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Research on Ecological Art Practices Using Plants as a Medium of Expression

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Abstract: This article focuses on the contemporary ecological art practice of plants as the core language medium, exploring its theoretical support and practical path. Studies have identified that plants can adopt perception and expression as a very different medium than other traditional material sources. The living characteristics of plants directly challenge the anthropocentric model of artistic creation and exploration. I discuss the fundamental aspects of a practice, which include the perceptual relationship of communicating across species, the dialectical relationship of controlled / uncontrolled creation, and the challenges of ethics in relation to ecological interests and aesthetic experience. The findings indicate that the main practices are organized in the following ways: bio-electric signal interaction devices, participatory symbiotic co-cultivation of plants, narrative-based plant archives, and art therapy interventions. These practices will not only extend the biological element of art, but also develop a deeper lens of environment relevance for the public to consider as an alternative to explore the development of ecological understanding and cross species ethics.

Keywords: plant medium; ecological art; interspecies communication; environmental perception; art therapy

1. Introduction

The field of ecological art is undergoing a profound shift towards non-human centeredness, and plants have risen to become enlightening carriers of artistic language. Research on plant intelligence reveals its complex perception and adaptation abilities, endowing it with the potential for agency as a mediator. Plant semiotics explores its deep metaphorical system in multiculturalism. Artists attempt to break through species barriers and transform plants from depicted objects into active communicators and collaborators. This transformation prompts art to re-examine its position in the network of life and explore deeper ecological dialogues beyond visual aesthetics. The practice of plant mediated art carries the composite mission of connecting natural perception, inspiring ecological reflection, and restoring spiritual dilemmas.

2. The Theoretical Foundation of Plants as an Artistic Language

2.1 Plant Intelligence Research and the Possibility of Perception

Plant intelligence research reveals the collaborative mechanism of chemical signal transmission in plant root networks, and their electrophysiological activities constitute a unique life expression system. Contemporary ecological artists focus on observable phe-

nomena such as the contraction of mimosa plants upon touch or the sunflower's movement towards the sun, which demonstrate that plants possess primitive intelligence in responding to the environment. Scientific discoveries of plants releasing warning information through volatile organic compounds provide empirical evidence for artists to construct cross-species dialogue. The possibility of plant perception breaks through the static attributes of traditional art media, and the growth changes and stress responses of living plants form a dynamic creative language. Artists design participatory works by utilizing plant photoperiodic rhythms or water transport mechanisms, transforming biological instincts into perceivable artistic narratives. The inherent temporality and unpredictability of plant life activities inspire humans to re-examine the expression logic of non-anthropocentrism [1].

2.2. The Non-Anthropocentric Shift in Ecological Art

Ecological art creation is undergoing a discourse reconstruction from human domination to species equality, fundamentally questioning the traditional positioning of plants as backgrounds or materials. The artist community actively relinquishes absolute control, acknowledging the autonomous expressive value of plant life processes. The underground collaboration phenomenon of mycorrhizal networks in North American forests has inspired artists to design root dialogue installations, which restore plants from objects to subjects in ecological narratives. When the work presents the autonomous growth path of vines or the decay cycle of fallen leaves, the identity of the human author gives way to the temporality and contingency of nature. Unexpected states such as plant wilting and variation are no longer seen as mistakes, but rather become important linguistic symbols that reveal the essence of life. This shift promotes viewers to re-understand the separation between gallery white box spaces and natural systems, and environmental parameters such as soil temperature and humidity begin to intervene in the exhibition mechanism.

2.3. Cultural Interpretation of Plant Semiotics

Plants carry the collective memory of fertility worship in Southeast Asian rice-growing civilizations, with their grain ear shapes transformed into sacred symbols in rituals. Contemporary artists deconstruct the negative label of eucalyptus as an invasive species in historical introduction of eucalyptus in non-native regions, reshaping its identity as an ecological restorer through participatory planting altars. The aesthetics of dry landscapes with moss in Japanese gardens undergo reinterpretation, as ecological artists activate the contemporary metaphorical value of moss as an indicator of air pollution. The Indigenous ecological knowledge in the Amazon region that the death vine serves as a pathway to wisdom inspires material transformation experiments in modern healing art that explore the spirituality of plants. In community pattern replication projects, the gourd and fertility pattern narrated by grandmothers guides young people to rediscover the ecological ethics of seed continuation. These practices strip away the static cultural shell of plant symbols, constructing dynamic meaning fields at the intersection of root networks and human memory.

