THE IMMERSIVE HEALING EXPERIENCES TO ALLEVIATE OFFICE WORKERS' STRESS IN URBAN ENVIRONMENTS

By
Mr. Shijie WU

A Thesis Submitted in Partial Fulfillment of the Requirements
for Master of Fine Arts Program in Design
Silpakorn University
Academic Year 2024

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Mr.Shijie WU

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Title	The Immersive Healing Experiences to Alleviate Office Workers' Stress in Urban Environments
By	Mr. Shijie WU
Field of Study	Program in Design
Advisor	Assistant Professor Dr. Atithep Chaetnalao

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This study first focuses on clarifying the research problem: in the context of urban internet-industry offices, what are the primary sources of stress under high-intensity workloads, and how can immersive experiences be leveraged to effectively intervene and alleviate employees' psychological burdens? Based on this problem, the research objectives were defined as follows: 1. Investigate the stressors and restorative requirements of urban office workers, and conduct an in-depth analysis of nature therapy principles. 2. Analyze modern office environments and identify optimal strategies for integrating multisensory digital technologies with nature -therapy frameworks. 3. Develop and prototype innovative immersive healing modalities, incorporating both application and empirical evaluation to quantify stress -reduction efficacy.In the research process, a mixed-methods approach was adopted—combining literature review, case studies, questionnaire surveys, and expert interviews—to deeply analyze both the theories of nature-based therapy and the characteristics of urban office settings. Drawing on these insights, a multisensory immersive experience prototype was then designed and implemented. Finally, two rounds of experiments of differing scales were conducted to quantitatively and qualitatively evaluate the prototype's usability, immersion level, and stress-reduction effectiveness.The experimental results demonstrate that the immersive multisensory experience—through the coordinated interplay of visual, auditory, olfactory, and tactile stimuli—significantly lowers participants' subjective stress scores, yielding greater relaxation depth and increased job satisfaction. Moreover, by introducing spatial narrative theory to construct a nature-based healing experience within an XR environment for the first time, this study not only opens new directions for design research in the health domain but also provides a theoretically grounded and practically viable model for the integrated innovation of future office spaces and psychological intervention strategies.

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Shijie WU

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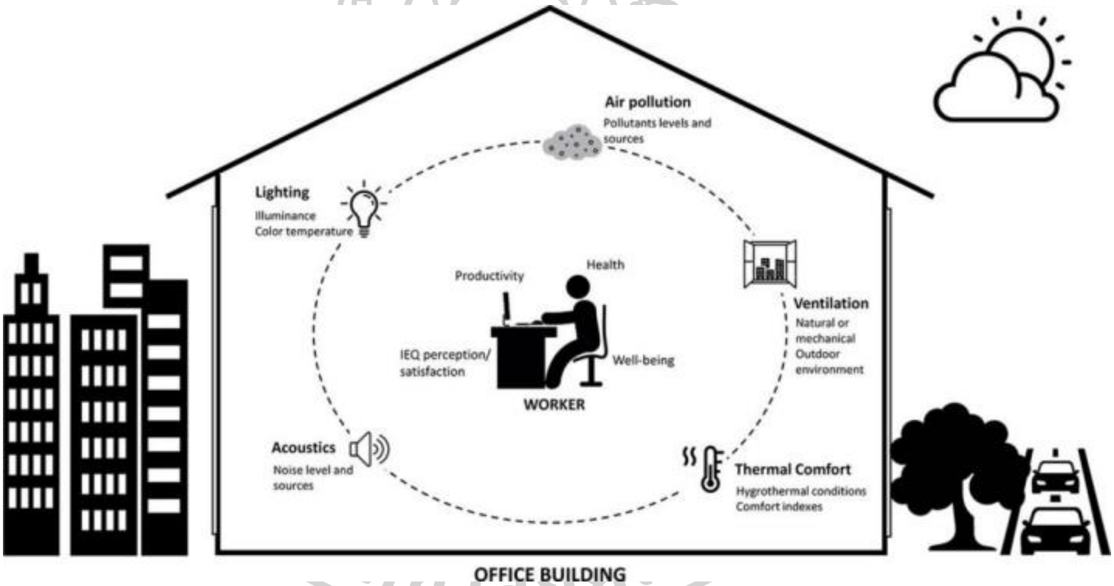
Introduction

1.1 Background and importance of the problem

Many office workers in contemporary metropolitan settings contend with stress, anxiety, and mental health challenges precipitated by the fast pace of life and the demands of high-intensity occupations (Odonkor & Adams, 2021). Among various stressors, the built environment particularly the office milieu emerges as a primary determinant of workers' perceived stress levels (Awada et al., 2023) (Figure 1).

Figure 1

Graphical Summary of Indoor Environmental Factors

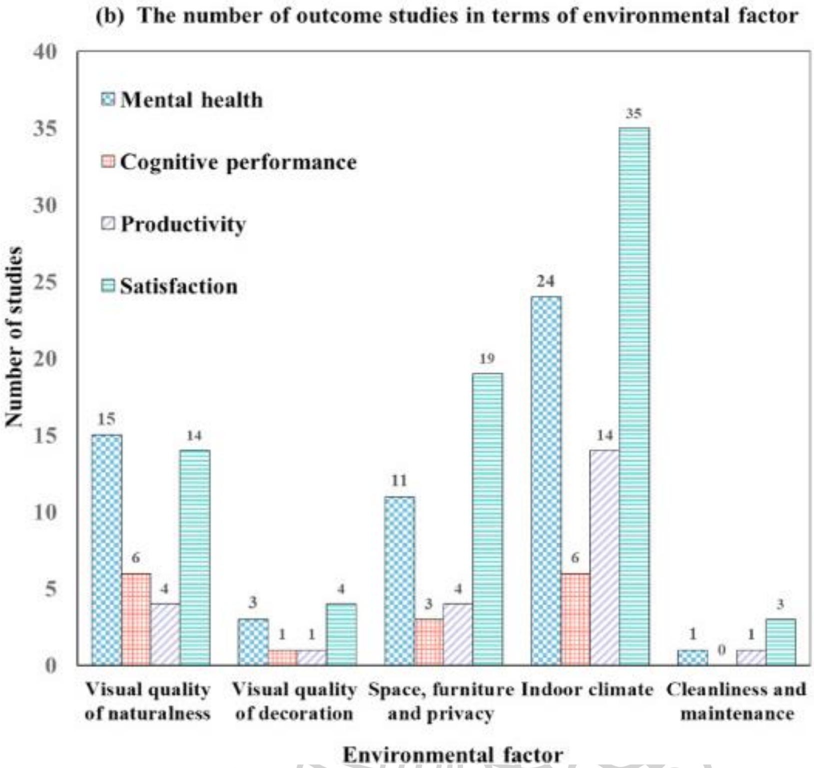


Note. (Felgueiras et al., 2023)

The biophilia hypothesis postulates an innate human affinity for the natural world. As the concept of biophilic design has evolved, scholars have begun to recognize the salutary effects of integrating natural elements into the workplace (Lei et al., 2021). Empirical investigations have substantiated these benefits, demonstrating that the inclusion of natural features in indoor settings enhances occupant well-being and productivity (Hung & Chang, 2024; Zhong et al., 2022) (Figure 2). Incorporating natural components within the office environment thus represents a promising approach to bolster employee health and performance (Lei et al., 2021; Schiebel et al., 2022). Consequently, researchers have increasingly focused on the psychosocial well-being of office personnel and their satisfaction with workplace environmental quality (Figure 3). report that a supportive office atmosphere correlates strongly with heightened work efficiency among employees.

Figure 2

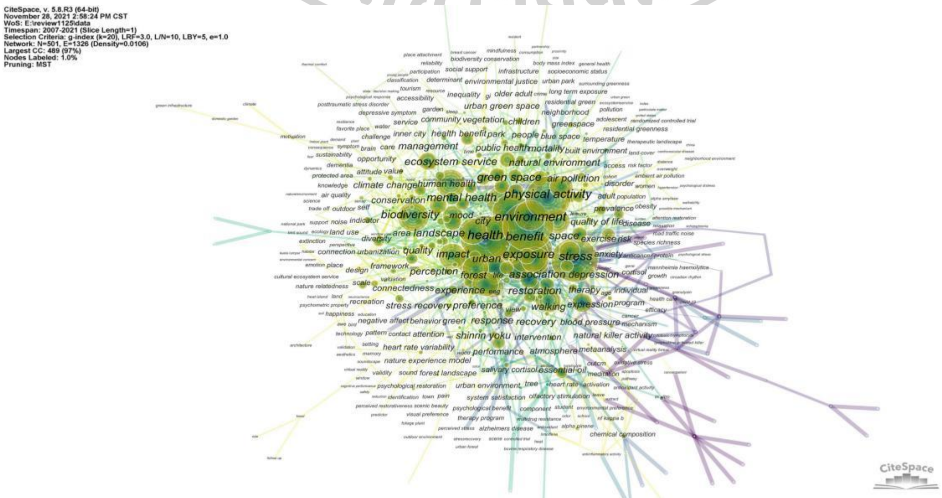
Number of research results on office environment factors



Note. (Felgueiras et al., 2023)

Figure 3

Keyword co-occurrence Visualization network



Note. (Wang et al., 2022)

Modern urban living has engendered a pronounced disconnect between individuals and their surrounding environment. As a result, engagement with outdoor spaces and greenery has become a widespread leisure strategy. Research indicates that such exposure is critical for maintaining health and facilitating stress recovery (Kotera et al., 2022; Rosa et al., 2021). Both the Attention Restoration Theory (ART) and the Stress Reduction Theory (SRT) affirm that immersion in arboreal and forested settings confers significant health benefits, including reduced stress and negative affect, alleviation of anxiety, augmentation of positive affect, restoration of attentional capacity, and enhancement of creative thinking(Gaekwad et al., 2023). Nature Therapy—defined as guiding individuals into natural environments and employing ecologically based interventions with an intent focus—encompasses modalities such as horticultural therapy and forest therapy (Figure 4). Widely endorsed as efficacious means of promoting psychological health, these interventions have demonstrated substantial therapeutic impact (Taye et al., 2022). Often championed as a form of preventive medicine, Nature Therapy seeks to maximize these salutary outcomes. Since the 1980s, Japan pioneered “forest bathing” (Shinrin-Yoku), empirically validating its therapeutic and medicinal virtues (Antonelli et al., 2019). Scandinavia, alongside China, South Korea, and countries across the United States and Europe, has similarly embraced forest therapy programs, integrating these practices into broader health promotion initiatives(Kotera et al., 2022). Today, forest bathing and related woodland therapies enjoy global popularity. Common research themes include health, benefits, physical activity, stress, environment, exposure, green space, and forest, as depicted in Figure 3. In Germany, forest therapy has been synergistically combined with traditional Nature-based treatments—such as Kneipp hydrotherapy and climate therapy (e.g., climatotherapy, heliotherapy, fresh-air rest)—to amplify health benefits(Hong et al., 2022) (Doherty et al., 2024; Vijay et al., 2024) (Stier-Jarmer et al., 2021).

According to World Health Organization analyses, over 55% of the global population resides in urban areas, a proportion that continues to rise. Of this urban demographic, more than 60% are employed. Consequently, occupational mental health, workplace conditions, sleep quality, absenteeism, and productivity losses attributable to health disorders have become pressing public health concerns(Furuichi et al., 2020) (Figure 5). (Goto et al., 2020) observe that many office workers are impeded from regularly engaging with Nature due to presenteeism pressures (Homrich et al., 2020). For example, (Xiao et al., 2020) note that the “996” work schedule prevalent in numerous Chinese tech firms renders routine access to forested areas virtually unattainable for employees.

Figure 4

Forest Therapy

Note. https://www.thenewslens.com/article/168625

Figure 5

Global trends (psychological stress, work stress, emotions)

Note. Illustrated by the researcher. (2024)

In response, practitioners have begun to replicate forest-derived sensory stimuli—such as aromas, soundscapes, and Visuals—through scent diffusion (Spence, 2022), audio playback (Jeon et al., 2022), and immersive technologies including Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR). These modalities enable individuals to experience lifelike natural environments and reap therapeutic benefits without physical travel(Browning et al., 2020; Frost et al., 2022; Jeon et al., 2023) (Figure 6). Comparatively, such virtual immersions can significantly attenuate negative affect and stress (Arpaia et al., 2022; Chen et al., 2024; Yu et al., 2018), enhance attention restoration and stress recovery (Ojala et al., 2022), and facilitate Nature-based healing among urban office workers. Immersive experiences thus represent a pivotal avenue for stress mitigation and mental health promotion.

Figure 6

Virtual forest environment

Note. (Mattila et al., 2020)

The confluence of intense occupational demands and estrangement from Nature precipitates a dual public health crisis in modern urban offices. Addressing this issue requires an interdisciplinary lens. From a design perspective, this paper introduces "Spatial Storytelling" as an integrative framework that fuses user experience principles, XR technologies, and Nature Therapy. It seeks to answer the following core question: through the digital reconstruction of spatial narratives, how can the intrinsic healing mechanisms of Nature Therapy be translated into an interactive, sensorily rich user experience?

Investigations into Nature Therapy reveal that Multisensory engagement with natural elements activates the body's self-regulatory systems (Stier-Jarmer et al., 2021). For instance, Olfactory exposure to pine volatiles can stimulate the parasympathetic nervous system, whereas the Auditory ambience of flowing water can alleviate attentional fatigue (Bhandarkar et al., 2024; Hsieh et al., 2023). However, conventional Nature Therapy is constrained by spatial and temporal limitations, posing challenges in alignment with the brisk tempo of metropolitan work life. XR technologies offer a solution by transcending geographical barriers through virtual Nature reconstructions. Yet, rudimentary 360° projections often lack Multisensory integration—olafactory, Tactile, and interactive dimensions—resulting in a fragmented healing experience. Current research tends to accrue technological functionalities without adequately translating the “essence” of Nature-based healing into design.

This gap underscores the critical role of design as the “meaning translator” of Nature Therapy within technical media. Spatial storytelling design commences from the emotional logic of user experience, converting the biological properties of natural stimuli—such as the calming aroma of plant-derived volatile organic compounds—into dynamic narrative elements within XR environments. In a virtual bamboo forest scenario, for example, the rustling of leaves (Auditory), the timed release of bamboo scent (Olfactory), and gesture-driven light-and-shadow interactions (Visual) can be orchestrated along a temporal arc—“morning awakening – midday focus – evening relaxation”—mirroring the circadian rhythms of real forests and their physiological influence on human users. By modulating narrative pacing and sensory layering, this design approach forges emotional connections between users and digital Nature, thereby transforming therapeutic interventions from mere functional triggers into immersive mind-body rituals rather than simplistic simulations.

Through immersive technologies, researchers have effectively integrated multimodal experiences—Visual, Auditory, and Olfactory—to create environments in which participants genuinely feel enveloped by Nature (Finck et al., 2023). uch Multisensory immersion yields expedited recovery for office workers and amplifies therapeutic efficacy (Collier, 2018).In implementing these solutions, designers must embed regionally specific natural metaphors to preserve cultural identity amidst technological homogenization, while grounding user experience design in empirical findings from Nature Therapy(Globa et al., 2022), Micro-interaction design should tactfully balance user autonomy with system guidance, serving as an unobtrusive director of behavioral flow. This trifold paradigm—Nature–technology–human—promotes a balanced discourse that neither indulges technophilic utopianism nor regresses into ecological fundamentalism (Gao et al., 2023).

Hence, by leveraging spatiotemporal coordination, sensory layering, and cultural encoding within spatial storytelling, how might we construct a “hyperreal” Nature experience suited to office contexts—one that retains the biological efficacy of Nature Therapy while resonating emotionally with digital natives? The answer may not only enrich a human-centered philosophy of technology in the digital age but also inspire innovative paradigms for office space design.

In summary, the rapid tempo of contemporary metropolitan work life and associated occupational pressures pose significant threats to the mental health of professionals. Nature-based interventions—ranging from horticultural therapy to forest bathing—have proven effective in mitigating stress, bolstering mental well-being, and enhancing workplace productivity. Yet, conventional access to natural environments is often precluded by austere work cultures and demanding schedules. Advances in digital media technologies, particularly VR and AR, offer compelling alternatives by recreating natural environments that impart analogous therapeutic benefits. While not a full substitute for real-world immersion, immersive virtual experiences substantially aid in emotional regulation and stress reduction. Integrating natural elements with digital technologies in future office spaces thus holds great promise for safeguarding the mental health and holistic well-being of the modern workforce.

1.2 Research Questions

1. How can the defining characteristics of Nature Therapy be systematically delineated, and how can urban office workers' stress levels and restorative needs be rigorously assessed?
2. How can advanced digital technologies be harnessed to seamlessly integrate Nature Therapy and generate effective virtual Nature–based healing experiences within office environments?
3. What empirical methodologies can be employed to evaluate the efficacy of immersive Nature–therapy interventions in mitigating stress among urban office workers?

1.3 Research Objectives

1. Investigate the stressors and restorative requirements of urban office workers, and conduct an in-depth analysis of Nature Therapy principles.
2. Analyze modern office environments and identify optimal strategies for integrating Multisensory digital technologies with Nature-therapy frameworks.
3. Develop and prototype innovative immersive healing modalities, incorporating both application and empirical evaluation to quantify stress-reduction efficacy.

1.4 Expected Benefits

1. Propose a comprehensive theoretical framework synthesizing Nature-therapy concepts with Multisensory digital technologies.
2. Devise an immersive healing design methodology grounded in the convergence of Nature Therapy and digital media, and empirically assess its therapeutic outcomes.
3. Establish a scientifically validated immersive healing system to enhance mental well-being and optimize work performance in urban office settings.

1.5 Research Scope

This study explores the integration of Multisensory digital technologies and Nature Therapy to effectively alleviate stress among office personnel in Internet-based enterprises. The research scope is delineated across three dimensions: information, target population, and design.

1.5.1 Information Scope

1. Examine definitions, classifications, therapeutic mechanisms, and practical applications of Nature Therapy.

2. Analyze occupational stressors, psychological demands, and restorative preferences of Internet-sector office workers.

3. Investigate application strategies for Multisensory modalities—Visual, Auditory, and Olfactory—in immersive healing contexts.

4. Evaluate the influence of office environmental factors on stress and propose optimization strategies to inform healing-experience design.

5. Review theoretical foundations, case studies, and user feedback mechanisms pertinent to immersive-healing design.

1.5.2 Population Scope

1. 300 office workers employed in Internet enterprises.

2. Six domain experts specializing in digital technology, Nature Therapy, spatial design, user experience, and psychology.

3. Two experimental cohorts:

Group 1: 10 participants;

Group 2: 30 participants.

1.5.3 Design Scope

1. Targeting Internet-sector office personnel, explore Multisensory interactive healing content and design principles that effectively reduce stress.

2. Develop a design prototype embedding natural healing scenarios within a framework of Multisensory digital technologies.

3. Select experimental sites, conduct prototype trials, and evaluate the intervention's stress-relief efficacy.

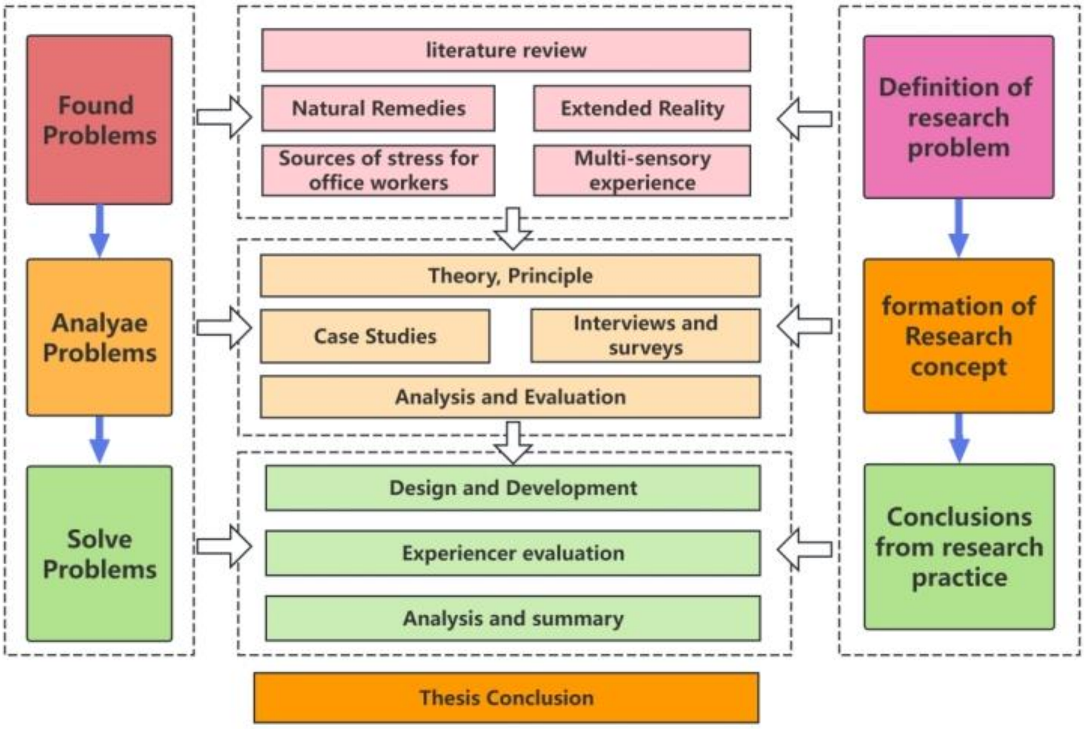
1.6 Research Methods and Process

This study employs a mixed-methods design, integrating qualitative inquiry, survey research, and experimental prototyping. A comprehensive literature review and multiple case analyses inform the identification of stressors among Internet-sector office workers and elucidate the influence of built environments. By synthesizing Nature-therapy principles with Multisensory modalities, the research advances an immersive healing paradigm.

The following procedural overview was developed by the researchers, as illustrated in Figure 7:

Figure 7

Research Methodology Framework



Note. Drawn by author (2024)

Step 1

1.Conduct a systematic review of scholarly literature on Nature Therapy's mechanisms for stress alleviation among urban office workers.

2.Examine empirical studies and technical reports concerning the integration of digital technologies with Nature-therapy interventions in occupational settings.

3.Analyze research data on the efficacy of Multisensory immersive environments for stress reduction in office populations.

4.Review literature delineating primary psychosocial stressors affecting urban office professionals.

5.Compile and appraise case studies detailing the confluence of Nature-based interventions and Multisensory experiences.

6.Survey research on office-environment parameters and their optimization for well-being design.

7.Develop and administer a semi-structured questionnaire to a sample of 300 participants, capturing preliminary data on stress levels and restorative preferences.

8.Design and execute structured interviews with six subject-matter experts (digital technology, Nature-based therapy, spatial design, user experience, and psychology) to gather in-depth insights.

Step 2

1. Synthesize and analyze the collected qualitative and quantitative data to derive theoretical constructs and foundational design principles.

2. Formulate an initial conceptual framework for a Multisensory immersive healing experience, and solicit critical appraisal from academic supervisors and domain experts.

3. Refine the framework iteratively based on evaluative feedback and recommendations.

Step 3

1. Construct a prototype model that operationalizes the integration of Multisensory experiential technologies with Nature-therapy modalities for stress mitigation.

2. Conduct two phased experimental trials:

Group 1: 10 participants experience the prototype, followed by post-experience surveys and interviews.

Group 2: 30 participants undergo the intervention, with subsequent data collection via standardized questionnaires.

3. Aggregate and analyze participant feedback and psychometric data from both cohorts.

4. Distill insights to develop novel methodologies that harmonize digital Multisensory stimuli with established Nature-therapy constructs.

1.6.1 Literature Review

1. Perform an exhaustive literature review on the conceptual underpinnings, theoretical frameworks, and therapeutic processes of Nature Therapy.

2. Examine advancements in Extended-Reality technologies and their capacity to deliver Multisensory experiences.

3. Aggregate findings on occupational stressors specific to urban office contexts through meta-analytic approaches.

1.6.2 A Case Study

1. Identify and evaluate exemplar implementations of digital-mediated healing interventions.

2. Analyze case efficacy in terms of design architecture, technological integration, experiential strategies, and therapeutic outcomes.

3. Critique prevailing limitations in current immersive-healing protocols.

4. Synthesize best practices tailored to the needs of Internet-sector office workers.

1.6.3 Interview with an expert

Execute in-depth, tool-facilitated interviews with six experts spanning digital media, Nature-based therapeutics, environmental design, user-experience research, and occupational psychology.

1.6.4 Survey questionnaire

1. Develop a comprehensive survey instrument incorporating demographic items, the Perceived Stress Scale, job satisfaction metrics, and environmental-perception measures.
2. Administer the survey to a stratified sample of 300 Internet-sector office employees.
3. Analyze data to elucidate stress antecedents, environmental appraisals, and restorative expectations for simulated natural settings.

1.6.5 Research through experimentation

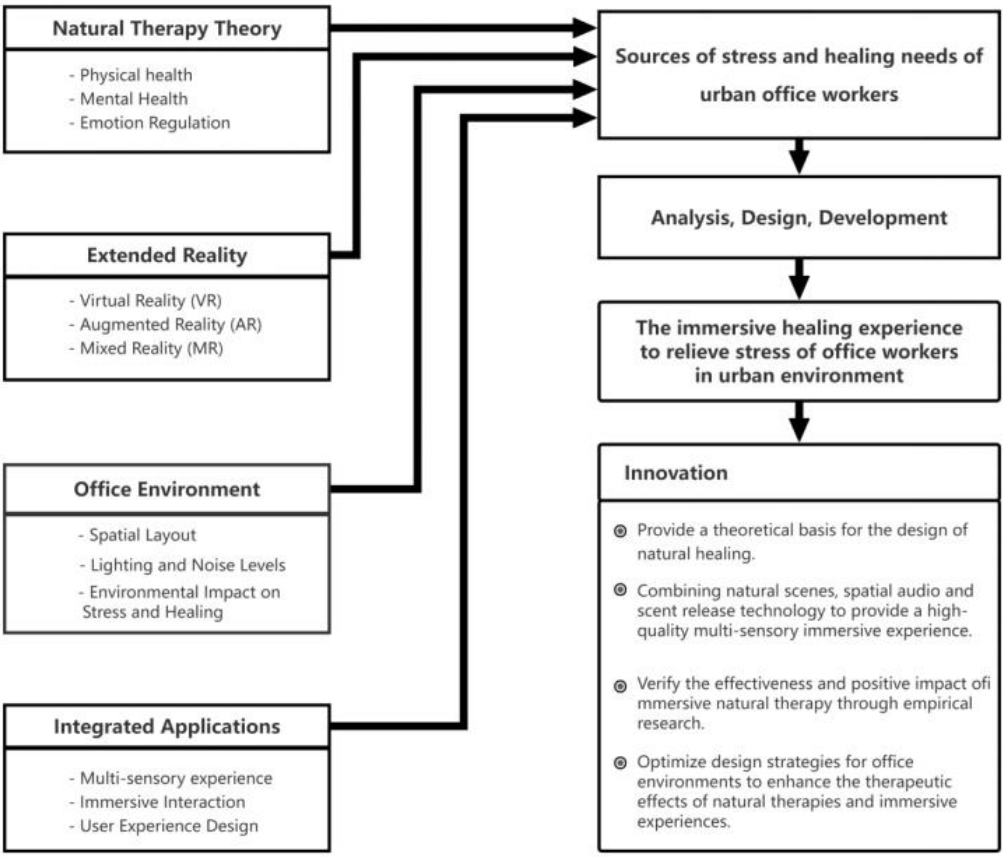
1. Conduct statistical analysis and thematic coding of collected survey and interview data.
2. Translate analytical findings into design prototypes, which undergo iterative expert review and revision.
3. Implement first-phase participant trials, capturing both quantitative and qualitative outcome measures.
4. Conduct second-phase trials to validate and generalize findings across a larger cohort.

1.6.6 Through integrative analysis of survey responses and expert-interview transcripts, extract data-driven insights and formulate actionable design recommendations.

1.6.7 Perform rigorous experimental testing to validate the efficacy of the design prototype and articulate a robust framework for integrating Multisensory digital technologies with Nature-therapy principles.

1.6.8 Summarize the design process, synthesize research outcomes, and delineate theoretical contributions and practical implications for future office-space interventions.

Figure 8
Research conceptual framework



Note. Drawn by author (2024)

1.7 Research conceptual framework

Figure 8 integrates four foundational pillars—Nature-therapy theory, Extended-Reality technology, office-environment parameters, and integrated application—into a cohesive model. By first examining the stressors and restorative requirements of urban office workers, the framework proceeds through three core phases: analysis, design, and development, culminating in an immersive healing intervention targeting occupational stress reduction. The diagram commences with the theoretical basis of Nature Therapy, encompassing dimensions of physiological and psychological well-being and affect regulation. It then incorporates Multisensory digital modalities—Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR)—which furnish the technological substrate for implementing Nature-therapy interventions in workplace contexts. Next, it overlays environmental determinants—workspace configuration, luminance and acoustics management, and personalization options—within the office milieu. In the integrated-application phase, the model unites Multisensory stimulation, interactive environments, and user-experience design. At the innovation tier, the framework not only consolidates the theoretical synergy between natural healing and Multisensory technology but also empirically validates therapeutic efficacy through hybrid real-virtual Nature scenarios, offering strategic recommendations for optimizing office environments. This interdisciplinary approach underscores the convergence of biophilic healing logics and digital media, providing a systematic methodology and practical guidance for advancing research in Multisensory interaction and Nature-based therapeutic applications.

1.8 Definition of terms

1.8.1. Natural Medicine

An evidence-based healing paradigm rooted in the biophilia hypothesis and Attention Restoration Theory, whereby engagement with natural elements (e.g., forests, flora, water bodies) modulates affective states, attenuates pain perception, and promotes holistic well-being. Modalities include horticultural therapy and forest bathing, each empirically demonstrated to reduce stress, mitigate anxiety, and facilitate emotional regulation.

1.8.2 Immersive Healing Experience

A novel therapeutic modality underpinned by Extended-Reality (XR) technologies, constructing Multisensory virtual Nature environments (Visual, Auditory, Olfactory, Tactile) to elicit immersive restorative experiences. Guided by the Emotion Regulation Model and Multisensory Integration Theory, this approach is deployed in clinical psychology and wellness interventions to accelerate psychological recovery and affect stabilization.

1.8.3 The Extended Reality

An umbrella term for Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) technologies that generate interactive virtual or hybrid environments. XR facilitates high-fidelity user immersion and real-time sensory interaction, with applications spanning education, healthcare, entertainment, and mental-health interventions. In therapeutic contexts, XR integrates biophilic elements to deliver novel psychological healing modalities.

1.8.4 Multisensory Interaction

The dynamic, synchronous engagement of Visual, Auditory, Olfactory, and Tactile sensory channels within virtual or physical environments. Grounded in the

Multisensory Integration Theory, this interaction paradigm amplifies user immersion and engagement, playing a pivotal role in the efficacy of immersive therapeutic experiences and virtual Nature simulations.

1.8.5 Workplace environment

The physical and psychosocial conditions of office settings—including spatial layout, lighting design, acoustic management, and indoor air quality—that directly influence employees' mental health, stress levels, and productivity. Environmental-psychology research substantiates that incorporating natural elements or designated restorative zones significantly enhances occupational well-being and performance.

1.8.6 Psychological Stress

A complex psychophysiological response to external environmental demands or internal cognitive appraisals, characterized by symptoms such as anxiety, fatigue, and impaired attentional capacity. The study of psychological stress draws on Stress Theory and Recovery Theory, emphasizing interventions—such as Nature Therapy and immersive healing—to alleviate distress and bolster resilience.

1.8.7 User Experience Design

A user-centric design discipline encompassing interface architecture, information hierarchy, and Multisensory integration to optimize overall usability, satisfaction, and emotional resonance. In immersive healing systems, user-experience design leverages Emotional Design Theory to craft personalized, immersive interactions that facilitate effective psychological interventions.

1.8.8 Virtual Natural Scenarios

Digitally rendered natural environments (e.g., forests, coastlines, mountain landscapes) produced via VR and AR. Based on Restorative Environment Theory, these scenarios employ multimodal stimuli to evoke perceived natural presence, thereby diminishing psychological stress and enhancing physical health. Virtual natural scenarios offer scalable, location-independent avenues for delivering Nature-based therapy in urbanized contexts.

Chapter 2

Literature Review and Related Research

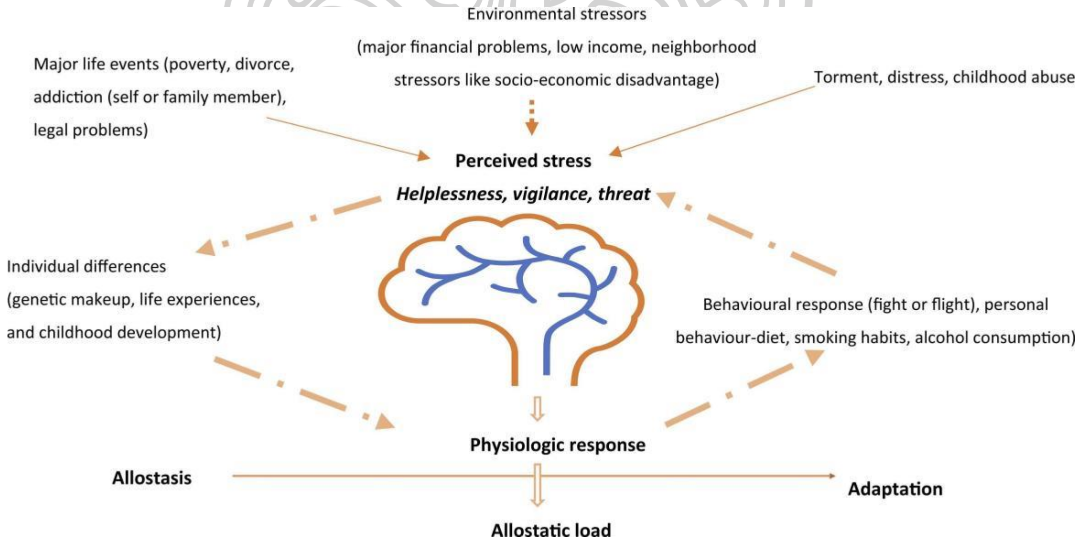
2.1 Office Workers' Stress

2.1.1 Definition and Concept of Stress

Stress constitutes an intrinsic adaptive response that enables individuals to navigate life's myriad challenges and threats. Every person experiences stress to varying degrees. Hans Selye first conceptualized stress in 1936 as the "General Adaptation Syndrome," describing it as the organism's nonspecific physiological reaction to any demand. The World Health Organization (Organization, 2024) further characterizes stress as a state of anxiety or mental tension induced by adverse or demanding circumstances. However, one's overall health is profoundly shaped by the efficacy of one's stress-management strategies (Lindert et al., 2021). According to Selye, stress is inescapable; even during rest, the heart, respiratory, digestive, and nervous systems remain active. Only at death is an organism entirely free from stress (James et al., 2023).

Figure 9

Mechanisms by which the body's natural balance is disturbed under chronic stress.

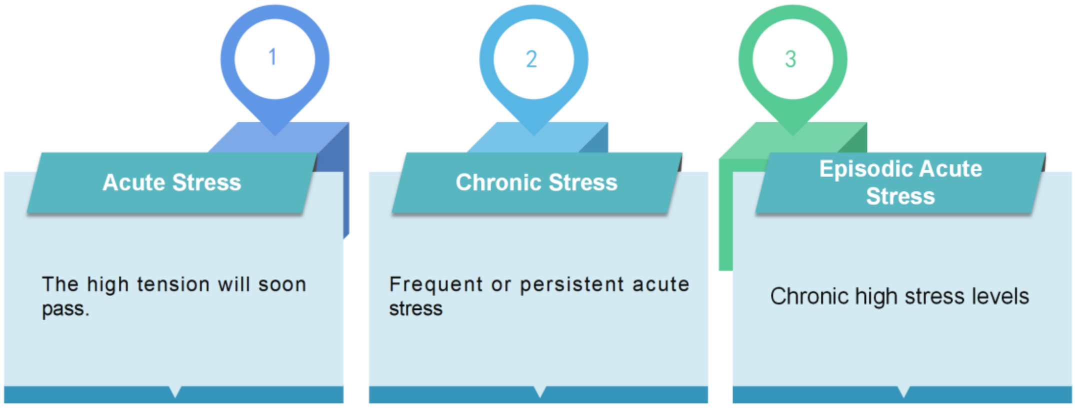


Note. (Georg Jensen et al., 2024)

Stress is a multidimensional construct that provides a robust theoretical lens for understanding its systemic impacts (Figure 9). Over the past few decades, scholarly discourse has refined the concept of stress, yielding more precise operational definitions across psychology, physiology, sociology, and environmental studies (Zafar et al., 2021) Variations in these definitions typically reflect differences in stress duration (acute vs. chronic) and intensity (eustress vs. distress) (Lu et al., 2021) (Figure 10).

Figure 10

Pressure classification chart



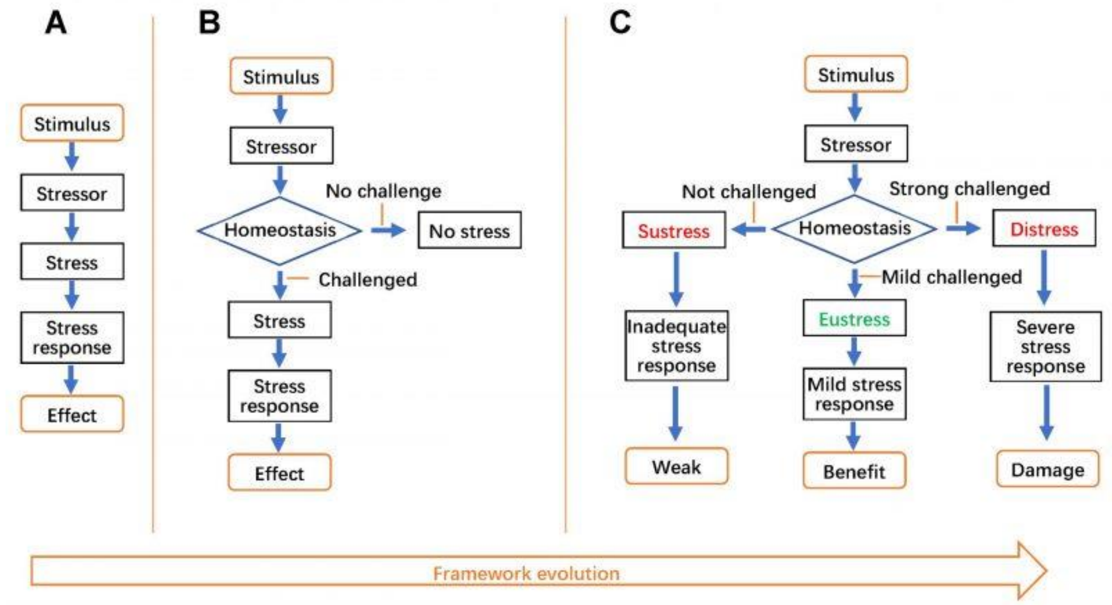
Note. Illustrated by the researcher.

Stress pervades our daily social interactions and occupational roles. Recognized by the WHO as a "twenty-first-century epidemic" stress originates from diverse sources, yet environmental and work-related factors predominate (Lukan et al., 2022). Consequently, establishing hygienic, ergonomically sound, and psychologically restorative workplaces has become imperative (Zhang et al., 2023). Environmental stress arises when indoor conditions fail to meet occupants' comfort and health needs. Empirical studies demonstrate that office workers' stress levels are modulated by interior design parameters—such as spatial layout, color schemes, furniture ergonomics, views, proximity to windows, personal environmental control, and biophilic elements—and by ambient conditions including temperature, air quality, lighting, and acoustic levels. These influences may exert both transient and long-term effects. Indeed, suboptimal office environments are frequently cited as significant contributors to work-related stress.

Stress stemming from professional, academic, or self-imposed demands manifests in various psychological domains (Furuichi et al., 2020). Emotionally, it precipitates negative affective states—anxiety, depression, irritability; cognitively, it undermines concentration, impairs memory retention, and hampers decision-making; behaviorally, it fosters maladaptive coping strategies such as binge eating, tobacco use, and excessive alcohol consumption, thereby exacerbating adverse health outcomes.

Figure 11

Evolution of the stress system framework.



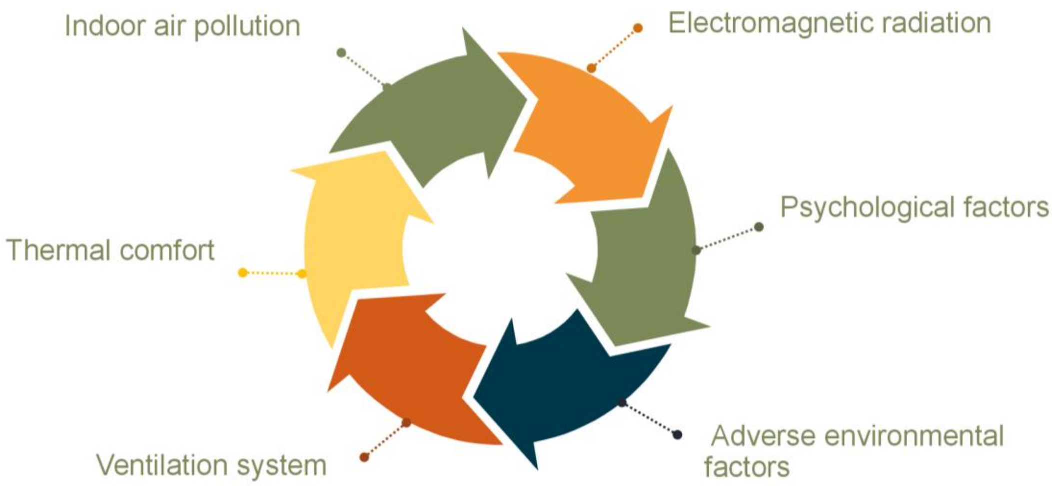
Note. (Lu et al., 2021)

Stress influences not only psychological and emotional states but also elicits profound physiological responses. Under acute stress, the hypothalamic–pituitary–adrenal axis is activated, resulting in the secretion of cortisol and adrenaline. These hormones facilitate a "fight-or-flight" response—mobilizing energy stores, elevating blood pressure, accelerating heart rate, dilating pupils, and redirecting blood flow to essential muscle groups. While these adjustments are adaptive in the short term, sustained hypercortisolemia disrupts metabolic homeostasis, impairs glucose regulation, and promotes visceral adiposity. Chronically elevated cortisol also compromises immune function, increasing vulnerability to infections. Over time, the cumulative burden of autonomic arousal and endocrine imbalance predisposes individuals to cardiovascular pathologies—including hypertension, atherosclerosis, and coronary heart disease—as well as metabolic syndrome and inflammatory disorders (Bergefurt et al., 2022; Grim & Grim, 2024). A substantial body of research thus confirms a robust correlation between persistent psychological stress and adverse physiological sequelae.

