A Study on Point Light Application in Public Landscape Design

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Abstract: The Interior environment is inseparable from the expression of color, and the color requires the illumination of light to show its own effect. The beauty of modern interior design is largely reflected by lighting, so in a sense, lighting is the soul of interior design and decoration. In this paper, through the analysis of the placement of used items in the space and the analysis of the dynamic natural light activity, the design method of supplemental light source is adopted to dynamically adjust the spatial light distribution according to the environmental needs of livable life.

1. Introduction
The role of the light is extremely important for the visual function. Lighting is not only the physiological needs of the shape, space and color of human visual objects, but also the indispensable material condition for beautifying the space environment. Different lights not only illuminate all kinds of spaces, but also create different spatial moods and atmospheres. Lighting plays a very important role in interior design.

Facing this changes, there is growing evidence of a range of ecological impacts of artificial light and awareness of light pollution as a significant environmental issue. [1]

Artificial lighting has transformed the outdoor nighttime environment over large areas, modifying natural cycles of light in terms of timing, wavelength, and distribution. This has had widespread benefits and costs to humankind, impacting on health and wellbeing, vehicle accidents, crime, energy consumption and carbon emissions, aesthetics, and wildlife and ecosystems. [3] Liang, J. demonstrate the advantage of using calculation charts to provide direct visual insights into the fractal distribution of the layout, through lacunas and shadowed boxes. The significance of new lacunas is presented and discussed in particular. The proposed method allows for quantitative measures, convenient evaluation, and potential feedback to improve the fractal quality of the green space design. [4]

Not only the physiological needs of the shape, space and color of human visual objects, but also the indispensable material condition for beautifying the space environment. Light can make up space and change space; it can both beautify space and destroy space. [5] Different lights not only illuminate all kinds of spaces, but also create different spatial moods and atmospheres. [6] The same space, if different lighting methods, different positions, angular directions, different lamp shapes, different light intensity and color, can obtain a variety of visual spatial effects. Lighting plays a very important role in landscape design.

The gardens are places where citizens relax, get close to nature and cultivate sentiment. The nighttime use rate in the autumn and winter parks is even higher than that in the daytime, and the
subsequent landscape lighting design has also attracted widespread attention. The garden night scene is not a simple continuation of the daytime landscape, but a kind based on the original landscape.

The opening of urban gardens at night brings social effects that can not be ignored, so the design of garden night lighting is highly valued. The article analyzes the landscape lighting design from the perspectives of illumination standard, lighting method, light source selection, power distribution and control methods. With the increasing nightlife of the city, more and more urban parks and leisure landscapes are beginning to open at night. The gardens are places where citizens relax, get close to nature and cultivate sentiment. The nighttime use rate in the autumn and winter parks is even higher than that in the daytime, and the subsequent landscape lighting design has also attracted widespread attention. The garden night scene is not a simple continuation of the daytime landscape, but a kind based on the original landscape.

2. Principles for rational lighting design

The landscape elements of the garden include: garden architecture, roads, rocks, water features, sculptures, trees, shrubs, greenery, flowers, etc.

Lighting design should follow the following principles:

- Landscape lighting design should firstly start from the perspective of lighting planning, according to the regional functional characteristics, under the premise of satisfying functional lighting.
- Landscape lighting design should fully understand the theme of landscape design, the shaping of garden landscape elements and the composition of landscape design. According to the nature and characteristics of the garden, the lighting of the garden's hard landscape (rock, road, building, running water and water surface) and soft landscape (green space, trees and flowers, etc.) are uniformly planned and carefully designed to form harmony.

![Figure 1. Direct reflection of light](image)

It can be illustrated via the basic illumination model. It can be described as Figure 1: global ambient light, point source (diffuse reflection component of ambient light, diffuse reflection component of point source, specular reflection component of point source), material coefficient (diffuse reflection coefficient, specular reflection coefficient), Self-illumination, fog effect, etc. The point source has radiation attenuation (distance) and angular attenuation, and affects the intensity (ie, color) of the light according to the distance or angle.

\[
I = I_{ambient} + I_{ambient} + \sum_{l=1}^{n} f_l \cdot \text{radiation} \cdot \text{angular}(I_{diff} + I_{spec})
\]

\[
I_{spec} = \begin{cases} 
0.0, & \text{if } N \cdot L \leq 0.0 \\
K_{spec} \max(0.0, (N \cdot H)^n), & \text{otherwise}
\end{cases}
\]
3. The general design styles

3.1. Direct lighting
Light is emitted through the luminaire, where 90%-100% of the luminous flux reaches the assumed working surface. This illumination is direct illumination. This kind of illumination has a strong contrast between light and dark, and can create interesting and vivid light and shadow effects, which can highlight the dominant position of the working surface in the whole environment, Show as Figure 2.

