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- Integrating technology with sensory experience can foster more adaptive and resilient approaches to landscape design
- Broader applications of sensory translation were proposed but not yet realized due to current technological limitations and cost-related constraints

RESEARCH FUNDS

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1. Front view of the *Windyhome* installation.

From Environmental Data to Therapeutic Landscapes: Sensory Design Innovations for Inclusive and Adaptive Urban Environments

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FEATURES

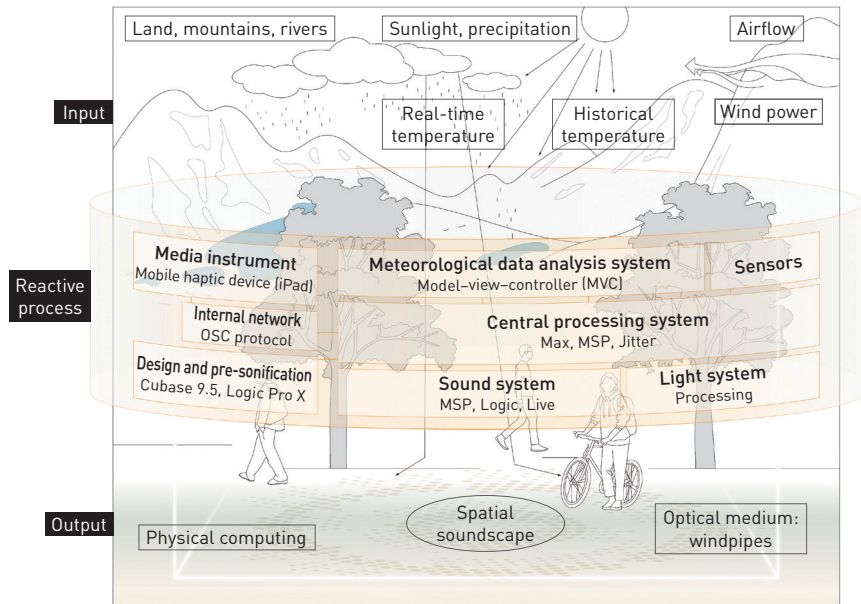
Digital Intelligence; Sensory Turn; Real-Time Data; Climate Change; Color-to-Sound Translation; Therapeutic Soundscape

PRACTICE REFLECTIONS

- The projects primarily explore bodily sensory experience and interaction in an automated society

1 Issues and Background

In the automated society shaped by technology, the human body—as the traditional subject of action and interaction—is facing the risk of being redefined. This phenomenon is particularly evident in the metaverse, a twin world woven from three-dimensional digital spaces and virtual information. Here, the physical body is displaced by virtual reality, replaced with a data-constructed image that defines a new mode of human existence and interaction. The boundless expansion of technological capital drives cities towards a complex and fragile state of increasing entropy, challenging traditional modes of human life and triggering



2. Systematic demonstration of *Windyhome*, showing the process of transforming climate datasets into a multisensory output of sound and light.

profound ethical and value crises.

The theory of Phenomenology of Perception proposed by French philosopher Maurice Merleau-Ponty offers a critical opportunity for reflection. Merleau-Ponty emphasized the central status of the body and its irreplaceable role in perceiving and experiencing the world. He argued that the body is the self—an intersection of external phenomena and internal perception—and that comprehensive understanding is achieved through perceptual experience.

In the 1990s, the “sensory turn” in Anthropology brought human perceptual experience to the forefront, giving rise to the theory of