2.1.2 Causes of Stress in Urban Work Environments

(Awada et al., 2023) demonstrate that office workers' perceived stress is significantly modulated by both indoor environmental parameters—thermal comfort, indoor air quality, natural daylight exposure, artificial illumination, and ambient noise—and spatial design attributes—office layout, interior color schemes, ergonomic furniture, window vistas, and biophilic elements. Fluctuations in stress levels not only impinge upon work performance but also cascade into personal life domains—straining interpersonal relationships, financial well-being, and overall psychological burden—thereby exacerbating anxiety and depressive symptomatology. Given that individuals spend approximately 80–90% of their time within built environments (homes, offices, commercial spaces), public health concerns related to indoor conditions have ascended in priority (Liu et al., 2022). A byproduct of modern construction materials, HVAC deficiencies, and inadequate ventilation is Sick Building Syndrome (SBS), characterized by a constellation of nonspecific symptoms—ocular and dermal irritation, respiratory discomfort, cephalalgia, fatigue, and metabolic disturbances—that abate upon vacating the premises (Niza et al., 2024). Figure 12 illustrates the multifactorial etiologies of SBS symptoms, which encompass chemical pollutants, poor ventilation, microbial contamination, and individual susceptibility factors.

Figure 12
Causes of SBS symptoms



Note. Illustrated by the researcher.

Recent investigations categorize SBS determinants into two overarching domains: indoor-environmental quality (e.g., volatile organic compounds, particulate matter, humidity) and individual vulnerabilities (e.g., atopy, stress reactivity) (Subri et al., 2024). This study specifically targets Internet-sector professionals who occupy open-plan offices for prolonged durations, where high occupant density and limited environmental control amplify exposure to stress-inducing stimuli.

2.1.3 Impact of Stress on Office Workers

Global estimates indicate that nearly 60% of the workforce experiences occupational roles—a figure that highlights the ubiquity of work-related stress—and that depression and anxiety collectively incur nearly USD 1 trillion in annual productivity losses worldwide (Organization, 2024). Empirical studies among Chinese office workers reveal pervasive stress stemming from both job demands and environmental inadequacies (Feng et al., 2022; Gu et al., 2019; Ji et al., 2018). (Yang & Chen, 2022) report that occupational stress in Chinese Internet enterprises manifests through poor sleep quality, diminished work efficacy, extended unproductive working hours, and an array of stress-related health complications. In high-pressure sectors—such as technology—where performance expectations are exacting and working hours protracted, occupational stress and its negative consequences are particularly pronounced (Ji et al., 2018).

Prolonged exposure to occupational stress frequently culminates in job burnout, a syndrome encompassing emotional exhaustion, depersonalization, and a reduced sense of personal accomplishment. Emotional exhaustion is reflected in pervasive fatigue, irritability, and psychosomatic complaints; depersonalization involves emotional detachment, cynicism, and a distancing from colleagues or clients; diminished personal accomplishment manifests as a pervasive sense of inefficacy and professional inadequacy. Although burnout lacks a universally standardized definition, numerous scholars have operationalized it through psychometrically validated instruments and delineated alternative evaluative frameworks (Guseva Canu et al., 2021).

2.1.4 Summary

For Internet-sector professionals subjected to relentless high-intensity workloads and open-plan office configurations, chronic occupational stress has emerged as a significant global health concern. Recognized by the WHO as a primary twenty-first-century hazard, stress exerts dual impacts: psychologically, by inducing emotional fatigue, cognitive impairment, and maladaptive coping; physiologically, by dysregulating endocrine and immune functions via sustained cortisol elevation. Empirical investigations consistently demonstrate strong correlations between specific office-environment factors—air quality, lighting design, spatial arrangement—and worker stress indices. Conventional stress-management strategies often prove impractical in the fast-paced corporate milieu, underscoring the urgency for innovative, empirically substantiated interventions. Multisensory Nature-therapy techniques—such as micro-scale indoor greenery, soundscapes replicating natural ambiences, and botanical Olfactory stimuli—activate the parasympathetic nervous system and facilitate recovery in accordance with Attention Restoration Theory (ART). By synergistically integrating environmental design and behavioral interventions, this proactive paradigm transcends the spatial and temporal constraints of traditional approaches, yielding sustainable enhancements in both occupational productivity and holistic well-being.

2.2 Nature Therapy for Stress Relief

2.2.1 Overview of Natural Therapies

Nature Therapy encompasses a diverse array of healing modalities that leverage immersion in natural elements—plants, bodies of water, sunlight, and more—to foster both psychological and physiological well-being. Its origins trace back to ancient Greece, where Hippocrates famously asserted that “Nature is the healer of disease,” positing that the body actively restores its own equilibrium following injury or illness, rather than passively succumbing to pathology. From this vantage, disease represents the organism’s endeavor to re-establish homeostasis.

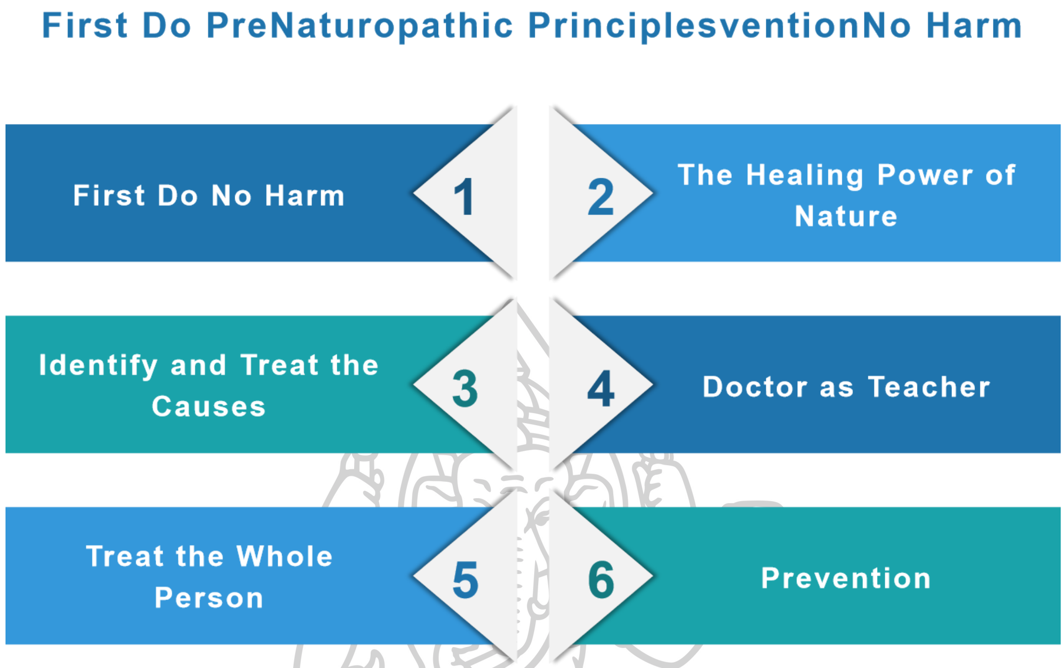
Over the centuries, this foundational principle evolved into modern naturopathy by the nineteenth century, situating Nature Therapy among the spectrum of alternative medical systems. Today, it encompasses techniques such as acupuncture, herbal medicine, floral-essence therapy, forest therapy, horticultural therapy, and hydrotherapy. Practitioners of naturopathic medicine advocate for the use of naturally occurring substances and emphasize patient engagement in preventive and restorative practices, striving to promote recovery and maintain health through minimal reliance on surgery and pharmaceuticals.

Definitions of Nature Therapy vary by cultural context and regulatory framework. The Association of Accredited Naturopathic Medical Colleges (AANMC) describes naturopathic medicine as a branch of alternative medicine that highlights the body’s innate capacity for self-healing, tailoring interventions—nutritional modification, lifestyle counsel, and holistic therapies—to each individual’s unique health profile. Practitioners may integrate contemporary scientific methodologies, conventional medical approaches, and empirical evidence into their therapeutic repertoire.

As a comprehensive medical system, Nature Therapy synthesizes natural, conventional, and alternative therapeutic strategies. Guided by six core principles of naturopathic medicine (Figure 13) (Snider & Zeff, 2019), it can be classified according to treatment modalities, theoretical underpinnings, and domains of application (Jeon et al., 2022) Table 1 (Gyllensten et al., 2019; Rousseaux, 2023; Siminiuc & Ţurcanu, 2023).

Figure 13

Six principles of natural healing



Note. Illustrated by the researcher.(2025)

Table 1

An overview of 15 natural remedies

(Scientific Validation: Therapies like phytotherapy and acupuncture have substantial research support, while energy-based modalities require further empirical evidence.)

Therapy Category	Core Principle	Common Methods/Examples
1) Nutritional & Dietary Therapy	Optimizing physiological function and disease prevention through nutrient intake regulation	Balanced diets, antioxidant supplementation, Mediterranean diet, vegetarianism, fasting regimens
2) Phytotherapy & Herbal Medicine	Utilizing bioactive compounds from plants to modulate bodily systems	Chinese herbal medicine (ginseng, turmeric), aromatherapy (essential oils), herbal teas (chamomile, peppermint)

3) Physical Therapies	Improving musculoskeletal/neurological function via physical interventions	Hot/cold compress, acupuncture, yoga, hydrotherapy (thermal baths), traction therapy
4) Psychological & Spiritual Therapies	Regulating emotional/cognitive states through mental interventions	Meditation, mindfulness-based therapy, art therapy, hypnotherapy, positive psychology
5) Energy Therapies	Restoring balance in the body's energy fields to stimulate self-healing	Qigong, Reiki, Biofield Therapy, crystal healing
6) Lifestyle & Environmental Therapies	Enhancing health through optimized living environments and habits	Natural light exposure regulation, forest bathing (Shinrin-Yoku), organic lifestyle, EMF reduction
7) Detoxification Therapies	Eliminating toxins to restore metabolic equilibrium	Colon cleansing, liver detox diets, sauna therapy, heavy metal chelation
8) Integrative Traditional Medicine	Combining theories/practices from multiple traditional medical systems	TCM-Western medicine integration, Ayurveda-nutrition synergy, Native American herbal-acupuncture blends
9) Biochemical Therapies	Modifying biochemical processes using natural substances	Enzyme therapy (bromelain), probiotic supplementation, acid-alkaline diet (lemon water therapy)
10) Sensory Therapies	Regulating psychophysiological states through sensory stimulation	Music therapy (alpha waves), phototherapy (SAD treatment), taste therapy (bitter compounds)
11) Biofeedback & Tech-Assisted Therapies	Using biosignal monitoring devices for self-regulation training	Heart rate variability training, neurofeedback, wearable-guided breathing exercises
12) Synergistic &	Systemic interventions	TCM Five Elements

Holistic Therapies	emphasizing mind-body-spirit synchronization	theory, Functional Medicine holistic assessment, Quantum Healing (theoretical)
13) Manual Therapies	Structural/functional adjustments through physical manipulation	Chiropractic, Tuina massage, Thai massage, craniosacral therapy
14) Breathing & Relaxation Therapies	Optimizing autonomic nervous system function through respiratory control	Diaphragmatic breathing, 4-7-8 technique, alternate nostril breathing (Nadi Shodhana), PMR
15) Community & Social Therapies	Promoting health through group dynamics and social support systems	Support groups (addiction recovery), community gardening therapy, collective dance/movement (square dancing), cultural ritual healing

Note. Collected and compiled by the researchers. (2025)

At its essence, Nature Therapy constitutes a broad spectrum of interventions aimed at disease prevention and health promotion via safe, natural means (Flies et al., 2024; Georg Jensen et al., 2024; Snider & Zeff, 2019). Each modality is grounded in distinct theoretical frameworks and practical protocols yet is often combined to meet individual patient needs. Embracing a holistic perspective, Nature Therapy attends to the integrated well-being of body, mind, emotions, and spirit. Expert naturopaths devise bespoke treatment regimens calibrated to each patient's health status, thereby optimizing potential outcomes.

Empirical evidence affirms that Nature Therapy yields significant benefits across mental and physical health domains:

Mental health aspects:

Mood elevation: Engagement with natural settings and participation in Nature-based activities enhance positive affect and attenuate symptoms of anxiety and depression (Sander et al., 2025; Yen et al., 2024).

Cognitive restoration: Exposure to natural environments facilitates attentional recovery, stimulates creativity, and improves problem-solving performance.

Psychological resilience: Regular Nature Therapy experiences bolster individuals' capacity to cope with stressors and enhance self-efficacy.

Physical health aspects:

Cardiovascular regulation: Nature Therapy is associated with lower blood pressure, improved heart-rate variability, and overall cardiovascular health.

Immune enhancement: Exposure to biogenic compounds and reduced stress hormone levels augment immune cell activity and resistance to illness(Norman-Nott et al., 2024).

Autonomic balance: Natural stimuli downregulate sympathetic arousal while activating parasympathetic pathways, promoting deep relaxation.

According to (Smith, 2022). Nature Therapy epitomizes person-centered care: achieving health through the harmonious balance of mind, body, and spirit. Developed outside the conventional medical paradigm, naturopathic medicine possesses a well-articulated theoretical foundation and clinical practice guidelines as an integrative system. By emphasizing lifestyle modification, emotional well-being, targeted nutrition, and noninvasive natural therapies, naturopathy aligns closely with contemporary preventive medicine principles—empowering individuals to harness their innate capacity for self-healing within the context of daily life.

2.2.2 Theoretical Frameworks Supporting Nature Therapy

Spending time in Nature—whether watching a sunset, gazing at the ocean or mountains, sitting in a park, retreating to the countryside, or even pausing for a few minutes to look out a window—provides opportunities for relaxation, reflection, and self-healing. Many have experienced this: after a difficult day or during a low mood, encountering a breathtaking view can captivate the mind and soothe the spirit. Such encounters underscore the vital role that natural environments play in replenishing mental resources: they alleviate cognitive fatigue and restore our capacity for directed attention.

Over the last several decades, empirical studies have demonstrated that exposure to natural settings enhances health, bolsters attentional control, and accelerates recovery. Attention Restoration Theory (ART), first formulated by Stephen and Rachel Kaplan in the 1990s, posits that natural environments not only foster positive affect but also replenish our capacity for sustained focus (Cooley et al., 2020). As urbanization advances, people increasingly spend time indoors, depriving themselves of opportunities for Nature contact (Figure 14).

According to the Kaplans, the restoration process unfolds in four sequential stages:

1. Clearing the mind: Residual thoughts, worries, and mental “to-dos” are allowed to surface and gently drift away, reducing cognitive clutter.

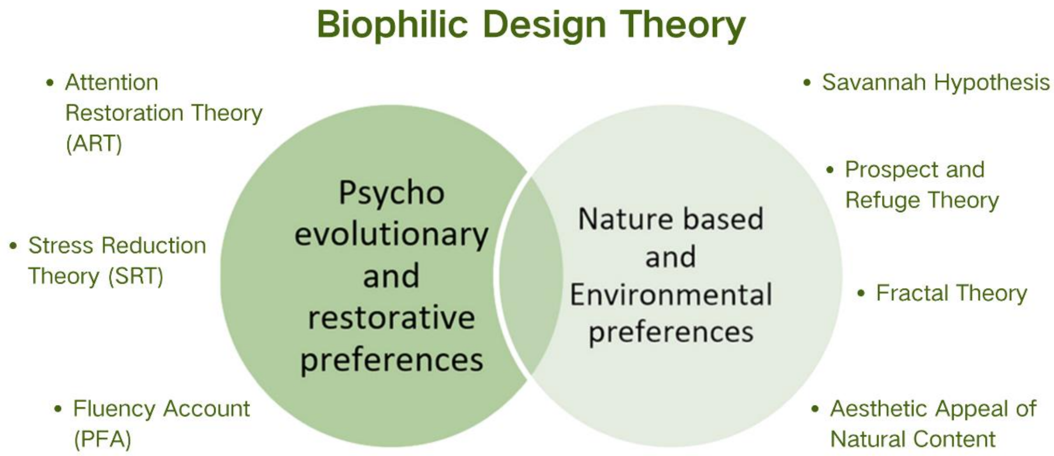
2. Initiation of restoration: Direct attention, fatigued by tasks requiring sustained focus, begins to recover once intrusive thoughts are no longer force-pushed but allowed to settle naturally.

3. Soft fascination: Individuals shift attention to low-effort, gently engaging stimuli—such as rustling leaves or flowing water—quieting internal chatter and fostering a tranquil mental space.

4. Deep reflection: Prolonged immersion in an environment meeting ART's restorative criteria enables profound relaxation, attention restoration, and contemplative reflection on one's life, priorities, and goals.

Figure 14

Theoretical framework of the biophilia hypothesis



Note. Illustrated by the researcher.(2025)

2.2.3 Efficacy of Natural Therapy

A robust body of research attests to the health benefits of Nature exposure. According to ART, natural settings effortlessly replenish executive attention. Meanwhile, Stress Reduction Theory (SRT) suggests that nonthreatening natural environments mitigate stress and improve physiological markers—lowering blood pressure and heart rate. Other studies indicate that the Multisensory stimulation inherent in natural surroundings bolsters immune function and diminishes stress. Through relaxation and emotional regulation, Nature contact can supplant fear, worry, or impulsivity with calm and balance.

Humans have evolved in, and remain more attuned to, natural environments than urban ones; this familiarity may explain why we so readily find solace in Nature. (Moran, 2019) found that simply viewing green landscapes or even images of Nature significantly reduces mental fatigue, fostering calm and logical thinking. Real-world Nature immersion dramatically lowers hypertension risk and depressive symptoms. Central to "forest therapy" is engaging all five senses—sight, scent, sound, touch, and taste—through activities like forest walks and sensory exercises, which research shows markedly improve mood, reduce anxiety, and enhance cognitive performance (Stier-Jarmer et al., 2021) (Antonelli et al., 2019) demonstrated that Tactile and Olfactory exposure to forest compounds significantly lowers salivary cortisol levels.

Natural soundscapes also contribute to recovery: listening to birdsong, flowing water, or rainfall has a demonstrable calming effect (Ratcliffe et al., 2013). S Inhaling fir essential oil, for example, elevates mood and alleviates tension, worry, and fatigue, while also improving physiological markers such as blood pressure and heart rate (Kim & Song, 2022).

Novative workplace designs have begun to harness these principles: at Microsoft's Redmond, Washington, headquarters, three treehouse office spaces were constructed within a forested campus (Figure 15). These covered meeting rooms, spacious decks, and panoramic forest views enable employees to immerse themselves in Nature, thereby enhancing focus, creativity, and well-being (Singer-Velush, 2017).

Figure 15

Microsoft Treehouse Workspaces

Note. https://news.microsoft.com/source/features/work-life/meet-me-in-the-trees/

2.2.4 Application of Nature Therapy in Indoor Environments

Originally a time-honored method of health promotion, Nature Therapy Traces its roots to ancient Greece. Hippocrates famously asserted that "Nature is the healer of disease," emphasizing the body's innate capacity for self-recovery through restored balance. Over centuries, this principle has evolved within medicine into diverse applications—acupuncture, herbal medicine, forest bathing, horticultural therapy, and hydrotherapy (Cooley et al., 2020; Hong et al., 2022). Its foundational tenets—"first, do no harm"; the healing power of Nature; identification and treatment of root causes; the physician as educator; holistic care; prevention as priority; and the promotion of overall well-being—not only underpin traditional therapeutic models but also provide a rich conceptual framework for interdisciplinary adaptation.

Within the humanities and social sciences, design scholars have increasingly interpreted Nature Therapy as a spatial strategy imbued with narrative depth and emotional resonance. Building on (Wilson, 1984) biophilia hypothesis—which posits an innate human affinity for natural environments—researchers have established a theoretical rationale for embedding Nature-based elements into the built environment. Recent advances in digital media art and cross-disciplinary methodologies have further invigorated this field. To create office environments that alleviate urban stress, bolster mental health, and catalyze creativity, designers incorporate living natural features (plants, water walls, dynamic daylight systems) alongside immersive digital simulations of natural experiences (Jim et al., 2022; Tekin et al., 2023).

Eyond fulfilling technical criteria, this design evolution foregrounds experiential and narrative dimensions. Kengo Kuma's "negative architecture," for example, employs natural materials and orchestrated patterns of light and shadow to produce spaces that feel both organic and alive. Empirical studies confirm that whether mediated through authentic biophilic installations or their digital counterparts, Nature Therapy consistently reduces negative affect, sharpens concentration, and nurtures creative thinking (Ba, 2016; Chulvi et al., 2020; Zhong et al., 2022). This design-mediated metamorphosis thus exemplifies the synergy of humanistic care and technological innovation, offering fertile ground for digital media art and multidisciplinary inquiry.

Numerous investigations have documented the capacity of Nature Therapy to lower office workers' subjective stress. Indoor plants, in particular, mitigate the anxiety associated with isolation: one study found that 61% of quarantined participants reported decreased anxiety thanks to indoor greenery, while interest in plant care rose by 33% and interaction frequency by 78%. In broader surveys, approximately 90% of respondents indicated improved mental health from tending plants, and 52% devoted more time to plant care when alone.

Research on the restorative impact of natural elements spans residential, commercial, educational, and healthcare contexts. Ranas et al. examined rehabilitation patients' health improvements when afforded window views of natural scenes; another study tracked reductions in consumer stress and enhancements in mood when green plants were displayed in retail settings. Benfield et al. observed that students exposed to outdoor greenery exhibited more positive affect and engagement than peers facing concrete walls, and Park et al. demonstrated accelerated patient recovery in hospital wards featuring live flora (Rauschnabel et al., 2022) .

Two seminal theoretical models elucidate how indoor greenery benefits human health: Stress Reduction Theory (SRT) and Attention Restoration Theory (ART). ART proposes that effortless engagement with natural stimuli—through "soft fascination"—replenishes directed attention depleted by cognitive tasks, thereby preventing mental fatigue and sustaining cognitive vitality. SRT, from a

Psycho-Evolutionary Perspective, asserts that nonthreatening natural environments immediately trigger positive emotional, physiological, and behavioral responses. Such settings downregulate sympathetic arousal—lowering heart rate and blood pressure—while enhancing parasympathetic activity, thus promoting relaxation and positive affect. Both frameworks have been instrumental in guiding urban planning and environmental design, and together they substantiate the cognitive, psychological, and physiological benefits of integrating indoor vegetation.

Growing recognition of Nature's restorative power in built environments has propelled indoor biophilic design into mainstream discourse as an effective means to enhance cognitive performance, alleviate work-related stress, and support overall well-being. Experimental comparisons of four ambient conditions—simulated windows, biophilic décor, live plants, and natural materials—revealed that participants in the live-plant condition demonstrated significantly faster reaction times (simple RT, choice RT, and total RT) during cognitive tasks. Notably, even in windowless offices, the presence of indoor plants markedly improved task efficiency, underscoring the profound influence of modest biophilic interventions on workplace productivity and health.

For example, Amazon's Seattle headquarters incorporates a remarkable biophilic intervention known as The Spheres (Figure 16). This trio of geodesic glass domes—each shaped as a pentagonal Hex triacontahedron and conceived collaboratively by NBBJ and Site Workshop—encloses a multi-level botanical conservatory that functions as both lounge and workspace. Housing over 40,000 specimens drawn from cloud forests across five continents, the environment employs vertical living walls, dense clusters of tropical flora, and a specialized daylight-diffusion system to embed the Multisensory principles of forest therapy within an office context. Employees spending time within The Spheres exhibit significant reductions in salivary cortisol and attendant improvements in measures of attentional restoration.

Crucial to this space is the integration of digital and physical elements: virtual canopy projections replicate dappled sunlight through forest foliage, while layered natural soundscapes—birdsong, rustling leaves, distant water flows—coalesce with 63% live-plant coverage to evoke a fully immersive "urban forest bathing" experience.

Attention Restoration Theory posits that exposure to natural stimuli markedly diminishes cognitive fatigue, yet modern urban lifestyles often sequester individuals from such restorative settings. Complementary frameworks—Ulrich's psycho-evolutionary model and Stress Reduction Theory—further explicate how natural environments initiate psychophysiological recovery processes, lowering sympathetic arousal and fostering positive affect. Together, these theories underscore Nature's capacity to alleviate mental stress.

Figure 16

The Amazon Spheres

Note. https://www.archdaily.com/920029/amazon-spheres-nbbj

Urban green spaces, especially proximate city parks, have therefore become vital outlets for stress relief. However, high-density development often constrains the creation of large parks. In response, "pocket parks"—small, publicly accessible green enclaves dispersed throughout urban neighborhoods—have emerged as critical nodes of human–Nature interaction. Their compact scale and ubiquitous distribution afford residents frequent opportunities for brief restorative encounters.

The COVID-19 pandemic has intensified awareness of urban mental-health deficits, highlighting the scarcity of accessible green refuges. Amid prolonged lockdowns, pocket parks' value has surged: free to enter and woven into the urban fabric, they provide essential spaces for psychological reprieve.

Indoor vegetation likewise contributes to well-being beyond aesthetics. Plants improve air quality by increasing oxygen levels and reducing pollutants, which in turn decreases stress. Drawing on both Stress Reduction Theory and Attention Restoration Theory, Evenson conducted a randomized, mixed-methods experiment demonstrating that the presence of indoor plants significantly enhanced environmental engagement.

Similarly, Field reported that office spaces enriched with potted plants saw a 37% reduction in self-reported coughing and a 30% decrease in fatigue, indicating that biophilic design can meaningfully alleviate both cognitive and physical discomfort.

2.2.5 Summary

A wealth of interdisciplinary research affirms that Nature Therapy—and forest bathing in particular—delivers significant psychological, physiological, and environmental benefits for mitigating occupational stress. Tracing its lineage to Hippocrates' ancient principle of self-healing, Nature Therapy encompasses a spectrum of practices—from Multisensory immersion to horticultural interventions. Among these, Shinrin-Yoku (forest bathing) has emerged as a particularly compelling modality for workplace integration, owing to its robust theoretical underpinnings and adaptable application.

At the conceptual level, Stress Reduction Theory (SRT) and Attention Restoration Theory (ART) articulate how natural environments catalyze recovery. SRT highlights Nature's capacity to downregulate sympathetic-nervous-system arousal, while ART describes how exposure to effortless "soft fascination" replenishes directed attention. Forest bathing engages multiple sensory channels—Olfactory inhalation of phytoncides, Visual shifts in canopy light, and ambient natural soundscapes—to effectuate reductions in cortisol, improvements in cardiovascular markers, and uplifted mood. Its immersive character more fully fulfills ART's four restorative criteria—fascination, being away, extent, and compatibility—than static interventions such as potted plants.

Empirical findings reinforce forest bathing's preeminence. Although indoor greenery provides modest benefits, its stress-reduction impact is comparatively constrained. In contrast, phytoncide exposure during forest bathing not only boosts immune function but also lends itself to biophilic adaptations—vertical green walls, simulated natural acoustics, and diffusion of wood-derived fragrances—that can be tailored to the spatial confines of modern offices. The COVID-19 pandemic has only magnified mental-health challenges, underscoring forest bathing's scalability, cost-effectiveness, and non-pharmacological appeal.

Unlike interventions such as meditation or yoga—which often require specialized instruction—or energy-based therapies lacking extensive empirical validation, forest bathing's passive, intuitive engagement ensures broad accessibility. Integrating insights from environmental psychology, neuroscience, and design practice, forest bathing stands out as the optimal strategy for embedding therapeutic qualities into office environments.

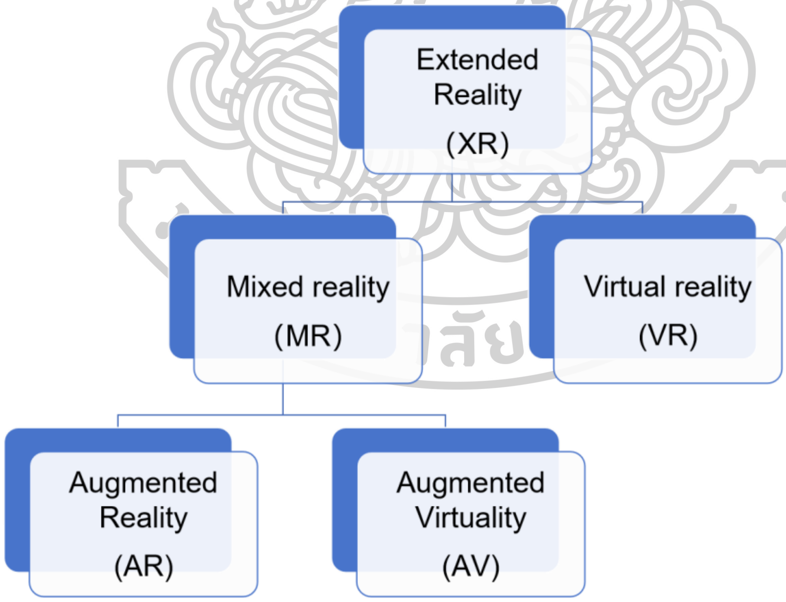
In the realm of health-focused workplace design, forest bathing—with its evidence-based, Multisensory synergy and spatial flexibility—offers a paradigmatic shift. By incorporating immersive natural elements or micro-restorative zones, designers can transcend traditional productivity metrics, reimagining occupational health through a synthesis of contemporary ergonomic standards and enduring biophilic wisdom.

2.3 Immersive Technologies and Multisensory Design Applied to Stress Healing

2.3.1 Immersive Technologies

Immersive technologies span a continuum—from completely physical, real-world environments to fully computer-generated virtual worlds—often referred to as the reality–virtuality spectrum. Over the past decade, these technologies have matured rapidly, seamlessly blending actual and simulated realms. Collectively labeled Extended Reality (XR), this family includes Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) (Kuhail et al., 2022) (Figure 17). XR platforms afford users deeply engaging experiences that transcend the limits of their immediate surroundings: by integrating sight, sound, and interaction within computer-generated environments, individuals can temporarily "tune out" external distractions and inhabit richly detailed simulated spaces, effectively merging virtual content with physical reality (Rauschnabel et al., 2022).

Figure 17
The concept of Extended Reality



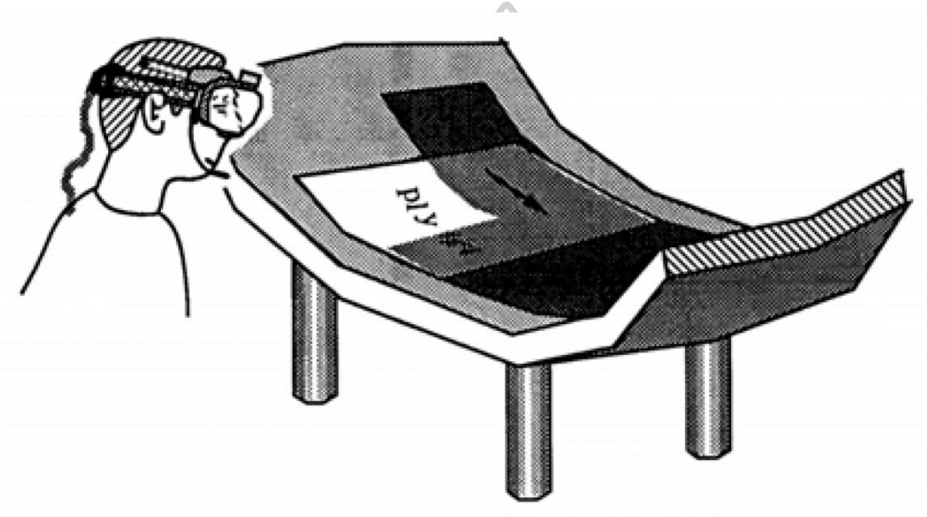
Note. Illustrated by the researcher.(2025)

2.3.1.1 Virtual Reality Technology

Virtual Reality (VR) immerses users in fully synthetic three-dimensional (3D) environments via head-mounted displays (Yeung et al., 2021)（Figure 18. Though the notion of "virtual worlds" can be traced to early science-fiction literature, the earliest practical precursor to modern VR was the panoramic painting—designed to envelop a viewer's field of vision and create a convincing illusion of presence (Ambrosio & Fidalgo, 2020).

Figure 18

Head-mounted display proposed by Caudell and Mizzel



Note. (Kamińska et al., 2023)

Immersive VR is widely acknowledged for its strengths in Visualization, interaction, and collaborative applications. It enables users to inhabit virtual environments or simulated scenarios, yielding measurable psychological benefits and enhanced knowledge retention(Ma et al., 2024). In mindfulness training, for example, VR's Multisensory engagement—sight, sound, and spatial cues—has been shown to deepen participants' sense of presence and accelerate learning when integrated with digital communication tools.

At the core of VR's transformative potential lies "immersion," the technology's ability to engage multiple sensory channels and evoke a convincing sense of "being there." The depth of immersion correlates with the number of sensory modalities activated and the realism of the stimuli: the more completely users' senses are engaged, the stronger their psychological experience of presence within the virtual world.

2.3.1.2 Augmented Reality Technology

The conceptual roots of Augmented Reality (AR) extend back to the 1950s, but it was Tom Caudell and David Mizell who, in 1990, coined the term when they devised a head-mounted display to assist Boeing technicians with assembly tasks. In its broadest sense, AR denotes the real-time overlay of digital content onto the physical environment, enriching users' perception with contextual information. A review of AR literature reveals its rapid evolution—from core tracking and display technologies to studies of its social and ergonomic impacts—and its proliferation across domains such as medical education, tourism, manufacturing, marketing, service management, and architecture.

Recent years have seen AR mature into numerous consumer applications (Rauschnabel et al., 2022). By superimposing virtual objects—text annotations, 3D models, interactive controls—onto real-world scenes, AR amplifies environmental affordances, whether in gaming (Khaleghi et al., 2024), classroom learning (Al-Ansi et al., 2023; Levstek et al., 2024), live events (Yu et al., 2024), sports broadcasting (Goebert et al., 2022), or navigation aids with GPS overlays.

According to (Kamińska et al., 2023) AR imposes fewer spatial constraints than fully immersive systems: because users maintain sight of their actual surroundings, AR experiences can unfold in cluttered offices, multi-user classrooms, factory floors, or outdoor environments without requiring large obstacle-free zones. Furthermore, tracking stability and registration accuracy—though inherently less precise than tethered VR systems—are sufficiently robust for everyday workplace and educational contexts. These characteristics make AR a versatile tool for embedding therapeutic content directly into users' routines.

2.3.1.3 Mixed Reality Technology

Mixed Reality (MR) occupies the intermediary spectrum between the entirely physical and wholly virtual. Two primary subcategories—Augmented Reality (AR) and Augmented Virtuality (AV)—describe MR's bidirectional blending of real and digital elements. AR enriches the real world with virtual augmentations—for example, Pokémon Go places digital creatures into actual geolocations—whereas AV introduces live camera or sensor captures of real objects into a virtual scene, as seen in Xbox Kinect's projection of a user's silhouette within a game environment.

As head-mounted displays converge AR, VR, and MR capabilities, their promise for stress reduction applications grows. Collectively called Extended Reality (XR), these technologies reconstruct users' perceptual environments through Multisensory stimulation—Visual, Auditory, haptic—creating a continuum from unmediated reality to fully synthetic worlds (Rauschnabel et al., 2022).

VR provides complete sensory isolation, allowing users to detach from real-world stressors (Yeung et al., 2021).

AR supplements the real environment with therapeutic overlays—guided breathing prompts, calming Visual filters, or interactive Nature simulations—making it suitable for integration into daily workflows.

MR dynamically balances real and virtual inputs, supporting naturalistic interactions where digital content responds contextually to physical surroundings.

Ergonomics and device performance critically shape therapeutic outcomes: prolonged comfort depends on headset weight and fit (Kamińska et al., 2023), while immersion and presence hinge on display resolution, field of view, and latency (Moinnereau et al., 2022) .

To guide the selection of hardware for XR-based stress-management interventions, we compare leading AR/VR/MR headsets as of February 2025 across key metrics—price, weight, battery life, and ecosystem support (Table 2). Our analysis highlights the Meta Quest 3 and PICO 4 as balanced choices: Meta Quest 3 excels in mixed-reality features (passthrough mode), hosts a mature productivity suite (Horizon Workrooms), and benefits from ongoing platform updates; PICO 4 offers a lighter form factor, longer battery endurance, and a more accessible price point, suitable for budget-sensitive deployments. Although the Apple Vision Pro delivers cutting-edge specifications, its premium cost may limit widespread adoption (Table 3).

Table 2

AR/VR/MR head mounted display device classification comparison table
Comfort: Lightweight and balanced design for prolonged use.
Battery Life: Minimum 2+ hours, with plug-in or external battery support.
App Ecosystem: Rich in office tools (e.g., virtual meetings, collaboration apps).
Immersion: Balanced virtual-real interaction (prioritizing MR capabilities).
Price: Cost-effective, fitting research budgets.

Device Name	Category	Price (USD)	Weight (g)	System/Platform	Battery Life (Hours)	App Count (Approx.)	Comfort Rating	Immersion Experience
Meta Quest 3	VR	$499	515	Meta OS (Android)	2-3 (Plug-in Option)	1,000+	Good (Balanced Design)	High (High Res + Low Latency)
PICO 4	VR	$429	586	PICO OS (Android)	2.5-3	300+	Good (Lightweight)	Medium-High (Balanced Performa

								nce)
PlayStation VR2	VR	$549	560	PS5 System	Wired (No Battery)	100+	Average (Wired Restraint)	High (Exclusive Content)
Valve Index	VR	$999	809	SteamVR	Wired (No Battery)	5,000+	Excellent (Adjustable)	Exceptional (Pro-Level)
Microsoft HoloLens 2	AR	$3,500	566	Windows MR	2-3	200+	Average (Front-Heavy)	Low (AR Limitations)
Magic Leap 2	AR	$3,299	260	Lumin OS	3.5	150+	Excellent (Modular)	Medium (Strong AR Interaction)
Nreal Air (Xreal)	AR	$379	106	Phone/PC Dependent	External Power	50+	Excellent (Lightweight)	Low (Lightweight AR)
Apple Vision Pro	MR	$3,499	600-650	visionOS	2 (External Battery)	1,000+	Excellent (Premium)	Exceptional (Ecosystem Strength)
Meta Quest Pro	MR	$999	722	Meta OS (Android)	1-2	500+	Average (Front-Heavy)	High (Rich MR Features)
HTC Vive XR Elite	MR	$1,099	625	Vive OS (Android)	2	200+	Good (Foldable)	High (Strong Overall Performance)

Note. Collected and compiled by the researchers. (2025)

By mapping device characteristics to therapeutic requirements—comfort for extended sessions, immersive fidelity for presence, and reliable tracking for interactivity—this comparative framework informs the evolution of XR-based healing environments.

Table 3

Meta Quest 3 vs. PICO 4: Key Advantages

Parameter	Meta Quest 3	PICO 4
Price	$499 (Mid-Range)	$429 (More Cost-Effective)
Weight	515g (Balanced Design)	586g (Slightly Heavier but Evenly Distributed)
System/Apps	Meta OS, 1,000+ Apps (Rich Office Tools)	PICO OS, 300+ Apps (Adequate for Basic Needs)
Battery Life	2-3 Hours (Plug-In Option)	2.5-3 Hours (Slightly Better)
Comfort	Good (Long Sessions)	Good (Lightweight Design)
Immersion	High (MR Features for Blended Reality)	Medium-High (VR-Centric with Passthrough)

Note. Collected and compiled by the researchers. (2025)

2.3.1.4 Multisensory Experience Technology

Sensory cues from our environment—temperature, acoustics, aromas, and lighting—exert a profound influence on our emotional states and behaviors (Chen et al., 2022). Despite inhabiting rich, dynamic Multisensory settings, research tends to examine each sense in isolation under tightly controlled conditions (Nitidara et al., 2022), leaving a gap in our understanding of how combined stimuli can be orchestrated to achieve consistent therapeutic outcomes.

Recent strides in wearable digital interfaces are beginning to address this gap, especially within Virtual Reality contexts (Lyu et al., 2023). Today’s haptic systems—ranging from full-body suits to gloves and sleeves—deliver precise Tactile feedback that corresponds to virtual events (Pacchierotti et al., 2024). Olfactory modules affixed to headsets release calibrated scent bursts in synchrony with on-screen environments (Figure 19), deepening immersion by engaging smell alongside sight and sound (Comsa et al., 2019).

Figure 19
The Smell Engine

Note. (Bahremand et al., 2022)

The overall quality of an immersive experience depends not only on the hardware but also on contextual factors and individual differences (Gougeh et al., 2022). Some participants report seamless engagement, while others experience cybersickness—a spectrum of motion-induced discomfort. Although Audio Visual Immersion has been extensively studied, systematic research into full multimodal integration remains nascent. Future investigations should map how specific combinations of sensory inputs affect users' presence, engagement, and emotional response.

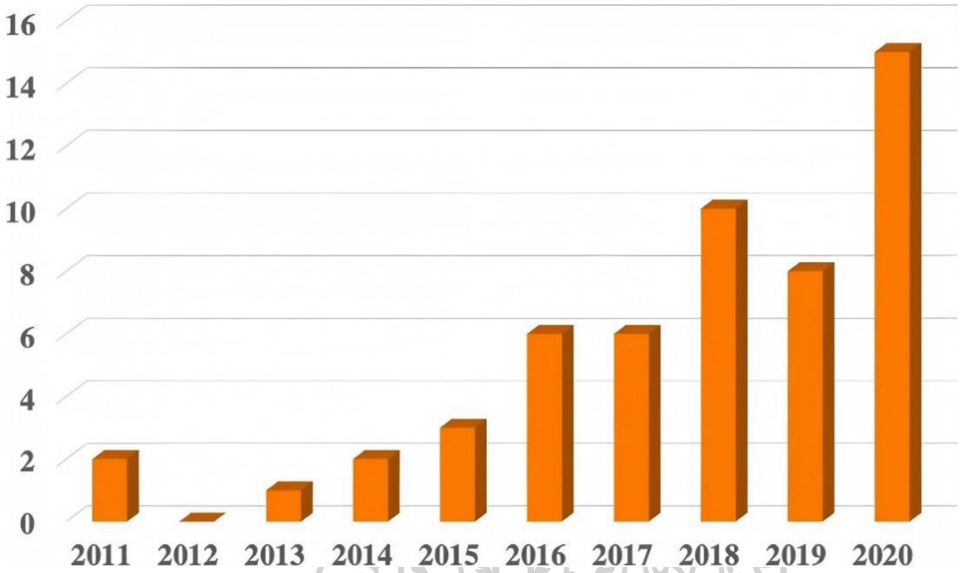
2.3.2 Applications of Immersive Technologies in Health and Well-being

As established in the natural-therapy literature, direct exposure to Nature yields measurable mental and physical health gains. Yet urban lifestyles often preclude frequent access to green spaces. Immersive technologies offer an alternative by recreating restorative environments in offices, clinics, and homes.

