

Exploring Sensory Interaction between Gardens and Paintings from a User Experience Perspective: The Case of European and American Gardens

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Abstract: Garden art and painting art are indispensable art forms, so how do they influence and shape each other? This paper takes European and American gardens as the research object, and deeply explores the internal relationship between the two through the sensory perspective of user experience such as vision, touch, hearing and smell. The study found that the art of painting has enriched the expression of the garden, and has produced corresponding expressions in terms of composition, color, light and so on. Therefore, the corresponding design strategy can be combined with the current technology to enhance the multi-sensory dimension of the garden experience of tourists.

Keywords: User Experience, Garden, Painting, Sensory Interaction, European and American Gardens.

1. Introduction

In the process of the development of human civilization, garden and painting are two important art forms, which influence and learn from each other, enriching people's aesthetic feeling and spiritual world. As early as in ancient Greece and Rome, murals were associated with gardens. For example, the scene in the mural will be integrated into the garden elements. In the Renaissance, the symmetrical figure painting was closely related to the aristocratic manor, and the layout of the manor often imitated the symmetrical structure in the painting. In the period of modernism, mixed landscape design and abstract painting are also closely related. Nowadays, user experience is valued. Studying the interaction between garden and painting from multiple perspectives has become an important topic[1] in expanding the field of art research and design practice.

This study focuses on European and American gardens. Over the centuries, European and American gardens have been influenced by style changes and artistic trends. They are not only rich in cases, but also have profound cultural heritage. They are an excellent example of exploring the interaction between garden painting and senses. By analyzing the interaction between the two, the research aims to explore the design methods and perception methods, provide new ideas for modern landscape design innovation, art cross-border integration and cultural heritage protection, fill the gaps in previous research, and promote the diversified development of art and humanities research.

This paper primarily aims to explore the relationship between painting and garden art through the sensory experiences of seeing, listening, touching, and hearing. It seeks to compare their similarities and differences while highlighting commonalities. After analyzing various examples and conducting comprehensive research from the perspective of user experience, this study presents design methods and painting techniques that can enhance the overall experience for audiences.

2. The Theoretical Basis of Sensory Interactive Experience and the Importance of Multi-sensory Experience

Sensory experience theory focuses on the importance of senses in the experience. They think that this experience is multi-dimensional. For example, visual, auditory, olfactory, taste and touch should be used together[2]. In fact, it is not only passive acceptance of external stimuli, but also has a lot to do with people's cognition, emotion and specific behavior. The so-called 'perceptual body' theory, which began to appear in the 1930s and developed in the 1980s, regards this as the basic way of dealing with people and the environment, and enriches the understanding of people in environmental regulation architecture with organic, dynamic and interrelated perspectives[3][1].

Nowadays, there are many studies on the five senses in landscape architecture design. Scholars have found that visual perception is the most direct and important aspect for people to feel the scenery. Different colors will bring different emotional reactions[4]. Different color collocations will also make the landscape effect different[5]. There are also sound and taste perceptions[6], which also affect people's overall perception of the environment, allowing people to have a subtle experience. Now researchers use various new technologies to scientifically quantify these experiences to explore people's more real feelings. Multisensory experience can enhance people's emotional and perceptual response to the environment and works of art, which is a very irreplaceable role[7].

3. Sensory Interaction Analysis of Garden and Painting

3.1. Visual Interaction

(1) Composition and spatial layout
Theoretical basis :

Visual interaction is an important connection between garden and painting. The beginning of the theory can be

traced back to the breakthrough of perspective in the period of literature and art restoration. In the 15th century, the Italian architect Leon Battista Alberti said in " On Painting " (1435) that the picture was like a window on the world, systematically summarizing the laws of linear perspective and bringing mathematical geometry into art[8]. This theory provides the basis of scientific perspective for landscape design, so the garden can also make a visual effect that looks great in a limited space. Alberti 's method pays attention to the order and proportional relationship of space, which becomes the theoretical basis for landscape design to arrange space.