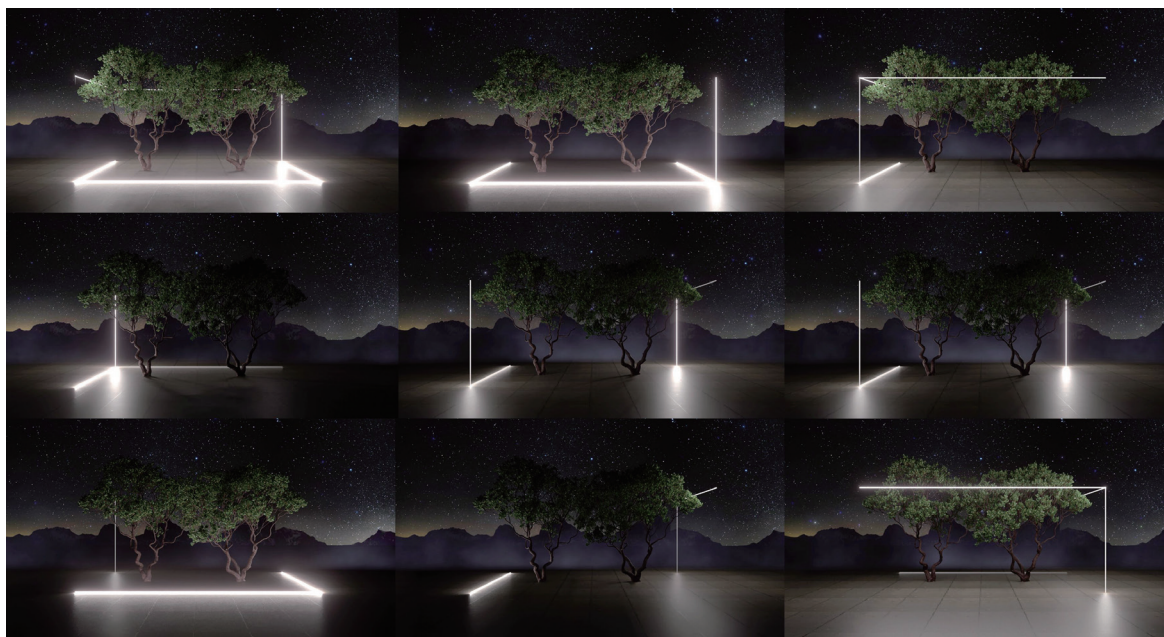
sensory placeness. This theory centers emotional knowledge on the relationship between people and places to resist the alienation induced by automation. Such emotional knowledge is highly personal and often ineffable and untranslatable, making individual perception of the world a private inner landscape. It is well understood that pleasant sensory experiences and health are closely interrelated. To foster a more extensive and profound connection between individuals and their surroundings, it is essential to transform personal imagination and sensibility into a positive force for engaging with the chaotic external world—a form of negative entropy—that supports the harmonious coexistence of humans and the environment and contributes to public health.

2 Design Strategies and Innovations

2.1 *Windyhome*

To uncover the hidden perceptual dimensions of urban life, the project team develops *Windyhome*, an interactive landscape installation. Drawing inspiration from dynamic climate data, the project transforms real-time and historical climate data into an immersive experience of sound and light. This creates an interactive landscape that intuitively reflects environmental changes and stimulates public perception and reflection.

The data, derived from local climate trends, is processed via creative algorithms into diverse timbral sequences, forming an auditory climate symphony system. Pitch is influenced by temperature indices, while volume dynamically responds to differences between real-time and historical temperature. The



3. Details of the marimba mechanism, with pitch and volume responding to fluctuations in temperature indices through a continuous timbral drift.
4. Conceptual framework of *Windyhome*. It transforms climate data into sound, allowing people to engage with the site's sensory atmosphere.

marimba's tones fluctuate across the index sequence, disrupting a literal mapping of data to sound and instead infusing the experience with poetic ambiguity and imagination. Numerous "wind pipes" respond to airflow, generating unique audio-visual combinations that reveal nature's infinite variation. This design innovatively translates the climatic characteristics of a given site into sonic elements, encouraging individuals to reflect on their relationship with the climate through multisensory experience. Continuously evolving with the seasons and the passage of time, *Windyhome* redefines the traditional notion of fixed visual landscapes.

2.2 *Blindergarten*

In response to the significant number of individuals with visual impairments in China—and the associated public health and social challenges—*Blindergarten* adopts the theory of sensory substitution to create a system that translates color into sound. Grounded in digital landscape design principles and sensory architecture, the core concept of this project is "hearing color," offering inclusive design solutions for the blind and other vulnerable groups.