In the past decade, VR-enhanced mindfulness and meditation have surged in scholarly interest (Figure 20). Studies consistently demonstrate that VR-based mindfulness reduces stress, anxiety, anger, and depression more effectively than traditional audio-only or small-screen approaches. By finely controlling Visual, Auditory, haptic, and Olfactory dimensions, VR enables deeply personalized interventions that adapt to individual needs and contexts.

Figure 20

Number of papers per years on VR-supported mindfulness published since 2007



Source:(Arpaia et al., 2022)

Beyond meditation, XR applications have expanded across healthcare, education (Pringle et al., 2022), manufacturing, cultural heritage, and retail. Interactive XR programs for stress management and relaxation often outperform conventional training (Döllinger et al., 2021). A keyword analysis—"simulation," "learning," "psychology," "cognition," "relief"—reveals a steady rise in XR research, underscoring its interdisciplinary momentum.

Debate continues over which modality—VR, AR, or MR—best supports mindfulness practice. VR's immersive enclosure shields users from external distractions, while peripheral Visual cues in XR can steer attention more subtly than audio prompts alone. AR enables overlaying calming Visuals or real-time biofeedback into actual spaces, and MR blends virtual and physical elements for seamless integration in everyday routines.

Yet designers must guard against unintended distractions: virtual avatars or absent bodily references can disrupt somatic awareness and self-monitoring. To maximize therapeutic benefit, XR experiences should minimize extraneous complexity, anchoring user attention to core cues and ensuring that each sensory element reinforces the intended restorative effect.

By thoughtfully combining tailored Multisensory stimuli with immersive platforms, XR technologies extend Nature-based stress interventions to populations and settings where direct Nature contact is limited, broadening access to proven restorative practices.

2.3.3 Advantages of Immersive Technologies in Stress Reduction Interventions

Automated digital platforms such as Virtual Reality (VR) and Augmented Reality (AR) facilitate the execution and iterative refinement of repetitive therapeutic tasks. Unlike traditional interventions, VR and AR afford users the opportunity to engage, within the safety of their own homes, in controlled, head-mounted simulations that permit endless rehearsal of fundamental activities. Moreover, these environments can be engineered to maximize engagement and intuitiveness, thereby fostering a more enjoyable therapeutic context. From a research standpoint, VR systems inherently support fine-grained data capture, enabling precise monitoring of patient progress over time.

The convergence of immersive technologies and mindfulness meditation has yielded novel therapeutic modalities. Recent evidence indicates that meditation practices augmented by immersive virtual environments substantially outperform conventional clinical meditation protocols in terms of stress alleviation(Arpaia et al., 2022).

Exposure to natural environments confers well-documented psychological benefits, and a growing body of research has sought to determine whether similar effects can be realized through VR simulations of Nature. (Frost et al., 2022) conducted a quantitative investigation into the influence of virtual natural immersion on psychological well-being; their findings demonstrate significant reductions in negative affect, while adverse responses remained unchanged in frequency. Physiological indices of stress similarly exhibited modulation in response to virtual environmental exposure.

(Ojala et al., 2022) extended these insights by recruiting full-time knowledge workers—including professionals in design, engineering, education, research, and administrative support—to participate in a triphasic experimental protocol. Results revealed marked reductions in subjective stress across multiple measures. Complementary work by (Jeon et al., 2022) showed that Audio Visual naturalistic videos facilitated more rapid emotional recovery from induced stress than either audio-only presentations or silence.

Sensory integration is fundamental to immersive experience. Vision, mediating information via the visible light spectrum (red to violet), is widely regarded as the preeminent sensory channel; photonic inputs reflecting off objects are transduced by the retina and interpreted by cortical structures. Auditory perception, derived from mechanical pressure waves, informs both emotional states—eliciting joy in response to familiar voices or music—and survival behaviors by signalling hazards (e.g., alarms, whistles, horns).

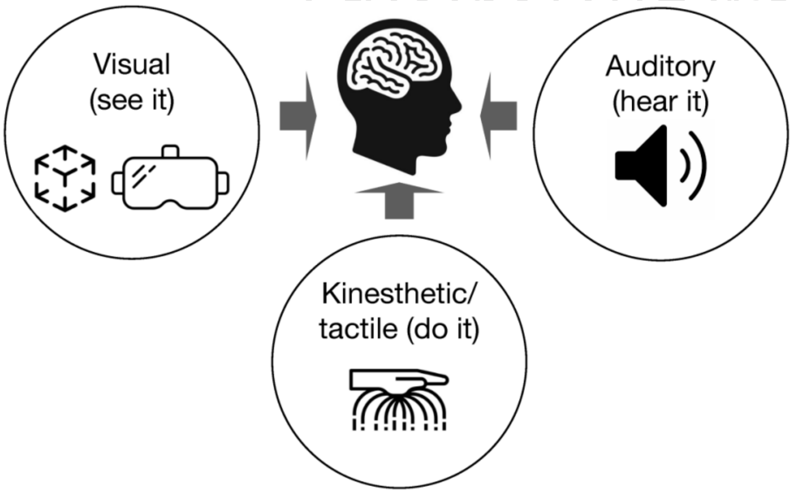
Despite these advances, most VR and AR applications remain confined to Audio Visual stimuli, neglecting the full spectrum of sensory modalities that characterize real-world experience. While the tandem design of Visual and Auditory elements in immersive applications is well-established and demonstrably effective for attention restoration and stress mitigation, reliance on only two channels may constrain ecological validity.

Indeed, empirical studies suggest that merely intensifying uni- or bimodal stimuli can skew user responses, potentially undermining the intended effect. Therefore, the integration of sophisticated perceptual design principles—or the invention of novel Multisensory fusion techniques within immersive spatial frameworks—is paramount.

Emerging immersive Multisensory environments (IMEs), which combine Visual, Auditory, Tactile, and Olfactory cues (see Figure 21), exemplify the next generation of experiential paradigms. (Melo et al., 2022) report that such multimodal designs not only enhance viewer immersion but also contribute to significant reductions in anxiety.

Figure 21

Multisensory learning approach involving vision, hearing, kinesthetics and touch - VAKT feedback.



Source:(Sanfilippo et al., 2022)

2.3.4 Case Studies on Immersive Experience Design

With the rapid development of digital health technology, Immersive Technology has shown unprecedented potential in the field of mental health intervention. Especially in metropolitan areas, the prevalence of mental illnesses such as anxiety and depression is increasing due to high-intensity work and environmental stress, and modern society is facing an increasingly serious mental health crisis, which urgently requires creative solutions. Against this background, digital Nature-based healing applications have evolved to provide consumers with a fast and effective psychological recovery experience through immersive digital Nature environments.

In this paper, from the perspective of experience design, we systematically examine the current mainstream VR naturopathy software and examine its basic technical features, healing mechanisms, and application results. Digital healing is fundamentally shifting from technology-driven to experience-driven. Early digital healing applications mainly focused on the realization of technical functions, and the systematic integration of user experience and psychological mechanisms was often neglected.

In recent years, healing software has adopted ideas from positive psychology and environmental psychology, emphasizing collaborative design across Multisensory channels, dynamic adaptation to physiological and psychological states, and the use of natural metaphors in human-computer interaction. In the field of mental health, this change has not only increased user acceptance of healing properties, but also promoted the development of immersive technologies.

In this paper, we cover various forms of intervention, such as immersive Nature experiences, mindfulness meditation, and art therapy, and select seven representative VR Nature Therapy applications (Table 4) for comparative analysis. By systematically analyzing the healing types, interaction techniques, core functions, and targeted diseases of these applications, we aim to find common design characteristics in digital healing and provide theoretical references for future research and application development.

It is interesting to note that, reflecting the advanced integration of technology and humanities, while these programs are technologically advanced, they also integrate contemporary psychotherapy ideas such as attention restoration theory (ART) and stress reduction theory (SRT) to various degrees.

Table 4

VR natural healing software comparison table

Application name	**Treatment type**	**Interaction method**	**Core functions**	**Applicable symptoms**	**Supported devices**
Nature Treks VR	Immersive Nature experience	Handle/gaze input	Dynamic exploration of 11 ecological environments	Anxiety disorders, attention deficit disorder; Stress relief, mood regulation; Fear of heights, risk taking disorders; Insomnia, chronic stress; Depression, anxiety disorders; Post-traumatic stress disorder (PTSD); Emotional imbalance, lack of concentration	Oculus/ Steam VR/PS VR
The Blu VR	Marine environment therapy	Spatial positioning interactio	Real-time interactive	Anxiety disorders, attention deficit disorder; Stress relief, mood regulation; Fear of heights, risk taking disorders;	HTC Vive/Oculus/Valve

		n	system for deep-sea creatures	Insomnia, chronic stress; Depression, anxiety disorders; Post-traumatic stress disorder (PTSD); Emotional imbalance, lack of concentration	Index
Everest VR	Exposure therapy	Handle navigation + somatosensory simulation	Altitude gradient adaptability training	Anxiety disorders, attention deficit disorder; Stress relief, mood regulation; Fear of heights, risk taking disorders; Insomnia, chronic stress; Depression, anxiety disorders; Post-traumatic stress disorder (PTSD); Emotional imbalance, lack of concentration	PSVR/ HTC Vive
Guided Meditation VR	Mindfulness meditation	Voice command + gesture recognition	Guided breathing training for 30+ scenes	Anxiety disorders, attention deficit disorder; Stress relief, mood regulation; Fear of heights, risk taking disorders; Insomnia, chronic stress; Depression, anxiety disorders; Post-traumatic stress disorder (PTSD); Emotional imbalance, lack of concentration	Oculus/ HTC Vive
TRIPP VR	Neural Visualization meditation	EEG biofeedback + eye tracking	Brainwave-driven generation of abstract natural landscapes	Anxiety disorders, attention deficit disorder; Stress relief, mood regulation; Fear of heights, risk taking disorders; Insomnia, chronic stress; Depression, anxiety disorders; Post-traumatic stress disorder (PTSD); Emotional imbalance, lack of concentration	Multi-platform + external biosensor
Tilt Brush by Google	Art expression therapy	6DoF spatial painting	Creative construction of three-dimensio	Anxiety disorders, attention deficit disorder; Stress relief, mood regulation; Fear of heights, risk taking disorders; Insomnia, chronic stress; Depression, anxiety disorders;	Steam VR/Oculus

			nal natural elements	Post-traumatic stress disorder (PTSD); Emotional imbalance, lack of concentration	
SoundSelf	Sound and light resonance therapy	Voice input + Visual feedback	Harmonic resonance to generate mandala landscapes	Anxiety disorders, attention deficit disorder; Stress relief, mood regulation; Fear of heights, risk taking disorders; Insomnia, chronic stress; Depression, anxiety disorders; Post-traumatic stress disorder (PTSD); Emotional imbalance, lack of concentration	Oculus/ HTC Vive

Note. Collected and compiled by the researchers. (2025)

A thorough investigation of the seven VR natural therapy programs (Table 5) provided a deeper understanding of the advantages and disadvantages of each application in various fields. TRIPP VR, which represents a development in the digital therapy field, stands out in terms of immersion, interaction complexity, biofeedback support, wide range of target symptoms, and multi-platform compatibility, providing users with a high-quality therapy experience.

Table 5

Comparative analysis of immersive natural healing software

Application name	**Immersion**	**Interaction complexity,**	**Biofeedback support**	**symptom breadth**	**multi-platform compatibility**
Nature Treks VR	4	2	1	3	5
The Blu VR	5	3	2	3	4
Everest VR	4	4	2	2	3
Guided Meditation VR	4	3	3	4	4
TRIPP VR	5	5	5	5	5
Tilt Brush	3	5	1	2	4
SoundSelf	4	4	4	3	4

(Rating instructions (1-5 points): Immersion: Evaluate the immersive experience of vision, hearing and other senses. Interaction complexity: Evaluate the complexity of the user's interaction with the application. Biofeedback support: Evaluate whether the application supports biofeedback such as EEG. Symptom breadth: Evaluate the range

of mental health symptoms that the application can be applied to. Multi-platform compatibility: Evaluate the number of VR device platforms supported by the application.)

Note. Collected and compiled by the researchers. (2025)

Blu VR's perfect immersion and spatial interaction capabilities allow users to interact with deep-sea creatures in real time, promoting emotional control and stress relief. For the care of insomnia and chronic stress, Guided Meditation VR offers guided breathing exercises for multiple scenarios.

Nature Treks VR excels in terms of immersion and cross-platform compatibility, but is relatively inferior in terms of interaction complexity and biofeedback support. It mainly relies on controller or gaze input, making it suitable for users with anxiety and attention deficit. Everest VR offers altitude gradient adaptation training, which can also be applied to fear of heights and adventure-related disorders, but has limited platform compatibility.

Google's Tilt Brush, with its 6DoF spatial painting function, allows users to creatively construct three-dimensional natural elements, which is useful as an adjunct therapy for post-traumatic stress disorder (PTSD). Sound Self combines voice input and Visual feedback to generate mandala-like landscapes through harmonic resonance. It is suitable for users with emotional instability and attention deficit, and also performs well as biofeedback support.

Based on the analysis results and related research literature, VR Nature Therapy software developed to meet the mental health needs of online office workers should focus on displaying natural environments and basic interaction techniques. Comparative data shows that programs such as Nature Treks VR and Guided Meditation VR perform better in terms of immersion and the range of target symptoms while reducing the complexity of interaction, making them suitable for users to quickly reach a state of relaxation in a short period of time.

These programs provide guided meditation and breathing exercises in various natural environments such as mountains, beaches, and forests, helping users relax and improve their focus. Research has proven that virtual Nature environments have a significant therapeutic effect in emotional intervention and cognitive training, especially due to their strong impact on emotional control. In addition, they have also been found to be very effective in recovering from physiological stress responses, and virtual Nature has been shown to effectively reduce negative emotions and enhance positive emotions. Therefore, VR naturopathic software should focus on displaying natural landscapes and designing simplified interaction methods to provide an effective and convenient relaxation experience, which can meet the mental health needs of online office workers. As technological development and the diversification of user needs mutually influence each other, it is predicted that VR naturopathic software will become even more important in the field of mental health in the future.

2.3.5 Summary

Stress problems in modern workplaces are becoming more and more prominent, especially for Internet industry workers. Time and spatial constraints often make it difficult to apply traditional stress intervention methods. This chapter systematically investigates Immersive Technology and Multisensory design to reveal the special relevance of these technologies in stress reduction in office environments. These technologies, such as Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), provide creative ways to reduce stress by imitating or improving sensory experiences. Research has shown that Immersive Technology not only protects consumers from external disturbances, but also directs their attention throughout a well-crafted virtual space, promoting psychological healing.

The development of multimodal experience technology is opening up further possibilities for stress reduction. Although traditional Audio-Visual stimuli have been shown to be effective in stress reduction and attention restoration, single-sensory stimulation methods have obvious limitations. For example, combining touch and scent not only enhances immersion but also stimulates other brain neural pathways, improving therapeutic effects. However, the complexity of Multisensory design also brings difficulties. Too much stimulation can cause sensory overload and reduce the effectiveness of the intervention. In addition, individual differences such as dependency on technology and cybersickness are also important issues that must be ignored.

The main advantage of Immersive Technology is its customizability and versatility. Unlike natural therapies, virtual spaces can provide therapeutic experiences to consumers anytime and anywhere without being tied to a physical location. For example, simulating natural scenes such as beaches and forests has been found to dramatically reduce cortisol levels in Audio Visual combinations. However, current research has not fully explored Multisensory integration, especially in office environments where the methodological framework has not yet been established.

2.4 Application of User Experience (UX) Design Principles in Multisensory Design

Many people consider user experience as a kind of experience. As in, "experience is a highly dynamic, complex, and subjective phenomenon." And it mainly depends on the context of the related activity. The overall effect that a user feels before, during, and after interaction with a product or system in an ecosystem is called user experience. Over the past two decades, technology has developed to facilitate social and collaborative use by multiple users. Smartphones and tablets have grown into fairly widespread technologies, as they are typically used for a variety of social purposes. Social media has gradually grown into a very popular medium that permeates many people's daily lives. In the design field, User-Centered Design (UCD) and User Experience (UX) techniques are increasingly being applied (Abbott, 2020).

Many studies on human-computer interaction have shown that interaction is at the intersection of User Experience (UX) (Fleury & Chaniaud, 2024) and Interface Design (a). From the end-user's perspective, interaction is crucial because it shapes the learner's view of usability and the relevance of the technology in achieving learning goals. The former is mediated by technology, while the latter is defined as "the meanings, actions, perceptions, emotions, insights, and social sensitivities that arise in the context of the interaction and its results." With the introduction of artificial intelligence and the widespread use of digital environments and virtual worlds, interactions in the virtual world are becoming increasingly dynamic. The metaverse, aimed at appreciation, learning, entertainment, and cultural dissemination, is an extension of experiential communication from two dimensions to multiple dimensions. The modern technological environment is merging socio-cultural communication spaces with the entry into experiential environments. This experience revolves around the participation of "humans" in a virtual world. People immersed in an activity enter a state of total isolation in the virtual world and get an immersive experience. As research progresses and technology develops, scientists have begun to investigate how user experience impacts various environments.

2.4.1 User Experience Design in Office Spaces

Multisensory architecture has evolved with the rapid advancement of building technology and the rise of new architectural needs. Phenomenology shaped this popular concept of Multisensory architecture in the 1990s through Multisensory experiences. Historically, architecture has been experienced primarily through the senses, but Finnish architect Juhani Pallasmaa has stated that "architectural experience is Multisensory. Qualities such as space, materiality and scale are equally measured by the eyes, ears, nose, skin, tongue, bones and muscles." Some studies emphasize the need for other senses in architectural experience and support the criticism of designs centered on Visual images. Some studies present a wide and advanced multimodal approach to the built environment. Other studies investigate the relationship between Multisensory environments and emotional experiences, pointing out that the interaction between the body and environmental cues is a fundamental element in generating emotional experiences, which in turn improves the quality of indoor experiences. Environmental cues provide different types of emotional experiences and Multisensory environments. The smooth integration of originally independent data on internal and external, social and non-social stimuli shapes perception. In sociology, philosophy, psychology, physiology, and neuroscience, sensory perception has been widely studied, including topics such as decision-making, mental imagery, forms of perception, and perceptual outcomes. For example, there are studies on indoor environments such as temperature, humidity, wind speed, noise, air quality, and illuminance (Felgueiras et al., 2022). There are already studies on the relationship between architectural space and sensory perception, and why sensory experiences in architectural spaces affect human behavior. In architectural phenomenology, human senses create the presence of place. At first glance, the world presented to us through our senses and our daily lives seems to be the world we know best. However, feedback from many sensory stimuli such as light, color, shape, and three-dimensional form combine into a whole spatial image of the built environment to understand sensory perception. On the other hand, space can affect human senses, and there is a special connection between stimuli, perception, and behavior in the built environment.

The concept of "perceptual interventions," which studies how space affects human senses, suggests that treatments to change behavior may not be effective unless they increase people's awareness of their surroundings. Appropriate design elements can help to enhance certain perceptual characteristics. Moreover, perceptual interventions have a very direct connection with enabling technologies. Perceptual interventions and perceptual enhancements can be utilized as tools to improve the quality of indoor environments. Architectural perceptual design can improve both positive and negative impressions, creating more intelligent and accurate multimodal architecture. However, little research has been done so far on the perceptual mechanisms by which sensory inputs interact in architectural experiences. Materiality as an environmental stimulus can enhance spatial experiences through physical interactions. In this way, materials can define indoor environments and directly trigger sensory experiences. In relation to stimulating human sensory perception, sensory aspects that include "material connections" include texture, light, shadow, color, temperature, sound, and scent (Nitidara et al., 2022). The context of spatial cognition includes both sensory (bodily and kinesthetic) and emotional (emotions and memories). The interior spaces of multimodal intelligent buildings help overcome motor and social disabilities (such as motor delays and poor social skills) by providing interactive sensory experiences for learning, reading, working, resting and playing.

2.4.2 Application of User Experience Design in Creating Stress-Relief Environments

Architects, designers, and planners strive to create environments that are attractive to the people and communities they are intended to build for. Many studies have explored why a design is deemed "effective" or how it is perceived in an immersive environment space, using approaches such as developing multiple innovative virtual-based evaluation approaches, measuring various aspects of a place using complex 3D Geovisualization and community-based accessible methods, or formulating pre-occupancy Mixed Reality design evaluation strategies to promote better design outcomes.

Virtual Immersive Technology can significantly increase emotional engagement through its sense of presence. Users who feel fully "present" in the virtual world respond emotionally in exactly the same way as they would in the real world. In an immersive experience, Multisensory design can significantly increase the emotional response. By incorporating sensory feedback other than the traditional Visual and Auditory elements, users can feel more immersed(Arpaia et al., 2022). In other words, the more sensory dimensions that are stimulated, the stronger the sense of immersion. For example, Olfactory stimulation during a Virtual Reality Nature walk shows how much scent enhances consumer engagement as the experience becomes more interesting. Users of a multimodal experience created by spatial audio and haptic input can see different perspectives. Thus, the sense of immersion is greatly increased by using multimodal techniques.

Developing a good user interface for an immersive virtual environment has different characteristics and difficulties than traditional 2D interface design. One of the main difficulties is developing a dynamic and simple experience in a 3D landscape that consumers are unfamiliar with. For example, controllers and gesture recognition require different user interface design techniques. Another key difficulty is balancing Visual realism and performance, as image quality affects the consumer's physical abilities and capabilities. To prevent user dissatisfaction and ensure understanding, it is important to address the cognitive limitations of VR interfaces and gain deeper knowledge. In addition, developing for a wide user base with different physical abilities and degrees of immersion increases the complexity of the UI design process. The dynamic Nature of immersive virtual worlds requires UI designs to constantly adapt to changing contexts and user states, creating additional challenges regarding responsiveness and consistency (Schott & Marshall, 2020).

2.4.3 Evaluating User Experience in Office Space Design

The evaluation of user experience in modern office space design is moving from traditional functional concerns to multidimensional and systematic research. This methodology essentially aims to reconstruct the interaction logic between people and their surrounding environment from the perspective of design research. Emphasizing user-centered spatial narratives, design research treats physiological responses, psychological perceptions, and behavioral patterns as a synthesis of spatial experience. For example, at the physiological level, the evaluation of stress hormones (e.g., cortisol) focuses not only on quantitative analysis but also on how environmental design, such as natural light, Visual green penetration, and soundscape construction, indirectly controls the balance of the autonomic nervous system. Research has demonstrated that Visually presenting a virtual natural environment significantly reduces sympathetic nervous system activity, while diffusing scents such as fir essential oil increases stress relief by 27% (Kim & Song, 2022). Reflecting the principle of "sensory layering" in design research, i.e., the overlapping of multiple sensory stimuli amplifies the user's immersion in the environment, this multimodal collaborative design supports the incorporation of cognitive abilities and emotions into spatial evaluation mechanisms from the perspective of psychological feedback. Standardized psychological scales (such as the Perceived Stress Scale) should be closely linked to design elements such as spatial aesthetics, color psychology, and material tactility. For example, designs with zone patterns and gradual color gradients can increase concentration and reduce anxiety levels, but frequent Visual interruptions, such as dense screen lighting, in open-plan office environments can worsen cognitive load. Furthermore, empirical results from cognitive function tests such as the digit symbol substitution task indicate that incorporating natural elements into the work environment, such as indoor green walls and dynamic waterscapes, may improve working memory stability. This result is in line with the paradigm of "biophilic design," which highlights the potential restorative power of natural metaphors in psychological well-being.

The dynamic interaction between the user and the space governs the behavioral element in the evaluation. By using IoT sensor networks to track staff movement patterns and dwell hotspots, designers can examine how spatial layouts affect privacy requirements and collaboration efficiency. For example, in one online company's lounge area, adding a "bamboo forest soundscape" and chairs with adjustable lighting resulted in a 40% increase in spontaneous employee gatherings, highlighting the design principle of "action-guided space" (Chen et al., 2024). User interactions with multimodal technology devices such as scent sequence controllers and desktops with haptic feedback reflect not only the usability of the technology but also whether the design effectively makes the technology undetectable within a natural experience. Google's "biophilic rest pod" is a good example. The seamless blend of the VR forest scene and seat vibrations allows employees to unconsciously regain focus, embodying "invisible design," which reflects the advanced goal of user experience evaluation.

However, evaluation from a design perspective also comes with certain challenges. The conflict between universality of design and individual differences is one of the main concerns. For example, some people show a strong preference for white noise at certain frequencies, while others reject scent-based designs due to Olfactory hypersensitivity (Doherty et al., 2024). Participatory design methods offer a solution. Through focus groups and co-creation workshops, users actively participate in the iteration of spatial prototypes, ensuring a design that is scientifically rigorous yet maintains human-centered flexibility. A failed startup case study showed that an over-reliance on Visual immersion and a neglect of Tactile input led to a fragmented user experience and increased dropout rates(Arpaia et al., 2022). This highlights the need for designers to maintain a harmonious sensory experience in the integration of technology.

User experience evaluation in office environments will soon move towards dynamic and intelligent systems. Machine learning-based environmental monitoring systems can automatically adjust lighting and ventilation equipment by analyzing real-time temperature, humidity, and sound pressure levels, creating a "perception and response" feedback loop. For example, one German company found that adding a dynamic water feature reduced anxiety levels by 18% through XR simulation testing (Stier-Jarmer et al., 2021). Such data-driven design not only maximizes spatial efficiency, but also changes the evaluation approach from static diagnosis to dynamic adaptability. In addition, the current lack of interdisciplinary evaluation criteria is urgently needed to improve. To ensure the scientific rigor and cross-industry compatibility of evaluation tools, a comprehensive framework including architecture, psychology, and interaction design (such as extending the ISO 9241-210 standard to the field of spatial design) must be built. Finally, evaluating office environments from the perspective of design research is fundamentally a dialectical practice between "human-centered logic" and "technical rationality". Designers are required to maintain a keen insight into the emotional needs of users while being deeply aware of the scientific limitations of sensory engineering. After all, the purpose of the clash between empirical research and artistic imagination is to create a future work environment that truly activates the mind and body.

2.4.4 Summary

This chapter considers the current status and development of user experience (UX) design in multimodal office environment design. Research has revealed that modern office space design has evolved from a focus on single functions to a multidimensional user experience by incorporating human-computer interaction into design theory. Multisensory design emphasizes the synergy of vision, hearing, smell, and touch, which significantly improves user satisfaction and reduces stress. For example, the combination of virtual natural scenery and plant essential oils has proven to be much more effective than Visual intervention alone. Although immersive technologies provide technical support, they need to be used carefully to avoid over-reliance on Visual input at the expense of other senses and creating a fragmented experience. In addition, UX evaluation systems are moving from mere functional evaluation to thorough real-time monitoring of physiological, psychological, and behavioral inputs. Future developments will focus on multimodal synchronization, dynamic interaction, and individual adaptation, even if, for example, fragmented norms and individual preferences remain issues. To balance technical rationality with human considerations and improve the mental and physical health of office environments, it is urgently necessary to build multidisciplinary evaluation frameworks, intelligent environmental control systems, and more comprehensive participatory design.

2.5 Multisensory Experience in Office Environments

2.5.1 Integrated Framework in Office Space Design

Previous studies have carefully documented the various benefits associated with contact with natural environments. The application of biophilic design, i.e., design that combines man-made spaces with Nature, has been demonstrated to enhance workers' health, well-being, and work efficiency. However, most studies on healing environments have prioritized the Visual appeal of natural experiences and ignored other sensory modalities. The importance of olfaction in the healing process has been largely ignored. Several studies have explored how the combination of Multisensory Nature experiences in office environments affects people. These studies have specifically investigated the restorative effects of integrating sensory elements such as sight, smell, and hearing, and the relative influence of each sensory element on the healing process (Di Giuseppe et al., 2024). The restorative effects of two workplace environments, one lacking natural elements and one offering a Multisensory Nature experience, were compared using a pre- and post-test experimental architecture. Research has shown that Multisensory biophilic offices have significantly improved cognitive function, reduced stress, and elevated emotional states compared to non-biophilic offices. A statistically significant correlation was found between olfaction and restorative effects. While Visual remains the primary tool for designing restorative work environments, the findings suggest that olfaction is crucial in the healing process. This study adds new insights to the growing body of knowledge in the fields of biophilia and architecture, providing empirical evidence of the important role of Olfactory cues in natural environments (Melo et al., 2022).

Research shows that while we spend most of our time (up to 90%) indoors, an increasing proportion of people living in urban areas are experiencing reduced contact with Nature. Alienation from the environment can have a significant impact on our health, well-being, and quality of life. Nowhere is this disparity more evident than in the workplace. According to a poll, more than half of office workers said their workplace lacked real plants and natural light. Employee well-being is seriously threatened by the lack of natural elements in the workplace, as well as poor indoor conditions (noise, uncomfortable temperatures, poor air quality, inadequate lighting, etc.) and work-related challenges (long working hours, chaotic work structures, unfavorable working conditions, etc.). These factors cause stress, fatigue, reduced productivity, and various psychophysiological and cognitive problems. However, according to the biophilia theory, contact with Nature is believed to help offset the negative effects of the office environment and urban life(Jutzi et al., 2025).

2.5.2 Design Strategies for Multisensory Experiences

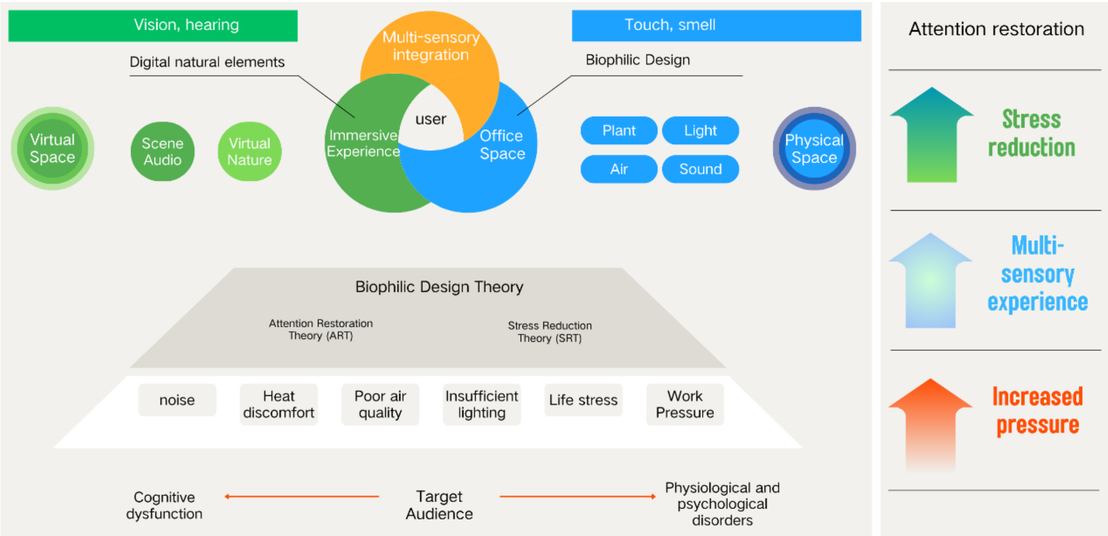
Studies that incorporate natural forms and features such as vegetation, daylight, window views, and natural materials into the workplace have shown benefits for employee health, well-being, and productivity. However, most research on biophilic design has focused on the Visual features of Nature encounters, and other sensory elements have been neglected. In particular, the relevance of Olfactory stimuli in the recovery process has not received enough attention. The basic idea of biophilic design is to stimulate outdoor experiences using sensory signals other than vision to connect people with Nature. Given the strong association between olfaction and mental health (e.g., emotions, memory, behavior, stress, and cognitive abilities), recognizing the Olfactory impressions of Nature is essential to fully understand the potential of biophilic design to create truly restorative and enriching environments (Figure 22).

The aim of this study is therefore to investigate the relationship between recovery effects and multimodal Nature experiences in industrial environments. In particular, we focus on how the three sensory modalities of vision, olfaction, and hearing interact and contribute to outcome measures. This study resolves a major contradiction by highlighting the often overlooked role of Olfactory stimuli in the recovery process. It enriches the field of biophilic design by improving our understanding of how multimodal Nature experiences, especially Olfactory stimuli, can improve the resilience of the workplace.

Especially in the face of the COVID-19 pandemic, which has generated questions about mental health and stress levels, much attention has been paid to studying the employment context. Employees gain a lot from Nature experiences in the office, including general well-being, mental health, mood, productivity, and job satisfaction. Studies have explored how various natural elements can be incorporated into the workplace environment, including vegetation, natural light from windows, natural lighting, natural simulations, natural ventilation, waterscapes, organic shapes, natural materials and colors, and Nature-inspired spatial configurations. However, most of the research on biophilic design has focused on the Visual aspects of the Nature experience, in some cases ignoring other sensory stimuli. While Olfactory stimuli have been largely ignored, the restorative power of Auditory stimuli remains understudied (Yildirim et al., 2024).

Figure 22

Multi-sensory experience design strategy framework



Note. Illustrated by the researcher.(2025)

Noise and poor acoustics have always been ranked as the main causes of disruption in the office. In particular, Audio Visual stimuli and connections with Nature are important in investigating 1) independent and interactive influences on the workplace soundscape, 2) physiological factors, and 3) possible relationships between physiological and soundscape responses. The first hints of biophilic design in the office environment come from Audio Visual stimuli related to Nature.

Although Nature is full of various scents, the sense of smell has been largely suppressed in biophilic design research. Yet, our emotions, memories, behaviors, tension, and cognitive abilities are greatly influenced by scent. This is mainly because the Olfactory system is closely connected to the limbic system (emotional system). In recent years, driven by the concept of the smellscape, there has been growing interest in how the sense of smell shapes human experiences in built and natural environments. Some studies have investigated the restorative effects of pleasant smells in many environmental settings, such as healthcare facilities, retail stores, and educational institutions, while others have explored how scents affect urban environments. Some have investigated the restorative potential of including constant Olfactory input in simulations or virtual worlds, and controlled laboratory studies have examined the psychological and physiological effects of specific odors (Spence, 2020).

2.5.3 Designing Multisensory Natural Environments in Office Spaces

Traditional mental health treatment has mainly relied on psychotherapy and pharmacological therapy. However, these methods have certain drawbacks, such as side effects and difficulty in access. Therefore, the search for non-invasive mental health treatment approaches has attracted more and more attention. The built environment and mental health have a complex and diverse interaction, and many elements of the physical environment affect a person's psychological health. By incorporating natural elements such as green spaces, daylight, and natural surroundings, a well-planned environment can help reduce stress and improve well-being. Our reactions and impressions are greatly shaped by the built environment. Whether these stimuli are stationary or moving, alone or in combination, the sensory inputs in the built environment have a significant impact on how a person perceives the indoor environment. Especially in the framework of an intelligent building environment, changing some aspects of the sensory stimuli can improve the overall impression of the built space.

Psychologically speaking, people have a natural urge to interact with the environment around them. Nature also provides humankind with cultural and social values. Erich Fromm empirically captured the passion people have for their surroundings and proposed the concept of biophilia. Biophilia theory defines the natural human affection as innate. Based on this theory, biophilic design aims to actively meet human needs by incorporating natural elements in various contexts. Incorporating natural elements into developed spaces helps relieve stress and mental fatigue. Biophilic design is supported by a strong evolutionary foundation and various design patterns. Research has shown that three categories can frame biophilic design: Nature in space, similarity to Nature, and the Nature of space, and they also help define biophilic architecture. Incorporating biophilic elements can not only help improve health and well-being, but can also lead to nurturing the relationship between humans and the environment. The philosophy of biophilic design has been utilized in many architectural sites in recent years, including educational facilities and hotels. In the future, office space design can combine spatial audio, smart lighting, and dynamic Visual feedback technologies from a design perspective to create a highly consistent multimodal experience and improve employee focus and comfort (Antonaci et al., 2024). The simultaneous incorporation of neuroscience technologies such as EEG monitoring and physiological feedback will enable a thorough evaluation of the impact of sensory consistency on the user's emotional and cognitive states, supporting customized optimization of office space design (Aristizabal et al., 2021).

The use of multimodal interaction technologies in office spaces marks a shift in design approaches from a focus on a single utility to an emphasis on holistic experience and emotional resonance. Early Virtual Reality tools were focused on technical aspects such as field of view and resolution. However, in recent years, the design community has placed more emphasis on how to maximize user experience through Multisensory integration(Bordegoni et al., 2023). his shift not only marks continued technological development, but also highlights the growing value of emotional expression and human-centered responses. For example, contemporary head-mounted displays have essentially shifted design from parametric concerns to experiential properties by incorporating design elements such as curved glass and flexible fabric straps to improve comfort when worn (Egger et al., 2024).

In parallel with this, Olfactory technology applied to multimodal design has produced great innovations. Based on situational awareness in the workplace, the Japanese company AromaJoin has developed a tabletop aroma device that can dynamically release lavender essential oil, adding a natural atmosphere to a standard office environment (Karan, 2019). In parallel with this, Olfactory technology applied to multimodal design has also produced great innovations. Based on situational awareness in the workplace, the Japanese company AromaJoin has developed a tabletop aroma device that can dynamically release lavender essential oil, adding a natural atmosphere to a standard office environment (Yildirim et al., 2024).

Research on the impact of the built environment on human behavior and mental health has become increasingly diversified in recent years, mainly focusing on Virtual Reality environmental simulation, the intervention mechanism of natural elements in improving creativity and stress control, and the use of biophilic design in healthcare environments. Empirical studies have shown that natural environments can greatly enhance designers' creativity (Chulvi et al., 2020), a and groups with different stress tolerances have very diverse needs regarding spatial arrangements and environmental characteristics (Xuan & Zhang, 2024). A meta-analysis also shows that Tactile surface textures and natural light can significantly improve patients' health (Tekin et al., 2023). As for Virtual Reality, even if multimodal, interactive, and immersive frameworks go beyond the constraints of traditional monosensory perception, their technical complexity still poses some difficulties for practical application (Lyu et al., 2023). In addition, a study on the effect of light intensity on stress recovery in a virtual forest environment revealed that a moderate brightness setting significantly reduces stress levels. However, comparative data with physiological responses in real natural environments is still lacking (Li et al., 2020). In the practice of Multisensory interaction, sensory congruence is regarded as a core factor that affects users' cognitive experience in virtual environments. When multiple sensory inputs, such as vision, hearing, and touch, are properly coordinated, the user's sense of immersion and emotional resonance can be significantly enhanced. Conversely, if there is a mismatch in sensory cues, such as a mismatch between Visual presentation and background sound effects, or between haptic feedback and the movement of virtual objects, the user's interactive experience may be compromised and the therapeutic effect of the entire space may also be reduced (Spence, 2022).

2.5.4 Case Studies on Multi-Sensory Design

Recent studies have shown that when wind sounds, dynamic lighting, and haptic inputs are highly synchronized in a virtual forest environment, users' tension and anxiety levels are significantly reduced (Yildirim et al., 2024). When virtual interactive items in an Augmented Reality (AR) environment properly coordinate Visual textures, Auditory effects, and haptic feedback, users' well-being is also significantly improved (Gao et al., 2024). Such improved sensory alignment, especially in high-stress work environments, not only improves the immersiveness of virtual experiences but also helps cognitive recovery and emotional control.

Sensory alignment is not only a technological need, but also has significant implications for human-centered care and cultural adaptation with interdisciplinary backgrounds such as natural medicine and multimodal digital technologies. Recent research suggests that traditional office spaces can be transformed into dynamic environments that provide resilience and emotional resonance while responding to the diverse needs of users from different cultural backgrounds through coordinated sensory stimuli (Bolliger et al., 2022; Fleury & Chaniaud, 2024; Spence, 2020). Future research should explore the integration of artificial intelligence and interdisciplinary technologies to make the most of sensory interaction mechanisms, enabling more personalized and effective spatial experiences and supporting a deep integration of design theory and practice.

However, in practice, the natural integration of multimodal digital technologies and Nature-based therapies remains challenging. It is necessary to satisfy the natural human desire for environmental exposure while avoiding the dangers that may be caused by sensory overload and technological abuse. This is particularly challenging in cross-cultural environments where perceptual responses to natural elements differ greatly, as design solutions require more cultural adaptation and technical soundness (Pollmann et al., 2023). Thus, exploring how to build a collaborative mechanism based on "technology experience culture" in an open-plan office environment not only has theoretical significance, but also has important practical value for improving the sustainability and health of modern workplaces.

Based on this premise, researchers used keywords such as "Nature-based healing," "biophilic design," "Virtual Reality," "augmented reality," "Mixed Reality," and "sensory interaction" to select excellent cases that demonstrate complete design and implementation track record, successful integration of technology and natural elements, and remarkable results in real office environments (Table 6).

Table 6

Analysis of the effects or feedback of multi-sensory techniques/naturopathic methods.

Case	**Technological Implementation (Multisensory Technology/Nature Therapy Approaches)**	**User Experience and Effects**
Case 1: Multisensory VR Simulation (Lyu et al., 2023)	Immersive Virtual Reality (Visual + Auditory + thermal Tactile); real-time interaction (walkable, interactive environment); thermal air device	Strong sense of presence, high immersion; significant relaxation effects; psychological and physiological responses vary notably with

	simulating microclimate	environmental changes
Case 2: VR Forest Light Environment (Li et al., 2020)	Virtual natural scene (forest) simulation; controlled lighting brightness levels (six light/dark conditions); immersive viewing via HMD headset	Moderate brightness scenes provide the best stress relief; overly bright or dark conditions are less effective; participants' subjective comfort is highest under optimal lighting
Case 3: Office Natural Elements Experiment (Chulvi et al., 2020)	Comparison of office environments with natural elements (real plants/simulated Nature) versus no natural elements; design task experiment method	Significant differences between environments with and without natural elements: natural element environments enhance design creativity; real and digital Nature have comparable effects
Case 4: Office Environment Resilience Survey (Xuan & Zhang, 2024)	On-site survey of six office buildings; interviews + questionnaires collecting spatial characteristics (rest areas, greenery, etc.) and user stress recovery evaluations	Rest areas provide the best recovery effects; high-stress individuals prefer quiet, private spaces, while low-stress individuals focus on environmental details; the impact of natural elements is relatively limited
Case 5: Biophilic Design in Maggie's Centres (Tekin et al., 2023)	Architectural space integrating Nature (large skylights and windows, indoor and outdoor gardens, natural materials such as wood); Multisensory experience (light, water features, fireplace, fragrance)	Reduced anxiety, increased well-being; the environment provides a sense of security and belonging, feeling "like home"; lighting and greenery are the most critical factors

Note. Collected and compiled by the researchers. (2025)

Through detailed comparative analysis of five representative case studies, the synergistic effects of Nature-derived healing and Multisensory digital technologies in open-plan office design were revealed. Overall, the case data indicate that both strategies play a positive role in reducing employee stress, enhancing well-being, improving concentration, and enhancing spatial satisfaction. As shown in Table 6, from Multisensory VR simulations to virtual forest lighting environments to real-world experiments with natural elements in the workplace, each case shows common features in both technical implementation and user experience. Whether through immersive Virtual Reality that recreates realistic natural scenes or through integrating real natural elements into physical spaces, these interventions significantly reduce users' subjective stress and physiological arousal levels while promoting emotion regulation and creative outcomes to various degrees. In case study 1, participants experienced a strong sense of presence and comfortable relaxation in the highly immersive Multisensory VR environment. In case study 2, it was shown that a virtual forest scene with moderate brightness was most effective, as lighting conditions that were too bright or too dark were not very conducive to stress recovery. Case 3 further confirmed that natural elements, regardless of their form, can stimulate designers' creative thinking. The investigation of Case 4 demonstrated that break areas as refreshment zones in office environments have a remarkable stress-relief function. Meanwhile, Case 5 showed that, from the perspective of biophilic design, integrating abundant natural light, greenery, and organic materials can create a homely and comfortable atmosphere, reduce anxiety, and increase users' sense of belonging.