Case:

Versailles Garden : Andre Lenotel designed the central axis with a little perspective method [9], drawing people 's attention to the Apollo Fountain, creating a sense of power similar to classical historical painting. The garden axis design of Versailles Palace allows visitors to feel particularly large and neat no matter where they stand [10], just like walking into a super-large historical painting.

Stoicheide Garden imitates the three landscape methods of Claude Lorraine 's paintings [11](the front is the grass, the middle is the waterscape, and the back is the woods), and uses the circular route to imitate the moving picture frame, which brings the idea of spatial layout in the painting to the garden. Tourists can feel the changes of different landscapes when they visit. This design not only makes the garden more artistic, but also makes the tourists ' eyes see more feelings.

The golden section ratio is widely used in landscape design, such as the division of flower beds and roads. According to the literature[12], this ratio can make the vision more balanced, so that the viewer 's attention can be focused on the main landscape. For example, the design of Suzhou garden follows this ratio, so that the proportion of each part is coordinated, with both natural sense and design beauty. This balance not only makes visitors feel comfortable, but also guides their eyes and highlights the key landscapes that designers want to emphasize.

(2) Color and light and shadow

Theoretical basis :

color plays a very important role in the field of art. Wassily Kandinsky said in his book " The Spirit of Art " that color can directly arouse people 's emotions [13].This view provides a theoretical basis for the use of color in landscape design. Color is not only a visual element, but also one of the important factors for people 's emotions and psychology. In landscape design, the use of color can create a different emotional atmosphere, including quiet and peaceful or enthusiastic, resulting in the impact of the experience of tourists.

Case:

Monet 's Garden : In the design of Monet 's Garden, it was largely influenced by the ' separation of light and color ' technique in impressionist painting. In the garden, the blue-purple iris and the orange troll are planted together. The use of such complementary colors not only makes the color contrast more obvious, but also produces a scene of light and shadow mixing and bright colors like that in Monet 's ' Nymphaea ' painting [14]. Such a design allows visitors to feel the visual shake and emotional vibration brought by color as if they had entered Monet 's paintings.

The Albra Palace in Spain uses white marble and red ceramic tiles in its garden design. The color contrast between the two is its main feature. This color matching refers to the aesthetic decoration of Islamic miniatures. The white purity

and warm red pottery bricks set off each other, making the environmental atmosphere solemn and elegant, and the sense of sacredness and art is also enhanced. Through the use of such colors, we can see the importance of color harmony and beauty in Islamic culture, which makes the garden not only a comfortable place space, but also a culturally significant artwork.

Functions:

In landscape design, color contrast has a special role. For example, the cold-colored plants such as blue cedar can create a far-reaching and quiet space effect, so that visitors look as if they have stepped back, and the space feels greater. Warm colored flowers like tulips can make the visual distance closer, and tourists feel more intimate and warm [15]. The interplay of color, light, and shadow creates a harmonious atmosphere that influences tourists' moods as they wander. Their emotions transition from tranquility to warmth, and from contemplation to joy in this enchanting environment.

(3) Dynamic vision

Theoretical basis :

Impressionist painter Monet brought inspiration to the time design of modern gardens by capturing the change of instantaneous light color. The rapid effect of light shadow and how to change the color are the key manifestations of the painting. This sensitivity to time and light is learned by landscape design, so that the garden is not just a fixed place, but can become an activity art that shows various forms with the passage of time.

Case:

Rio de Janeiro, Brazil 's seaside promenade design, they used a wave-shaped ground pavement and reflective pool, which echoes the Brazilian artist Amado his geometric abstract paintings, then the spot will beat the visual effects. Amado 's works are famous for their geometric shapes and abstract forms, and the design of the coastal trails uses wave-shaped pavements and reflective pools, which turns his artistic ideas into actual spatial experiences. The sun shines on the surface of the pool water to make the spot jump. With the change of light at different times and the different angles of people 's walking, this walkway looks like a different feeling. This design brings the dynamic and abstract beauty of painting to the public space.