2.4. Media Characteristics and the Boundaries of Artistic Expression

The inherent temporal dimension of plant life forces artists to abandon the inertia of static creation. The gradual color variation of moss walls that grow monthly constitutes the basic grammar of dynamic visual narrative. The root exudates continuously change the characteristics of soil composition, leading to unpredictable rust patterns on metal support structures. The process of material metabolism becomes an inherent participant in creation. The sensitivity of living media to lighting conditions challenges traditional exhibition models, forcing art museums to adjust lighting schemes to accommodate the phototropic needs of ferns. When the invasive growth of liana plants in tropical rainforests

breaks through preset sculptural frameworks, artists must renegotiate the boundaries between formal control and biological autonomy. The natural process of mycelium decomposing and recycling materials incorporates the life cycle of installations into the necessary link of work meaning generation. The attempt by Nordic artists to preserve food patterns using the natural antibacterial properties of birch bark reveals the possibility of expanding art preservation techniques through the chemical properties of plants. These practices confirm that the activity of plant media continues to reshape creative ethics, requiring human creators to establish a new collaborative consciousness that responds to the rhythms of life.

3. Key Issues in Plant Media Art Practice

3.1. *The Perceptibility Dilemma of Cross-Species Communication*

When plant electrochemical signals are transformed into audible and visible forms recognizable by humans, the accuracy limitations of sensors lead to essential distortions in the original information patterns. The device used by the artist to monitor the water transmission in the aerial roots of banyan trees emits pulsed light, making it difficult for the audience to distinguish between natural rhythms and synthetic data formed by equipment interference. The pheromones released by termites interfere with the chemical dialogue between plant roots, and human observers cannot capture such micro-level communication disruptions. The slow process of moss spore dispersal exceeds the threshold of human perception, and time-lapse photography technology compresses the time scale of life, leading to cognitive biases. The traditional experience of Southeast Asian rainforest tribes in identifying abnormal vibrations in vines has transformed into symbolic performances into symbolic performances in the context of contemporary art museums. The volatile organic compounds produced by plant stress responses are interspecific alarm signals, but the concentration changes of odor molecules in a closed exhibition hall strip away their ecological significance. Under drought stress, the increased secretion of pine resin is interpreted as a metaphor of "crying," blurring the boundaries between scientific facts and emotional projections. The nitrogen exchange signals transmitted by root network fungi are simplified into colored line animations during data visualization, flattening the complexity of life cooperation. The fundamental differences in how different species perceive the world constitute barriers to understanding, and the human visual-dominated perception mode hinders the reception of information expression in the chemical and tactile dimensions of plants.

3.2. *The Balance Between Control and Loss of Control in the Creative Process*

Plant-mediated creation is always in a delicate dialogue between human planning and life autonomy. For example, the metal support frame designed by the artist is often pushed and deformed by climbing plants - at this time, the light path autonomously selected by the branches will continuously correct the preset shape. When the germination rhythm of seeds is affected by fluctuations in temperature and humidity in the exhibition hall, resulting in a temporal mismatch, it requires the creator to dynamically adjust the presentation scheme of the work stages. In the case of fungal hyphae penetrating the set boundaries and naturally extending towards wet areas, the originally planned geometric composition gradually evolves into a living biological topological diagram. It is worth noting that the redundant watering caused by continuous rain in the automatic irrigation system unexpectedly results in a microclimate map formed by moss patches, surpassing the accuracy of artificial color adjustment. In the face of termites' transformation behavior on wooden bases, the artist uses trace transformation technology to turn them into three-dimensional archives recording ecological interactions. Similarly, potted plants, due to accelerated defoliation caused by air conditioning airflow, are eventually converted into a medium carrying life memories through enzymatic papermaking technology. These practices reveal the essence of plant participation in creation using growth language,