Furthermore, Table 7 provides a comprehensive overview of each case in terms of research background, main findings, methodology, experimental techniques, research limitations, and future directions. Through the comparative analysis in Table 7, we can see that although each case employs different experimental approaches and technological tools, they all emphasize the importance of Multisensory experiences and interactions with natural elements.

Table 7

Case study based on digital technology and natural therapy

Case	Key Findings	Methodology	Experimental Techniques	Research Gaps	Future Research	Outcome Measures
Case 1: Multisensory VR Simulation (Lyu et	This paper proposes a new approach to integrate Multisens	- Integrate Visual, Auditory and thermal stimulati	Virtual Reality Headsets and Environments - Using Quartz	Lack of research on multimodal (Visual, Auditory, thermal)	1. Consider heat transfer devices in addition	1) Physiological response (galvanic skin response

al., 2023)	ory Virtual Reality (VR) technology into laboratory experimental processes to better understand human-environment interactions under multimodal conditions.	on into an immersive Virtual Reality environment - Enable dynamic interaction between participants and the virtual environment	Tungsten Halogen Lamps to Simulate Sunlight - Using an Array of Bladeless Fans to Simulate Airflow - Ambisonic Audio with Head-Related Transfer Functions for Spatial Audio	conditions in human-environment interactions - Lack of research on Multisensory simulations of outdoor/semi-outdoor environments	to the heat lamps and fans currently used to simulate thermal conditions. 2. Use HVAC systems or local humidifier devices to add humidity to MIVE simulations.	) 2) Cognitive performance 3) Subjective experience (perceptual response, restorative experience, emotion, sense of presence) 4) Behavioral response (movement and orientation in the virtual environment)
Case 2: VR Forest Light Environment (Li et al., 2020)	The bright virtual forest scenes (brightest, brighter, brighter) were more effective in reducing stress than	Virtual Forest Environment: A 400-meter circular path surrounded by common urban trees	Paced Auditory Serial Addition Task (PASAT) to induce acute stress - Biofeedback system to measure physiologic	The effects of different natural light conditions (from day to night) on stress resilience in forest environme	Use real-life video scenes as stimuli, rather than just computer-generated virtual environments,	1) Physiological response: skin conductance level (US) and blood volume pulsation (no

	the darkest night scenes.	created using VR simulation software	al responses (skin conductance level and blood volume pulse)	nts is an under-researched area that requires further investigation.	and collect illumination data to better investigate the dose-response relationship between brightness levels and stress recovery.	standard unit) 2) Psychological response: state anxiety measured using the Spielberger State-Trait Anxiety Inventory (STAI-S)
Case 3: Office Natural Elements Experiment (Chulvi et al., 2020)	Environments with natural elements (whether real or simulated) can increase the creativity of product design concepts compared to environments without natural elements.	An experimental design in which participants worked in three different environments (real Nature, simulated Nature, and neutral) to develop design concepts for three	Participants worked in 3 different environments: real Nature (outdoor garden), simulated Nature (indoor room with natural elements), and neutral (classroom)	The influence of natural environment on the creativity of design engineers in new product development	To study the effect of introducing design methods into research and analyze how it affects the problem understanding stage of the conceptual design process.	1. Number of design proposals 2. Diversity of design proposals 3. Novelty of the selected design proposals 4. Quality of the selected design proposals

		different design problems.				
Case 4: Office Environment Resilience Survey (Xuan & Zhang, 2024)	Occupants with high stress tolerance (H-ST) paid more attention to different types of office spaces for repair, while occupants with low stress tolerance (L-ST) paid more attention to specific environmental details.	Field surveys and interviews in six office buildings in Hefei, China, to identify environmental factors associated with mental health and recovery	Investigating restorative environment design in offices through interviews and questionnaires	Exploring differences in combining physiological and psychological measures to assess resilience	1. Combine physiological and psychological indicators to more comprehensively evaluate the differences in recovery. 2. Expand the sample size and include other professional groups besides the relevant practitioners in the research design.	Users' subjective perception of the restoration quality of office space environment (workspace, leisure space, toilet space)
Case 5: Biophilic Design in	Biophilic design parameters such as light,	Conduct a scoping search to identify relevant	Systematic search strategy - Analytical data	Need for original data specifically targeting	Obtain original data from studies specifica	Not mentioned (this article does not

Maggie's Centres (Tekin et al., 2023)	greenery, and natural materials were found to be essential in promoting health and well-being in the non-institutional treatment environment of the Maggie's Center.	literature and design a review protocol - Systematic search of 6 databases using specific search terms	extraction and categorization - Interpretive analysis using an inductive approach using open coding - Use of qualitative analysis software (NVivo)	testing the value of biophilic design	lly focused on biophilic design to provide more rigorous results. Integrate analyses from clinical and nonclinical settings and compare study results with objective scientific data on the effects of biophilic design on humans.	report any primary outcomes or endpoints measured in the empirical studies)

(This table provides a comprehensive overview of the research background, key findings, methodology, experimental techniques, limitations, and future research directions of the five cases in the integration of digital technology and Nature-based experiences.)
Note. Collected and compiled by the researchers. (2025)

In case 1, we utilized multimodal sensors and dynamic interaction technologies to systematically collect physiological, behavioral, and subjective experience data, demonstrating the potential of digital technology to reconstruct the natural experience. In case 2, through a rigorously designed experiment, we explored the subtle effects of light intensity on stress recovery, highlighting the lack of research on light regulation in virtual environments. In case 3, we compared the impact of real and simulated natural environments on design creativity and found that they were comparable in stimulating creative thinking. In case 4, we used questionnaire surveys and interviews to explore the different recovery needs of groups with different stress tolerances, providing empirical evidence for individual adjustments in future office space design. In case 5, we used a metasynthesis approach to summarize the key parameters of biophilic design and revealed further research opportunities in integrating qualitative and quantitative data.

Overall, these findings indicate that the integration of Nature-based healing and Multisensory digital technologies has significant benefits in enhancing the health and human-centeredness of office environments. At the same time, the analysis also reveals challenges regarding technology implementation, user adaptability, and synergy effects of Multisensory digital technology in open-plan workplace design and natural therapy. Through a detailed comparative study of five sample situations, the case data generally show that both approaches help employees reduce stress, promote well-being, improve concentration, and increase spatial satisfaction. From Multisensory VR simulation to virtual forest lighting environment to actual trials with natural elements in the workplace, each case shows common features in both technology execution and human experience, as shown in Table 6. These interventions, whether by immersive Virtual Reality that reproduces realistic natural scenes or by integrating real natural elements into the physical environment, significantly reduce users' subjective stress and physiological arousal levels and promote emotion regulation and creative output to various degrees. In case 1, subjects felt very present and relaxed in a highly immersive multimodal Virtual Reality environment. In case 2, we found that virtual forest images with moderate brightness were most effective, as lighting conditions that were too bright or too dark were not conducive to stress recovery. Case 3 further examined how natural elements in all their forms can stimulate designers' creativity. Case 4 study revealed that rest areas as rest zones in the workplace have a clear stress-relieving effect. Case 5 showed that, from the perspective of biophilic design, the combination of sufficient natural light, vegetation, and organic materials could create a home-like and calming environment, reduce anxiety, and increase users' sense of belonging. Furthermore, Table 7 provides a detailed summary of all the cases in terms of the research background, main conclusions, approach, experimental tools, research constraints, and future directions. The comparative analysis in Table 2 reveals that, despite the use of diverse experimental strategies and technological equipment, the cases all emphasize the need for Multisensory experiences and connections with natural elements.

In case study 1, dynamic interaction techniques and multimodal sensors were used to systematically collect physiological, behavioral, and subjective experience data, demonstrating the potential of digital technologies in replicating natural phenomena. In case study 2, we highlighted the lack of research on light control in virtual environments and investigated the subtle effects of light intensity on stress recovery through a carefully designed experiment. In case study 3, we compared real and artificial natural environments in terms of their impact on design originality and verified their equivalence in stimulating creative thinking. In case study 4, questionnaire surveys and interviews were used to explore the diverse recovery needs of groups with different stress tolerances, providing empirical data for individualized responses in the design of the next office building. In case study 5, we further demonstrated the potential of research integrating qualitative and quantitative data by describing the main criteria of biophilic design using a metasynthesis approach

These results suggest that the combination of Multisensory digital technologies and natural therapies can bring significant benefits in improving the health and human-centeredness of office environments. At the same time, the study also reveals continuing difficulties in cross-cultural design, user adaptability, and technology application.

A consistent conclusion is that the integration of Nature-derived healing elements and Multisensory digital technologies plays a significant positive role in improving the office environment. Although the various technological approaches have different emphases, digital methods show notable advantages in scenario switching and interactivity, while physical Nature interventions offer unique advantages in long-term stability and a sense of belonging to the environment. This is evident from the detailed analysis of the research background, main findings, experimental techniques, and methodology of the cases shown in Tables 6 and 7.

At the same time, the impact of cultural and individual differences on design effectiveness is highlighted, so future design plans should provide both cross-cultural adaptation and customized personalization. The study also highlights many limitations in current practice, including device comfort, long-term effects, ethical privacy issues, and data collection techniques. These difficulties provide useful theoretical justification and practical directions for future research in the areas of intelligent sensory interaction, customized spatial adjustment, and interdisciplinary collaborative design. Within the framework of multidisciplinary integration, this study not only provides new design pathways for improving employees' mental and physical health and work performance in modern office environments, but also provides strong theoretical justification and practical inspiration for the next generation of office space design.

2.5.5 Summary

With the changing health consciousness in modern urban workplaces, design research is moving from individual function optimization to systematic experience construction. This chapter identifies three basic propositions: perceptual quantification criteria of natural elements, narrative logic in the collaboration of physical and virtual spaces, and a dynamic stress response assessment model that integrates theories of environmental psychology, digital interaction, and ecological aesthetics in dense office environments. Effective therapy design should break the paradigm of Visual dominance by activating and reconstructing human-Nature interactions through Multisensory layering. Visual penetration should maintain the visibility of green plants at 18-25%, soundscape design should incorporate natural white noise at 45-55 dB, and Olfactory stimulation should utilize the gradual release of volatile compounds to create a non-intrusive sensory immersion. The integration of Virtual Reality technology based on the narrative consistency of virtual and real spaces has redefined the spatiotemporal flexibility of natural experiences. The deep layers of the virtual projection need to be dynamically aligned with the Visual axis of the physical space, and the rhythm of light and shadow should be linked to the human circadian cycle. The adaptive treatment unit created by this "extended nativeness" paradigm allows staff to participate in an immersive recovery experience through divided work intervals. The originality of the evaluation system further highlights the value of data-driven design by building a closed-loop optimization system of "spatial response-physiological feedback-performance output" through eye tracking, behavioral pattern analysis, and adaptive environmental adjustment.

This study highlights the need for recovery design to tolerate local natural symbols and customized sensory thresholds, while also showing the moderating effects of cultural cognition and individual differences. Future innovations will focus on the integration of invisible technology. Smart materials and adaptive interfaces will erase the presence of gadgets, allowing digitized natural elements to play a silent role in the spatial narrative. This "minimal intervention" approach redefines the function of technology and achieves a dynamic balance between environmental performance, spatial efficiency, and human experience, providing a scalable, health-oriented design framework for high-density office environments.

2.6 Related Literature Review

2.6.1 From Basic Concepts to Practical Applications

Suman Dutta's "The Immersive Realm of Augmented Reality" (published in 2024) is a monograph that thoroughly explores the history, evolution, and cross-disciplinary applications of Virtual Reality (VR), Augmented Reality (AR), and Extended Reality (XR) technologies. The book delves deep into how these innovative ideas are changing the future in various fields, highlighting the possibilities and challenges of Immersive Technology. Highlighting the applicability of VR, AR, and XR to various fields, the book begins by outlining the basic ideas of Immersive Technology. By systematically analyzing the concept of "presence" in the virtual world, Suman Dutta uncovers the psychological concepts that deeply affect immersive experiences and provides a theoretical foundation for the development of next-generation technologies (Dutta, 2024).

In the field of immersive experience design, Suman Dutta explores how to build efficient user interfaces and interaction designs to ensure a natural connection between technology and users. In particular, the section on the evolution of Virtual Reality hardware provides an overview of its development from early prototypes to today's advanced devices, highlighting the profound impact that hardware evolution has on immersion and user experience. The paper explores how artificial intelligence (AI) can be used in AR, VR, and XR, and points out that through real-time data analysis and behavioral prediction, AI technology can enrich immersive experiences as well as improve intelligent interactions in virtual worlds.

Furthermore, Suman Dutta examines the opportunities and challenges in the commercialization of AR, VR, and XR technologies, highlighting their great potential in areas such as gaming, entertainment, and advertising. In discussing application areas, Dutta highlights the creative use of AR, VR, and XR, especially in education and healthcare. Virtual surgical simulation and telemedicine are gradually gaining popularity as practical options in healthcare. Immersive learning environments provide students in the education sector with a completely different and interactive learning opportunity.

The paper also addresses ethical issues in the useful implementation of Immersive Technology, highlighting the need for developers to consider privacy, data security, and other important issues foremost in the design process. Through 3D modeling and user interface design, the book offers useful advice and provides essential technical assistance to developers, especially those developing VR apps using platforms such as Unity.

2.6.2 User Experience Design in XR Environments

Cornel Hillmann's book "UX for XR: User Experience Design and Strategies for Immersive Technologies" aims to comprehensively explore user experience design in Virtual Reality (VR), Augmented Reality (AR), and Extended Reality (XR). As immersive technologies change rapidly, designers are increasingly being asked to create creative interaction models and UX strategies that are appropriate for these new platforms. This book helps designers, developers, and strategists to understand and implement design ideas specific to XR environments to maximize XR experiences.

The book begins by examining the special possibilities and challenges of XR experience design. In particular, XR design requires designers to create more complex spatial interactions and a higher degree of immersion compared to traditional 2D screen-based interactions in order to allow people to interact with the digital world naturally and intuitively within a virtual environment. Furthermore, the book emphasizes that user experience design in an XR environment is not just about interfaces and functionality, but about creating an immersive sensory experience (Hillmann, 2021).

In his talk on spatial interaction, Cornell Hillman states that XR technology is at the heart of spatial awareness in design. Designers who use spatial interaction must consider the user's movement, movement, and perspective changes in three-dimensional space, not just traditional graphical interfaces. Careful design can give users a more natural experience of operation. Especially in Virtual Reality (VR), spatial orientation and user behavior patterns are primary considerations in design.

Unlike traditional screen-based interactions, XR experiences enhance immersion through multimodal stimuli, including touch, sound, and vision. Hillman's book also touches on the concept of sensory input and interaction "beyond the screen." To increase user engagement and realism, designers need to create various types of interactions, including motion control, haptic feedback, and Auditory feedback. Therefore, designers need not only to be experts in the latest hardware and technology, but also to understand how multimodal contact shapes emotional experiences.

In his Emotional Design part, Cornell Hillman emphasizes the important role that XR technology plays in creating emotionally rich user experiences. The strong emotional responses that come from immersive environments, storylines, and interactive elements in virtual and Augmented Reality make emotional design a key element of the field. Designers who want to create experiences that evoke emotional resonance while also fulfilling functional needs must first deeply understand the emotions of their users.

Finally, Cornell Hillman emphasizes the need for data-driven design by introducing an approach to user experience research in XR environments. By explaining how to conduct efficient user research and providing suitable testing strategies and tools for XR experiences, this book will help designers constantly improve their design process and ensure that the final product meets users' wants and expectations.

2.6.3 From Interaction Design to Application Development

The 2022 monograph "Virtual and Augmented Reality (VR/AR) Foundations and Extended Reality (XR) Methods" by Ralf Donner, Wolfgang Broll, Paul Grimm, and Bernhard Jung aims to provide readers with a theoretical foundation and useful approaches for Virtual Reality (VR), Augmented Reality (AR), and Extended Reality (XR) technologies. Establishing itself as an important reference in the VR/AR field, the book provides detailed analysis and approaches for experienced professionals, while also serving as an introductory guide for beginners(Jung, 2022).

The book explores how the reproduction and improvement of human sensory perception in VR/AR environments creates immersive experiences. It analyzes the ideas behind each technology and how it shapes the user experience, and provides a thorough description of the various input/output devices required for VR/AR, including head-mounted displays, sensors, tracking systems, and interaction controllers.

Another important theme of the book is interaction design. It highlights how natural user interfaces (NUIs), such as gesture recognition and voice control, can improve interactivity and user engagement in virtual worlds. With this in mind, the authors cover design concepts, user behavior in virtual environments, and interaction models, providing useful advice on interaction design.

There are also numerous case studies of VR/AR applications that highlight the widespread use of VR/AR technologies in education, healthcare, entertainment, and industry. Through these illustrations, readers can gain a deeper understanding of real-world VR/AR deployment situations and gain insightful practical experiences and design inspiration.

2.6.4 From Theoretical Foundations to Practical Applications of Sound Therapy

Published in 2022, Sound Healing: How to Overcome Tension and Anxiety by Farzana Ali examines how sound therapy can reduce anxiety and tension. Explaining how sound affects human mental and physical health, the book blends modern science with traditional therapy. The book also offers useful ways to practice sound therapy, which can improve the state of mind and body through sound (Ali, 2022).

The first chapter discusses the scientific basis of sound therapy, explaining how sound affects the physiological and psychological state of the body through vibration and frequency. Ali explains how sound therapy acts on the brain, promoting harmony and balance in the nervous system, relaxing the body, and reducing stress and anxiety. Through controlling physiological rhythms and promoting blood circulation, sound therapy not only acts directly on the cerebral cortex, but also promotes overall health.

Based on this foundation, the book covers various forms of sound therapy, including sound baths, vibroacoustic massage, and soundscapes. These therapies stimulate various parts of the brain using different sound frequencies and vibration patterns, resulting in deep relaxation and calming effects. The book particularly focuses on traditional instruments such as Himalayan singing bowls and tuning forks, which are widely used in sound therapy because they have special vibration frequencies that help reduce anxiety and elevate mood.

The book also highlights the effect of sound therapy in improving sleep, relieving physical discomfort, and reducing anxiety. With continued practice, sound therapy can effectively control the body's stress response system and help readers relieve daily stress. Ali further emphasizes that combining sound therapy with mindfulness and natural environments can enhance its effectiveness, increase its therapeutic effect, and extend its lifespan.

From a practical point of view, the author provides easy-to-follow methods and exercises for readers to incorporate sound therapy into their daily lives. These exercises include art therapy, breathing exercises, active listening, and more, all of which are effective ways to help relax the mind and reduce anxiety. Ali emphasizes that sound therapy is particularly suitable for people who are constantly under great pressure, as it is not only a therapeutic technique but also a kind of passive rest.

2.6.5 The Art of Smell

Larry Shiner's book Art Scents: Exploring the Aesthetics of Smell, published in 2020, explores the use of Olfactory art in contemporary art. By closely examining how scent is represented and perceived as an art form, Shiner presents readers with an interdisciplinary perspective, highlighting the importance of scent in artistic creation while also examining its aesthetic value and ethical issues (Shiner, 2020).

Defining Olfactory art and unraveling its diverse manifestations is one of the main challenges. Shiner points out that Olfactory art includes Olfactory aspects applied to art installations, environmental scents, theater, film, and even culinary arts, in addition to the production of perfumes and fragrances. Through these diverse art forms, scent is incorporated into traditional art exhibitions, commercial environments, and everyday life, transforming people's experience of art.

Shiner explores a series of questions Olfactory art raises in the dialogue between ethics and aesthetics. For example, the status of perfume as a work of art, and the use of body odor, environmental scents, and food scents in commercial and consumer culture have all sparked extensive ethical debate. The book explores whether scent is a mere extension of commercial and consumer means or whether it can be considered a fully-fledged creative expression. The author also emphasizes that Olfactory art must take into account emotional and social impacts in addition to sensory appeal.

Scheiner also offers a philosophical study of Olfactory perception, revealing how the human response to scents affects emotions and cognition, combining it with fundamental knowledge of Olfactory neuroscience. These theories and studies not only give a scientific basis to Olfactory art, but also enable the reader to understand the special role that scent plays in the human experience. From an interdisciplinary perspective, Scheiner shows how olfaction interacts with other senses and can be a powerful tool in creative expression.

2.6.6 The Development and Future Trends of Virtual Reality (VR) Technology

Published in 2019, Sheng Yi's monograph "Immersed in the Dream of VR" explores the basic concepts, historical evolution, enabling technologies, application scenarios, and future trends of Virtual Reality (VR), immersing us in the dream world of VR. The book thoroughly summarizes the technical nuances of VR and its wide range of applications across many fields, allowing readers to fully understand the multifaceted characteristics of this developing technology (Sheng, 2019).

The book first focuses on the four main characteristics of Virtual Reality: immersion, interactivity, conceptuality, and Multisensory perception. Virtual Reality provides consumers with a highly immersive experience, integrating multiple senses to allow people to immerse themselves in and resonate with the virtual environment according to their individual needs. The creation of Virtual Reality comes from imagination and design, and multimodal input further enhances user engagement and realism.

In terms of technology, this book provides a comprehensive overview of the key technologies that support Virtual Reality (VR), namely projection, display, ergonomics, and haptic interface technologies. These key elements, especially high-quality display devices and interface technologies, allow people to experience more natural and realistic virtual environments, and greatly influence the development of VR technology. Furthermore, in expanding the applications of VR, ergonomic design ensures the comfort and ease of use of VR devices.

This book examines the historical evolution of this medium, dividing VR into four stages: the imagination stage, the rise of the technology, the initial construction of the theoretical framework, and the final general application stage. The development of VR has not only attracted much attention in academic research, but has also steadily produced results in commercial use. With the continued development of technology, VR is rapidly spreading not only in entertainment, games, and filmmaking, but also in fields such as education, medicine, the military, and social interaction.

The author also considers the future of Virtual Reality, suggesting that technologies such as Augmented Reality (AR), Mixed Reality (MR), and computational reality (CR) will expand the limits of Virtual Reality. The future of Virtual Reality holds both possibilities and challenges, and with continued technological development, it is expected to become increasingly important in a variety of fields.

2.6.7 Learning Reference in the Field of Virtual Reality

Yizhe Zhang's monograph "A Virtual Reality Revolution Not to be Missed" in 2017 thoroughly explores the core, applications, and commercial potential of Virtual Reality (VR) technology. It not only examines the fundamental characteristics of VR, but also explores the future growth of VR from various perspectives: technology, industry, and market(Yizhe, 2017).

The book defines the main concepts of VR, emphasizing immersion as the fundamental element of the Virtual Reality experience. The author states that Virtual Reality provides a completely new sensory experience, breaking the limitations of traditional physical space by allowing users to freely explore and interact in a virtual environment. Users of VR technology can Visualize and interact in a world created entirely by a computer. This is a level of immersion that is unmatched by traditional media.

Technically, the book provides a thorough review of Virtual Reality hardware and software systems, such as head-mounted displays (HMDs), motion controllers, and sensors, as well as the current status and development of these tools. It also covers techniques such as graphic rendering, spatial tracking, and interaction methods used to create virtual environments. Yizhe Zhang examines the applications of VR in various fields, including education, entertainment, gaming, and film. As hardware constantly evolves, VR is finding more applications in entertainment and education, especially in games, where users can enjoy more participatory and immersive events. The book also heavily emphasizes the commercial potential of Virtual Reality. VR is not only a groundbreaking technology, but also highly valuable commercially. VR offers new opportunities in the entertainment sector, such as games, movies, and even theme parks. VR simulation virtual classrooms and labs in the education sector help students engage in immersive learning. VR offers creative ideas for psychotherapy and surgical training in the medical field. The book asserts that these technologies will drive the development of immersive experiences and also explores the convergence of Augmented Reality (AR), Mixed Reality (MR), and Virtual Reality (VR).

2.6.8 Intelligent Applications of Virtual Reality and Augmented Reality

Published in 2023 by Bao Jinsong and Wu Dianliang, "Virtual Reality and Augmented Reality" is a monograph with a special focus on the application and development potential of Virtual Reality (VR) and Augmented Reality (AR) technologies in the field of intelligent manufacturing. This extensive book covers the key concepts, application methods, and development approaches of VR/AR technologies. The book aims to provide a systematic technical manual to help readers understand and master these state-of-the-art technologies (Bao Jinsong, 2023).

Starting from the core concepts of VR and AR, the book explores the background and key concepts of the development of Virtual Reality and augmented reality. The authors clearly show how these two technologies overcome the limitations of traditional manufacturing technologies and bring significant improvements to the intelligent manufacturing field, and explain their immersive characteristics.

Then, we consider the 3D geometry representation and processing technologies that underlie VR/AR applications. The method of managing 3D model data is clarified by the method of processing polygon mesh and point cloud data, providing theoretical support for the construction of three-dimensional virtual scenes.

In addition, the authors also cover AR scene fusion techniques, with a particular emphasis on tracking techniques, camera calibration, and registration of virtual and real scenes. These discussions show how virtual and real world components can be combined to achieve realistic and participatory experiences.

In terms of graphics rendering, the authors provide a thorough explanation of the key stages of the rendering pipeline, including model, view, projection transformation, rasterization, shading, and texture mapping. Useful examples using tools such as Unity are used to show the path to photorealistic rendering.

The book also explains strategies for motion simulation and animation production, including how to generate dynamic scenes using keyframes and physics simulation, and how to build mechanism animations using kinematics simulation. The book establishes the technical foundations for dynamic interactive experiences in Virtual Reality (VR) and Augmented Reality (AR).

2.6.9 Introduction to Virtual Reality Technology and Application Guide

The textbook "Virtual Reality and Interactive Applications" by Zhao Feng focuses on Virtual Reality (VR) technology and its interactive applications. It is suitable for VR enthusiasts and professionals, but is mainly aimed at university students majoring in digital media, film and animation, game design, etc. This book comprehensively explains the basics of VR technology, development tools, modeling and design processes, and building immersive experiences through systematic theoretical explanations and practical case studies. It aims to enable readers to gain a deep understanding of VR technology and its useful applications in various scenarios (Feng, 2024).

This book covers the basics of Virtual Reality technology, including the definition of Virtual Reality, the development background, and main characteristics. The author discusses the diverse applications of VR in various fields, such as games, education, medicine, and military, and provides a thorough explanation of key VR technologies, such as stereoscopic display devices, tracking and positioning systems, interactive devices, and 3D modeling tools.

In terms of development and modeling, it provides detailed guidance on how to apply standard programs such as 3ds Max and Unity. In particular, the part on designing and building virtual scenes explains the standards and workflows of virtual environment development, and how to apply these tools in model generation, material design, texturing, rendering, etc. Through detailed operation guidelines, readers can learn how to design high-quality virtual environments and lay a solid foundation for the evolution of Virtual Reality applications.

In the part on virtual roaming and interactive design, the focus is on how users interact with Virtual Reality. This book covers approaches such as building interaction methods, creating virtual scenes, and applying scene transitions, helping readers master general interaction techniques and implement roaming systems in Virtual Reality applications.

This book also covers 3D panoramic VR production, including creating dynamic panoramas and capturing panoramic images, giving readers useful knowledge and experience in panoramic VR development. In particular, it clearly explains how to apply immersive interaction design development tools such as VRTK and SteamVR. Through in-depth case studies, you will understand how to implement these techniques in real-world projects to make your VR experiences more immersive and interactive.

2.6.10 Unity 3D Fundamentals and Development

The textbook "VR/AR Application Development (Unity 3D)" by Shi Hui, He Ling, and Huang Yingcui will be published in 2022, aiming to equip learners with the systematic skills required for Virtual Reality (VR) and Augmented Reality (AR) production. Using Unity 3D as the main development platform, the book gradually develops from basic knowledge to practical development, making it ideal for beginners interested in VR/AR technology as well as developers seeking deeper knowledge of Unity 3D development (Shi Hui, 2022).

The book starts with the basic concepts of Virtual Reality (VR) and Augmented Reality (AR), systematically explains the basic operations and interface of Unity, and thoroughly explains Unity's interface components, core functions, and resource management, providing a solid foundation for beginners to start their Unity journey. Through these first sections, readers can quickly become familiar with the development environment and prepare for further practical development.

In the Basic Operations section, the author also explains the commonly used components of Unity 3D, such as the physics engine, particle system, and animation system. This clearly shows the reader how to combine elements to create various effects in Virtual Reality (VR) and Augmented Reality (AR), including training based on examples. The book covers designing virtual landscapes, reproducing physical interactions, and improving the expressiveness of virtual worlds using particle systems. The purpose of the book is to familiarize readers with the basic technologies and development techniques of Unity.

The project creation section of the book introduces three real-life examples, showing how to build a full-scale virtual simulation project, build a landscape, and generate a panoramic view. Through these scenarios, readers can improve their development capabilities and effectively apply theoretical knowledge to real development. These projects cover not only the basic use of VR and AR, but also interactive design and building complex scenarios, allowing readers to gain practical project experience.

The authors focus on the mainstream devices and development platforms on the market, such as HTC Vive, Vuforia, and Shadow Creator MR glasses, to clearly explain the basic knowledge of VR/AR device interaction and project development process. Readers will not only learn how to use Virtual Reality (VR) and Augmented Reality (AR) apps on various devices, but also understand the unique features and development methods of each platform. This part will help readers understand the current mainstream VR/AR technologies and improve their practical application development capabilities.

2.6.11 Summary

The ten monographs, each with a different perspective, provide a bird's-eye view of the evolution of immersive experiences, Virtual Reality (VR), Augmented Reality (AR), and their interactive technologies from the perspective of cutting-edge contemporary researchers in technology and art. Embodying a grand vision of multidimensional experiences brought about by digital technology, these works are composed of academic articles that balance theory and practice, and exploratory articles that integrate interdisciplinary approaches. While providing detailed commentary on technical implementations, real-world applications, and aesthetic aspects of interdisciplinary art, the stories of the works complement each other and provide a detailed analysis of user experiences in future virtual environments.

Some works are composed based on a wide range of academic perspectives and delve deep into the core of immersive experiences and the disruptive changes brought about by new technologies. For example, "Immersive Realm of Extended Reality" and "Immersion: The Unmissable Virtual Reality Revolution" approach the topic from the perspective of technological foundations and future application prospects, respectively, and reveal how virtual worlds will reshape the human perspective through immersion and interaction. In these dialogues, the authors not only highlight the advances in VR hardware and software implementation, but also the revolutionary impact of immersive experiences on traditional entertainment, education, and business models, stimulating imagination and research into the possibilities of future digital life.

Parallel to this trend of interdisciplinary integration, there are also design-oriented works such as "UX for XR: User Experience Design and Strategies for Immersive Technologies" and "Art Scents: Investigating the Aesthetics of Smell and the Olfactory Arts." The former highlights the need for sensory engagement and emotional resonance as the boundaries between virtual and real become blurred, and explores how to build and maximize user experiences in virtual and Extended Reality environments. On the other hand, the latter focuses on the usually neglected sense of smell and highlights the interaction between digital technology and traditional art forms by exploring the artistic value and ethical issues of Olfactory art. These research findings highlight the wide range of possibilities offered by experience design and its important role in Multisensory integration.

In the field of technology implementation and application development, monographs such as "Virtual and Augmented Reality (VR/AR): Fundamentals and Methods of Extended Reality (XR)" and "VR/AR Application Development (Unity 3D)" provide thorough technical guidance and practical insights. From basic modeling, rendering, and animation to virtual interaction and hardware integration, each stage is painstakingly explained and verified with examples. A wide range of industrial application examples of virtual environments are presented, including education, entertainment, and manufacturing. On the other hand, with regard to engineering technology and system development, more emphasis is placed on "Virtual and Augmented Reality" and "Virtual Reality and Interactive Applications". These two books not only cover key technologies from theory to development process, but also provide project examples that show how digital technology can be transformed into useful solutions, bridging the gap between intelligent manufacturing and the digital transformation of industry.

In addition, Sound Healing: How to Use Sound to Relieve Stress and Anxiety highlights the potential of digital technology to transcend traditional health fields, including sound therapy. By analyzing the subtle interplay between sound waves and emotion control, the book presents the infinite possibilities of technological applications in the field of mental and physical health.

These ten books provide a panoramic perspective on the fusion of Virtual Reality, augmented reality, interface design, and sensory art. They highlight not only the creative power of digital technology but also the diversity and interdisciplinary fusion in useful applications, providing a solid theoretical basis and useful direction for future technological evolution and digital art creation.

2.7 Chapter Summary

Through the literature review presented in this chapter, we systematically investigated the latest research in related fields, including natural therapy, Augmented Reality technology, Multisensory experience technology, user experience design, and indoor office environment, and established a solid theoretical basis for this study. Regarding natural therapy, we investigated various therapies such as hydrotherapy, horticultural therapy, and forest therapy, as well as their mechanisms and effects in supporting psychological and physiological health. These studies show that natural therapy can significantly reduce stress, enhance emotional states, and improve overall health. Meanwhile, urban office workers have few opportunities to interact with Nature amid urbanization and busy lives. How to optimally utilize natural therapy in cities remains a major challenge.

We focused particularly on their creative activities in health and treatment settings, and investigated the development and deployment of Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) in the field of Augmented Reality technology. Previous studies have shown that virtual natural environments created with Virtual Reality can provide consumers with a highly immersive experience and reduce tension and anxiety. With the development of multimodal experience technologies such as spatial audio, scent diffusion, and haptic feedback, the reality and immersion of virtual environments are becoming even more intense, enhancing the user's therapeutic experience. However, research on how to combine these cutting-edge technologies with Nature-based therapy is currently scarce.

In terms of user experience (UX) design, we recognize that the success of immersive therapy systems depends heavily on good user experience. Analysis of successful cases reveals that user-centered design strategies can significantly increase product usage and satisfaction, improving therapeutic outcomes. We also investigated how indoor work environments affect employees' mental health and stress levels. Research has shown that perceived stress and work efficiency are directly correlated with physical aspects of the workplace, such as spatial arrangement, lighting conditions, and noise levels. Therefore, incorporating natural elements into the office or improving environmental design could be a good approach to reduce employee stress. By combining research in the specific fields mentioned above, we found both the creative contributions of this study and the current research gaps. Studies combining natural medicine with Augmented Reality technology to provide immersive therapy experiences using multimodal technology to urban office workers are rare, even though both have a strong research base. Furthermore, more advanced research is needed on the specific application and optimization techniques of user experience design in such systems. Therefore, the originality of this study lies in integrating natural medicine with advanced technology, exploring its application in urban areas, and providing a new technique to reduce stress for office workers.

Chapter 3

Research Methods and Process

3.1 Research Methodology

This study combines literature analysis, case study, questionnaire survey, depth interview, design development, and evaluation to conduct a mixed-method study to comprehensively understand the impact of improving the work environment on stress for office workers engaged in Internet business. This study examines the extent to which the integration of naturopathy and multimodal design can reduce stress for office workers. The quality of the research is evaluated using the facts, approaches, and tools applied in this project.

The researcher has created a framework diagram of the research process.

3.2 Research Subjects (Population and Sample)

3.2.1 Expert Introduction

1. 2 Digital Technology Experts
2. 1 Naturopathy Expert
3. 1 Environmental Design Expert
4. 1 User Experience Expert
5. 1 Psychology Expert

3.2.2 Target Audience

Preliminary research and observations suggest that many office workers working in modern urban environments face stress, anxiety, and mental health problems due to high-intensity work and hectic lifestyles. Therefore, the subjects of this study are set to be between 25 and 45 years old.

3.2.3 Sample Subjects

To ensure the diversity and representativeness of the sample in terms of gender, age, job title, and work experience, the researcher plans to randomly select 300 office workers from the targeted Internet companies and invite them to participate in the questionnaire survey. From this group, 40 volunteers will be randomly selected to participate in the experimental study. Participants will be recruited through invitations, referrals, emails, and other outreach methods to find individuals willing to participate in the experiment.

3.3 Research Tools

3.3.1 Research Tools

The purpose of this study is to create an innovative experience that helps reduce stress for urban office workers through an integrated design that combines natural therapy, immersive experience, and Multisensory design.

The research methods are as follows:

1. Literature Review

The literature review involves a series of steps to identify relevant literature. A systematic review is conducted on the history and development of natural therapy, Immersive Technology, Multisensory experience design, and spatial design. The types of literature include journals, monographs, master's theses, doctoral dissertations, websites, newspapers, and images. In this process, we analyze cases where tradition and innovation are combined, and explore the existing research scope, academic perspectives, gaps, entry points, main research foci, and research questions identified from the literature.

2. Case Study

The case analysis involves an in-depth investigation of a specific case and a thorough consideration of how to address related challenges. In this study, we focus on a case study that combines natural therapy and immersive Multisensory experience design, and conduct a case analysis. We will investigate how these cases address stress, anxiety, and mental health issues caused by high-intensity work and hectic lifestyles.

3. Questionnaire survey

A semi-structured questionnaire (including demographic information, perceived stress scale, job satisfaction scale, environmental awareness, etc.) will be developed and distributed to 300 subjects. The purpose of this questionnaire is to understand the office workers' sources of stress, their perception of the work environment, and their expectations of the simulated natural environment.

4. Expert interview

We will develop structured interview questions to conduct in-depth discussions with four experts in the fields of digital technology, natural therapy, spatial environment, and user experience. The purpose of these discussions is to explore appropriate integrated design approaches.

5. We will develop a questionnaire and submit it to the advisors and experts for review.

6. We will refine the survey tool based on the feedback from the advisors and experts.

7. We will prepare the final survey tool for data collection.

3.3.2 Tools for Evaluating Prototypes

The survey tools used for data collection include interviews, questionnaires, and behavioral observations.

1. Interview

Determine the theoretical basis and design principles of this study through interviews with experts in the fields of digital technology, natural therapy, spatial environment, user experience, and psychology.

2. Survey

Create a semi-structured questionnaire for employees aged 25-45 years old working in Chinese Internet companies.

3.3.3 Research Instrument Review

Three experts were invited to evaluate the survey tool.

The three experts are Associate Professor Wannaporn Chujitarom (PhD), Assistant Professor Donlaporn Srifa (PhD), and Assistant Professor Prangthong Changtham. (Figure 23) shows the expert review process to ensure the reliability of the research tool and the consistency of the study.

Figure 23
IOC Review

Note. Photo taken by a researcher.

3.4 Research Process

This study belongs to the research and development field.

The researchers divided the research process into three steps.

Step 1:

Academic papers on the use of naturopathy in reducing stress for urban office workers.

Academic papers and research data on the integration of digital technology and naturopathy to reduce stress for urban office workers.

Data on the use of Multisensory immersive experiences to reduce stress for urban office workers.

Academic papers on stress factors for urban office workers.

Create a semi-structured questionnaire for 300 subjects to collect preliminary information.

Study related cases that combine Multisensory experiences and naturopathy and collect related data.

Visit urban office environments to collect related information.

Design a structured interview and use the tool to interview six experts in related fields (digital technology, naturopathy, spatial environment, user experience, psychology) to collect information.

Step 2:

After obtaining the above information, organize and analyze all the data and establish guiding theories and design principles. Develop an initial concept proposal for a Multisensory immersive experience and submit it to advisors and experts for review and evaluation.

Revise the proposal based on feedback and suggestions from advisors and experts.

Step 3:

Develop a model that integrates Multisensory experience technology and natural therapy to help urban office workers reduce stress.

The experimental study is divided into two groups.

Group 1: 10 participants are invited to participate in the experience, and then a questionnaire survey is conducted using the survey tool.

Group 2: 30 participants are invited to participate in the experience, and then a questionnaire survey is conducted using the survey tool.

The researcher collects and analyzes interview data from participants in both groups.

Through this analysis, we summarize an innovative method that combines Multisensory experience technology and natural therapy.

3.5 Data Collection

The data collection methods for this study are mainly questionnaire surveys and interviews with experts.

3.5.1 Questionnaire Survey Data Collection

An anonymous online survey was conducted on individuals aged 25-45 who work for Internet companies in China. After the questionnaire responses, the collected data was analyzed.

3.5.2 Expert Interview Data Collection

The researcher conducted structured interviews with six experts in related fields.

The interview content was organized and analyzed, and the main findings were summarized.

3.6 Data Analysis

3.6.1 Quantitative Data Analysis

After collecting the questionnaires, data analysis was performed using the following steps.

1. Check the completeness of each questionnaire.

2. Use percentages to perform statistical analysis of the questionnaire data and build a basis for discussing the research results.

3. Respondents' views on issues related to natural therapy and Multisensory experiences were analyzed using descriptive statistics, focusing on their knowledge, preferences, and acceptance of natural therapy and digital technology.

4. Respondents' interest in Multisensory experiences was investigated, and open-ended responses were examined using descriptive statistics.

5. These analyses help evaluate issues related to the interaction between natural therapy and Multisensory experience technology, and contribute to future research discussions.

3.6.2 Qualitative Data Analysis

The interviews with six experts provided valuable insights for this study.

The specific steps of the analysis are as follows:

1. Transcribe the interview recordings into text.
2. Extract key points and suggestions from the interviews and code the data.
3. Analyze the important information obtained by coding the data and conduct a comprehensive analysis.
4. Interpret and discuss the research results and provide a direction for the entire study.

3.7 Ethical Considerations

1. Explain the purpose and procedures of the study to participants and encourage voluntary participation.
2. Process the data anonymously to ensure the security of personal information.
3. Ensure that the intervention is safe and harmless and provide an opt-out mechanism.