Real-time color data is captured from pedestrians' clothing or umbrellas during rainy days in urban areas. Through algorithms that balance scientific objectivity and artistic interpretation, this data is transformed into a wide range of timbral sequences, creating

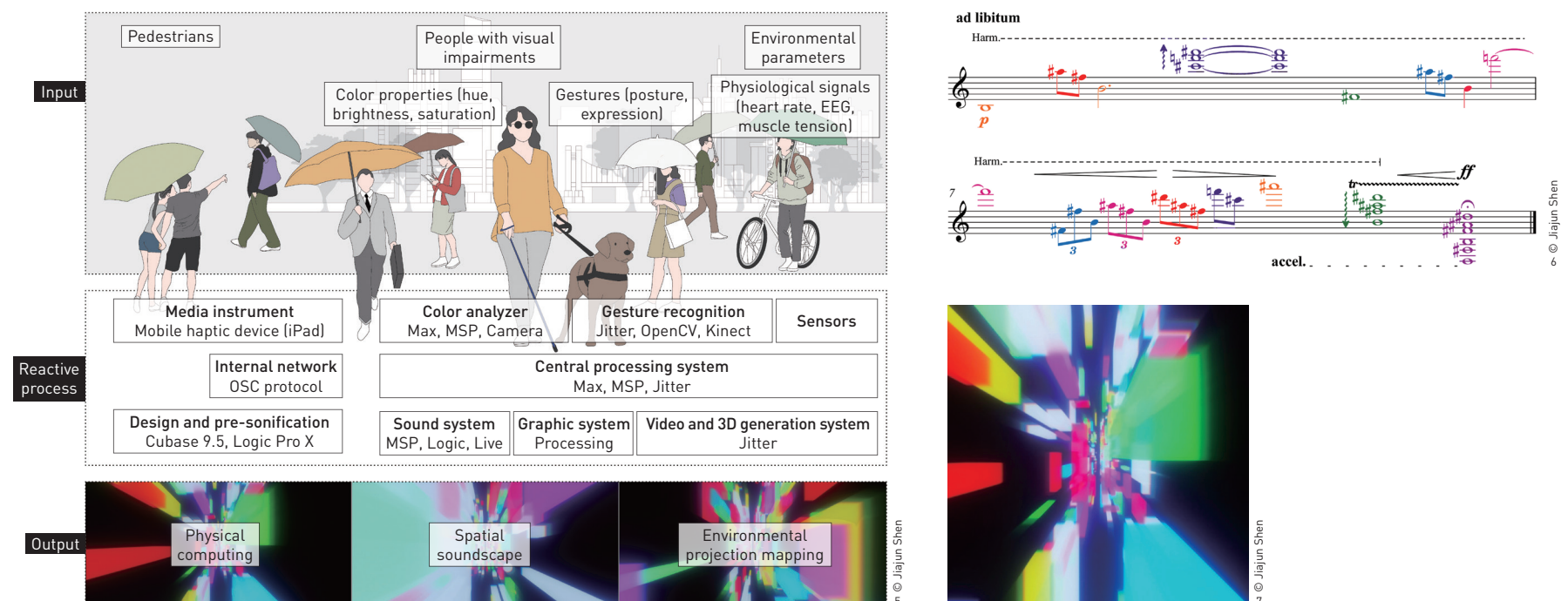
a unique auditory urban color system. It allows for multiple modes of interaction, such as real-time translation, single-day data selection, or aggregated monthly data, thereby showcasing a dynamic portrayal of color evolution.