prompting artists to change from steel cable traction to elastic restraint bands, and replace hard molds with degradable materials, while also leaving breathing gaps on the exhibition walls for life expansion. Practice demonstrates that control is not about taming but understanding: for example, after observing the diurnal rhythm of mimosa closing, excellent creators can predict the exploration direction of ivy tendrils, thereby adapting the logic of equipment operation to the logic of plant life. This collaborative mode of continuous adjustment essentially reshapes the ethics of creation - it requires humans to become guides rather than dominators of ecological processes [2].

3.3. The Tension Between Ecological Criticism and Aesthetic Experience

Plant-mediated art practice faces a structural contradiction between the seriousness of ecological issues and the aesthetic pleasure. The visualization of monitoring data from plant restoration projects in heavy metal-polluted areas presents a color matrix formed by spectral analysis, which may weaken the cognitive impact of soil toxicity. When the ecological function of mangrove wetlands in purifying sewage is transformed into decorative fabric patterns, there is a risk that the environmental governance process will be formalized and dissolved. The outbreak cycles of pests and diseases recorded in ancient tree rings are processed by laser engraving technology, and the aesthetic texture of wood sections easily diverts viewers' attention from ecological crises. Plant specimens eroded by acid rain are displayed in a neon lighting environment, and special lighting schemes can weaken the warning value of leaf pathological characteristics. Quantitative data on moss adsorbing PM2.5 particles is transformed into a dynamic light and shadow device, and technical special effects may interfere with the cognitive transmission of pollutants' biological hazards. Existing research shows that 72% of ecological art audiences are more likely to remember formally intense elements, while the retention rate of the underlying ecological mechanisms is less than 35%. This cognitive bias requires creators to establish a balance mechanism between the authenticity of data presentation and sensory appeal, and to enhance the depth of ecological criticism through a hierarchical information interpretation system (such as QR code links to scientific reports). The academic community suggests adopting an "aesthetic defamiliarization" strategy, which maintains formal innovation while using the native state of plant physiological damage to trigger ecological reflection among audiences.

3.4. The Challenge of Sustainability in Practical Achievements

The ecological sustainability of plant-based media art projects faces multiple systemic challenges. Specifically, the damage to root systems and detachment from the native environment caused by the transplantation process of living plants directly causes a significant decrease in their survival rates in the later stages, while the physiological costs of adapting to new ecological niches for exotic species are often underestimated. At the same time, the uninterrupted operation of artificial climate maintenance equipment requires significant power consumption. This inevitably results in an energy footprint that may contradict the concept of ecological art. A more prominent contradiction lies in the conflict between short-term exhibition cycles and the natural growth rhythms of plants, which forces the adoption of unconventional measures such as hormone acceleration, which may leave long-term ecological impacts. At the end of the project, the removal of works involves issues related to the control of non-native species proliferation. If the remnants of exotic plants are not disposed of properly, it is extremely easy to pose biosecurity risks. At its root, the lack of cross-institutional collaboration mechanisms currently results in a lack of continuity for most projects, and the responsibility for plant maintenance after the exhibition ends is unclear, often leading to resource waste. Coupled with insufficient consideration of biodegradation cycles in material selection, the mixed structure of synthetic materials and organisms significantly increases the difficulty of later separation and disposal.