3.8 Chapter Summary

This chapter uses mixed research methods such as literature review, case study, questionnaire survey, and expert interviews to build a comprehensive research framework that covers both theoretical foundations and practical applications, and systematically explains the methodology and overall process of the study titled "Multisensory Integrated Design and Nature-Based Intervention in Office Environment for Stress Reduction". A thorough justification is provided for the research subjects, tools, data collection and analysis methods, and ethical issues.

With a stepwise design and development strategy that proceeds from theoretical analysis to prototyping and empirical evaluation, this study clearly defines the objectives and research process, and shows a practical path to verify the intervention effects of Multisensory integration and Nature-based therapy. By establishing multiple research and evaluation tools, we can combine questionnaire surveys and expert interviews to obtain multidimensional data support, integrate literature reviews and case studies to investigate theoretical and practical foundations, and finally complete the verification and refinement of the prototype by behavioral observation and interview feedback.

Selecting office workers aged 25-45 years old from an Internet company as the main target group, this study also shows the diversity and representativeness of the research participants. Experts from multiple fields are invited to conduct interviews and make recommendations. This ensures the scope and validity of the study in terms of interdisciplinary integration and practical relevance. This study incorporates ethical and safety issues throughout, and ensures voluntary involvement, data privacy, and intervention safety to improve compliance and reliability of procedures. This chapter theoretically and methodologically provides a foundation for empirical research of Multisensory integration design and Nature-based intervention in the workplace environment. Future studies will expand on accepted tools and stepwise research approaches and provide in-depth analysis and discussion of intervention outcomes.

Chapter 4

Design

4.1 Data Analysis

4.1.1 Questionnaire Data Analysis

Based on 310 accurate online survey data, this study conducted an in-depth survey of online professionals on their work-related stress, stress relief needs, and awareness and willingness to use digital immersive experiences. The survey participants ranged in age from 20 to 45 years old, mainly representing small and medium-sized Internet companies, and held a wide range of roles, including technology, product management, and operations. The main data and results of the two analysis reports are systematically integrated and explained in the next chapter.

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4.1.1.1 Sample Profile and Demographics

Age and gender distribution (Figure 24):

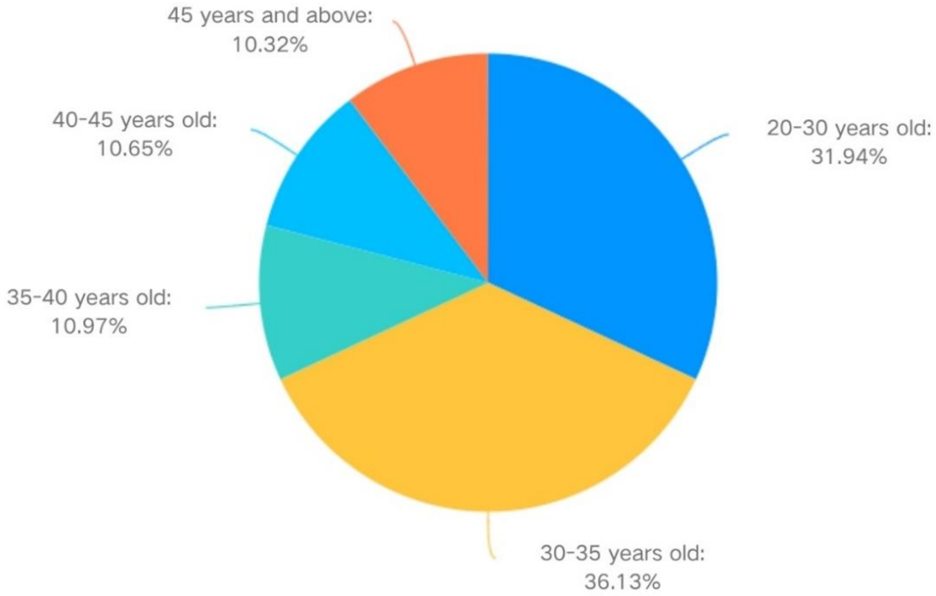
The largest group was 20 to 30 years old (31.94%), followed by 30 to 35 years old (36.13%), together accounting for about 68%. This shows that the average employee in the Internet industry is at a relatively young stage and is often on the path to professional development. About 20% of respondents aged between 35 and 45 years old, although the percentage is low, show a clear trend of maturity in years of employment and need for stress relief. Regarding gender (Figure 25), 51.61% of respondents were female, 25.48% were male, and 22.90% selected "other or no answer". This indicates a significant imbalance in gender distribution within the sample, which should be taken into account when interpreting the data.

Company size and job type (Figure 26):

Medium-sized online companies with 100-999 employees accounted for 46.13% of the total, surpassing large companies (30%) and small startups (23.87%). This variation may be due to factors such as the structural characteristics of the industry and the recruitment channels of the survey participants (Figure 27).

Figure 24

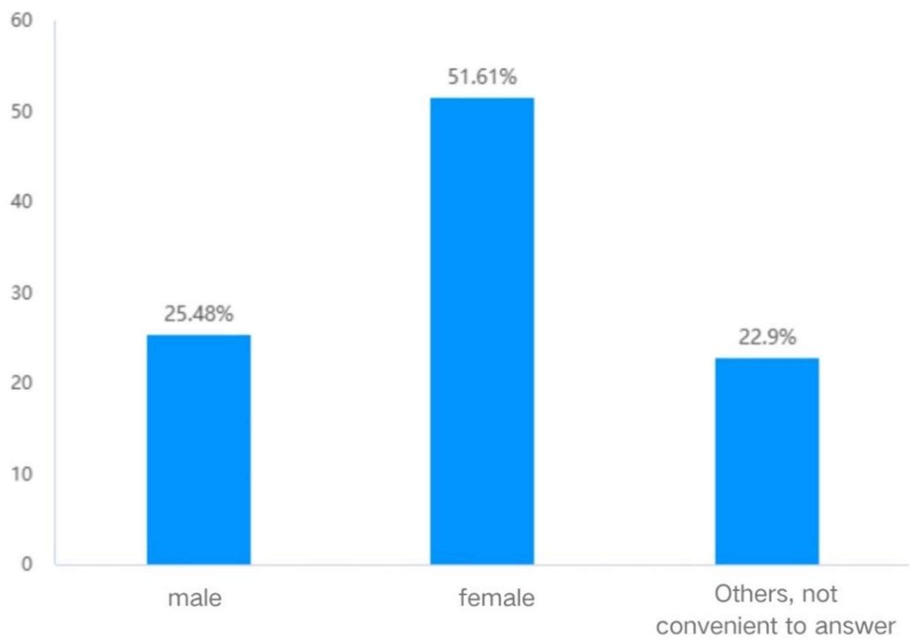
Age of survey participants



Note. Collected and compiled by the researchers.（2025）

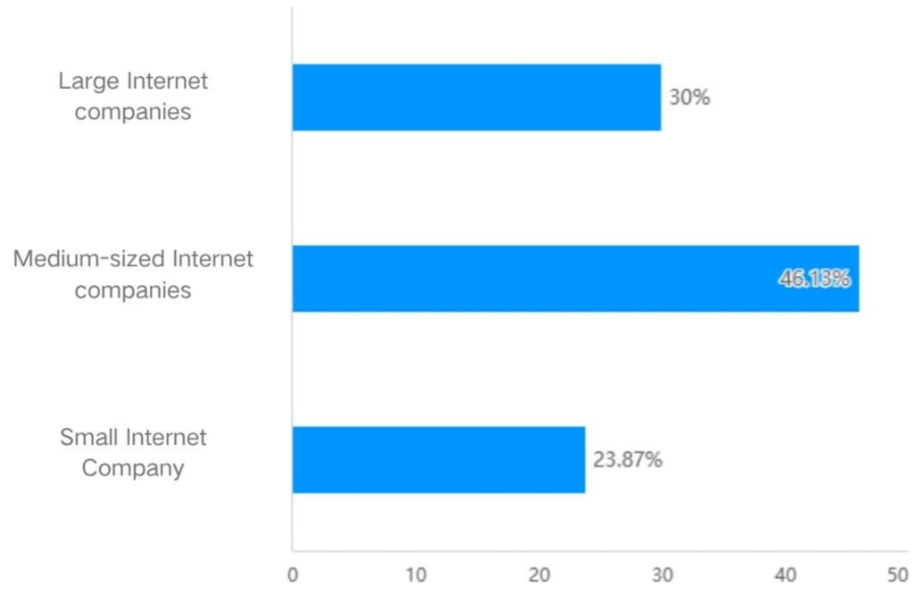
Figure 25

Gender of survey participants



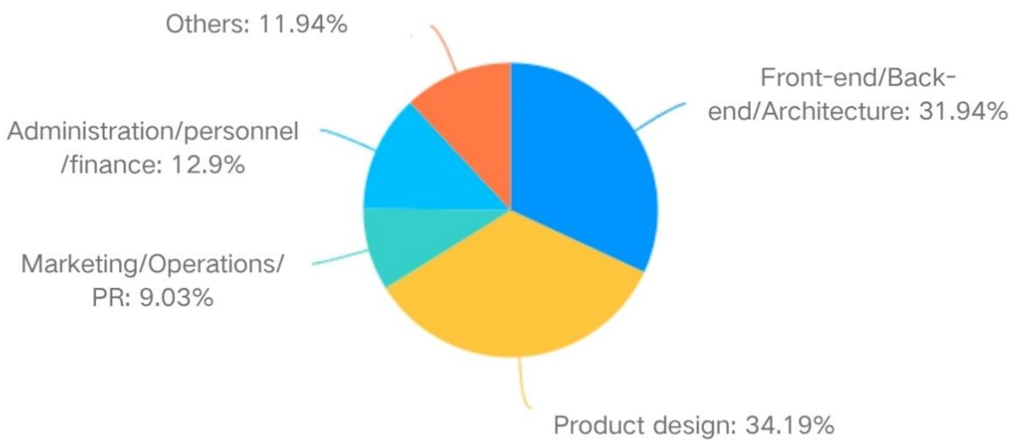
Note. Collected and compiled by the researchers.（2025）

Figure 26
The size of the survey participants' companies



Note. Collected and compiled by the researchers.（2025）

Figure 27
Survey participants' positions



Note. Collected and compiled by the researchers.（2025）

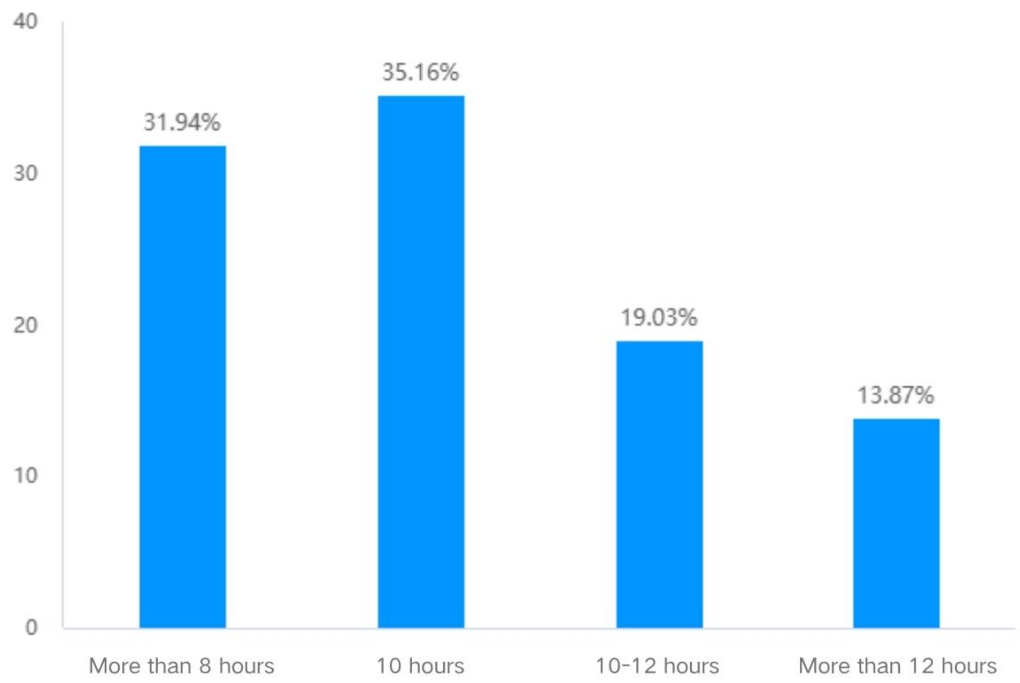
Working Hours and Overtime Conditions (Figure 28):

Approximately 39% of respondents reported working 10 hours or more. Male employees and employees of large companies are more likely to experience "overwork" per day (combining 10-12 hours and over 12 hours), with more than 30% of respondents reporting significant stress peaks during overtime or in the 1-2 hours just before the end of the shift.

This "overwork" group generally shows a high openness to new stress relief methods and tends to face stress due to more complex factors such as interpersonal communication disorders and unclear goals, and a correlation has been shown between "high stress" and "high challenge motivation."

Figure 28

Survey participants' daily working hours



Note. Collected and compiled by the researchers.（2025）

4.1.1.2 Work Stress Levels and Major Stressors

Stress Score and Time Periods:

When asked to self-assess their "work stress in the past three months (on a scale of 1 to 10)," half of the respondents indicated a stress level of 6 or higher, suggesting a considerable state of psychological tension. The three times when daily stress peaks were most concentrated were as follows (Figure 29): 1-2 hours before the end of the workday (36.77%), 1-2 hours after the start of the morning shift (36.13%), and during overtime (34.84%).

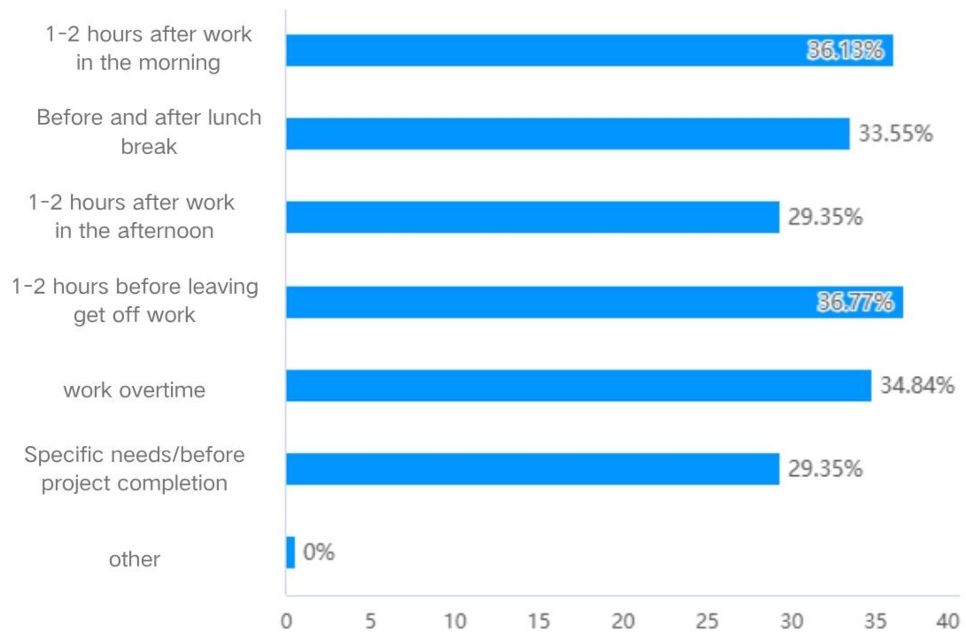
These results suggest that the start and end of the workday and long working hours are the moments most likely to cause emotional fluctuations in the workplace.

Diverse sources of stress (Figure 30):

The survey found that the five major stressors, namely excessive workload (40%), unclear or frequently changing work goals (41.94%), problems in interpersonal communication and team collaboration (39.68%), concerns about career development (37.74%), and monotonous work content/lack of accomplishment (40.65%), show almost equal proportions. This suggests that multiple stressors coexist without a clear dominant cause.

Figure 29

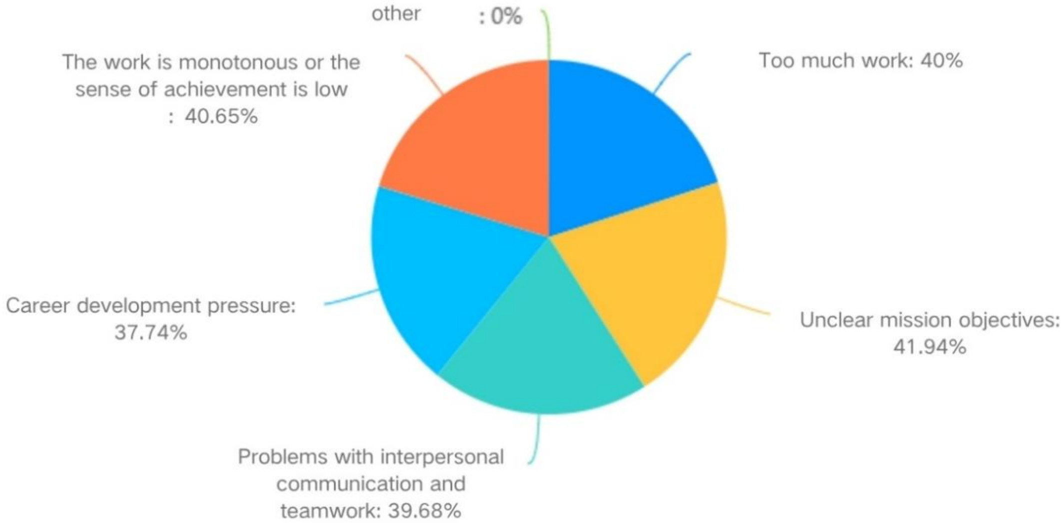
The time period when the participants experienced stress



Note. Collected and compiled by the researchers. （2025）

Figure 30

Survey participants' sources of stress



Note. Collected and compiled by the researchers. （2025）

Stress-relief preferences vary by source of stress. For example, respondents who cited "unclear goals" as their main source of stress tend to prefer structured or guided stress-relief strategies, such as meditation or professional counseling.

Influence of age and career stage:

The 30-35 age group is often at the peak of their careers and often faces rising performance KPIs and role changes. Therefore, they are in high demand for many stress-relief methods and are very sensitive to various stress factors. As adjustment problems with superiors and colleagues are increasingly acting as a kind of "latent" stress, the 35-40 age group feels stress related to interpersonal communication and team collaboration more prominently.

Work-related stress has various characteristics (Figure 31) and is closely related to age and stress-relief preferences. For all age groups, the main common sources of stress are unclear work goals, too much work, and monotony. However, there are clear differences across age groups.

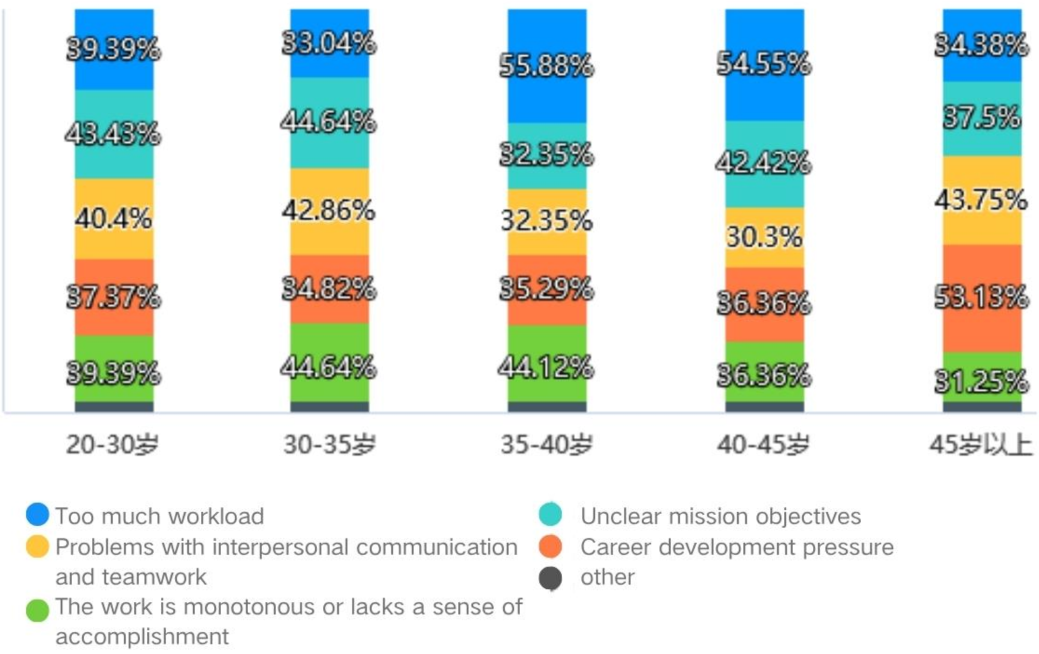
Those aged 30-35 reported the highest stress levels related to unclear goals (44.64%) and monotonous tasks (44.64%).

For those aged 35-40, stress due to excessive workload (55.88%) is prominent.

Those aged 45 and above have significantly higher levels of anxiety regarding career development (53.13%) compared to other age groups.

Figure 31

Comparison of the main causes of work stress in different age groups



Note. Collected and compiled by the researchers. （2025）

4.1.1.3 Main Stress Relief Methods and Effectiveness Evaluation

Common stress relief methods (Figure 32):

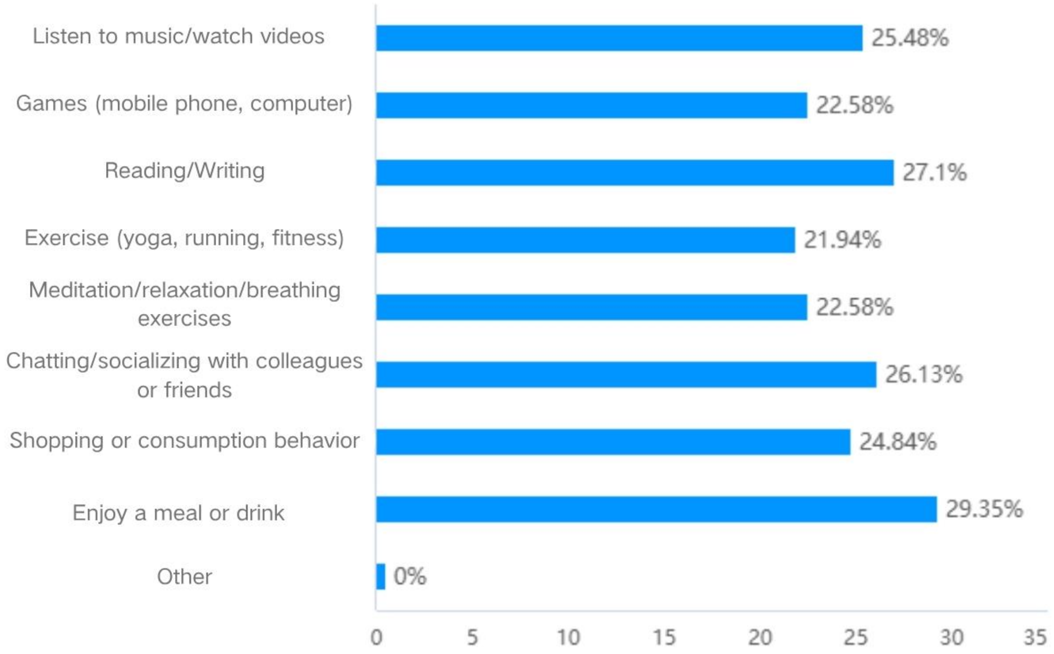
Listening to music/watching videos (25.48%), social activities (26.13%), and enjoying food and drinks (29.35%) were the most popular choices. Exercise (21.94%) and meditation/relaxation/deep breathing (22.58%) also had a significant share.

Notable gender differences:

Men preferred games and exercise more than women. Women were more likely to participate in social events and consumption experiences. Age also influenced preferences for relieving stress, with people 45 and over preferring eating and drinking, while those in their 20s and 30s were more likely to use games and short movies as entertainment. Those 35 and over were more likely to prefer quiet, private, deep relaxation (Figure 33).

Figure 32

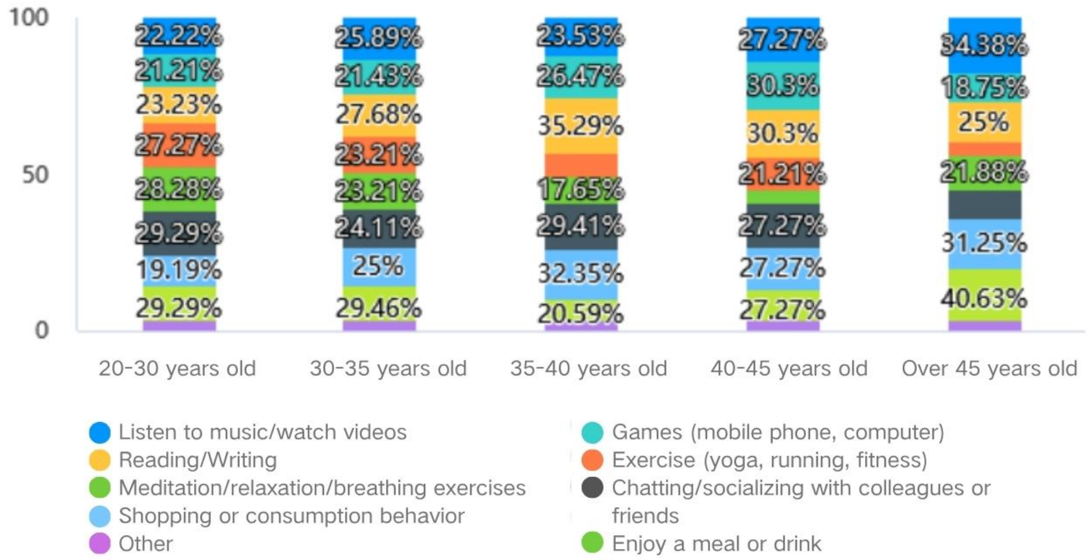
Survey participants' daily stress relief methods



Note. Collected and compiled by the researchers. （2025）

Figure 33

Comparison of age and sensory preference



Note. Collected and compiled by the researchers. （2025）

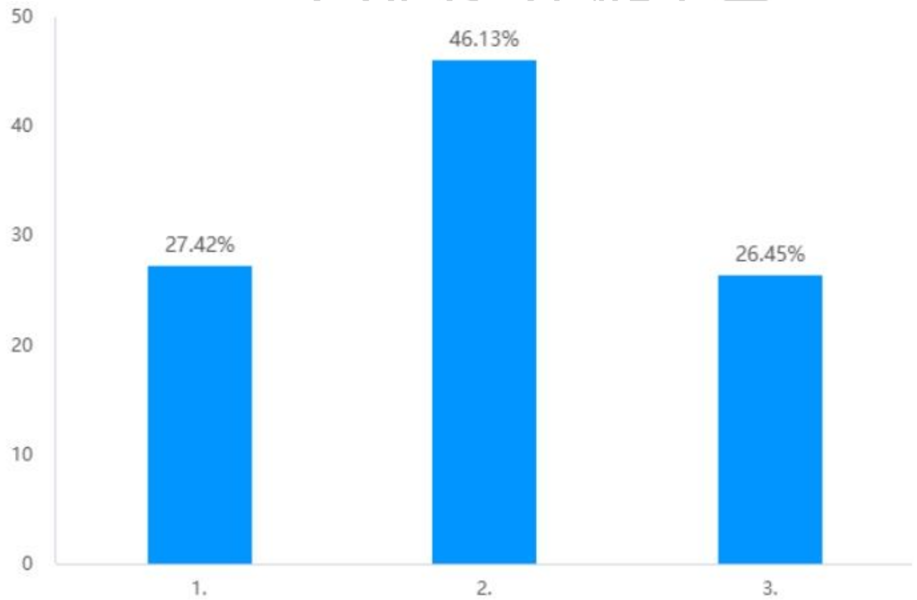
Ranking of the most effective stress relief methods (Figure 34):

When asked to subjectively rank the three methods they selected, around 46.13% of the respondents chose “Option 2” as the most effective. This option encompasses more structured and practical stress relief methods such as meditation, deep breathing, and resting, indicating that guided and structured methods are more appealing to participants.

Furthermore, around 26.45% preferred more flexible and easy-going methods (e.g., listening to music or talking with friends whenever they like), suggesting that the demand for sporadic and lighter stress relief methods remains high.

Figure 34

Rank the stress-relief options that survey participants found most effective.



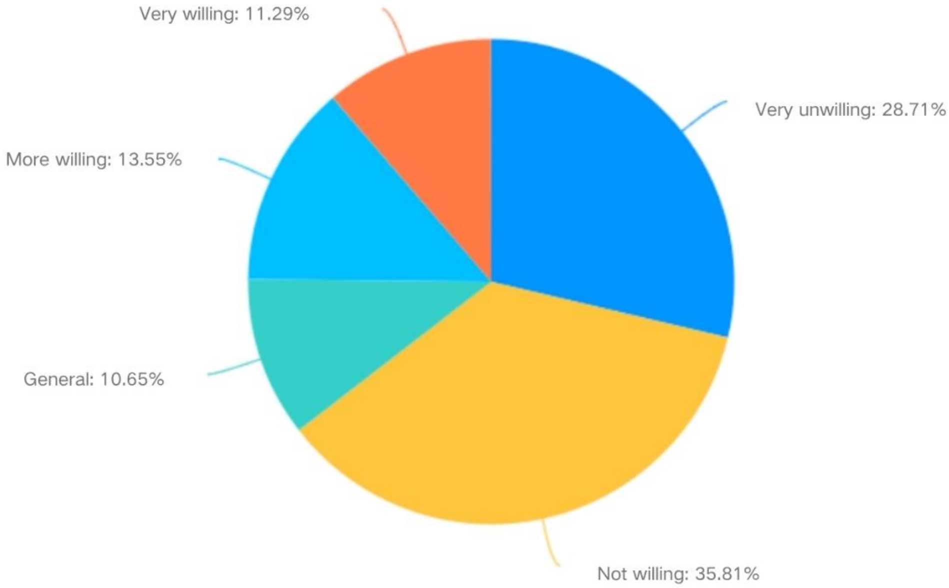
Note. Collected and compiled by the researchers. (2025)

Attitude towards current stress relief activities (Figure 35):

Around 60% of the respondents considered the current stress relief methods offered by companies to be generally ineffective or “rarely participated in.” This was mainly due to doubts about the actual stress relief effect and concerns that the timing and format of the activities conflict with their work schedule. The 35-40 age group generally “is reluctant but not completely opposed” to them, but they are cautious in their attitude of “seeing actual results before participating.”

Figure 35

Survey participants' attitudes toward current stress reduction activities



Note. Collected and compiled by the researchers. (2025)

However, the choice of stress relief method is largely influenced by age and sensory preferences, with food and social activities being the primary choices. Enjoying food and drink is the most commonly used stress relief method across all age groups, especially among those aged 45 and over. This age group is significantly more likely to choose food and drink as a stress relief method than other age groups, with 40.63% choosing food and drink as a stress relief method (29.29% of 20-30 year olds and 29.46% of 30-35 year olds).

There is a correlation between preferred stress relief methods and Multisensory sensitivity. Those with low sensitivity prefer listening to music (30.30%) and shopping (27.27%), while those with high Multisensory sensitivity tend to choose food (32.35%) and social events (29.41%).

4.1.1.4 Awareness and Acceptance of Digital Stress-Relief Methods

Question 13 of this survey (Table 8) revealed that the awareness of respondents towards VR/AR technology varies greatly depending on age group and company type. Employees of large online companies have low awareness among those in their 20s and 30s, with 44.83% saying, "I have heard of VR/AR, but I don't know what it is." On the other hand, employees of medium-sized and small startup companies have high awareness, with 77.27% of employees of small startup companies saying, "I have heard of VR/AR, but I don't know much about it."

Respondents aged 35-40 and 40-45 from large online companies are more likely to know about VR/AR as they get older, but their actual knowledge remains low. In particular, 75% of employees aged 40-45 from large Internet companies said, "I have heard of VR/AR, but I don't know anything about it."

By type of organization, employees of large Internet companies tend to have a lower understanding of VR/AR, with a particularly high percentage of people in the 35-40 and 45+ age groups who have heard of but do not understand the technology. Meanwhile, employees of medium-sized and small online companies have a good knowledge of these developing technologies. In particular, younger employees of small startup companies show a positive awareness and experience of VR/AR, with many having tried related items.

In general, younger employees, especially employees of small Internet startup companies, tend to have a better awareness and experience of VR/AR technology. Meanwhile, the awareness of older employees of large Internet companies is very low. This suggests that companies should take into account the age of their employees and the type of company in particular in order to create more effective training and outreach plans when promoting new technologies.

Table 8

Question 13

(Have you heard of ways to relieve stress using immersive technologies such as VR (Virtual Reality), AR (augmented reality), MR (Mixed Reality), spatial audio, digital smells, holographic fans, etc.)

X\Y	Have not heard of it	Have heard of it but don't know much about it	Have heard of it and know a little about it	Have experienced similar products/services	Subtotal
20-30 years old/Large Internet company (more than 1,000 employees)	5(17.24%)	13(44.83%)	6(20.69%)	5(17.24%)	29
20-30 years old/Medium Internet company (100-999 employees)	16(33.33%)	19(39.58%)	7(14.58%)	6(12.5%)	48

20-30 years old/Small Internet startup (less than 100 employees)	3(13.64%)	17(77.27%)	2(9.09%)	0(0.00%)	22
30-35 years old/Large Internet company (more than 1,000 employees)	11(29.73%)	17(45.95%)	4(10.81%)	5(13.51%)	37
30-35 years old/Medium Internet company (100-999 employees)	9(19.15%)	20(42.55%)	8(17.02%)	10(21.28%)	47
30-35 years old/Small Internet startup (less than 100 employees)	8(28.57%)	9(32.14%)	4(14.29%)	7(25%)	28
35-40 years old/Large Internet company (more than 1,000 employees)	0(0.00%)	4(50%)	2(25%)	2(25%)	8
35-40 years old/Medium Internet company =Company (100-999 employees)	3(17.65%)	8(47.06%)	4(23.53%)	2(11.76%)	17
35-40 years old/small Internet startup (less than 100 employees)	1(11.11%)	6(66.67%)	0(0.00%)	2(22.22%)	9
40-45 years old/large	0(0.00%)	6(75%)	2(25%)	0(0.00%)	8

Internet company (more than 1,000 employees)					
40-45 years old/medium Internet company (100-999 employees)	4(20%)	8(40%)	5(25%)	3(15%)	20
40-45 years old/small Internet startup (less than 100 employees)	1(20%)	3(60%)	1(20%)	0(0.00%)	5
45 years old or older/large Internet company (more than 1,000 employees)	4(36.36%)	5(45.45%)	1(9.09%)	1(9.09%)	11
45 years old or older/medium Internet company (100-999 employees)	4(36.36%)	3(27.27%)	3(27.27%)	1(9.09%)	11
45 years old or older/small Internet startup (less than 100 employees)	2(20%)	5(50%)	2(20%)	1(10%)	10

Note. Collected and compiled by the researchers. (2025)

Data analysis of survey question 15 (Table 9) reveals that employees' willingness to try new technologies such as VR, AR, MR, and spatial audio varies greatly across age groups and company types.

Firstly, among respondents aged 20-30, employees at mid-sized online companies showed the highest willingness to try new technologies, with 47.92% saying they would try them if they had the time. Reflecting the high receptivity of young people to innovation, 37.93% of employees at large online companies in the same age group had a positive view of these technologies.

Secondly, employees aged 30-35 are somewhat more balanced in their willingness to try new technologies across all company types, especially in mid-sized Internet companies, where 31.91% were willing to try new technologies and had high expectations for the results.

On the other hand, in large online companies, employees aged 35-40 and 40-45 tend to have a relatively low willingness to explore new technologies. In particular, 50% of employees in large companies aged 40-45 years old said they would never try new technologies, suggesting a low acceptance of new technologies in this age group.

Finally, among employees aged 45 and over, employees in small start-up online companies were the least willing to try new technologies, with 70% saying they would never try them. This could be due to resource constraints in small companies and lack of technology knowledge among senior employees.

Especially in large Internet companies, older employees are generally more cautious, while in mid-sized Internet companies, younger employees are more receptive to new technologies and more willing to try them. These results provide companies with an important new perspective on the consumers they target for new technology introduction.

Table 9

Question 15

(If the company provides a short-term immersive experience space based on VR, AR, MR, spatial audio, holographic fans, etc. in the office area, allowing you to wear the device to quickly relax your body and mind, would you try it?)

X\Y	Not at all	Will try if I have time	Willing to try, looking forward to the effect,	Will definitely try, may use it frequently	Subtotal
20-30 years old/Large Internet company (more than 1,000 employees)	11(37.93%)	11(37.93%)	2(6.90%)	5(17.24%)	29
20-30 years old/Medium Internet company (100-999 employees)	10(20.83%)	23(47.92%)	9(18.75%)	6(12.5%)	48
20-30 years old/Small	7(31.82%)	9(40.91%)	3(13.64%)	3(13.64%)	22

Internet startup (less than 100 employees)					
30-35 years old/Large Internet company (more than 1,000 employees)	9(24.32%)	10(27.03%)	9(24.32%)	9(24.32%)	37
30-35 years old/Medium Internet company (100-999 employees)	15(31.91%)	15(31.91%)	9(19.15%)	8(17.02%)	47
30-35 years old/Small Internet startup (less than 100 employees)	9(32.14%)	12(42.86%)	3(10.71%)	4(14.29%)	28
35-40 years old/Large Internet company (more than 1,000 employees)	2(25%)	3(37.5%)	2(25%)	1(12.5%)	8
35-40 years old/Medium Internet company =Company (100-999 employees)	8(47.06%)	7(41.18%)	1(5.88%)	1(5.88%)	17
35-40 years old/small Internet startup (less than 100	2(22.22%)	4(44.44%)	2(22.22%)	1(11.11%)	9

employees)					
40-45 years old/large Internet company (more than 1,000 employees)	4(50%)	0(0.00%)	2(25%)	2(25%)	8
40-45 years old/medium Internet company (100-999 employees)	6(30%)	8(40%)	3(15%)	3(15%)	20
40-45 years old/small Internet startup (less than 100 employees)	0(0.00%)	2(40%)	1(20%)	2(40%)	5
45 years old or older/large Internet company (more than 1,000 employees)	2(18.18%)	5(45.45%)	1(9.09%)	3(27.27%)	11
45 years old or older/medium Internet company (100-999 employees)	3(27.27%)	3(27.27%)	2(18.18%)	3(27.27%)	11
45 years old or older/small Internet startup (less than 100 employees)	7(70%)	1(10%)	1(10%)	1(10%)	10

Note. Collected and compiled by the researchers. (2025)

Around 22.90% of respondents have never heard of digital stress relief technologies such as VR/AR/MR. On the other hand, 46.13% answered that they have heard of them but do not fully understand them, suggesting great potential for cognitive development. In addition, 14.52% of respondents answered that they have actually experienced similar products or services, mainly concentrated in the 30-35 age group and employees of small and medium-sized enterprises (Figure 37). Awareness of cognitive abilities is positively correlated with willingness to try immersive experiences (Figure 38) (Figure 39). Of those who answered that they would definitely like to try them, more than half are in the "I have heard of them but do not fully understand them" stage, suggesting great interest and conversion potential for this demographic.

Effectiveness assessment of digital stress relief (Figure 40):

65.16% of respondents stated that digital technologies have “limited” or “little use” in reducing work-related stress, reflecting widespread doubts about the practical relevance of digital solutions alone. On the other hand, 16.77% expressed great interest in immersive events and would “frequently use” them if the experience design was simple and user-friendly. This shows the polarization of opinions on digital stress relief experiences.

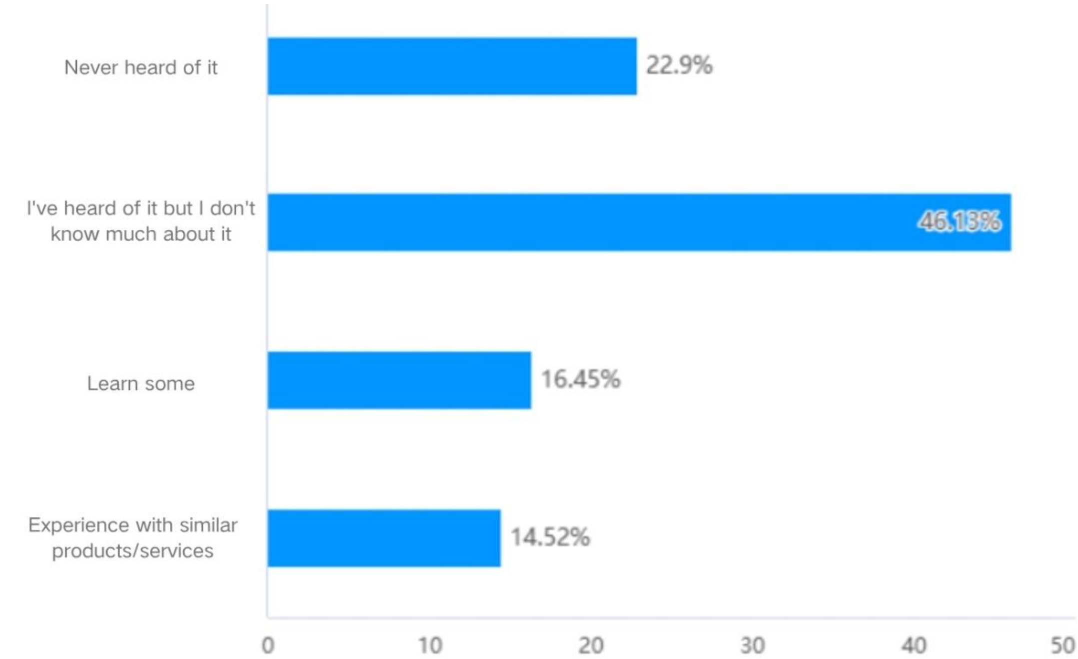
Preferences for Multisensory experiences and natural scenery (Figure 41):

More than 30% chose “guided meditation,” while others frequently expressed a preference to integrate smell and touch with natural scenery such as forests and plants. 32.90% specifically cited “natural scenery” as their preference for digital experiences.

About 38.06% of respondents were positive about Multisensory design, but emphasized avoiding stimuli that were too complex or too intense. On the other hand, 32.90% supported the idea that “the more immersive, the better.” This indicates variability in sensory tolerance and calls for flexible design modifications.