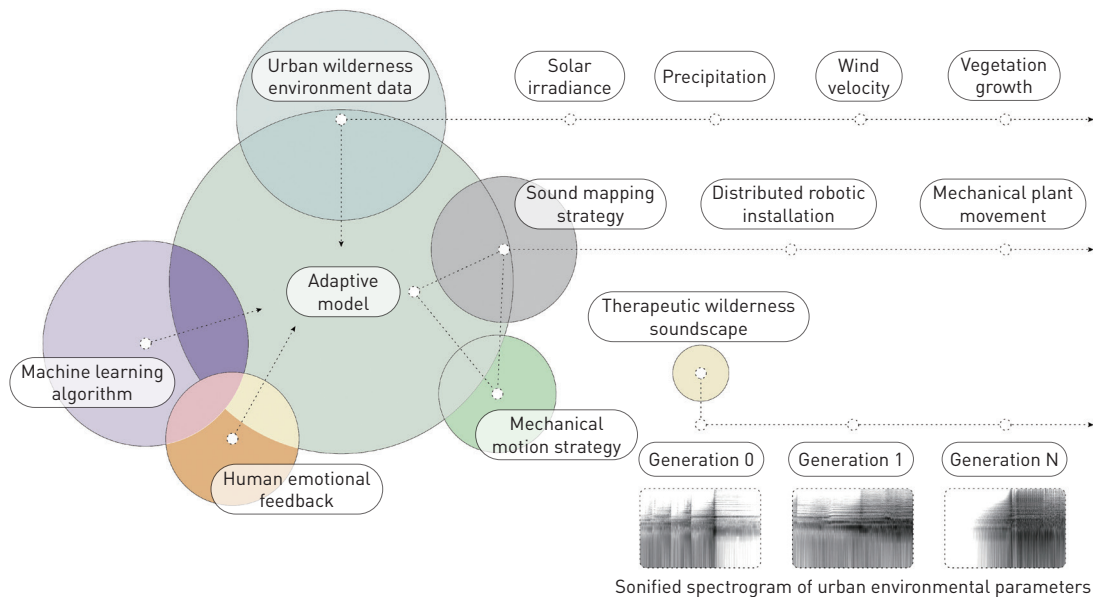
2.3 *Breath of the Wild*

The global health crisis in recent years has profoundly impacted the mental health of urban residents. Urban wilderness landscapes provide high therapeutic value by offering refuge from urban stress and reconnecting the individual with nature.

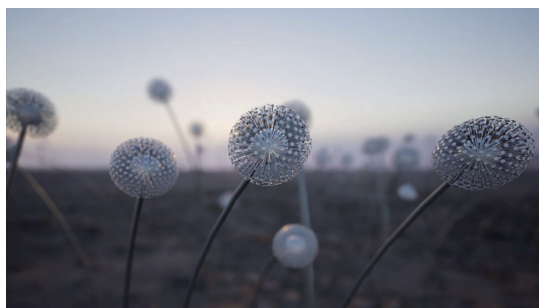
Breath of the Wild builds on this by utilizing urban wilderness information systems to cultivate a new type of wild soundscape to support therapy. The environmental data is mapped into various timbral sequences using creative algorithms, which are played through the "mechanical dandelion" devices that provide an integrated visual and auditory healing effect. An artificial intelligence (AI) system monitors the emotional responses of anxious individuals after exposure to the sounds and adjusts the sound output accordingly, developing a self-learning design logic to provide precise and effective mental health interventions. The project introduces the conceptual framework of a "wild-nurtured soundscape," moving beyond the limitations of static soundscape imagery and human-generated designs. By deeply integrating natural elements, AI, and

5. System demonstration of *Blindergarten*. Real-time pedestrian color data are translated into sound through algorithmic modulation, generating visual-musical scores.
6. Auditory output of umbrella colors on 16 May 2020 in Hangzhou.
7. Color data of *Blindergarten*.





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8. System demonstration of *Breath of the Wild*. Environmental parameters are processed through a dynamic sound generation algorithm.
9. Synchronization of acoustic output with kinetic movement of the mechanical dandelion, forming a responsive wilderness-inspired soundscape.

human-centered design, the system creates an interconnected and dynamically evolving therapeutic soundscape.

3 Conclusions

The three landscape design projects

explore the spatial possibilities for the co-evolution of technology and human perception from the perspective of the sensory turn. These practices serve as exploratory prototypes for a diversified sensory turn in landscape architecture. They aim to establish a perceptible and

flexible interface between the human body and the natural environment, while advancing the integration and application of digital intelligence in contemporary landscape design. However, in practical applications, the stability and durability of the device strategies are partially compromised, as electronic components are vulnerable to damage in wild or outdoor environments and lack the self-renewing capabilities of regenerative organisms. These limitations hinder their large-scale deployment and long-term implementation in real-world scenarios.

Competing interests | The authors declare that they have no competing interests.

Project Name: Windyhome
Location: Wangjiang Mountain, Hangzhou City, Zhejiang Province, China
Size (area): 0.8 hm²
Principal: Jiajun Shen
Design Team: Yihang Bao
Design Time: June 2021
Awards: Excellence Award in the Design Intelligence Award 2021; Bronze Award in the C-IDEA Design Award 2022

Project Name: Blindengarten
Location: Urban area of Hangzhou City, Zhejiang Province, China
Size (area): 20 hm²
Principal: Jiajun Shen
Design Team: Yan Da, Jiuheg Hou
Design Time: June 2020
Award: Excellence Award in the Design Intelligence Award 2020

Project Name: Breath of the Wild
Location: Wangjiang Mountain, Hangzhou City, Zhejiang Province, China
Size (area): 7 hm²
Principal: Jiajun Shen
Design Team: Yihang Bao
Design Time: June 2022
Award: Bronze Award in the C-IDEA Design Award 2023