2.3. Comparison of various types of plant model software

2.3.1. 3D SMAX
3D SMAX is a well-known three-dimensional software, used for making various models and with post-rendering and other functions. It can well reflect the sense of space and scale of objects, and it is also very useful in gardens. For example, the production of garden renderings, as an auxiliary tool for garden design, etc., will give designers a sense of space and scale, which not only enables designers to better understand and expand their design ideas, but also allows designers to design more intuitively. The full picture of the landscaped landscape and every detail is shown to others.

2.3.2. Tree Storm
Tree Storm is one of the plug-ins for 3D. It is a software used for professional tree model construction. Its 3D plant model has a strong ornamental and natural atmosphere, and it is very natural for landscape scenery. Tree Storm can make various tree models in 3ds max, and can simulate the effect of wind blowing leaves according to wind shaking. The built-in plant library provides 280 basic tree models and 140 leaf models, plus a large number of adjustable parameters, you can create many plants, including trees, shrubs, herbs.

Use Tree Storm's tree library to choose different types of trees. One of the advantages of the plug-in is that it can produce different types of tree models. Tree Storm can set the number of trunks, branches, etc., of the tree model, so that different precision tree effects can be produced according to the needs of the scene. Although the plug-in provides a variety of tree models, but considering that it cannot fully meet the needs of users, some of the functions of the plug-in allow users to make tree model effects by themselves.

2.3.3. Xfrog
Xfrog is also a plug-in based on 3D. The model built by Xfrog is very realistic, and there are many kinds of plants. The model library provides more than 600 plants. It can not only make trees, flower components, but also make ground covers and animations. Leaves, trunks, and flowers are all used. Physical scanning is more real. Material aspects such as bark, leaves, flowers, etc. can be achieved through related textures, and the textures can be used by exporting the corresponding format after PS processing. However, the Xfrog software lacks the dynamic effect of wind blowing, and the operation process is relatively complicated, so there are many areas for improvement.

2.3.4. Comparison conclusion of plant modeling software
It can be seen from the comparison that the CAD software is more suitable for use in garden-aided design. While ensuring the effect, the number of vertices and patches is reduced as much as possible, and the production efficiency is improved; and the shadow is sharp, supports various renderers and dynamic systems, and can produce animations of trees; there are many types of plant models, which can meet The demand for plants in garden-aided design.
3. CAD tree modelling principles and examples of bird plum models

The basic principle of CAD is to edit parameters. After the software is started, it comes with an initial tree model, and the trees to be created must be edited based on this. First, based on the morphological characteristics of each tree, determine the basic skeleton of the tree on the Global Properties page; second, edit the tree trunk, branch and leaf attributes. Tree branches are arranged in a hierarchical manner, first-level branches, second-level branches, third-level branches, etc.; finally, add leaves, edit the shape, size and color of leaves (Figure 2).

3.1. Morphological characteristics of bird plum

Bird plum (Padus racemosa), Rosaceae, Bird plum, deciduous tree, height 15m, leaf oval, apex and tail tip, round base, with sharp serrations, equal-length stipules and petioles. The raceme has more than 20 flowers, with small leaves 1-4 at the base, flower mortar color, and stamens nearly half shorter than the style. Fruit ovoid, reddish brown to black, which are distributed in Heilongjiang, Jilin, Liaoning, Inner Mongolia, Hebei and other places. It likes sunlight, relatively hardy, like fertile and humid sandy soil. The inflorescence is long and beautiful, and the species of flowers and foliage are watched in early spring. The fruit attracts birds.

3.2. Creation of bird plum model

Bird berry is one of the main greening tree species in Northeast China. It has a full crown and yellow-red autumn leaves. It is widely used in campuses, public green spaces, and urban parks. It is a good garden ornamental tree species. This study mainly simulates the appearance of bird plum from the perspective of ornamental and design application of garden plants.

(1) Setting of the overall skeleton

Global attribute, the main parameter is Randomize, according to the characteristics of bird plum, randomly select the overall shape of the tree to simulate the general skeleton of bird plum. This property page shows the number of branches, leaves, and fronds scraped by the bird plum, and the overall coordinates of the die (Figure 2).

