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MULTISENSORY INTERACTIVE LANDSCAPES: DIGITAL APPROACHES TO RURAL LANDSCAPE DESIGN

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Against the backdrop of the convergence of digital transformation and rural revitalization strategies, rural landscapes are transcending the limitations of 'visual appreciation' and evolving into multi-sensory interactive experiences. This paper combines digital technology with rural landscape design to explore how the concept of multi-sensory interaction, facilitated by digital technology, can stimulate multidimensional perceptions of rural landscapes, thereby providing theoretical and practical insights for innovating the perception and experience of rural landscapes in the digital age.

Key words: multisensory interactive landscape; digital technology; rural landscape; perceptual experience.

INTRODUCTION

Against the backdrop of the convergence of rural revitalization and digital transformation, rural landscapes are evolving from traditional visual spectacles into multi-sensory interactive spaces. Digital technologies provide the foundation for innovation in rural landscapes, whilst techniques such as parametric design are driving the evolution of rural landscape design from merely fulfilling functional requirements to enhancing aesthetic appeal. Drawing on local rural resources and focusing on the dimensions of design and aesthetics, this paper explores how digital technologies can optimize design decisions to achieve a harmonious integration of functionality and experience in rural landscapes.

PURPOSE

The aim of this study is to explore how digital technologies can be integrated into rural landscape design to enhance multisensory perception and user experience, and to develop a design-oriented framework that combines spatial composition, aesthetic expression, and local cultural identity.

RESULTS AND DISCUSSION

1. Multisensory Experiences of Rural Landscapes and the Aesthetic Integration of Digital Technology

The multisensory resources of rural landscapes are rooted in the dual contexts of natural ecology and local culture, with their aesthetic value lying in the multidimensional interplay of 'sight, sound, touch and smell'. Digital technology enhances the aesthetics of rural landscapes by transforming these multisensory



resources into a design language that can be controlled and optimized. Parametric design extracts aesthetic elements such as rural topography and plant arrangements to precisely realize spatial aesthetics; Digital twin technology replicates the natural aesthetics of rural landscapes, optimizing visual hierarchy and spatial proportions through dynamic simulation; VR/AR technology superimposes symbols of local cultural aesthetics, allowing visitors to perceive the fusion of culture and natural beauty. For instance, Jin-Young Park's team has integrated digital twin technology into landscape planning, combining human psychological behavior with landscape aesthetics to open new possibilities for dynamic, visual aesthetic expression. [1]

2. Creating Spaces for Multisensory Experiences and Approaches to Integrating Digital Technology

Spatial composition is the core vehicle of rural landscape aesthetics; digital tools profoundly influence the viewer's sensory experience by reconfiguring the scale, proportion, sequence and boundaries of space (fig. 1). The 'Heart of the Forest' project at Beijing Forestry University in China, characterized by interactive generative aesthetics, breaks away from the traditional 'static presentation' paradigm of landscape design. The interactive installation of spiral lamp posts in the rural square maintains an appropriate relationship with the scale of the surrounding trees, ensuring harmonious spatial proportions. The light show in front of the lamp posts depends on users interacting by holding hands; each participant becomes part of the aesthetic expression, creating a dynamic effect where 'a thousand people, a thousand faces'. This design confers the identity of 'creator' upon users, enabling landscape aesthetics to be co-created by the public, enhancing the sense of experience and making the space more vibrant and diverse.



China:
Interactive
Musical Spiral
Light Column

Netherlands: VR Boat
Tour of Giethoorn

Sydney : 80Hz
Acoustic
Installation

Japan: Light and
Shadow Rice
Fields

Fig. 1. Rural Multi-sensory Landscape Experiences

The core of multisensory aesthetic experience lies in synergy and emotional resonance; digital technology enhances the aesthetic expression and coordinated interaction of the various senses, thereby improving the quality of the rural landscape experience. Visually, the village of Giethoorn in the Netherlands uses VR technology to transport visitors back to 19th-century peat-digging scenes, allowing



them to experience historical settings. Digital intervention preserves the aesthetic value of traditional visual elements whilst enhancing appeal through dynamic, immersive expressions; the Echigo-Tsumari Art Triennale in Japan features 'Light and Shadow Rice Fields', utilizing digital projection technology to project traditional artistic patterns, creating an interplay of reality and illusion with the farmland to craft a dynamic visual landscape.