Functions:

The mirror water landscape in landscape design can enhance the spatial level and depth, and can also reflect the image of the sky and the surrounding scenery, resulting in a picture effect of light and shadow overlapping like Monet 's painting. Monet 's ' Rouen Cathedral ' series of paintings show the appearance of the church at different times and in the light, showing the different feelings of the church 's outer walls in the light changes [16]. The mirror water landscape in landscape design not only improves the overall visual effect of the garden, but also allows visitors to have more novel and varied viewing experience, so that they can find new and changing surprises in different time periods.

3.2. Tactile Interaction

(1) Material and texture

Theoretical basis :

The phenomenologist Merleau-Ponty said that "the body is the medium used to perceive the world" and identified the dominant role of the body [17]. This theory believes that body perception is very important in the experience space, and provides a philosophical basis for the texture of materials

used in landscape design. Tactile touch is an important way of human perception, which can directly affect people's experience of space and emotional response, and is the core of space immersion.

Case:

Located in Guel Park, Spain, the mosaic texture of mosaics and natural stones arranged by designer Gaudi with tile fragments looks like the texture of Spanish surrealist painter Milo. Gaudi put the different materials and textures of various materials together to create a garden environment with both artistic sense and level. When visitors touch or see these materials, you can feel a special attraction and space to bring the strange enjoyment.

Functions:

Different materials and their touch can convey different cultures and emotions. The smooth-surfaced stone material like marble, because it is hard and slippery, is often used to represent the concepts of power, eternity and nobility, so it is widely used in many palaces, monuments and other gardens. The wood material with the original natural feeling like the bark is more easily reminiscent of nature and rural life, so it is mostly used in gardens that want to achieve more natural relatives.

(2) Interactive device

Theoretical basis :

Artist Olafur Eliasson has a philosophy: ' Art should make the body move '. This idea aims to hope that art works and viewers should have interactive effects. He believes that art is not only for people to see with their eyes, but also for the audience to participate in it in person, so as to better feel art. This view has a great influence on the interactive facilities in landscape design, so the dynamic garden is no longer just a place to watch, but also a place to interact between tourists and between tourists and venues.

Case:

There is a metal bell device that can rotate in the garden of the Eindhoven Eber Modern Gallery in the Netherlands. After touching, it will produce sound and light and shadow effects. This design refers to the dynamic extension feeling of Mondrian's " red, yellow and blue composition. " When tourists touch the operation with their hands, the wind bell begins to rotate to bring about changes in sound and light and shadow. In this way, the geometric elements in Mondrian's paintings are transformed into dynamic and feelable art forms, so that people can experience the attraction of art in the process of participation.

Functions:

Through tactile interaction, tourists' physical memory can be strengthened. When tourists use their hands to touch or operate the interactive devices in the garden, this sense of physical participation can make the experience of the garden more profound and memorable. This kind of physical memory can also make everyone's tour experience more personalized and unique, because different people's movements and interactions are different.

3.3. Auditory Interaction

(1) Natural sound and artistic conception

Theoretical basis :

Acoustic Ecology believes that sound is an important part of the environment. This theory points out the importance of sound in shaping environmental experience, and provides theoretical support for the use of natural sound in landscape design. Sound not only affects people's emotions, but also

enhances the immersion of space and the transmission of artistic conception.

Case:

There is an artificial stream here in the Diana Gardens of the Fontainebleau Palace in France. Its appearance refers to the underwater sound in the rural landscape in Nicholas Poussin's paintings, creating an ancient sense of quiet. Poussin's paintings often have a quiet and harmonious rural picture. Diana Garden builds this stream, turning the feeling of rural poetry in the painting into a real sound. When visitors visit the garden, they can experience the peace and harmony of the ancient times as they look at the scenery.

Functions:

The sound of water can cover the hustle and bustle of the city, the wind can make the charm of nature more strong, and the birdsong can make the whole region full of vitality. The sound of nature in the park in the city can well cover up the noise of the outside world and provide people with a quiet place to rest. For example, the sound of the babbling water, the sound of the wind gently brushing the trees, and the chirping of the birds, these natural sounds not only strengthen the sense of nature, but also make the whole place full of vitality, so that people feel relaxed and happy.