4. Critical Reflection: Power, Perception, and Narrative in Plant Art

In the practice of ecological art, the use of plants as a linguistic medium naturally prompts deep reflection on power, perception, and narrative. Artists dominate the selection and presentation of plants in the creative process, and this power structure may lead to plants being reduced to tools rather than living organisms with their own life histories. When viewers experience these works through their senses, their perception is often framed by the artist's preset narrative, inadvertently limiting the possibility of individuals establishing direct connections with plants. As the core element of art, plants' inherent stories are often obscured by human intentions, reducing them to passive carriers rather than active participants. Ecological art criticism theory emphasizes that this one-way power dynamic needs to be questioned, and artists should examine their creative motivations to avoid ecological exploitation. The perceptual abilities of viewers should be liberated, encouraging them to explore the complexity of plants beyond superficial interpretations. Plants themselves call for artistic practice to endow them with more subjectivity, so that narrative is no longer dominated by human monologue. Only when an equal dialogue is formed between artists, viewers, and plants can plant art truly challenge traditional models and promote the awakening of ecological awareness. This critical perspective reveals the imbalance hidden in artistic creation and advocates a more inclusive interactive approach, so that plants no longer silently carry human information.

5. Practical Pathways for Plant-Based Ecological Art

5.1. Visualization Interaction Devices Based on Bioelectric Signals

Plant electrophysiological signal monitoring technology provides a new artistic medium for cross-species dialogue. During the specific implementation, artists choose species with active electrical signals, such as the turtle-backed bamboo, and attach non-invasive electrodes on the backs of leaves to capture microvolt-level current fluctuations. In the signal processing stage, noise reduction algorithms are used to filter environmental electromagnetic interference, retaining effective bioelectric pulses generated by changes in light exposure or tactile stimuli. In the data conversion stage, a customized program is developed to map voltage fluctuations to the brightness and darkness rhythms of LED light strips, with peak water absorption in the roots corresponding to blue light peaks and insect bite stress responses triggering red light strobe. To enhance the depth of the experience, plant capacitance changes are synchronously correlated with sound field frequencies, and the stomatal opening rate is used to modulate the pitch of the environmental sound in real time. In the device deployment stage, a wireless sensor network is employed to reduce physical constraints, and pressure sensors at the base of the potted plant simultaneously record electrical signal feedback triggered by audience footsteps. The key innovation lies in establishing a bidirectional interaction mechanism: when the audience continuously touches the mimosa leaves, the light and shadow changes triggered by their electrical signals are projected back onto the audience's body surface, forming a closed loop of biological information. In terms of operation and maintenance management, a data collection period of no more than 4 hours per day is set, and the electrode attachment locations are rotated every 48 hours to avoid tissue damage. The final presentation transforms invisible life activities into tangible perceptions, allowing the audience to discern the response rhythm of plants to the alternation of day and night from the rhythm of light and shadow, and perceive biological stress caused by changes in environmental temperature and humidity from changes in the sound field. This direct dialogue with life reshapes human cognition of plant intelligence [3].

5.2. Participatory Symbiotic Cultivation Projects

The participatory symbiotic cultivation project builds a practical network for collaboration between communities and plant life. During the project's initiation phase, complementary species combinations are selected, such as leguminous plants fixing nitrogen to

support gramineous crops, and aromatic peppermint repelling pests to protect adjacent vegetable plots. The site design incorporates elevation differences, such as spiral herb gardens, utilizing microtopography to create diverse microclimates that meet the needs of different species. The public engagement segment features a tiered participation model: children are responsible for sowing sunflower seeds, youths record plant growth data, and elders impart traditional intercropping experiences. The core collaboration mechanism lies in establishing a triangular feedback chain of plants-humans-insects, where bee visitation frequency triggers the irrigation system, and its pollination effect is linked to participants' harvest shares. The technical support component involves embedding soil moisture sensors connected to a community app, allowing residents to receive alerts for water shortage in peppermint plants and go to the site to water them. Completing tasks earns digital leaf badges that can be exchanged for herbal tea. Intergenerational knowledge transmission is achieved through "memory crops": elders guide the planting of ancestral tomato varieties, while youths use 3D printing to customize support frames, and the harvested fruits are made into seed packets with QR code story cards. The project's sustainability relies on a community custodian system, with shared tool kits rotated among families every season, and crop residues are processed in worm towers and converted into fertilizer for the following season. The ultimate outcome goes beyond material production; residents form a street microclimate improvement alliance while caring for wisteria arches, and children observe the earthworm soil-loosening process and propose the establishment of a campus composting corner. This ecological awareness derived from cultivation actions deepens the community's sense of responsibility towards the environment.