![Figure 2. Direct reflection of light](image)

3.2. Semi-direct lighting
The semi-direct illumination method is that the lampshade made of translucent material covers the upper part of the light source, and 60%-90% of the light is concentrated to the working surface, and 10%-40% of the light is diffused by the translucent lampshade and diffused upward as Figure 3.
3.3. Diffuse lighting
The diffuse illumination method uses the refraction function of the luminaire to control the glare and spread the light around. There are two general forms of such illumination. One is that light is emitted from the upper opening of the lampshade through the flat top, both sides are diffused from the translucent cover, and the lower part is diffused from the grille. It shows on Figure 4.

4. The effects and functions of lighting design method
The main road in the garden is the main route of the tourists. It connects the various scenic spots, main scenic spots and activity facilities in the park. For good design will bring excellent experiment for people.

4.1 Performance and determination of lighting design themes
The choice of lighting methods is closely related to the garden road, the type of trees and the forms of green spaces, flower beds and water features.

For the road lighting, according to the characteristics of the level, direction, width, slope and other characteristics of the road, the surrounding plant characteristics and landscape performance requirements, determine the height of the lamp, the spacing of the lights, the layout, the type and style of the lamps. It shows as Figure 5.
The main road in the garden is the main route of the tourists. It connects the various scenic spots, main scenic spots and activity facilities in the park. If necessary, a small number of vehicles are managed. The width is generally 4~10m. The part of the road should be double according to different widths. Rows of symmetrical or single-row lamps, the height of the pole should be controlled within 5m. The courtyard lights should be in regular lighting, paying attention to the control of glare.

4.2 Make full use of tree shape and natural light

The steps or other paths in the garden are for the rest of the tourists and guide the tourists to the depths of the garden. Most of them are arranged in a twist and twist, and the width is between 1.2 and 2 m. In this kind of small road, the focus of lighting is not to give people a clear ground recognition, but should retain a certain degree of darkness, so that visitors relax, reduce visual fatigue and feel the real night. It shows on Figure 6.

![Figure 6. Emphasis on part of the lighting design](image)

For the lighting of trees in the garden, different lighting methods should be set according to the tree shape of different trees. The floodlights or buried lights can be set up under the trees to illuminate the vertical plane of the trees. The lighting method of the green lawn in the garden can be horizontally projected by a small floodlight, and a strong and weak lighting effect is formed on the surface of the lawn. You can also place stone lamps (light stones) and low lawn lamps in the lawn to express natural taste.

5. Conclusions

Light has a very important shaping effect on space. And the light of different states is also an integral part of modern life. It can create an atmosphere: Different lights can create a different atmosphere. And it can transform color. And the third is on riching style.

Create an atmosphere: Different lights can create a different atmosphere. Even if the desk lamp is carefully arranged, the projection effect and mood produced by it will change a lot. Light and transparent paper shades, the light that shines through to the surroundings, appears soft and ethereal; and those that are not light-transparent will condense the light down to produce a variety of different effects.

Transform color: Color is an important means of interior decoration, and it is easy to adjust the color of the room by the color of the light, and the combination of light and shadow is the most effective. If color lacks change for a long time, people tend to take it for granted and lack freshness. It's hard to change the color of the general decoration, but the change of the light is very easy. You can change the light bulb of different colors.

Rich style: The light can enhance the three-dimensional sense of the structural lines, and the smooth lighting shape will also bring the decorative artistic effect to the space. Sometimes the use of light and dark changes in the lighting can also make the Interior living room more layered. The shape of the wall, such as a triangle or a rectangle, plus the curved light from the luminaire, enriches the shape. In a styling, if you use up, down and backlight, and use different colors, it will produce different effects, and the interior seems to have added several new styles.

Artificial lighting is strongly associated with urbanisation and is increasing in its extent, brightness and spectral range. Changes in urban lighting have both positive and negative effects on city performance. In landscape design, lighting is very important, and point light source is an important
factor in shaping the night scenery. The basic principles given in this paper provide a basis for
landscape nightscape design.

Acknowledgements
This research was financially supported by Li Yueen’s Doctoral Research Fund of SDJZU.

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