In the realm of auditory aesthetics, digital technology helps to create soundscapes that foster a harmonious coexistence between humans and nature. The outdoor sound installation at the State Library of New South Wales utilizes curved wooden surfaces and ceramic tiles to form resonant chambers; natural light filters through the gaps in the tiles, whilst digital technology analyses the colors, composition and rural-themed metadata of the artwork, transforming visual elements into an auditory experience. When visitors select a painting by turning a handle, a multi-channel system plays a bespoke soundscape, whilst at night, light and shadow dance across the surface of the ceramic tiles in time with the audio.

Digital technology can be used to achieve precise and context-specific expressions of tactile and olfactory aesthetics. For example, at the Echigo-Tsumari Art Triennale in Japan, a 'Earth Touch Platform' was set up in a rural square to capture the force of touch using pressure sensors; in the hands-on experience area, digital modelling was used to recreate the tactile sensations of traditional crafts; "Wind Instruments" along mountain trails allow visitors to perceive tactile feedback at varying wind speeds, precisely creating tactile experience scenarios. In terms of olfactory design, digital sensors monitor environmental temperature, humidity and footfall density to intelligently regulate the release of scents from local aromatic plants. The festival has installed "Seasonal Scent Boxes" around guesthouses, which use digital controls to change scents with the seasons, allowing the aesthetics of smell to convey the rural memories of the seasons.

3. Optimized Design System for Rural Multi-Sensory Interactive Landscapes

Firstly, a multi-sensory integration strategy centered on the senses, drawing inspiration from the cross-sensory collaborative design of 'Heart of the Forest', organically combines digital technology with sight, hearing, touch and smell to construct a comprehensive immersive experience chain.

Secondly, a data-driven optimization strategy is implemented to precisely match users' sensory preferences and optimize the layout of multi-sensory elements. [2]

Thirdly, a strategy of adapting local materials and technologies is employed, extracting rural cultural symbols to integrate into digital interaction design, simplifying interaction logic, selecting low-energy-consumption equipment, and combining interactive installations with local materials to achieve the 'invisibility' of technology.

Fourthly, an eco-sustainable design strategy involves selecting native plants and renewable materials, integrating digital devices with the ecosystem, and safeguarding the rural ecological foundation and indigenous aesthetics.

When comparing traditional and digitally driven multisensory interactive design, the latter uses technology to connect people with nature and local culture,



enhancing the landscape experience and appeal, whilst strengthening cultural dissemination and ecological distinctiveness [3]. However, technology is a tool serving the countryside; an excessive pursuit of it may cause the rural landscape to lose its authenticity. Therefore, the integration of digital technology with rural multisensory landscapes must adhere to the principles of prioritizing locality, ecology and people's livelihoods.

CONCLUSIONS

Driven by digital technology, this paper focuses on research into multi-sensory interactive landscapes and perceptual experiences in rural settings. It proposes four key design strategies – multi-sensory integration, data-driven optimization, ecological sustainability and local adaptation – to provide a pathway for enhancing the rural landscape experience. The integration of digital technology and multi-sensory design can break through the visual limitations of traditional rural landscapes and enhance users' immersive perception. Rural landscape design must strike a balance between technology and local context, grounded in the needs of villagers, so that multi-sensory interactive landscapes serve rural landscape design, thereby achieving both innovation and sustainable development.

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МУЛЬТИСЕНСОРНІ ІНТЕРАКТИВНІ ЛАНДШАФТИ: ЦИФРОВІ ПІДХОДИ ДО ДИЗАЙНУ СІЛЬСЬКОГО ЛАНДШАФТУ

У контексті поєднання процесів цифрової трансформації та стратегій відродження сільських територій сільські ландшафти виходять за межі традиційного «візуального споглядання» та трансформуються у мультисенсорні інтерактивні середовища. У статті поєднано підходи цифрових технологій і дизайну сільського ландшафту з метою дослідження того, як концепція мультисенсорної взаємодії, опосередкована цифровими технологіями, може активізувати багатовимірне сприйняття ландшафту. Отримані результати спрямовані на формування теоретичних і практичних засад інноваційного розвитку досвіду сприйняття сільських ландшафтів у цифрову епоху.

Ключові слова: мультисенсорні інтерактивні ландшафти; цифрові технології; сільські ландшафти; перцептивний досвід.