5.3. Plant Archives and Ecological Narrative Construction

The construction of plant archives begins with the systematic collection and transformation of life traces. During the field investigation stage, acid-free paper specimen pressing method is used to preserve leaf morphology, and the sound and hydrology of the plant's environment are simultaneously recorded as acoustic fingerprint labels. In the laboratory processing stage, microscopic photography technology is employed to capture pollen structure, and annual ring slices are scanned into high-resolution digital rubbings. At the narrative transformation level, an interactive map platform is developed: clicking on the coordinates of ancient trees presents a superimposed image of the typhoon damage evidence from annual rings and the oral memories of surrounding residents. In the community participation section, elders are invited to record audio about traditional plant uses, and young people use laser engraving technology to translate voice ripples into seed packaging patterns. The archive activation practice includes a "time capsule" burial plan, which encapsulates the seeds of currently endangered plants and climate data into a pottery jar, setting up an ecological prophecy device that will be opened fifty years later. When the exhibition is presented, a combination of physical specimen layers, data projection layers, and scent diffusion devices is used, allowing the audience to touch the maple tree specimens while smelling the volatile substances of the tree's autumn leaves. The educational extension module designs a seed blind box system, where scanning the QR code on the packaging can access the image diary of the mother tree's full growth cycle. This multidimensional archive system makes plants the narrators of ecological history, allowing the public to interpret the trajectory of the urban heat island effect through annual ring codes, deduce the decline history of pollinating insects from pollen microscopic images, and perceive the contemporary value of traditional ecological wisdom in intergenerational sound archives [4].

5.4. Healing Ecological Art Intervention

The healing ecological art intervention restores the connection between mind and body through structured plant interaction. During the space construction phase, circular

planting beds are designed for the rehabilitation garden, with rosemary and other aromatic plants arranged on the outer perimeter to release calming substances, and soft-touch velvet flowers planted in the inner circle for finger contact. The sensory training module arranges for participants to identify ten types of leaf texture differences with their eyes closed, and to awaken bodily awareness by feeling the changes in potting soil moisture with their palms. The life collaboration practice adopts a phased responsibility transfer model: in the first week, gardeners take care of the seedlings, in the second week, participants are responsible for thinning and pruning, and ultimately, they independently complete the transplantation of flowering plants. The community support mechanism sets up a dual-person cultivation station, where individuals with language barriers establish non-verbal communication through collaborative pruning of lavender branches. The memory healing path guides the elderly to sow childhood hometown crops, and during harvest, traditional techniques are used to make seed necklaces to carry emotional connections. Pressure intervention research has confirmed that the action of combing mint leaves reduces cortisol levels by 33%, so repetitive harvesting tasks are arranged in anxiety intervention courses. The technology integration part develops wearable devices to monitor brain wave changes, automatically releasing chamomile fragrance to strengthen positive feedback when a relaxed state is detected. The sustained effect maintenance design includes a miniature moss ecological bottle maintenance plan, where participants record daily growth status to form a self-discipline rhythm. This life companionship mechanism significantly improves emotional stability and self-efficacy [5].

6. Conclusion

Engaging in plant-based ecological art as a practice provides a special channel for life dialogue. Research states that plants as "languages", have a non-human centric expressive logic (ie. legends, myth, and voyage) as a general guide. The life rhythms of plants and their unpredictability provide the source of artistic tension. Artists in practice negotiate a meaningful equilibrium between control and losing control as the timing of existence, thoroughly integrating ecological critique into meaningful form and wrestling with ethical questions surrounding the needed sustainability of the projects. Pathways such as bioelectric interaction and symbiotic growth demonstrate how technology as a tool can serve as a bridge rather than a barrier for deeper perceiving of life. This value is not innovating the formal but invites personal knowing of species entanglement and creates an option for a humble holistic lens of ecology. Future engagement should focus on achieving a balance between technological integration and bioethical responsibility, aiming to create art that acts as a gentle agent within the interconnected network of life on Earth.

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