(2) Music and rhythm

Theoretical basis :

Kandinsky said that both painting and music share abstract rhythms. This view emphasizes the common place between art, and believes that painting music expresses emotions and creates beauty with abstract rhythm and rhythm. This theory provides theoretical support for the use of music and rhythm in landscape design.

Case:

In the Baquan Palace of the Italian Tivoli Ester Manor, the sound of a scale-like sound produced by the staircase fountain due to the up-and-down difference of the water flow is related to the Baroque musical counterpoint. In this way, the rhythm and melody of music are put into the waterscape of the garden. When tourists look at the fountain, they can also feel the music and the scenery.

There is a music experience park called EMP in Seattle, USA. The metal curved wall designed by Frank Gehry will reflect the surrounding sound, and then form an abstract sound scene similar to Schoenberg's untempered music. Such a design allows the interaction between the appearance and sound of the building, thus creating a special auditory experience, so that visitors can experience the abstract beauty of music in the park.

Functions:

Rhythmic waterscapes such as intermittent fountains can regulate the mood of tourists, and the unexpected sound of hanging bells when they are blown by the wind can be a surprise. In landscape design, rhythmic things are used, such as rhythmic fountains and changes in the speed of water flow, so as to regulate the mood of tourists and the speed of their walking. Those objects such as wind bells will make occasional sounds when they are blown by the wind, making tourists feel interesting. In this way, the sounds in the garden become more diverse, and it can also make people feel more energetic and energetic when visiting. Such a design can not only make the ears hear different sounds, but also make the garden seem to have a sense of dynamic.

3.4. Olfactory Interaction

(1) Plant aroma and emotion

Theoretical basis :

Neuroscience studies have shown that olfactory signals can be directly connected to the limbic system of the brain, which can trigger people's strong emotions and memories. In 2007, Herz found that smell had a unique effect on emotion and memory, which provided a scientific basis for landscape design and made aroma design an important way to create emotional space.

Case:

The citrus orchard in the Palace of Versailles in France can be traced back to the era of Louis XIV. The orange trees and jasmines planted here at that time carried the holy fire of aromatic aroma, which showed the immortal honor that the Sun King yearned for. In the view of the French aristocratic royal family at that time, this was a keen desire for power and glory. By using the mythological language in visual art, vision was transformed into a perceptible smell. When tourists walked at this time, they could truly feel the era and its state and emotion.

The purple lavender fields of the Hidcote Manor in the UK contrast with the white rose lounge, mimicking the cool and warm colours of Turner's landscapes. By matching different flowers and plants, the designer turns the color contrast and light and shade changes in Turner's paintings into differences in smell, so that visitors can smell different fragrances when they go to different places, just like seeing the mood changes of Turner's landscape paintings, so that the artistic feeling of the garden is stronger.

Functions:

From the perspective of landscape design, the fragrances emitted by different kinds of plants have different functions. For example, the taste of lemongrass, a plant, has the effect of expelling insects, which can make tourists more comfortable when enjoying the garden. Lavender, a plant that exudes a soothing mood, can relax people's mood, reduce the anxiety of tourists, and is conducive to the mental health of tourists; for example, the aroma of osmanthus, a kind of flower, carries heavy cultural significance, which can stimulate people's feelings of home and country, and make the garden a gathering place of feelings and memories between people.

(2) Seasonal variation

Theoretical basis :

Japan's 'Wabi-sabi' aesthetics pays special attention to the sensory experience of the traces left by time. Their aesthetic views believe that the beauty of things mainly comes from the fact that the existence time is not long and not perfect. With the passage of time and seasonal changes, these things can gain their own unique attraction and connotation.