Figure 36

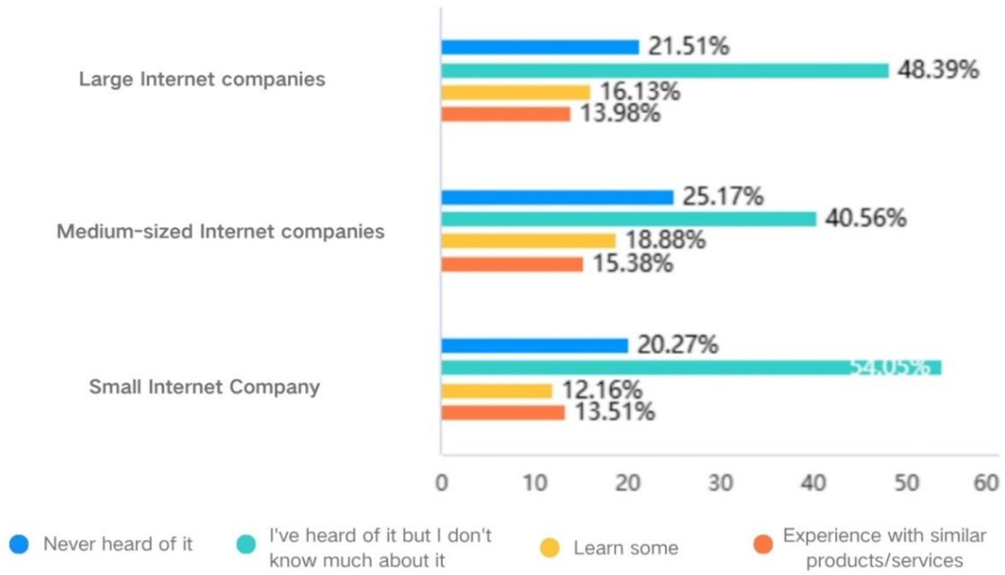
Survey participants' perceptions of Immersive Technology



Note. Collected and compiled by the researchers. (2025)

Figure 37

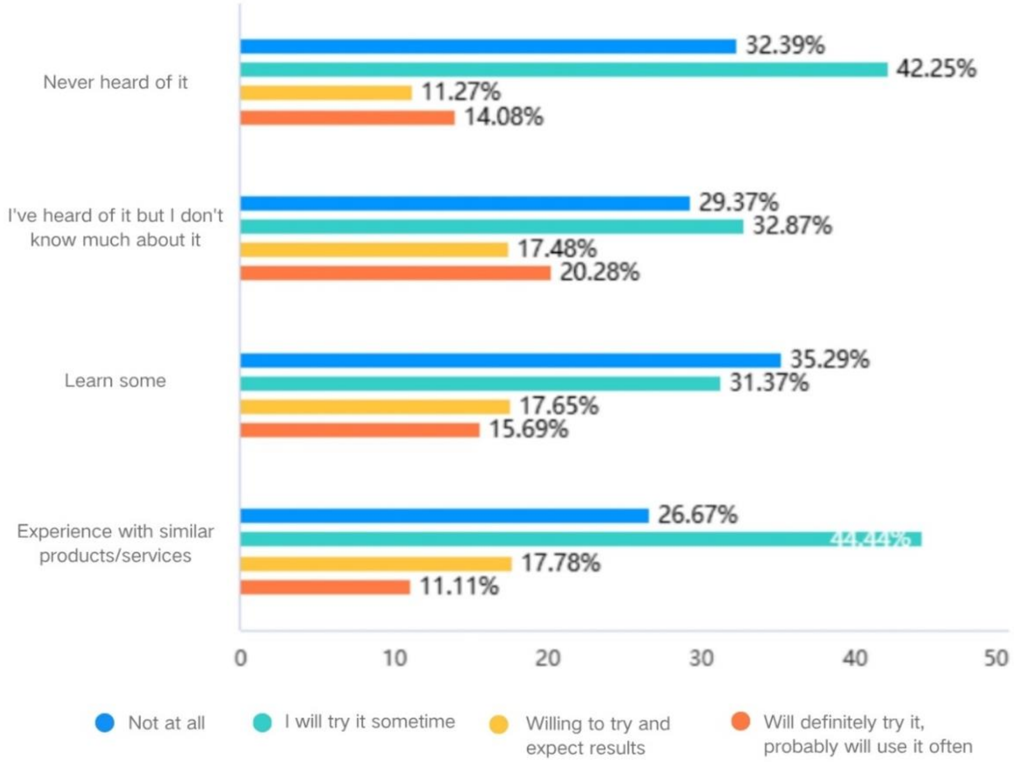
Cross-comparison of survey participants' age, company size, and awareness of immersive technologies



Note. Collected and compiled by the researchers. (2025)

Figure 38

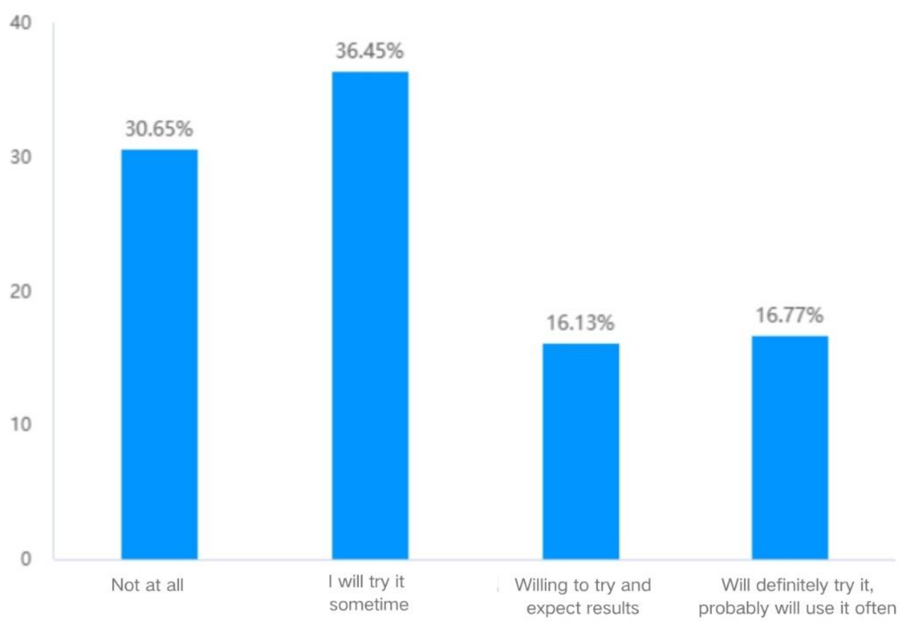
Cross-comparison of survey participants' awareness and willingness to experience



Note. Collected and compiled by the researchers. (2025)

Figure 39

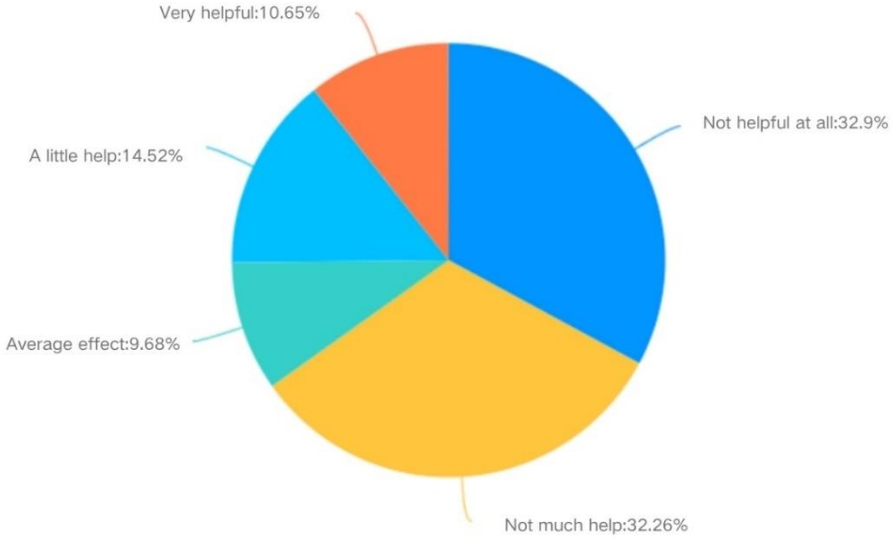
Survey participants' experience willingness



Note. Collected and compiled by the researchers. (2025)

Figure 40

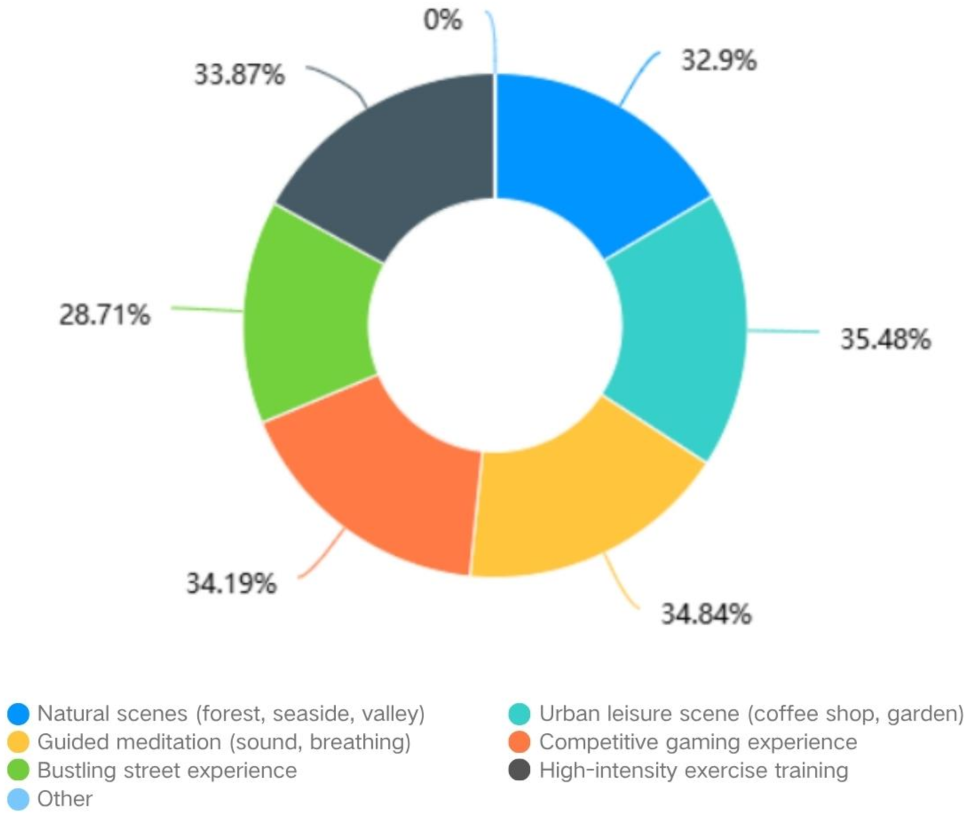
Survey participants' willingness to experience Immersive Technology



Note. Collected and compiled by the researchers. (2025)

Figure 41

Survey participants' needs for multi-sensory and natural scenes



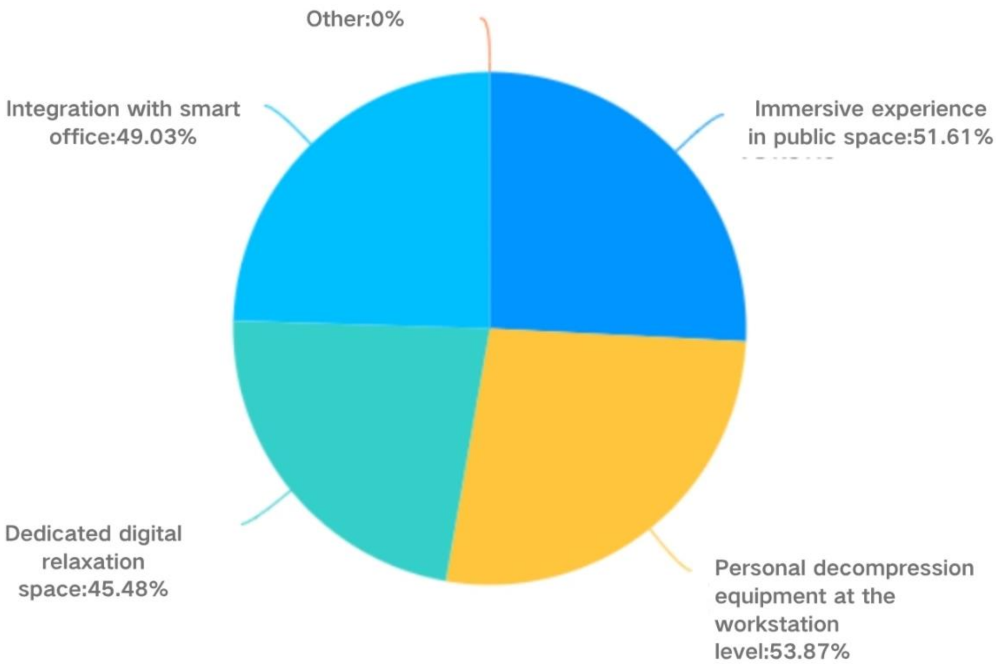
Note. Collected and compiled by the researchers. (2025)

Introduction to office scenarios:

More than 50% of respondents would like immersive interactive experiences to be provided in public leisure areas and designated relaxation spaces, and 53.87% were willing to use relatively light equipment at personal workstations. In response to the question, "What physical environmental improvements do you need in the future?", about 40% chose "diversification of rest areas" and "quiet rooms/meditation rooms," indicating a desire for "virtual and reality integration" with digital solutions and upgrading of real spaces (Figure 42).

Figure 42

Survey participants' choices of implementation methods in office scenarios



Note. Collected and compiled by the researchers. (2025)

4.1.1.5 Summary

High work pressure due to diverse causes:

Due to different time allocations and root causes, online workers generally experience higher work-related stress. This suggests that future stress reduction measures should incorporate certain elements such as goal ambiguity and stress peak times, and continuously implement flexible and diverse interventions.

Potential of natural elements in digital stress relief:

The survey found that there is a high demand for "Nature-themed" immersive stress relief activities and Multisensory designs. However, 65% of respondents were skeptical or gave very low ratings to these effects. This highlights the importance of finding a balance between "digital empowerment" and "authentic Nature", breaking away from dependency on screens and Virtual Reality and reflecting the potential of these technologies.

Personalization and low barriers to entry:

Users emphasized the need for simplicity, customizability, and interesting engagement. Devices and methods that lack deeper psychological support or are overly complicated may quickly lose popularity. "Lightweight, anytime, anywhere" solutions are likely to gain popularity among people with busy schedules and fatigue.

Group differences and spatial synergies:

In terms of age, the younger generation (20s to 30s) tend to prefer games and stimulating activities. The middle-aged (35-45 years old) value tranquility more. In addition, factors that influence the willingness to adopt and the desired application situation include gender and company size. About 60% of respondents chose a hybrid paradigm that integrates digital and physical methods, while about 40% still favor the traditional physical environment. If companies only invest in digital technologies and ignore improving physical elements such as indoor planting, lighting, and acoustics, it will be difficult to holistically meet the needs of most employees.

Overall, the survey results revealed the current stress levels and need for stress relief among online professionals. Respondents generally agreed that natural therapies have a positive effect in reducing anxiety and tension, and showed some interest in applying Multisensory tools such as VR/AR and spatial audio in the office environment. Still, questions remain about the actual effectiveness and usability of such therapies. Therefore, in the next stage of the design process of this study, a key goal and challenge will be to determine the synergy between technological tools and real-world ecological settings to create immersive, rapidly deployable, and personalized Nature-based healing spaces.

4.1.2 Qualitative Research through Online Interviews with Experts

4.1.2.1 Digital Technology Experts

Using the methodology of “lightweight hardware – Multisensory synergy – real-time physiological closed loop”, the technical vision proposed by two experts can be integrated into a clearer form: a standalone VR helmet is integrated into the physical office environment as the only wearable device, creating a Multisensory experience space with Tactile, Auditory and osmotic sensations. Expert 1’s “instant disengagement – gradual immersion” approach is still valid, but “lightweight” means that the weight, cables and steps of the same VR headset are compressed vertically, allowing users to enter a virtual forest, stream or bird song scene within 30 seconds and “take a light, deep breath”.

Desktops and walls are equipped with soft vents, natural plants and indirect lighting to provide complementary sensory input in the real office space. When the user puts on the helmet, the Unity/Unreal scene created inside is skillfully blended with physical elements such as the release of plant scents and dynamic lighting, creating a continuous experience that blends virtual graphics with real Tactile, Olfactory, and light stimuli.

When answering the questionnaire, Expert 2 regularly evaluated "medical value" and "technical feasibility" within the same coordinate system. He confirmed that VR/AR can create an immersive environment in the workplace that is somewhat different from the usual environment and reduce white-collar stress. However, he emphasized that to be truly considered "therapeutic", it is first necessary to demonstrate the special advantages of Immersive Technology that exceed traditional treatments and to formulate specific goals, procedures, and medical evaluation criteria.

He therefore believes that the synergy of XR, spatial audio, and Multisensory interaction is not a simple superposition, but requires the construction of an explanation mechanism and an experimental verification system customized for the sensory pathways of vision, hearing, smell, and touch. He recommends the introduction of standalone VR/AR headsets to provide Visual immersion and reduce the psychological burden on users in terms of device selection, utilizing spatial audio and digital fragrance devices. Similarly, manage real-time rendering with Unity or Unreal, control audio with FMOD/Wwise, and complete the closed loop of multimodal signals with hardware SDK and MRTK interface.

Regarding Multisensory synchronization, data fusion, and individual differences, he pointed out that only high-precision algorithms and edge computing can reduce latency, ensure signal consistency, and enable "personalized healing" through AI-based adaptive control. In light of this, he suggested that digital twin Nature platforms, blockchain-based privacy protection, and real-time scene changes through machine learning should be positioned as future directions. In his view, digital technology should not only provide a momentary "escape," but should develop into a scientific intervention tool that is incorporated into daily office work, backed by safety guidelines, reliable data, and measurable effects. The expert summarized the research path of immersive natural therapy as "based on medical evidence, bridged by Multisensory integration, and rooted in algorithms and security." He emphasized that only by advancing interdisciplinary validation and simplifying the technology in parallel can digital naturotherapy truly take root in busy urban environments and withstand scientific and regulatory scrutiny.

In this way, immersive therapy becomes a “breathing corner” in the workplace, a space that can be accessed at any time without relying on scattered devices or dedicated rooms. Workers simply put on a standalone VR helmet and enjoy a 10-minute forest bathing experience that blends virtual and real elements. When they remove the headset, their body is gently enveloped in an environment that slowly releases light, air and fragrance.

In this Multisensory environment, the engineering requirements of “easy to use, functional and imperceptible” are aligned with the medical criteria of “effective, reliable and safe”, allowing digital naturotherapy to truly integrate into the rhythm of busy office life.

4.1.2.2 Spatial Environment Expert

Spatial environment experts see the "VR Stress Relief Pod" as an effort to blend the physical and digital environments. First, experts recommend that the immersive experience must be integrated within a highly adaptable modular partition, and that only by "stitching" the virtual space into the daily office routine through soft lighting, natural acoustics, and quiet circulation can employees truly relax. Secondly, experts emphasize that the feeling of relaxation is created by Multisensory synergy. Real plants and the texture of wood and stone provide solid support for vision and touch, while simulated sound fields harmonize Auditory and Tactile stimuli with the Visuals of the virtual space, forming an "emotional buffer zone". From a safety perspective, they recommend imposing a time limit on each session to prevent overstimulation.

To show that the synergy between Nature and technology is becoming the new standard in employee wellness spaces, experts cite global examples such as Google's meditation dome. Using a three-stage approach of "physical Nature + digital enhancement + biofeedback", real waterscapes and plants form the base environment, while virtual landscapes extend the Visual dimension.

Looking to the future, he sees a three-stage evolution of office space towards "humanized experience, ecosystem integration and seamless technology". Healing systems will no longer exist as independent devices, but will work in conjunction with architectural structures, materials and even air circulation, transforming the office itself into a constantly breathing space for mental and physical recovery.

4.1.2.3 Psychology Expert

In the interviews, the experts made the following suggestions:

Evaluation system

Measure momentary changes in stress, anxiety and depression using the DASS-21 scale, record positive and negative emotions using the PNAS scale, and complement the long-term assessment of well-being with the Life Satisfaction Scale. Wearable gadgets will allow the collection of skin conductance data and heart rate variability if monitoring of physiological markers is required. Nevertheless, within the framework of the Design Education Initiative, "questionnaire + simple physiological indicators" is considered sufficient. It is essential to eliminate the placebo effect by establishing a control group and to conduct pre- and post-tests on VR interventions.

Theoretical basis for healing

The design of a healing environment that combines Nature and digital is based on two classic models: stress recovery theory (emotion-based) and attention restoration theory (attention resource-based). The four aspects of attention restoration theory (attractiveness, range, distance, and compatibility) can be substituted into the scenario evaluation scale. Recommended intervention parameters: Session duration: 20-30 minutes for optimal effect, Frequency: "3 times a week or more, 10 minutes or more per session" is effective as a long-term plan, but experimental costs and operational costs must be balanced. AI-generated content and rotating content should be utilized to maintain the freshness of the scenario, and Visual fatigue should be avoided.

In VR, which is purely Visual and Auditory, the increase in endorphins and serotonin caused by physical movement, sunlight, and plant scents is not observed. Ensure that the experience area has a walkable space and create real vegetation and natural scents such as mint, lemon, and pine. To counterbalance the “walking effect”, walking or light frame-based movement interactions should be incorporated whenever possible.

Key aspects of experimental design

All other Visual and Auditory environments should be kept constant, and the experimental and control groups should only vary in the presence or absence of natural scenery. This emphasizes the value of “VR natural scenery”. When comparing “VR vs. real-world walking”, the increase in uncontrollable variables must be considered, which is appropriate for long-term intervention studies. Controlling experience variables, recording intervention costs, and confirming significance with regression or analysis of variance (ANOVA) are crucial.

Effective implementation advice

White-collar professionals in urban areas may lack sufficient time or access to natural environments. Therefore, a prototype of an indoor “hybrid forest bathing” that combines VR with real plants is considered as an alternative. At the design level, the first step is to ensure the experience quality and validate it with defined indicators. After that, collaboration with medical teams will strengthen research on physiological markers, allowing for gradual interdisciplinary application.

4.1.2.4 User Experience Expert

Academicians and experts discussed the use of virtual background technology in office environments and how digital technology can be used to create immersive landscapes to reduce work-related tension. They also considered how customized services can address various consumers' stress levels and selection needs. In addition, the role of AI products in creating immersive therapy treatments was also discussed. Finally, the meeting also discussed issues such as interdisciplinary collaboration and personal data protection.

Experts made the following suggestions:

1. Building and optimizing immersive therapy environments

Experts noted that tools such as Meta Quest 3 can help in creating healing environment models, combining real plants and other hardware with immersive forest and natural landscapes. They also recommended incorporating easy UI navigation and adjustment controls within the user interface. However, such design changes should not only be about simplicity, but also aim to improve the user's physical perception in line with the intended purpose. In addition, the latest user research methods and tools such as Net Promoter Score (NPS) and satisfaction surveys were also discussed. These are useful for evaluating the overall user experience of integrated services and product systems.

2. User experience design and data analysis

User research methodology requires objective data and subjective analysis. Data funnels and user behavior flows help to discover problems. Other effective strategies cited are competitive analysis and comparative studies. In addition, the use of wearable devices in user research, such as blood pressure, blood oxygen level, and heart rate monitoring, was also discussed. Finally, it was emphasized that in user experience design, it is essential to set clear design goals and take individual needs and preferences into full consideration.

3. Exploring personalized services

User experience can be improved by making personalized adjustments according to the user's stress level and preferences (forest, sea, chat, music, etc.). In addition, it was explained how to design with the needs of the target customers in mind and how to understand user needs through surveys and communication. Finally, it was emphasized that environmental interaction and guide functions can greatly improve the user's immersion, which is in line with the main goal of this study.

4. Detailed analysis of product design and user experience

The main focus is on how to build a highly immersive environment and incorporate guide elements to allow the consumer of the product to use it freely with peace of mind. To achieve better results in product design, multiple factors, including Visual and Auditory elements, must be considered. At the same time, appropriate instructions and encouragement must be given according to the user's level of use and requirements. Excessive interference with the user during the product use process should be avoided so as not to affect the therapeutic effect. Essentially, it is necessary to understand the timing and method of coaching so that the user can enjoy the product and achieve the expected results at the same time.

5. Interdisciplinary Design and User Experience Strategy

In the future, artificial intelligence may be used for initial instructions and evaluation in the treatment field, but experts advise that user privacy must be considered as a top priority. In addition, the difficulty and complexity of interdisciplinary subjects were also addressed.

4.1.2.5 Natural Therapy Expert

Experts pointed out that Nature-based treatments in office environments should adopt a multi-sensory, complementary and superimposed approach. The photosynthesis of green plants provides Visual relief, touching succulent plants can reduce cortisol levels, natural sounds such as water and birdsong help mask office noise, dynamic color temperature is consistent with circadian rhythms, and essential oil aromatherapy helps with mood regulation. In addition, digital projections and small waterscapes that can overcome spatial and temporal limitations also improve immersion. He said that in projects such as Beijing Xuanwu Hospital, plants were selected according to regional functional changes, and the transpiration and respiration of plants were used to control humidity and absorb formaldehyde and nicotine, which received a good response.

Experts emphasized in the creation of virtual natural scenes that the rapid improvement of the sense of presence and relaxation depends on high-quality audio-Visual elements: Visual resolutions above 4K and spatial audio positioning can produce a realistic forest soundscape. Although expensive, dynamic interactions such as rippling water or waving grass can greatly improve immersion. The expert said that in the future, wearable gadgets may be used to track real-time heart rate and stress levels, combined with artificial intelligence, to automatically modify the lighting, music and aroma in the environment according to physiological data, thereby achieving personalized rehabilitation. The simultaneous release of important oil fragrances such as pine and cedar that match the image can enhance the immersive experience.

Regarding the feasibility of combining Virtual Reality with conventional treatment, he believes that their synergy will overcome geographical and time limitations and greatly improve the efficacy through sensory layering and tailored adaptation. The natural healing corner should be small and light, suitable for use in the workplace, so that office workers can conveniently participate in scattered time. At the same time, controlled studies need to compile supporting data, so that wide applicability is allowed.

4.1.2.6 Summary

A clear interdisciplinary consensus framework for the use of immersive therapy experiences in office environments emerged by integrating the ideas of six experts in the fields of digital technology, spatial environment, psychology, user experience, and natural therapy. Whether choosing a VR all-in-one device, spatial design, or a single-session intervention, each option represents a realistic compromise with the fragmented time and limited physical space of urban white-collar workers, i.e. the principle of a “light” implementation consistently emphasized by several experts. Digital expert 1’s “instant separation” theory mirrors the attention restoration theory mentioned by the psychology expert, indicating that the fundamental value of such technologies lies in their ability to quickly build a natural digital barrier that stops work-related cognitive processes.

In terms of technology, the experts strongly agreed on “Multisensory collaboration.” The XR framework provides the Visual foundation, while spatial audio creates a soundscape for instruction. Haptic and Olfactory peripherals expand the limits of physical sensations – this “trio” solution was mentioned repeatedly. In particular, the ecological perspective presented by the naturopathic expert suggests that future therapeutic environments should reflect the symbiosis of biological and digital elements by blending real plant photosynthesis with digital scenes and connecting plant scents with the virtual environment, adding a new dimension to a purely digital approach. The spatial environment expert fleshed out this idea of blending virtual and real with his advice to build an “emotional buffer zone”. Directional sound fields, micro-vibrations and Tactile textures intertwine to form a multidimensional sensory network.

The difficulties of technology implementation highlighted the necessity of interdisciplinary collaboration. A second digital technology expert highlighted the need to integrate flexible electronics and edge computing to address future synchronization accuracy challenges. A psychologist highlighted the relevance of the DASS-21 scale with physiological monitoring, and the need for behavioral science literacy in the development team. A user experience expert mentioned the danger of “over-intervention” and said that this needs to be avoided by a co-design approach to maintain balance. By building interdisciplinary cooperation mechanisms that combine medicine, neuroscience, industrial design and computer engineering, these obstacles can be overcome from all directions. "The therapeutic system will eventually become the nerve endings of architectural structures," one expert aptly stated.

The future direction of innovation shows two seemingly contradictory but essentially common trends. One is the pursuit of "invisibility" in technology, such as brain-computer interfaces that directly control brainwaves and AR glasses that automatically adapt to the environment. The other is the emphasis on the "embodiment" of Nature, creating a sensory loop by combining the biochemical effects of real plants with digital augmentation. This dialectical relationship may reveal the ultimate form of Nature-based healing technology. It is not about replacing reality with a virtual world, but using digital media to reawaken urban dwellers' instinctive view of Nature, creating an intelligent therapeutic ecosystem that is as present in Nature as breathing. The "breathing architecture" envisioned by experts raises fundamentally great expectations for the humanization of technology, that is, to transform healing from an intentional act into an environmental service provided spontaneously.

4.1.3 Digital Technology Analysis and Selection

4.1.3.1 Integrated Analysis of Questionnaire Data and Expert Interviews

Analysis of 310 valid surveys revealed that age and company size have a significant impact on the acceptance of digital technologies for stress relief by employees in the Internet industry. Employees over 40 years old are more conservative (50% of employees in large companies said they would never try it), while employees aged 20-35, especially those in medium-sized Internet companies, have a higher awareness of VR/AR technology and a higher willingness to try it (47.92% said they would try it if they had time), while 38.06% of respondents supported multimodal design, but emphasized the importance of avoiding overly complex themes in digital therapy experiences. 32.9% of respondents specifically chose "natural scenery".

Interviews with experts further supported these results. Psychology experts emphasized that a Visual and Auditory-only VR experience lacks the psychophysiological effects of real Nature (e.g., endorphin release) and needs to be supplemented with live plants and haptic feedback. Digital technology experts emphasized that while VR's "instant detachment" feature is suitable for fragmented office environments, it must meet two key requirements: "lightweight" hardware. Technologies such as "lightweight" (e.g., all-in-one headsets) and "Multisensory integration" are gaining attention. At the same time, naturopathic experts proposed a "virtual-real symbiosis" approach to enhance the virtual forest experience with the scent of real plants.

4.1.3.2 Technology Selection and Strategy Determination

After a thorough investigation of the survey data, expert comments, and evaluation of AR/VR/MR technologies, the study concluded that VR is the best solution for immersive naturopathic interventions in office environments. Survey results showed that 32.9% of participants specifically wanted a Nature-themed digital therapy experience, a need that is perfectly aligned with VR's ability to create highly immersive natural environments. The intervention time of 10-20 minutes recommended by psychology experts also fits perfectly with VR's strength of "instant detachment" and is particularly suitable for the fragmented usage conditions typical of Internet company employees.

Technically, the use of standalone VR helmets such as Meta Quest 3 allows for the integration of VR and reality. It integrates spatial audio systems, biofeedback devices and other multimodal components through a central hardware platform. By combining the real office environment, including indoor plants and wood-grain surfaces, with this lightweight Multisensory solution defined by a "VR-led, physical environment complementary" approach, VR not only has a more mature hardware and software ecosystem (e.g. standardized development process in Unity/Unreal), but also benefits from an all-in-one helmet design. This significantly lowers the barrier to entry for VR, an advantage frequently pointed out by interviewed experts. Unlike AR and MR technologies.

According to the proposed deployment strategy, VR digital technology should be at its center and physical office space should be utilized as a support under a hybrid paradigm. Hardware-wise, the VR headset is responsible for Audio Visual rendering, while indoor plants and scent diffusers provide Olfactory and Tactile feedback. Dynamic natural scenery is generated software-wise using the Unity engine. Geographically, the addition of specific "healing corners" perfectly integrates Virtual Reality and real-world environments, allowing the user to continue experiencing the therapeutic effects long after removing the helmet.

This technology choice not only meets the consumer need for a natural immersive experience, but also effectively eliminates the existing technical constraints of AR/MR. More importantly, it meets the basic ideas advocated by experts: verified medical effectiveness, simplified and effective technical implementation, and the philosophy of interdisciplinary co-creation.

Table 10

XR technical characteristics comparison analysis table

Technical dimensions	VR (Virtual Reality)	AR (Augmented Reality)	MR (Mixed Reality)
Immersion level	Full immersion (enclosed)	Partial immersion (superposition)	Dynamic Immersion (Interactive)
Device examples	Meta Quest 3, Valve Index	Microsoft HoloLens 2, Magic Leap	Varjo XR-4, Apple Vision Pro
Technical maturity	★★★★★ (popular in consumer market)	★★★☆☆ (Enterprise-level application)	★★☆☆☆ (Prototype stage)
Office adaptability	Short-term use in dedicated rest area	Instant interaction at workstations	Long-term wear in mixed space
Sensory support	Audio-Visual + extended touch/smell	Vision-dominated + limited hearing	Full sensory dynamic mapping
Implementation costs	Medium ($300-$1000/set)	Higher ($2000-$3500/set)	Extremely high ($5000+/set)
Natural healing efficacy	Deep recovery (ART theory)	Mild adjustment (micro-rest)	Progressive intervention

Note. Collected and compiled by the researchers. (2025)

4.1.4 Summary

From the perspective of design research, supported by data analysis and expert interview results, this study clearly reveals the actual pain points experienced by Internet company employees in terms of work-related stress in Internet companies and their preferences for digital Nature-based therapeutic experiences. The survey results show that Internet company employees generally experience significant levels of work stress, showing several time characteristics, especially concentrated in the early morning working hours, the end of the workday, or during overtime. In addition, the data capture the diversity and complexity of stressors. Common difficulties are vague task goals, excessive workload, and interpersonal interaction problems. Therefore, it is necessary to provide targeted interventions for the special stress faced by different users.

Based on the quantitative study of the survey results, the researchers found that Internet company employees showed great interest in immersive, multimodal therapeutic experiences based on Nature aspects. Younger employees and employees employed by medium-sized Internet companies showed more open and proactive behaviors, clearly demonstrating this curiosity. In contrast, employees of large companies and older employees tend to be more conservative. These results provide useful evidence for applying unique customized design concepts. Regarding sensory preferences, it is generally agreed that Olfactory and Tactile connections combined with Visual and Auditory stimulation, rather than real plants, are highly appreciated. This validates the great design possibilities of the "virtual-physical symbiosis" approach that combines Virtual Reality with the actual office environment.

Special emphasis was placed on the need to keep the equipment lightweight, multi-sensor coordinated, and interface-friendly during technology implementation. The qualitative analysis of expert interviews further validated and deepened the findings, demonstrating rapid, convenient, and continuously effective stress intervention. Experts also generally agreed that design should integrate multidisciplinary knowledge from disciplines such as medicine and psychology, supplemented by quantitative evaluation and feedback systems to ensure that the design output provides sustainable scientific therapeutic value, rather than just temporary Visual or psychological relief. In order to maximize the therapeutic effect and optimize the user's sensory experience, this study therefore explicitly uses VR helmets as the central carrier of its design strategy, supplemented by elements such as plants, natural materials, and spatial audio inside the physical office environment.

4.2 Design Objectives and Strategies

4.2.1 Design Objectives

The project aims to provide a long-lasting, multi-sensory immersive rehabilitation experience in a contemporary open office environment, so that Internet professionals can quickly rebuild psychological resilience under a high-intensity work rhythm. Through sensory modalities such as vision and hearing, the main design goal is to create a "second Nature" environment, an environment close to real Nature, allowing users to quickly change their attention and calm their emotions in a short period of time. At the same time, the system must strike a balance between technical feasibility and usability; therefore, equipment deployment should be as "plug and play" as possible, and interactive technology should minimize the learning curve. The choice of hardware and software should be flexible in terms of cost, maintenance, and upgrades to achieve seamless integration and long-term operation in the current spatial environment. This will lay the foundation for the next version.

4.2.2 Design Principles

The proposed immersive rehabilitation system highlights the interactive concept of "what you see is what you get, one-step to get it": the interface should have a low Visual load and a short operation path, allowing users to select scenes and enter the experience in a few seconds, thereby avoiding additional cognitive costs in a high-pressure work rhythm. Under this theory, we still follow the principle of multi-sensor consistency to ensure precise time synchronization of Visual and audio inputs to avoid cognitive discomfort caused by cross-modal delays. At the same time, we use a low-intrusion approach to closely adjust the thresholds of sound, light, and fragrance flow to ensure that the treatment environment coexists harmoniously with adjacent workstations. We also respect data privacy and security standards: all physiological and behavioral data are encrypted and stored locally, and can be anonymized when necessary according to GDPR and business regulatory standards. Finally, the peripheral expansion interface is maintained through modular software and hardware design to ensure that the system can easily integrate future sensory devices and achieve sustainable iteration and maintenance.

4.2.3 Design Method

In general, there are still four stages that define the design process: demand analysis, scenario construction, prototype development, and effectiveness evaluation. Despite this, the hardware layout and multi-sensor configuration have been carefully modified. For the Olfactory dimension, instead of using digital odor devices, we use indoor plant modules that release natural volatile organic compounds, which interact with light and sound field scripts to form a maintainable and low-cost natural micro-ecosystem. First, based on research and interviews to identify stress triggers and sensory preferences, we used Unity engine combined with professional spatial audio middleware to build a dynamic scene library around low-impact natural themes such as "mountains, coastlines, and grasslands after rain." "

Secondly, using a simplified two-step UI flow, the interaction smoothness and motion sickness in the prototype iteration phase were studied; after that, we used a post-experience questionnaire to evaluate the relaxation effect. In order to allow flawless access to different sensory equipment in the future, the backend also includes a universal API for communication with wearable devices.

Finally, in the A/B testing phase, the immersive healing experience was compared with the traditional relaxation area to provide data support for the next step of implementation.

4.3 Design Concept

Through extensive research on questionnaires and expert interviews, the researchers suggested "multi-sensory synchronous narrative" as the basic design framework for combining digital technology with natural environment Table 11. By using dynamic spatial storytelling, the framework seeks to transform the biomechanics of natural therapy into an observable, interactive immersive experience, thereby meeting the desire of employees of metropolitan Internet companies for effective and decentralized treatment methods. 92% of respondents expressed great interest in multi-sensory digital rehabilitation solutions that include natural elements, but user research showed that 87% of respondents believed that current workplace stress relief methods (such as short breaks and psychotherapy) were inefficient.

Table 11

A multi-sensory framework guided by sight, sound and smell

Guidance Dimension	**Survey Analysis Results**	**Expert Interview Summary**	**Multisensory Framework Design Key Points**
Visual Guidance	Respondents reacted positively to the highly immersive scene colors and lighting effects, noting that these elements effectively capture	Experts emphasized the importance of realistic detail rendering and the design of spatial flow lines, observing that greater authenticity more readily evokes emotional resonance.	Employ rhythmic shifts in color and illumination, spatial composition, and circulation paths to create a “Visual focus → scene transition → feedback prompt” loop, ensuring that key elements stand out at a glance.

	attention and facilitate emotional transition.		
Auditory Guidance	Most participants indicated that natural soundscapes (e.g., birdsong, flowing water) can quickly induce calm, and that layered audio effects enhance immersion.	Experts recommend a layered soundscape approach, blending ambient noise with theme-specific audio and using gradual adjustments in volume and rhythm to intensify the experience.	Construct a three-tiered natural audio structure (“background – midground – foreground”), use volume and frequency gradients to guide attention, and include “sonic transition” effects at scene changes.
Olfactory Guidance	Some respondents reported that a subtle botanical fragrance significantly enhances relaxation without disrupting their work flow.	Experts suggest using low-concentration, controllable essential-oil releases, synchronized with the Visual and Auditory timeline.	A “fade-in-maintain-fade-out” scent sequence was designed using volatile scent plants, distributing different plant scents to coordinate Olfactory cues with the light and sound landscape.

Note. Collected and compiled by the researchers. (2025)

The creation of the design concept stems from a reinterpretation of the core of natural therapy. Natural therapy is the coordinated activation of the body's self-healing system through multimodal stimulation, not just the accumulation of natural ingredients. For example, in forest therapy, inhaling plant scents can reduce the activity of the sympathetic nervous system, and the Auditory input of flowing sounds can divert attention from workplace-related stress. But the spatial dependence of traditional natural therapy is essentially contrary to the trend of increasingly dense contemporary office buildings. In this regard, the "spatial narrative translation" method proposed in the expert interview has become a key breakthrough in the reconstruction of the spatiotemporal logic of natural healing through XR technology. For example, the soundscape of flowing water is converted into spatial audio with directional gradients, thereby decoupling the biological efficacy of natural therapy from geographical limitations and embedding it into the fragmented time of the office environment. Then, the smell of plants is transformed into potted green plants in the physical office.

User feedback shows that the ideal duration of a single healing experience is between 5 and 15 minutes (accounting for 76% of respondents), which requires the design to achieve multi-target sensory activation, emotional regulation and cognitive recovery within a limited time frame. The first concept revolves around the balance between "micro-intervention" and "immersion", such as virtual scenes, through the interaction of light and shadow in the scene (Visual), indoor potted plants (Olfactory), and the Tactile experience of touching plants (Tactile), rather than just Visual replication of natural landscapes, to form a narrative rhythm. This design language borrows the "fascination-distancing" idea of Attention Restoration Theory (ART), using dynamic sensory cues to gently transition users from a stress-induced state of attention to a state of physical and mental relaxation.

Experts emphasize the need to avoid the dual hazards of "sensory overload" and "overexposure to technology", and at the level of technological integration, emphasize that simply adding more sensory dimensions (such as excessive Olfactory or Tactile feedback) may cause 32% of users to be distracted, thereby hindering stress relief. Therefore, the design adopts a "layered sensory activation" strategy: the Olfactory Tactile layer acts as a modulation layer to enhance the sense of presence through intermittent stimulation (for example, potted plants release odors); the audio-Visual layer serves as a foundation to provide a low cognitive load immersive environment (such as 360-degree forest projections, surrounding birdsong). This layered approach protects the integrity of the therapeutic experience and allows the open work environment to adapt to its susceptibility to distraction.

The deep map user experience further exposes the need for culturally universal design. This study downplays the distinct expressions of Eastern and Western cultural symbols, but the construction of natural metaphors still needs to focus on cross-cultural cognitive commonalities. The "de-symbolized" translation of Nature ensures that the design may adapt to the various backgrounds of global office employees. Therefore, the current conceptual exploration defines three basic principles:

1. Sensory coordination narrative (constructing healing rituals through dynamic sensory cues);

2. Adaptability of technological invisibility (achieving seamless interaction driven by biofeedback);

3. Cross-cultural metaphor neutrality (extracting cross-cultural natural prototypes).

These principles provide a theoretical framework for subsequent prototype development and lay the foundation for a paradigm shift in the design of healthy office spaces in the digital age.

4.3.1 Concept Sketches and Preliminary Prototype Design

Based on the “Multisensory synchronous storytelling” paradigm constructed in section 4.3.1, this project examines the interpretation logic of the natural healing effect in a virtual office environment through sketching and prototyping. The reconstruction of the biodynamics of naturopathy, i.e., translating the natural mechanism of forest bathing into a programmable digital sensory language, determines the essence of the concept design. In the sketching stage, a healing story including a temporal element was constructed using the “dynamic layering” method.