(2) The setting of the trunk

The Trunk attribute mainly sets the length, width, curvature, and branch growth of bird plum trunks. Among them, the length and radius of bird plum trunk are two important parameters. Start angle controls how the trunk grows relative to the ground. Flexibility determines the flexibility of the trunk and is distributed along the growth of the tree. According to the natural situation of bird plum, its details are further perfected by radius curve, curvature curve and angle curve. The texture of the bird plum bark is represented by the horizontal and vertical relationship between the heart coordinate and the t coordinate of the texture (Figure 2).

![Figure 2. CAD tree modeling principle diagram.](image-url)
3.3.2. Plant material preservation

3.3.1. Material saving
Open COMPILER, there is a button of add trees in the pop-up dialog box, select this command to add the plant model that has been done.

3.3.2. Click add trees
To add the completed Hibiscus SPM model, click Next in order. After the prompt, you need to add the output path. The output path can be placed in the desired folder. In this step, set the file output path to the desktop MUJIN folder. In the TREE COMPILER software that has been imported, the material of
the Hibiscus model appears on the interface. Select the start compilation option in the Session menu bar to enter the material export stage.

![Importing materials](image)

**Figure 3. Importing materials.**

### 3.3.3. Exporting materials
As a plant component, the plant model made by TREE is imported into the rendering software to bring wind effect, and the plant model has a certain vividness and authenticity.

### 4. Summary
The data created by the CAD software for the bird plum model shows that from the perspective of the appearance of the model, its reality is relatively high, and it can clearly and accurately express the morphological characteristics of the trees. It can also be used for post-model effect processing, using lighting attributes to produce light and dark and color changes, simulating light sources to generate shadow effects, and can be added to the wind field to produce the effect of swinging with the wind, and can control the amplitude and intensity of the wind swing to make the tree model With a dynamic effect, more realistic.

In summary, through CAD virtual garden tree modeling technology, it is possible to intuitively explore the plant morphological structure, and rationally use plant modeling software, which is of great significance to guide the expression of garden plant configuration effects and the selection of plant species.

### References

[1] Krix D W, Murray B R . Landscape variation in plant leaf flammability is driven by leaf traits responding to environmental gradients[J]. Ecosphere, 2018, 9(2):1-8.

[2] Monika K, Fernando Z, Montti Lia, et al. Effects of Landscape Structure on Medicinal Plant Richness in Home Gardens: Evidence for the Environmental Scarcity Compensation Hypothesis[J]. Economic Botany, 2018, 72(2):150-165.

[3] Akinobu MURAKAMI, Eiko KUMAKURA, Hiroki TAKAHASHI. The Process of Landscape Design and Maintenance Using Thermal Environment Simulation at Passive Town
Kurobe[J]. Landscape Research Japan Online, 2019, 2(4):102-110.

[4] Jan W. Designing the garden of Geddes: The master gardener and the profession of landscape architecture[J]. Landscape and Urban Planning, 2018, 178(1):198-207.

[5] Woudstra, Jan. Designing the garden of Geddes: The master gardener and the profession of landscape architecture[J]. Landscape & Urban Planning, 2018, 5(1):42-49.

[6] Shackleton M E, Rees G N, Watson G, et al. Environmental DNA reveals landscape mosaic of wetland plant communities[J]. Global Ecology and Conservation, 2019, 19(9):23-30.

[7] Schrader J, Markus Franzén, Sattler C, et al. Woody habitats promote pollinators and complexity of plant-pollinator interactions in homegardens located in rice terraces of the Philippine Cordilleras[J]. Paddy and Water Environment, 2018, 16(2):253-263.

[8] Gao Y, Yu L. 94.Application of Evaluation System of Garden Plant Landscape Based on Fuzzy Data[J]. Boletin Tecnico/Technical Bulletin, 2017, 55(12):700-712.

[9] Schmidt, King, Meier. Plant-microbe interactions at multiple scales across a high-elevation landscape[J]. Plant Ecology & Diversity, 2015, 1(2):1-8.

[10] Mueller N, Sukopp H. Influence of different landscape design styles on plant invasions in Central Europe[J]. Landscape & Ecological Engineering, 2016, 12(1):151-169.