Case:

Plants in New York's High Line Park mark the season with smell. Winter's pine releases a cold fragrance that feels like stepping into Edward Hopper's picture of freezing time - those silent streetscapes always carry the illusion of eternity. The sweet fragrance of flowers in summer is like the gradient light and shadow on the canvas, hiding the traces of flow in the stillness. The alternation of rosin and sweetness forms a unique perception game. The change of odor not only follows the natural rhythm, but also creates the illusion of fixed time by stabilizing the fragrance. This reproduces Hopper's artistic magic: he uses still images to capture the flow of modern life. When the rosin is replaced by the floral fragrance, the life rhythm of the plant becomes smelly. The designer transforms this metabolic process into the artistic language of the city, so that people in the complex can still hear the natural heartbeat.

Functions:

in landscape design, through the change of plant fragrance in different seasons, make the garden rich in more cultural and philosophical significance. The fragrance of plum blossoms in spring represents a new beginning and the resurrection of life, bringing hope to tourists for the arrival of spring. The smell of ginkgo fruit rot in autumn reminds people of life cycle and natural changes, and makes people think about life and time. According to the different smells produced by seasonal changes, the garden space has become an artistic place that can move people and make people think.

4. User Experience Promotion Strategy

Modern designers enhance the visitor experience through interactive devices. The touch screen allows participants to adjust the landscape elements independently, and the fingers can switch the plant combination or waterscape form, and see the design concept into a real scene in real time. This instant feedback mechanism activates the dual perception of vision and touch. The sound sensing device establishes a more intuitive interaction. When the footsteps trigger the light ripples, the clapping sound wakes up the fountain water column, and the human body action and the landscape change have a causal connection. In the process of creating sound wave patterns, tourists virtually become the cooperators of space design. AR technology overlays virtual and real landscapes on mobile phone screens. When tourists scan specific areas, historical garden images and contemporary design are interwoven in the lens. VR equipment builds an interactive three-dimensional garden, and people can adjust the growth trajectory of virtual plants by hand. These two technologies break through the physical limitations and extend the spatial experience from three-dimensional to multi-dimensional. Designers use such tools to build a perceptual closed loop. Each operation of tourists triggers environmental feedback, and the information received by the five senses stimulates new actions, forming a continuous and strengthened cycle of participation. This dynamic design strategy has changed the one-way viewing mode of traditional gardens and transformed static space into growing organisms.

For example, Singapore's Marina Bay Garden uses a mobile phone APP for AR navigation. When visitors sweep the signs next to the plants, there will be virtual instructors jumping out and animations showing how 3D plants grow. In the exhibition hall called Cloud Forest, the sound sensor detects that the person walking will make the light color change and the spray fog rhythm everywhere, thus forming the interactive effect of sound and light. In addition, those 18 huge artificial trees are equipped with solar panels and LED lights, which will change the dynamic effect of the lights at night according to the size of the surrounding noise. Shenzhen's talent park has created an AI light and shadow trail, using the ground's pressure sensor and face recognition technology, people will leave a specially designed light track when they walk past. Through the distributed sound system, the sound can be delayed and changed between the flower decorations separated by a long distance, and the effect of interaction like microphone can be made. In addition, with 5G and 8K live broadcast technology, the mobile phone can be used to scan the sign of the viewing platform, and the high-altitude picture taken by the drone can be easily switched. The future design should combine tactile auditory vision to make a variety of sensory experience design, so that interaction can have a variety of ways to interact.

5. Future Development Trends and Potential Impacts

New technologies will promote the evolution of interactive design to multidimensional perception. Artificial intelligence can analyze the behavior data of tourists, automatically allocate the combination of light and shade and fragrance, and form an exclusive sensory formula. For example, when Mother's Day tourists stop at the Rose Garden, the system instantly mixes floral fragrance and lullaby sound effects. Such a dynamic response enables each visitor to gain a unique memory. The visualization design concept of virtual reality technology in advance. The designer wears a head display device, can walk between the paths of future plant growth, and personally adjusts the extension angle of the virtual branch. This pre-experience mechanism greatly reduces the trial and error cost of physical construction, and increases the speed of creative iteration by more than three times.

These technologies reconstruct the human-scene interaction mode. The space is no longer an object to be watched, but a living body that can perceive emotions and evolve independently. The design focus has shifted from morphological aesthetics to neural feedback, eventually creating a breathing landscape ecosystem.

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