4.3.1.1 Multi-Sensory Spatial Concept Design

In 1989, NASA collaborated with the American Association of Landscape Architects (ALCA) to study the ability of various indoor plants to remove volatile organic compounds (VOCs), such as benzene, formaldehyde, and trichloroethylene, in a closed environment. The study revealed that plant leaves, roots, and microorganisms in the soil cooperate to effectively absorb these harmful substances. For example, plants such as spathiphyllum (Spathiphyllum ‘Mauna Loa’) and sansevieria (Sansevieria tryphancata ‘Laurenti’) have shown high purification capabilities in experiments. Although the NASA study demonstrated the air purification capabilities of plants in a laboratory environment, subsequent studies have pointed out that these effects may be overestimated in real open environments. For example, different plants have different effects on psychological and physiological health. Some plants, such as Vicks plant and rosemary, have shown positive effects on most indicators. Another study revealed that the main mechanism by which plants purify the air relies not only on the leaves but also on microorganisms in the roots and soil. There are also some innovative designs to enhance the air purification capabilities of plants, such as flower pots that combine activated carbon filters and ventilation systems(Cui et al., 2025). Although plants have limited air purification effects in real environments, studies have shown that they can improve mental health and indoor environmental comfort (Berger et al., 2024). Research has shown that indoor plants can reduce stress levels, improve mood, and increase focus and productivity. Examples include golden ficus, hypericum, goldenrod, delicious monstera, dragon's blood tree, golden epipremnum aureum, asparagus, and trifoliate bauhinia (Thatcher et al., 2020). Therefore, incorporating plants into a Multisensory interior design can be an effective way to improve the quality of life(Figure 43).

Figure 43

Indoor potted plants illustration

Note. Illustrated by the researcher. (2025)

Table 12

Indoor plant classification table

Type	Plant Name	Size Category	Key Benefits	Recommended Placement
Large Plants (Suitable for Reception Areas, Corners, or Open Spaces)	Fiddle Leaf Fig	Large	Visual appeal, air purification	Office corners
	Bird of Paradise	Large	Tropical ambiance, Visual interest	Reception areas
	Rubber Plant	Large	Air purification, low maintenance	Office corners
	Areca Palm	Large	Humidity increase, air purification	Common areas
	Monstera Deliciosa	Large	Artistic foliage, air purification	Open spaces
	Dragon Tree	Large	Air purification, drought tolerance	Office corners
	Happiness Tree	Large	Positive symbolism, air purification	Reception areas
	ZZ Plant	Large	Low light tolerance, air purification	Office corners
	Cordyline Fruticosa	Large	Colorful foliage, decorative appeal	Reception areas
Medium Plants	Anthurium	Medium	Vibrant flowers, air purification	Meeting rooms

(Ideal for Desks, Shelves, or Meeting Rooms)	Golden Pothos	Medium	Air purification, easy care	Desks, shelves
	Money Tree	Medium	Symbol of prosperity, air purification	Office desks
	English Ivy	Medium	Air purification, versatile placement	Shelves, partitions
	Asparagus Fern	Medium	Soft texture, Visual interest	Desks, shelves
	Parlor Palm	Medium	Low light tolerance, air purification	Meeting rooms
	Philodendron 'Golden Emerald'	Medium	Bright foliage, decorative appeal	Desks, shelves
	Chinese Evergreen	Medium	Air purification, low maintenance	Office desks
	Philodendron Selloum	Medium	Unique leaf shape, air purification	Meeting rooms
Small Plants (Perfect for Individual Desks or Small Spaces)	Cactus	Small	Low maintenance, decorative appeal	Individual desks
	Succulents	Small	Variety of shapes, low water needs	Individual desks
	Peperomia	Small	Compact size, diverse foliage	Individual desks
	Snake Plant	Small	Air purification, low light tolerance	Individual desks
	Spider Plant	Small	Air purification, easy propagation	Individual desks
	Asparagus Fern	Small	Soft texture, Visual interest	Individual desks
	Portulacaria Afra	Small	Bonsai potential, drought tolerance	Individual desks
	Pennywort	Small	Air purification, suitable for water culture	Individual desks
	Dwarf Syzygium	Small	Bonsai potential, decorative appeal	Individual desks

Note. Collected and compiled by the researchers. (2025)

The researcher developed three plant combination schemes(Table 12) and a conceptual picture of the experience space (Figure 44) based on the aforementioned research analysis results; these were then presented to the adviser for evaluation.

Figure 44

Concept map of experience space

Note. The author used AI to draw (2025)

Table 13

Space plant combination plan

Plan Name	Plant Name	Size Category	Recommended Placement
Office Plant Plan A	Rubber Plant	Large	Corner
Office Plant Plan A	Bird of Paradise	Large	Reception
Office Plant Plan A	Cordyline Fruticosa	Large	Reception
Office Plant Plan A	Golden Pothos	Medium	Shelf
Office Plant Plan A	Chinese Evergreen	Medium	Desk Side
Office Plant Plan A	Philodendron'Golden Emerald'	Medium	Shelf
Office Plant Plan A	Pennywort	Small	Window Sill
Office Plant Plan A	Dwarf Syzygium	Small	Cubicle Divider

Office Plant Plan A	Asparagus Fern	Small	Desk Top
Office Plant Plan B	Fiddle Leaf Fig	Large	Reception
Office Plant Plan B	Bird of Paradise	Large	Open Area
Office Plant Plan B	Cordyline Fruticosa	Large	Reception
Office Plant Plan B	Parlor Palm	Medium	Meeting Room
Office Plant Plan B	Money Tree	Medium	Meeting Room
Office Plant Plan B	Philodendron Selloum	Medium	Desk Side
Office Plant Plan B	Spider Plant	Small	Window Sill
Office Plant Plan B	Dwarf Syzygium	Small	Cubicle Divider
Office Plant Plan B	Pennywort	Small	Window Sill
Office Plant Plan C	Areca Palm	Large	Open Area
Office Plant Plan C	Rubber Plant	Large	Reception
Office Plant Plan C	ZZ Plant	Large	Reception
Office Plant Plan C	Chinese Evergreen	Medium	Meeting Room
Office Plant Plan C	Golden Pothos	Medium	Shelf
Office Plant Plan C	Asparagus Fern	Medium	Meeting Room
Office Plant Plan C	Cactus	Small	Cubicle Divider
Office Plant Plan C	Pennywort	Small	Window Sill
Office Plant Plan C	Peperomia	Small	Window Sill

Note. Collected and compiled by the researchers. (2025)

The researcher simulated the integration of plants (Figure 45) with the space (Figure 46) epending on the conceptual design of the experience space and the plant combination schemes.

Figure 45
Space plant plan

Note. Illustrated by the researcher. (2025)

Figure 46

Floor plan of people and space

Note. Illustrated by the researcher. (2025)

The researcher created three layout plans and submitted them to the superiors for evaluation.

Plan 1 (Fig. 47) aims to achieve the coexistence of a warm environment and the essence of Nature. The spatial composition and focus of this plan are large plants such as Cordyline fruticosa, Bird of Paradise, and Rubber Tree. In the public spaces and reception rooms, these simple and vivid plants act as striking accents. In the corridors, bookcases, and conference rooms, medium-sized plants such as Pothos, Aglaonema, and Anthurium are placed to improve the spatial layout and greening. Small plants such as Cactus, Peperomia, and Pennywort, which are ideal for workstations and windowsills, save space and bring a sense of peace and unity. Overall, this design creates a friendly, natural, and bright work environment.

Plan 2 (Fig. 48) emphasizes plantings that promote greater concentration and calm the mind. This combination uses large potted plants such as "Radelmakela (China Doll)", "Monstera" and "Areca Palm" to reduce eye fatigue, enhance the sense of unity in the space and create a calming atmosphere. In addition, the combination of medium-sized plants such as "Moneyglove", "Parlor Palm" and "Asparagus Fern" promotes air circulation and gives the space a soft atmosphere. In addition, plants such as "Sansevieria", "Portulacaria afra" and "Cactus" are placed on the tabletops and in the partitioned sections, and small potted plants are beautifully arranged to create a beautiful space with a harmonious air purification effect. This combination is ideal for office environments that emphasize efficiency, concentration and rational aesthetics.

Figure 47
Combination plan 1

Note. Illustrated by the researcher. (2025)

Option 3 (Figure 49) is bright, comfortable, and creatively stimulating. Three fairly large plants—'Fiddle Leaf Fig,' 'Bird of Paradise,' and 'ZZ Plant'—placed in a meeting space or lobby help create an open, lively first impression. Visual accents and transitional components are placed on shelves and aisles between medium-sized plants such as 'Philodendron Selloum,' 'English Ivy,' and 'Golden Philodendron.' At workstations and leisure areas, small plants like 'Pennywort,' 'Premna Microphylla,' and 'Peperomia' help relieve eye fatigue and stimulate user creativity. Design-oriented, creative workplace environments will find it perfect because the overall layout emphasizes releasing freedom and imagination space.

Figure 48

Combination plan 2

Note. Illustrated by the researcher. (2025)

Figure 49

Combination plan 3

Note. Illustrated by the researcher. (2025)

4.3.1.2 Virtual Scene Concept Design

Using the literature review in Chapter 2, as well as the mixed analysis of questionnaire data and expert interviews, the researcher created hand-drawn conceptual sketches (Figure 50) to reproduce and present the general experience process of virtual scenes. Inspired by the design of these sketches, the researcher used artificial intelligence to prototype three virtual scenes with different therapeutic effects: virgin rainforest, wetland, and lakeside. Through stylized translation, these scenes not only met the needs of diverse Nature experiences desired by 82% of respondents, but also succeeded in conveying the concept of natural therapy in cross-media. Under the guidance of the supervisor, each scenario was created in three artistic styles (realistic, sci-fi, and cartoon), resulting in nine Visual variations to explore the dynamic balance between Visual language and therapeutic effects. The pristine jungle landscape, painted in a realistic style with a well-balanced reproduction of irregularly cracked bark and feathery fern leaves, painstakingly depicts the characteristics of the plant. The sci-fi interpretation of the flora, reproduced as translucent crystalline structures and with softly glowing bioluminescent edges on the leaves, gives it a futuristic impression while preserving the spatial density of the jungle. With simple geometric shapes and vivid layers of color, the cartoon version exudes a soothing atmosphere that exudes childlike joy (Figure 51).

The stream and marsh scenes feature a dynamic depiction of water bodies and plants. The realistic version faithfully reproduces the refractive effect of the patterns on the turbulent water surface, while the sci-fi version preserves the rhythmic flow of the water surface while enhancing the surreal texture of the material. The cartoon version emphasizes the decorative flatness of the landscape with layered color blocks and simplified ripple patterns (Figure 52).

The landscape along the lake shore presents highly innovative stylistic experiments. The realistic version uses atmospheric perspective and water reflections to create depth. The sci-fi version, on the other hand, preserves the flowing qualities of the water and depicts its surface with futuristic light effects, creating a rich, futuristic atmosphere, while the manga version recreates the lake shore with animated lines and highly saturated colors (Figure 53).

Figure 50

Hand-drawn sketch of the virtual scene experience process

Note. Illustrated by the researcher. (2025)

Figure 51

Original Jungle Style Simulation (realistic, science fiction, cartoon)

Note. The author used AI to draw (2025)

Figure 52

Stream Wetland Graphic Style Simulation (realistic, science fiction, cartoon)

Note. The author used AI to draw (2025)

Figure 53
Lakeside Scene Style Simulation (realistic, science fiction, cartoon)

Note. The author used AI to draw (2025)

4.3.1.3 Scene Audio Selection

Recent studies on the restorative properties and mechanisms of natural soundscapes, such as water sounds and birds singing, on psychological and physiological recovery have been systematically investigated. Studies have revealed that not only water sounds but also biophonic elements such as birds singing have a significant restorative effect. (Kim et al., 2021) verified that artificial soundscapes induce significant negative emotional responses, while water sounds combined with open views in forest environments can enhance positive emotions. (Bai & Zhang, 2024) further suggests that the combination of multiple natural sounds, such as flowing water, birds singing, and wind, can have a better restorative effect than single-element soundscapes. Elderly and highly educated people living in urban environments rate natural sounds (e.g., birds singing, running water) as more restorative sounds (Guo et al., 2022). Cross-modal effects of combining Audio Visual with Olfactory and Auditory senses have been widely studied. A Multisensory experiment with 308 participants (Qi et al., 2022) found that pairing birdsong with Visual scenery promoted alpha wave activity (promoting physiological recovery), while Olfactory stimuli (e.g., plant scents) could inhibit the recovery effect (indicated by elevated SCL values). In contrast, (Korpilo et al., 2024) found that a combination of Audio Visual and Nature sounds (high NDSI and Nature views) reduced electrodermal activity (EDA) by 32% compared to an urban park. In a workplace environment, combining Nature sounds (O+N) with indoor plants reduced pulse rate (PR) by 5.7 bpm (Latini et al., 2024). With an HRV optimization rate of 18%, (Hsieh et al., 2023) evaluated high-decibel and low-decibel (45 dB vs. 75 dB) water sounds in a VR environment and found that the low-decibel sounds significantly reduced anxiety levels in university students. In addition, blood oxygen levels dropped by 22%. (Song et al., 2023) mixed the sounds of valley water with songbird calls to show how naturally occurring sounds enhance parasympathetic nervous system activity. Common methodological elements are group-based controlled studies and bimodal validation, i.e., the combination of physiological markers and psychological measures. However, limitations center on sampling bias (e.g., mostly student groups), short trial time (3 min), and spatial homogeneity (limited to forest parks).

Based on the results of the case study, the researchers showed the sounds used in the virtual environment to help more accurately reflect reality (Table 14). Using pink noise-like waterfall, lake waves, and tides as the basic soundscape can quickly suppress sympathetic nervous system activity and block out urban noise, creating a stable and safe psychological space for Internet company employees who are under high stress. Although environments such as virgin forests, mountain lakes, and beaches are ecologically distinct, they share a common three-layer acoustic structure: low-frequency water sounds, mid-frequency rhythms, and high-frequency details. Typically located between the natural rhythms of 80-100 BPM, the mid-frequency layer (such as birds chirping, frogs croaking, and insect choruses) synchronizes with the user's breathing, sustaining a sense of well-being and providing rhythmic direction during meditation. High-frequency elements such as rustling leaves, the friction of fine sand, and the popping of shrimp have strong "Auditory and Tactile" properties, significantly increasing alpha wave activity and immersion.

Table 14

Scene audio element comparison table

Scene category	Element name	Acoustic characteristics	Healing effect
Primeval jungle	Dawn Chorus	2–6 kHz polyphonic harmony; loose rhythm	Reduce anxiety and paranoia, enhance positive emotions for more than 8 hours
	Waterfall/ Rain	Broadband pink noise 0.1–2 kHz; coherent masking	
	Wind in the Treetops	2–8 kHz continuous rustling; with fine high frequencies	Quickly reduce heart rate and skin electricity, improve attention recovery
	Frog/Insect Chorus	80–100 BPM repetitive beats; prominent at night	

Mountain lake beach	Waves on the Lake	1–3 Hz shore pounding + <400 Hz water seepage	Synchronize with breathing rhythm, enhance meditation depth
	Footsteps on the Beach/Sand Sliding	2–5 kHz particle friction; near-field ASMR	
	Wind in the Grass	2–8 kHz short-period airflow; wide dynamics	Natural metronome, improve HRV and reduce tension
	Loons and Waterfowl	1–6 kHz rich echoes; intermittent long tones	
	Echoes in the Valley	≈0.3 s natural reverberation; low artificial noise	Restore skin electricity and reduce cortisol within 10 minutes
	Night Frogs/Insects	80–100 BPM repetitive chorus	
Stream wetland	Tidal Streams Lapping at the Shore	<400 Hz rhythmic water sound; changes with tide level	Trigger Alpha waves and pleasant "thrill" feeling
	Pistol Shrimp/Fiddler Crabs Bursting	2–20 kHz transient pulses; "popcorn" background noise	
	Red Mangrove Leaves in the Wind	2–8 kHz fine high frequencies	Provide gentle rhythm for yoga/breathing training
	Kingfishers/Egrets Calling	1–6 kHz strong localization	
	Dusk Frogs/Insect Chorus	80–100 BPM beats; unique to wetlands	Trigger "open and safe" associations, stabilize emotions

Note. Collected and compiled by the researchers. (2025)

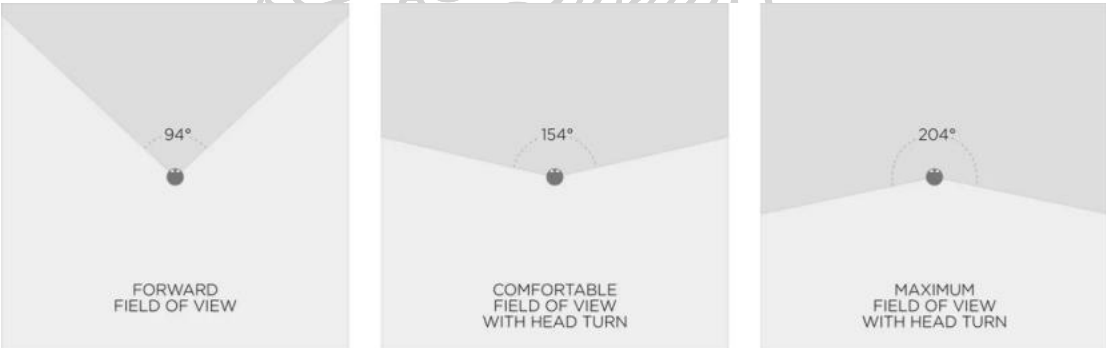
This three-layered soundscape is ideal for modular configuration by design. Deep meditation can emphasize mid-frequency rhythms, while short periods of quick relaxation can emphasize water sounds or high-frequency ASMR. The volume and spatial impact of each layer can be dynamically changed in real time to customize the therapy experience for different daily stress situations, with a gradual soundscape flow that moves from "quick calm" to "deep recovery".

4.3.1.4 Storyboard Setting

A storyboard was created for the design planning of the virtual space to ensure that the design of the Virtual Reality space was well suited to the needs and preferences of the consumer. Validating Mike Alger's VR conceptual design approach helped in the creation of the storyboard(McCurley, 2016). Research on the field of view (FOV) of VR head-mounted displays has found it to be approximately 94 degrees. If the user is seated, the head can easily rotate 30 degrees to the side and up to approximately 55 degrees. If the user is wearing wireless headphones while sitting in a chair or standing, the field of view range is even wider (Figure 54).

Figure 54

Field of view based on comfortable head rotation ranges.

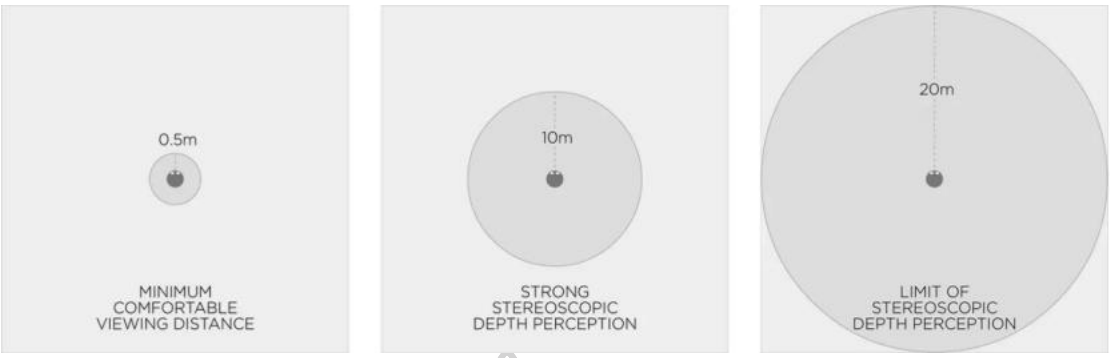


Note. (McCurley, 2016))

Vincent points out that the minimum viewing distance for a headset is about 0.5 meters. However, beyond 10 meters the sense of 3D depth begins to fade, and beyond 20 meters it is virtually lost. Thus, the optimal viewing distance for viewing materials is between 0.5 meters and 10 meters (Figure 55).

Figure 55

Viewing distance based on comfort and strength of stereoscopic depth perception.

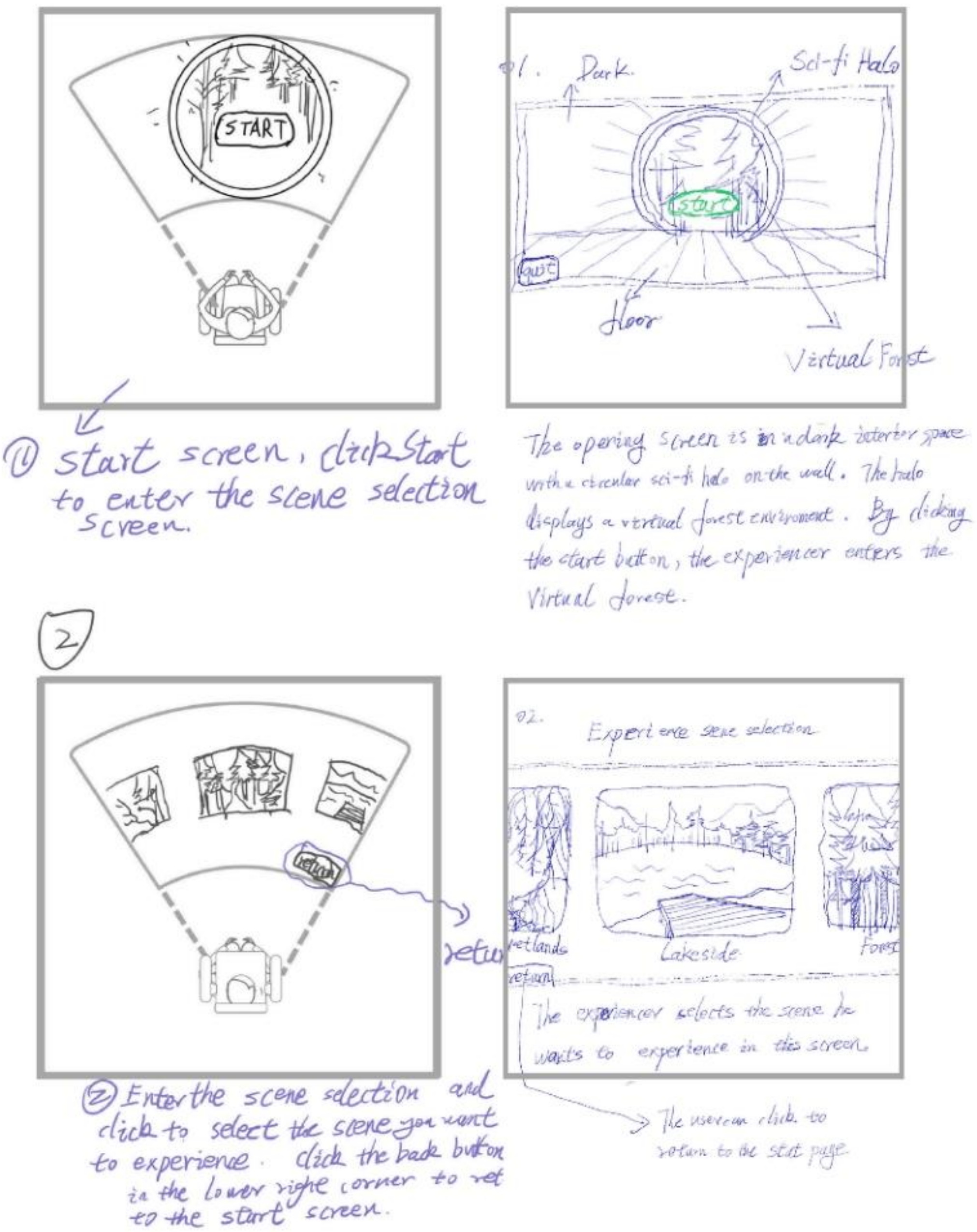


Note. (McCurley, 2016)

Based on the results of the literature survey and data analysis, along with the conceptual framework established in the previous chapter, we created a storyboard of the virtual scene design that shows the overall process of the immersive experience (Figure 56) (Figure 57) (Figure 58) (Figure 59) (Figure 60). This storyboard provides an information framework for subsequent expert review and design development.

Figure 56

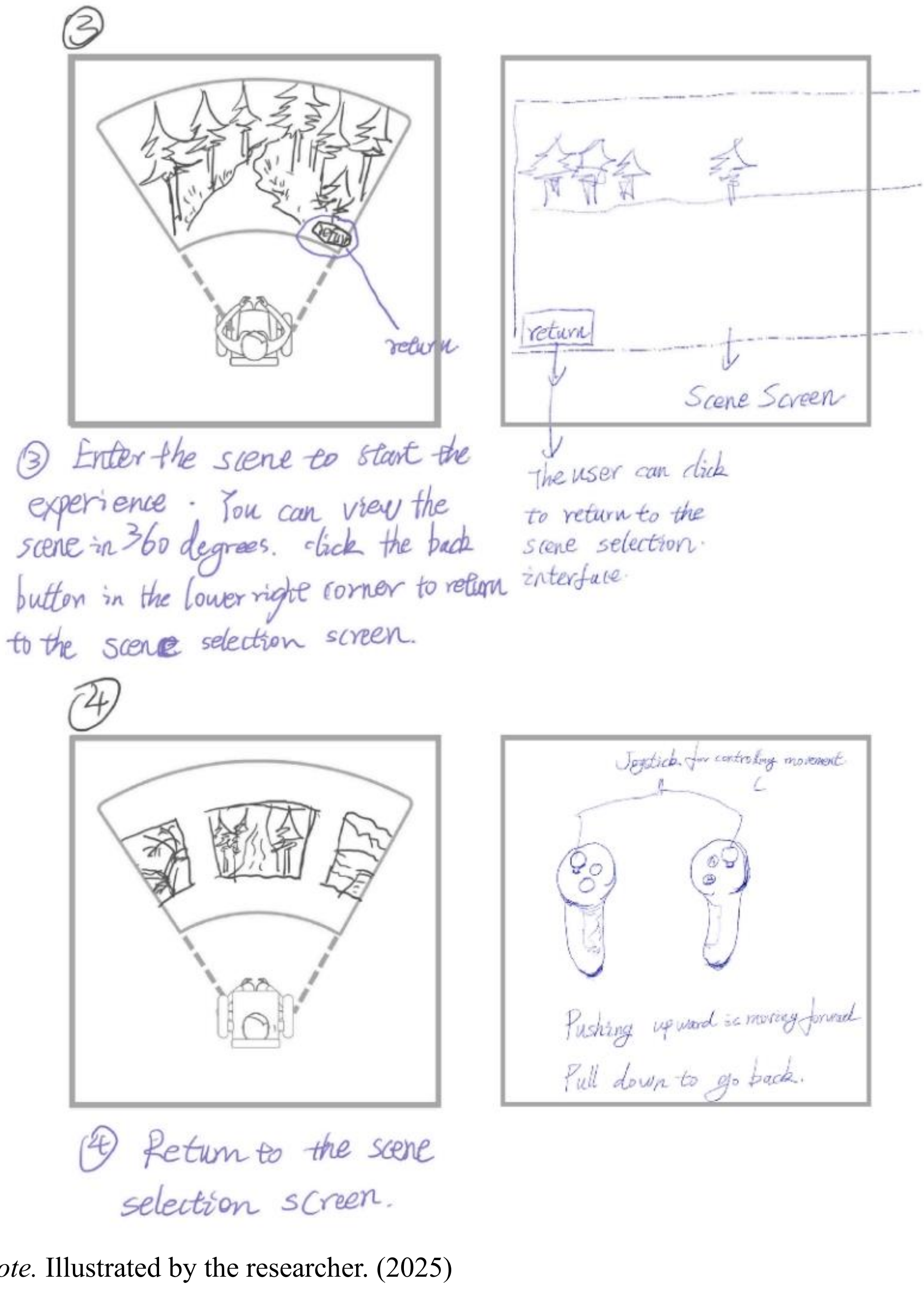
Virtual scene start and selection screen



Note. Illustrated by the researcher. (2025)

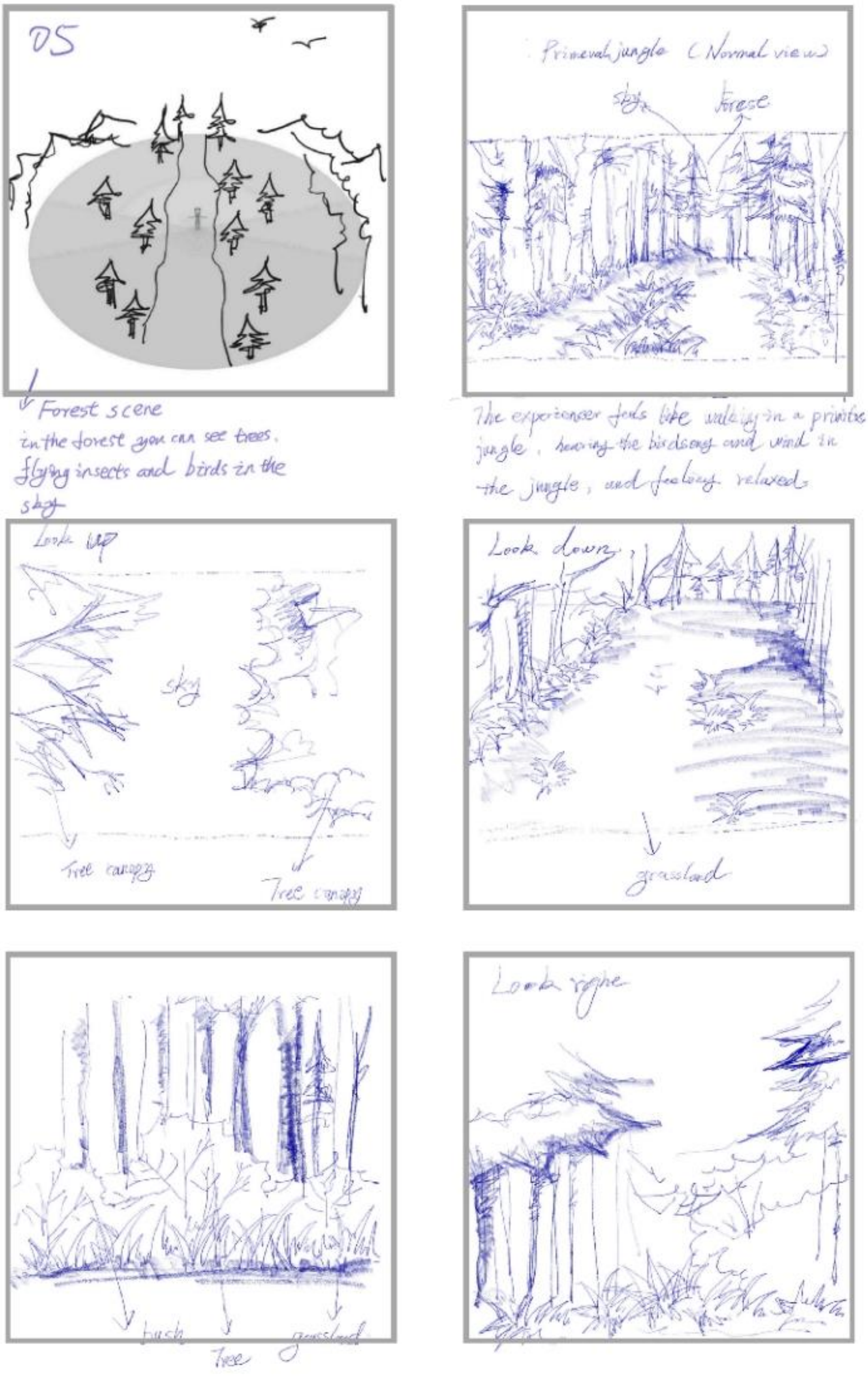
Figure 57

Scene experience screen and return



Note. Illustrated by the researcher. (2025)

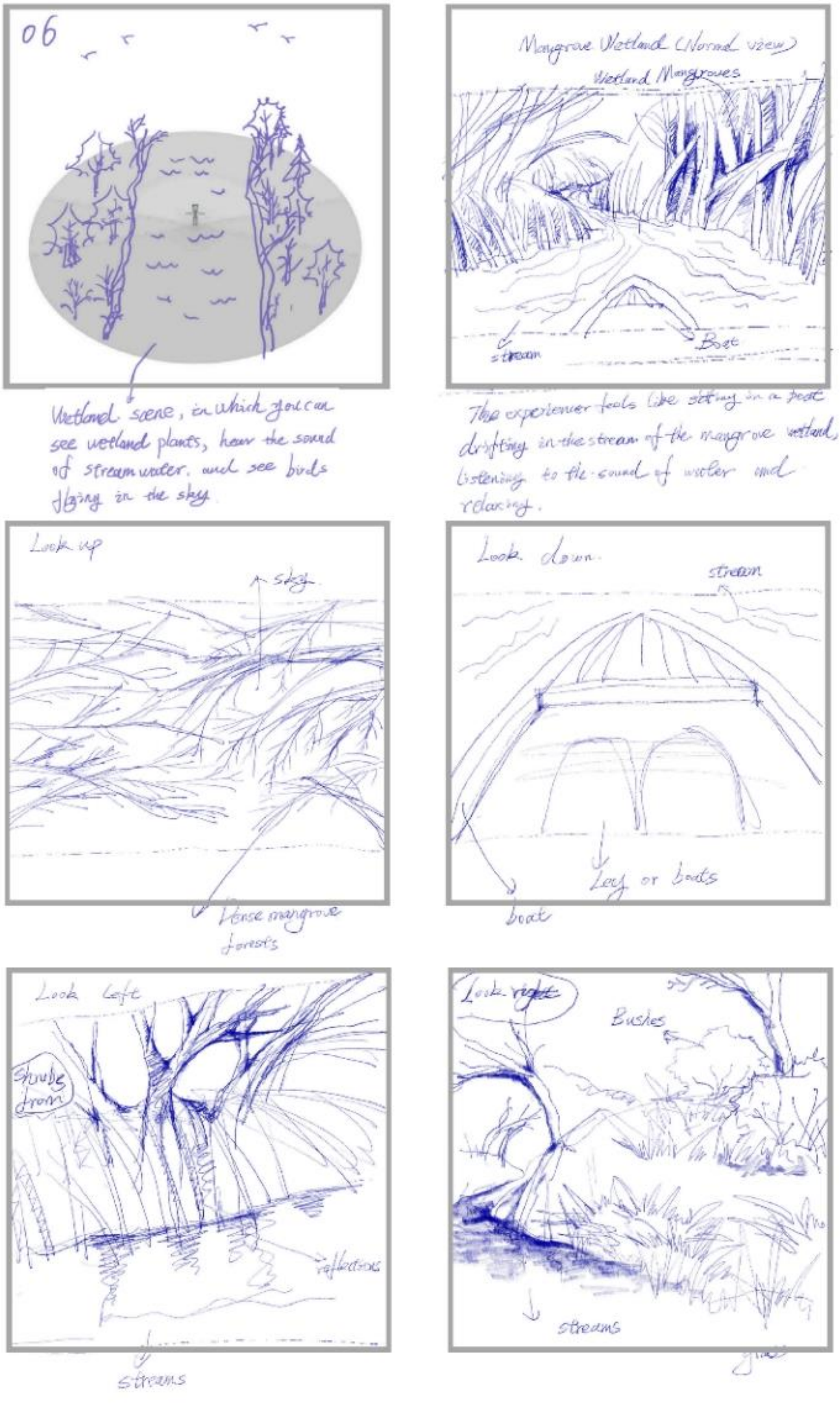
Figure 58
Original jungle scene experience screen setting



Note. Illustrated by the researcher. (2025)

Figure 59

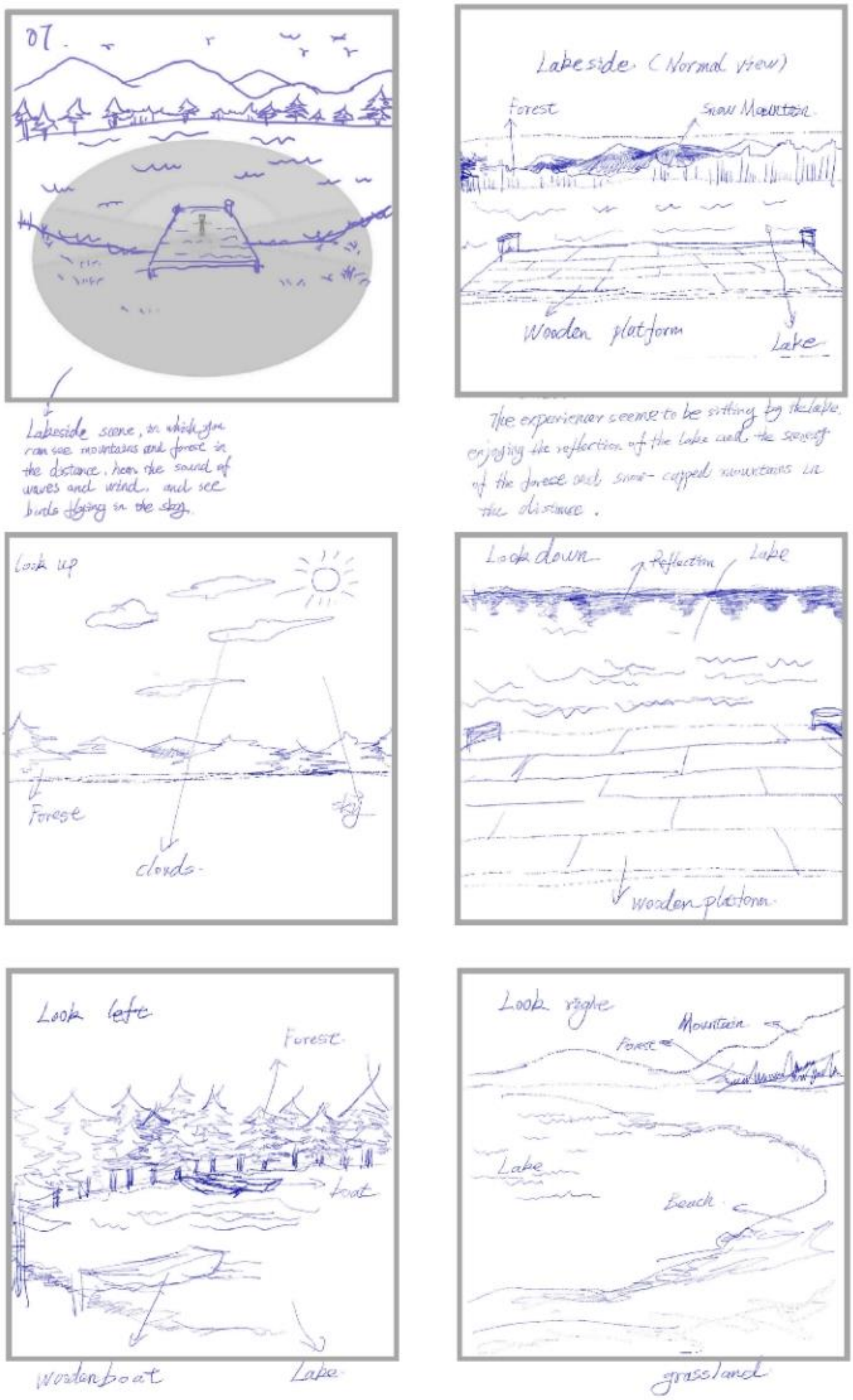
Stream wetland scene experience screen setting



Note. Illustrated by the researcher. (2025)

Figure 60

Lakeside scene experience screen setting



Note. Illustrated by the researcher. (2025)

4.3.2 Expert Evaluation of the Conceptual Scheme

The researcher invited six interdisciplinary experts to serve as an evaluation panel. Through the thorough evaluation and systematic analysis by the six experts, this study provided clear and comprehensive insights into the selection of Visual style, storyboard setting, and audio elements in the context of natural therapy (Table 15). According to the evaluation results, the three graphic styles, namely, realistic, cartoon, and sci-fi, show a clear hierarchical structure. Among these styles, the realistic style was unanimously highly rated by experts due to its vivid and detailed Visual depiction and close connection with users' real-life memories, and was shown to have a good effect on emotional healing and psychological relaxation. Although the overall design merits of the cartoon and sci-fi styles are relatively small, they still have great value. These styles can act as flexible supplementary and expansion elements within the whole experience system, effectively stimulating users' interest and interactive possibilities in specific situations.

Table 15

Graphics style expert evaluation table

(★: support strength level (maximum 5 stars)

Expert Type	Cartoon Style	Sci-fi Style	Realistic Style	Core Basis
Digital technology design expert 1	★	★	★★★	Realistic physical rendering technology makes it easier to achieve multi-sensory interaction
Digital technology design expert 2	★	★	★★★★	Realistic scenes meet biophilia theory
Natural therapy expert	★	★	★★★★★	Realistic natural elements are consistent with the Visual experience of natural therapy
Psychology expert	★	★	★★★★	Really realistic effect appears more effective in relieving stress
User experience design expert	★★	★	★★★★	Realistic scenarios can reduce cognitive load
Spatial environment expert	★	★	★★★★★	Real-scale spatial mapping improves scene credibility

Note. Collected and compiled by the researchers. (2025)

At the same time, the three experience modes of dynamic, semi-dynamic and static have also been well received by storyboard professionals. This multi-modal architecture allows users to dynamically select the most appropriate experience mode according to their real-time psychological state and needs, fully reflecting the value of people-oriented design. In particular, experts emphasize that the user interface should be quite simple, avoiding complex interactions and unnecessary learning costs, allowing users to enter the treatment scene within 10 seconds. This strategy conforms to the real usage pattern of employees of Internet companies and maximizes the effective use of their scattered time.

Regarding the evaluation of Auditory components, psychologists and natural therapists specifically recommend a wide spectrum of natural sounds, including birdsong, running water, breeze, insects, etc. Studies have shown that these natural soundscapes have significant benefits in supporting psychological and physiological recovery; they can quickly improve attention and heart rate variability (HRV), thereby reducing anxiety levels and enhancing well-being. The precise selection of sound elements directly interacts with the Visual presentation of the treatment image, enhances the overall immersive treatment experience, and enhances the multidimensionality and authenticity of the treatment.

This paper proposes to use realistic Visual style as the main aesthetic foundation, natural soundscape as the core Auditory background, expert advice on Visual style, storyboard design, audio elements, etc. as the basis, and simplified and effective interaction design as the implementation path. These elements are used together to create a complete experience framework that maintains great versatility and ease of use while producing immersive therapeutic effects. It aims to create an overall design system that integrates emotional recovery, physiological control, and meeting personal needs, so as to achieve effective and continuous intervention in the physical and mental health of users. Future design development will continue to refine this comprehensive evaluation result.

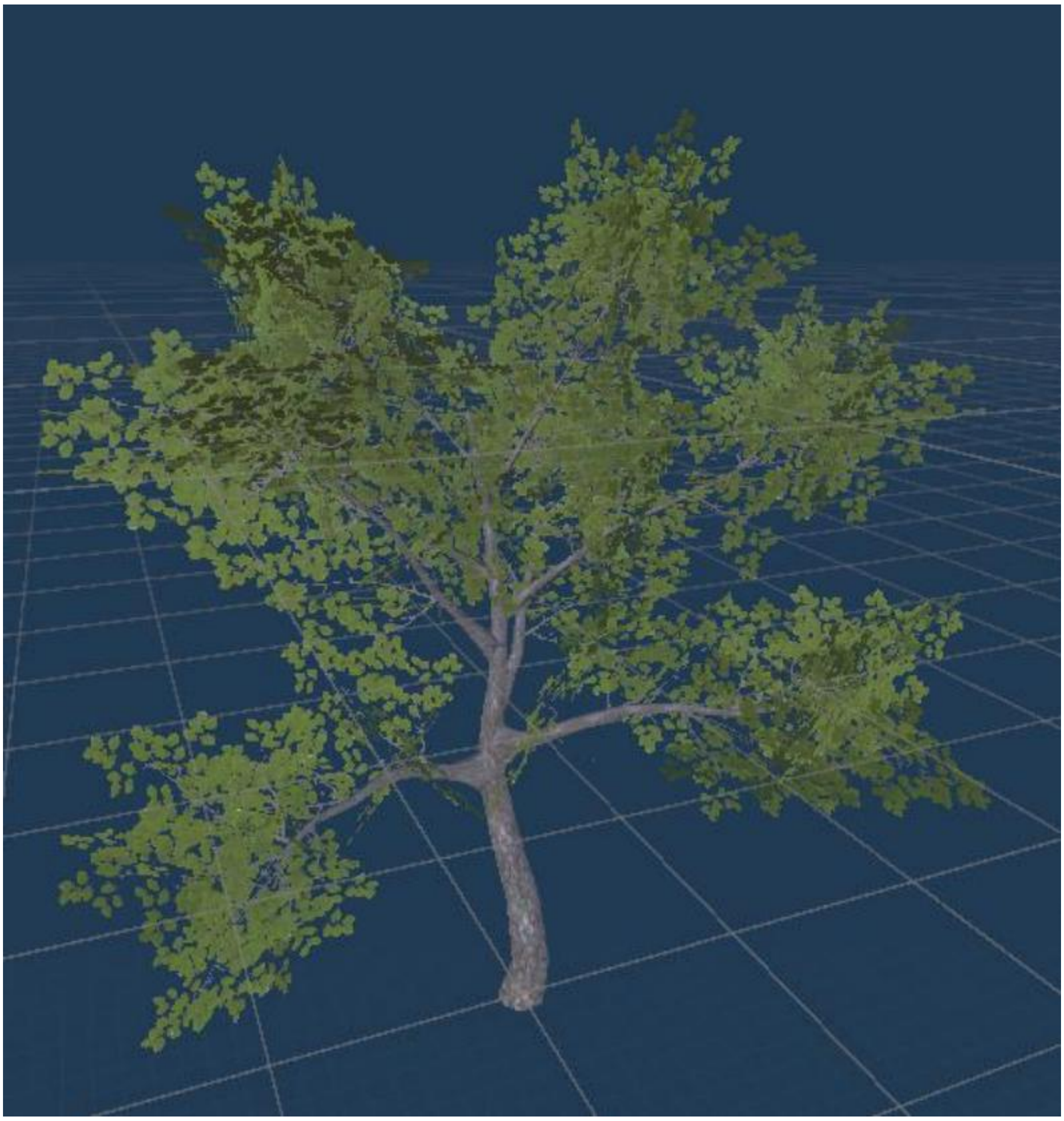
4.4 Design Development

4.4.1 Model Creation and Selection

After the data analysis, design concept, storyboard, and expert evaluation opinions were established, the project started the real design development stage. At this stage, the selection and improvement of plant models is the first priority. Low polygon count, high recognizability, combined with performance standards in the operation of the virtual environment, and the smoothness of subsequent scene interactions guide the selection and optimization of plant models from a perspective. These models reduce system load while maintaining a high degree of Visual accuracy and aesthetic appeal. As shown in Figures 61 to 88, the plant species finally selected Visually and psychologically meet the user's multi-level perception needs of the natural environment, ranging from trees, shrubs, flowers and ground cover plants.

Figure　61

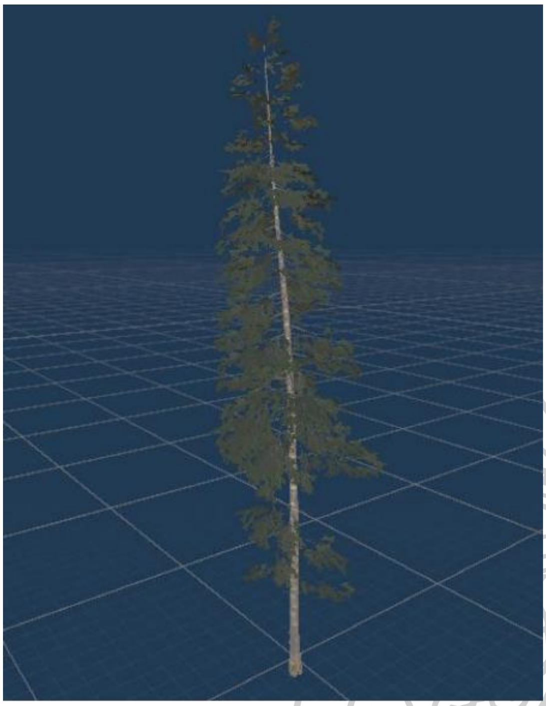
Tree Model 1



Note. Produced by Author（2025）

Figure 62

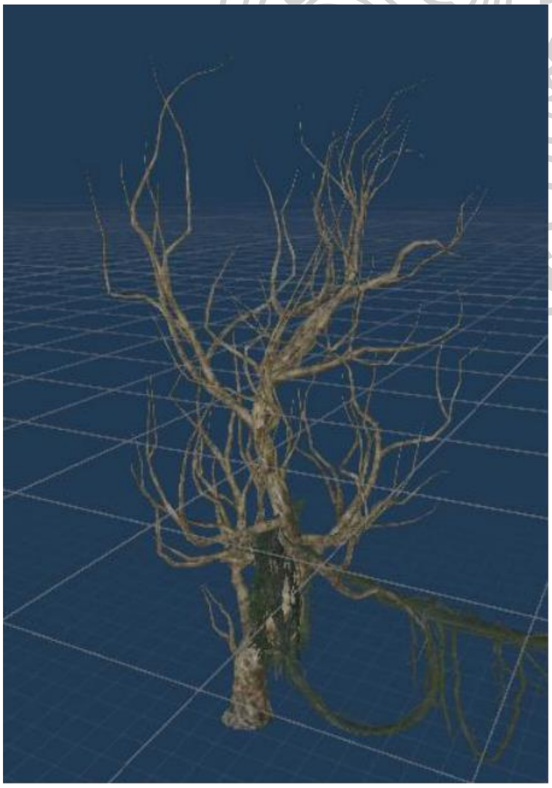
Tree Model 2



Note. Produced by Author（2025）

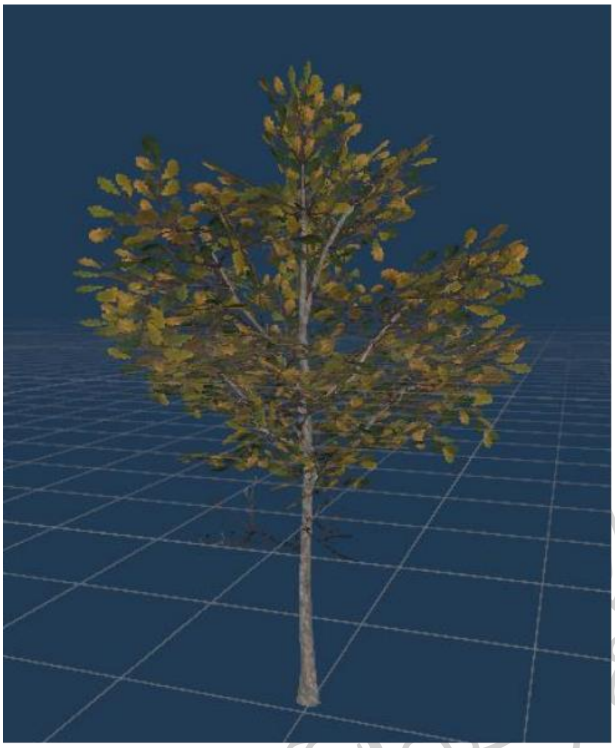
Figure 63

Tree Model 3



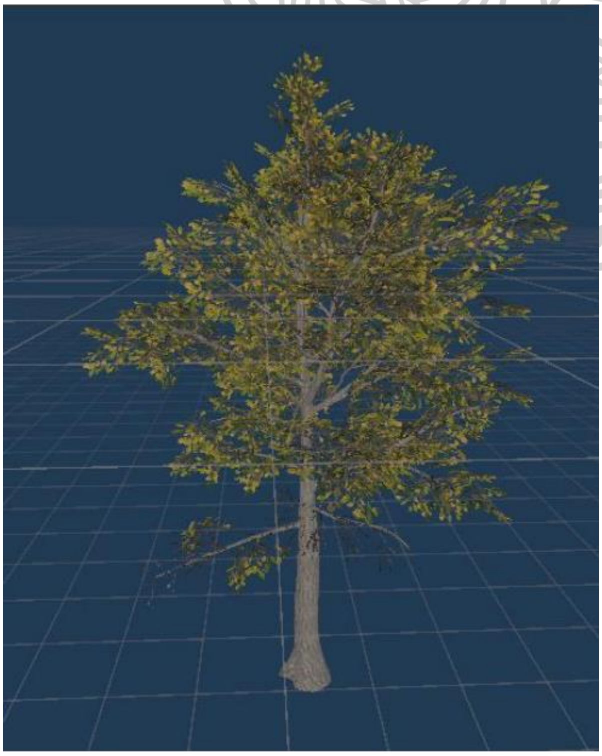
Note. Produced by Author（2025）

Figure 64
Tree Model 4



Note. Produced by Author（2025）

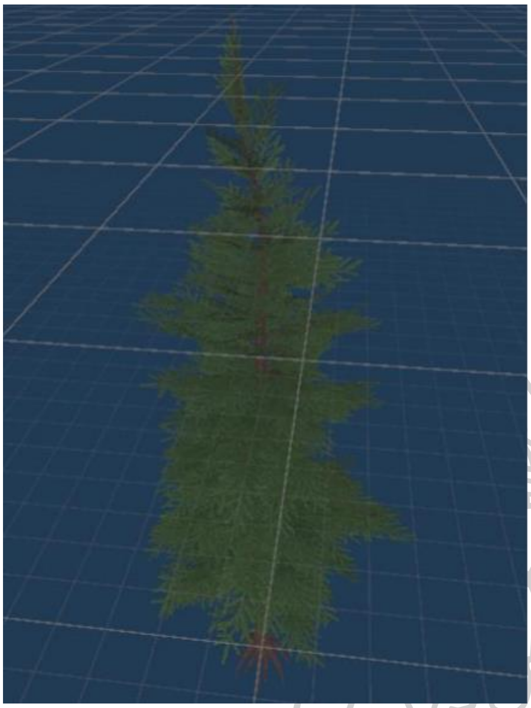
Figure 65
Tree Model 5



Note. Produced by Author（2025）

Figure 66

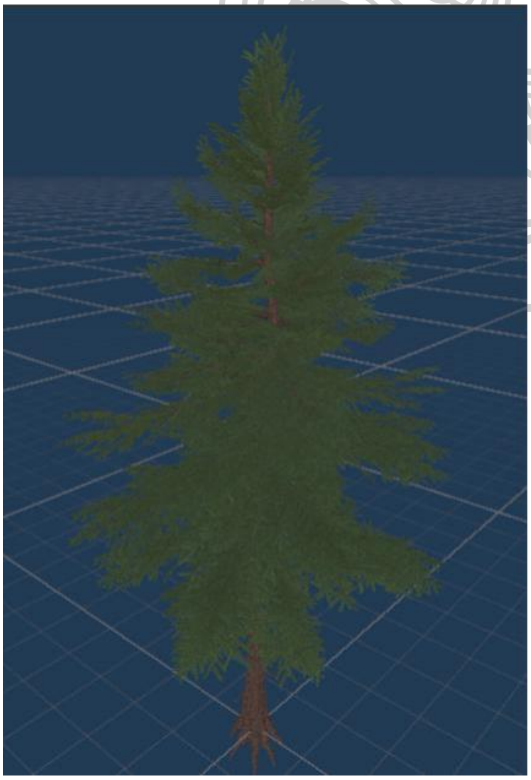
Tree Model 6



Note. Produced by Author（2025）

Figure 67

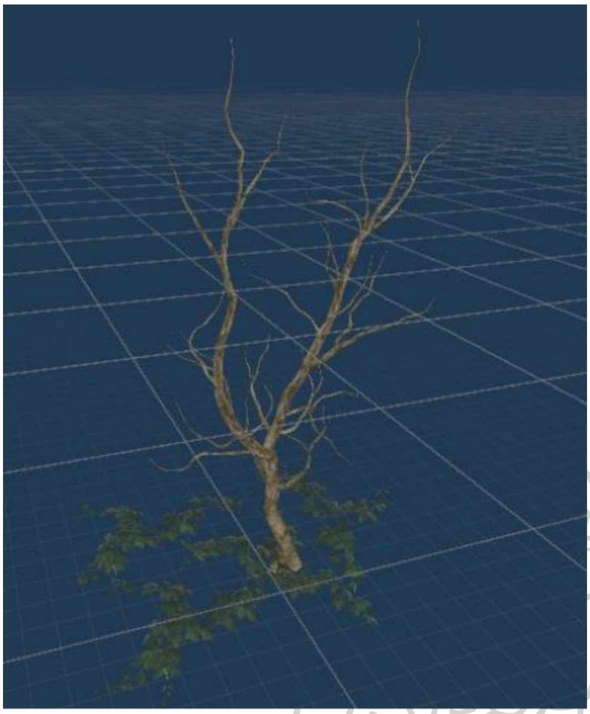
Tree Model 7



Note. Produced by Author（2025）

Figure 68

Tree Model 8



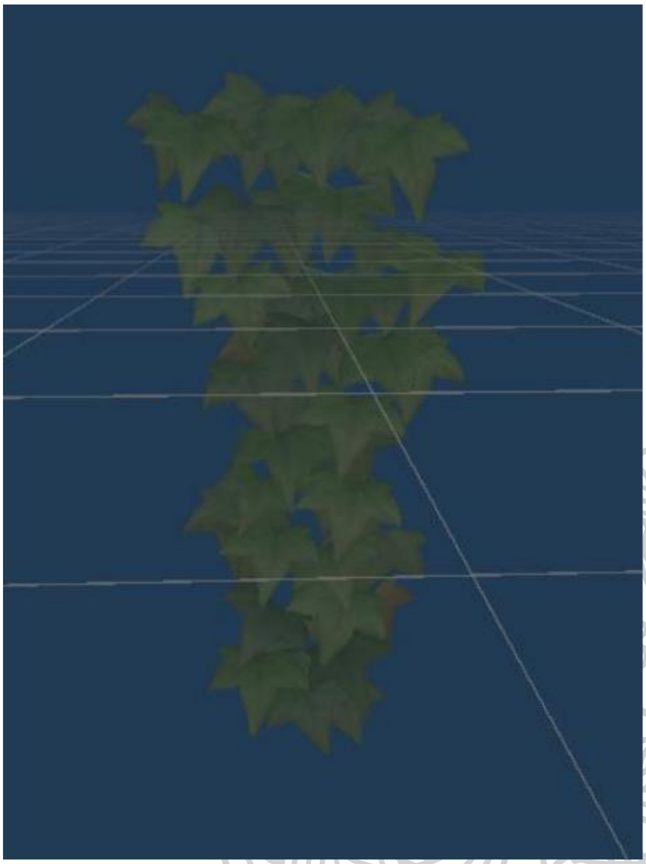
Note. Produced by Author（2025）

Figure 69

Vine Model 1

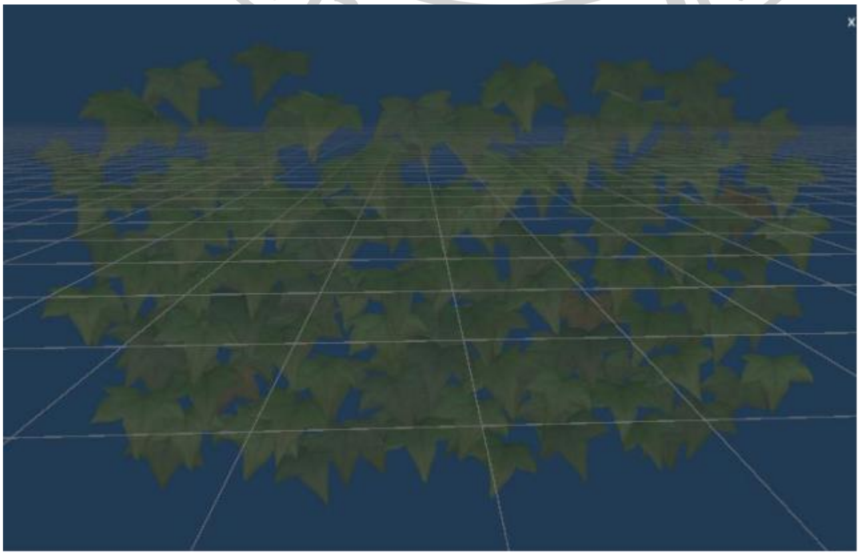
Note. Made by the author (2025)

Figure 70
Vine Model 2



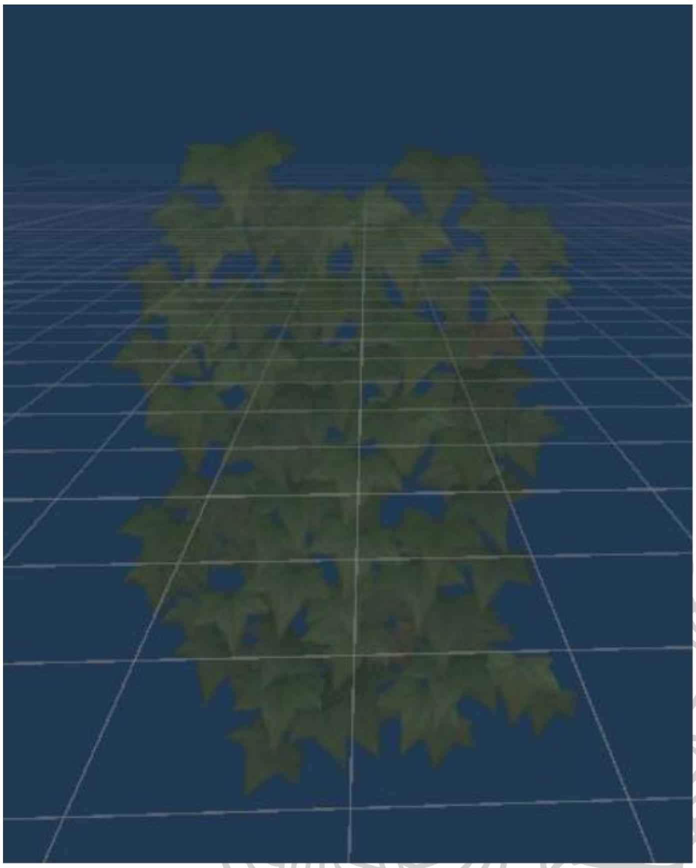
Note. Made by the author (2025)

Figure 71
Vine Model 3



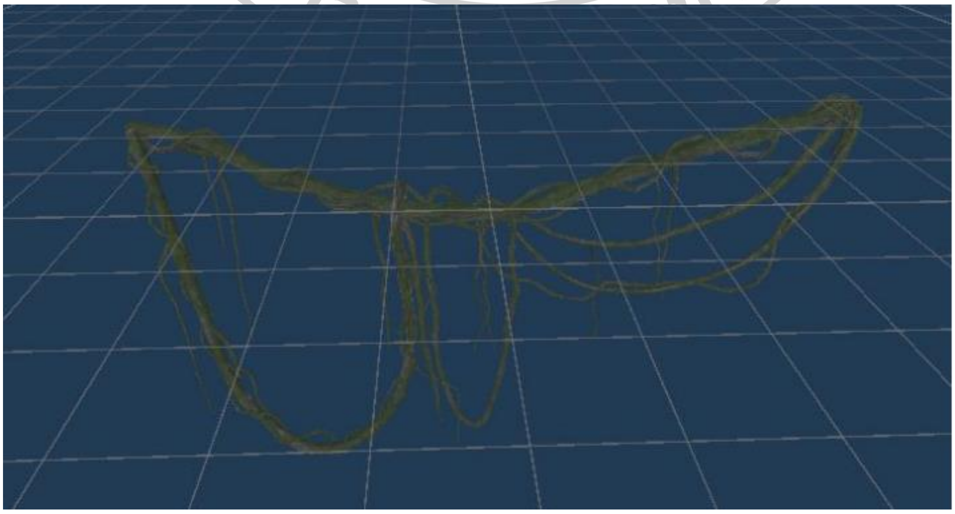
Note. Made by the author (2025)

Figure 72
Vine Model 4



Note. Made by the author (2025)

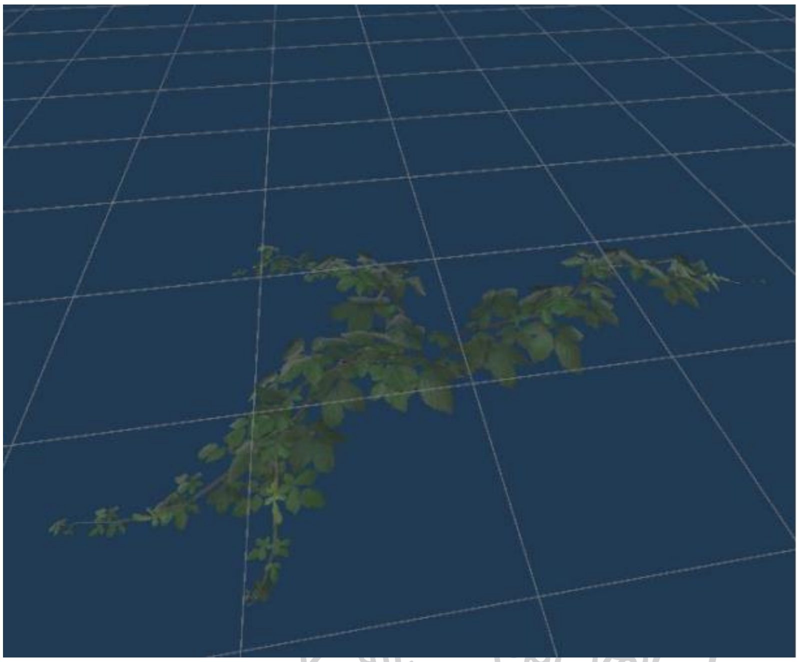
Figure 73
Vine Model 5



Note. Made by the author (2025)

Figure 74

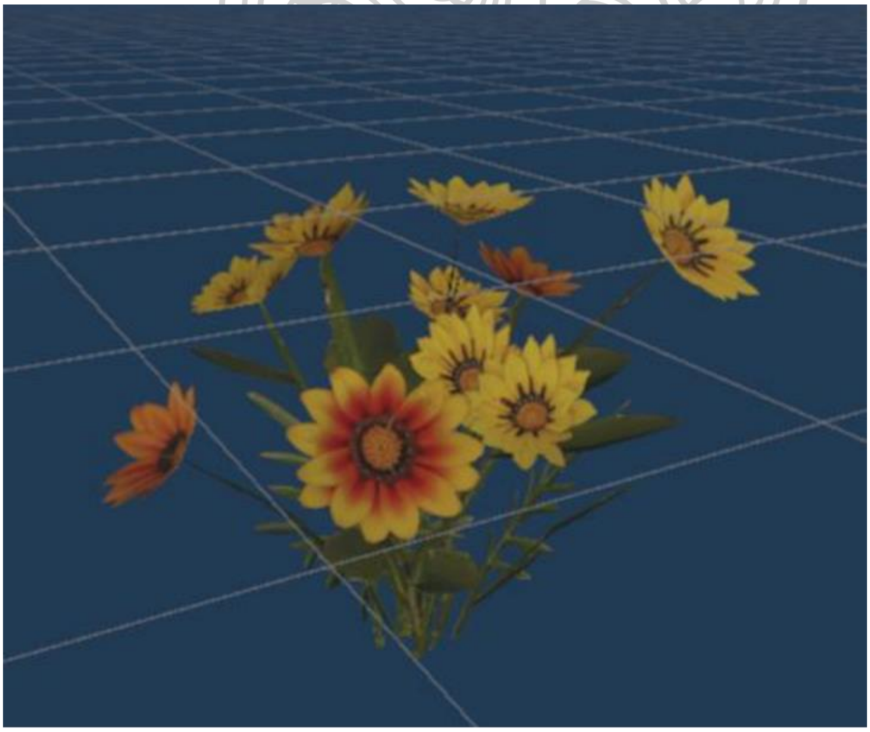
Vine Model 6



Note. Made by the author (2025)

Figure 75

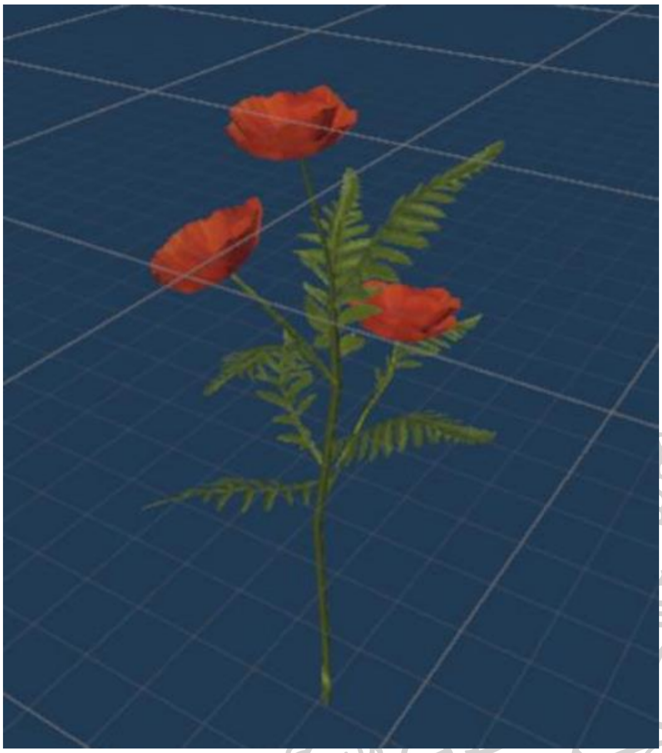
Flower Model 1



Note. Made by the author (2025)

Figure 76

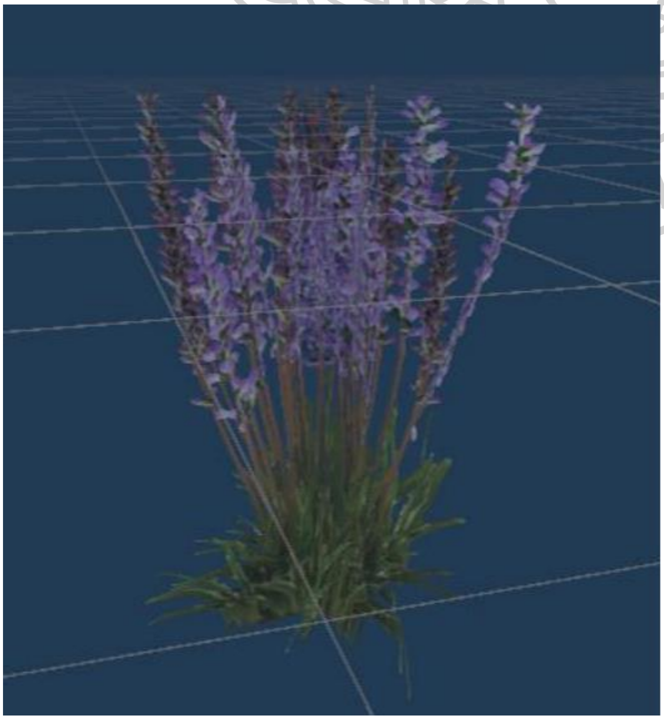
Flower Model 2



Note. Made by the author (2025)

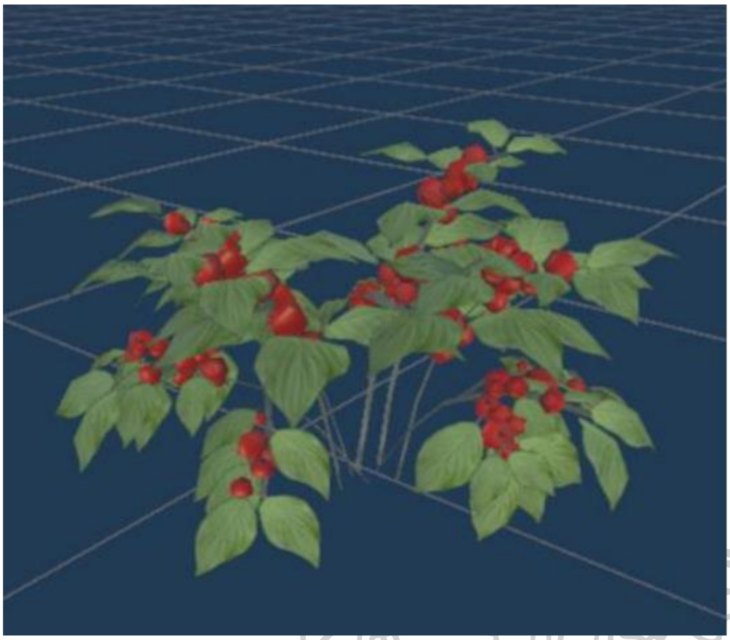
Figure 77

Flower Model 3



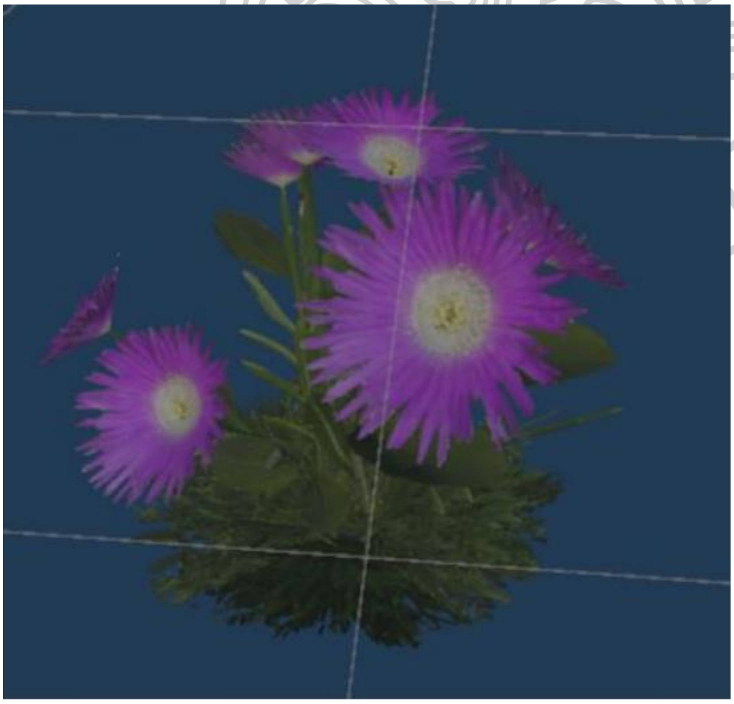
Note. Made by the author (2025)

Figure 78
Flower Model 4



Note. Made by the author (2025)

Figure 79
Flower Model 5



Note. Made by the author (2025)

Figure 80

Flower Model 6

Note. Made by the author (2025)

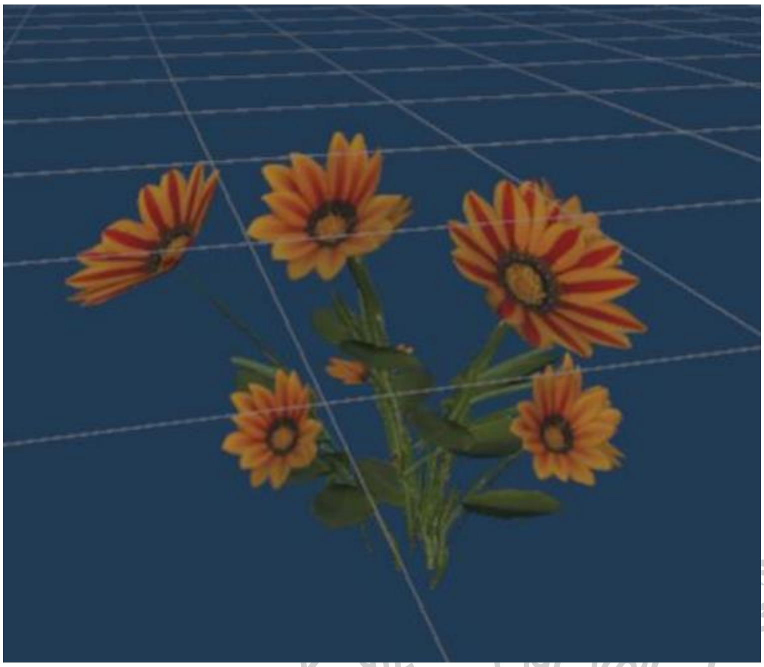
Figure 81

Flower Model 7

Note. Made by the author (2025)

Figure 82

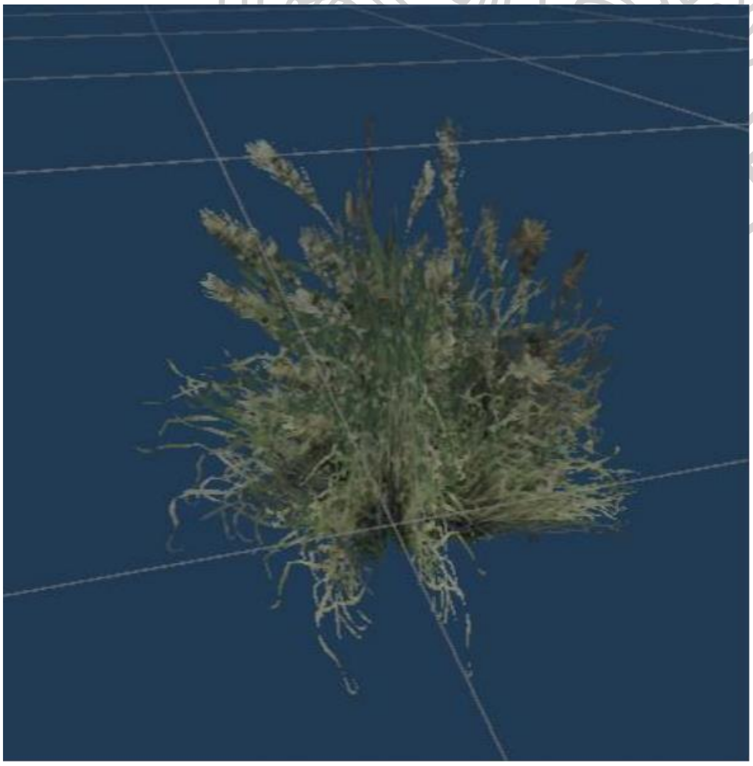
Flower Model 8



Note. Made by the author (2025)

Figure 83

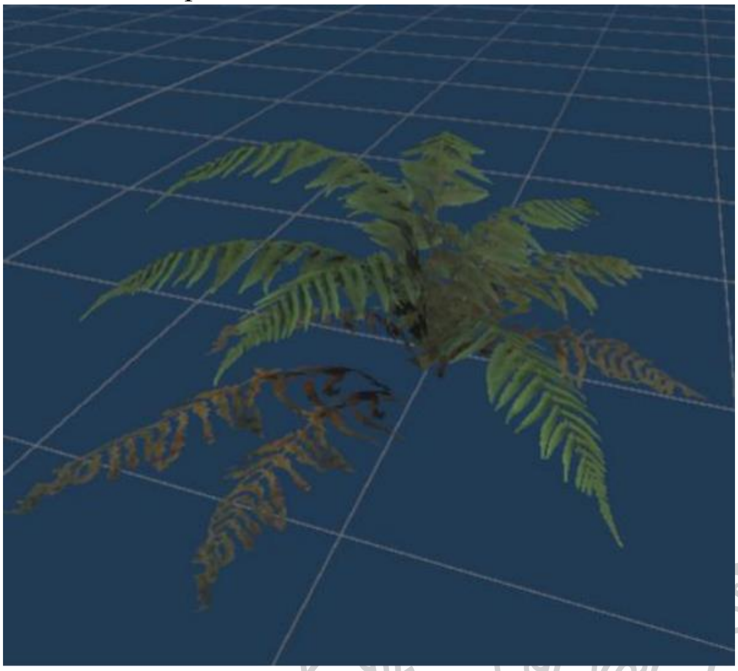
Ground cover plant model 1



Note. Created by the author (2025)

Figure 84

Ground cover plant model 2



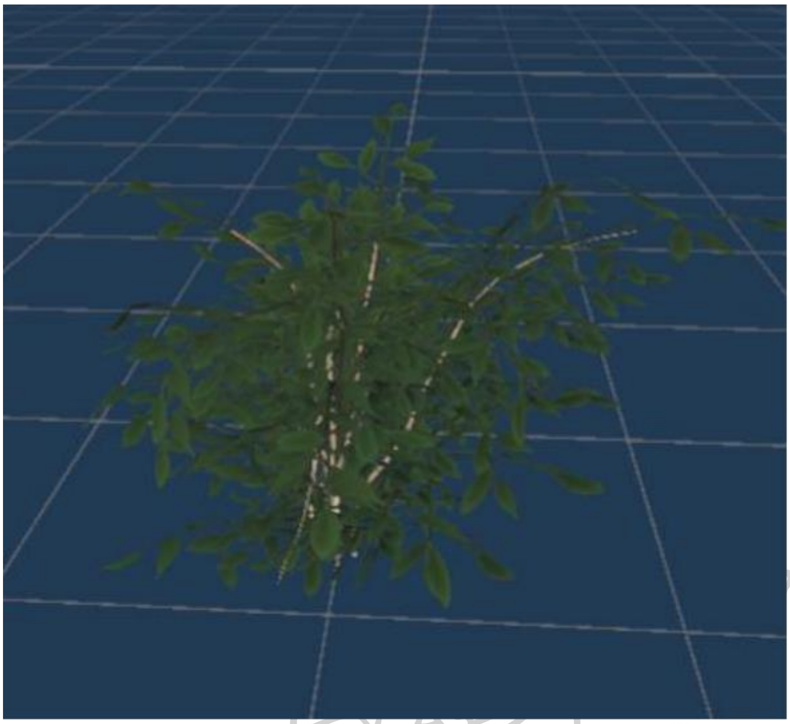
Note. Created by the author (2025)

Figure 85

Ground cover plant model 3

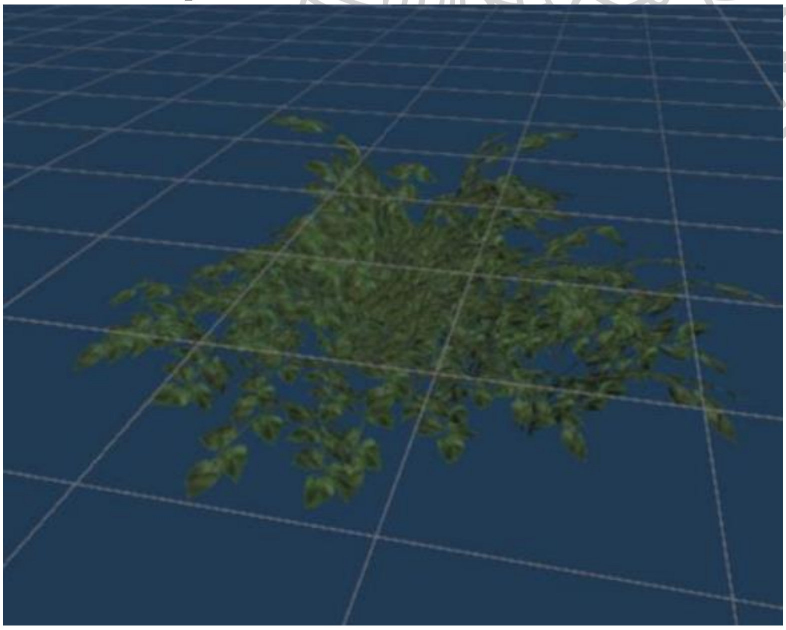
Note. Created by the author (2025)

Figure 86
Ground cover plant model 4



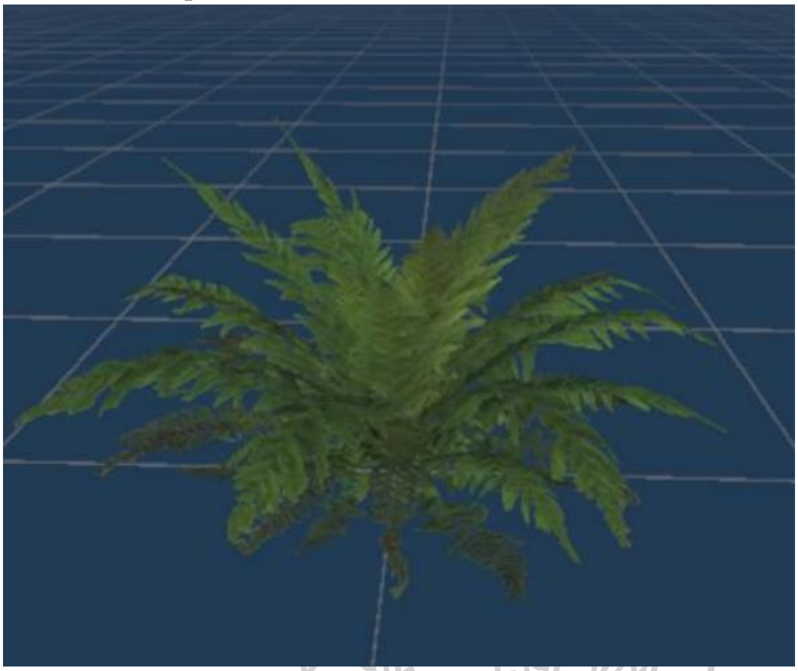
Note. Created by the author (2025)

Figure 87
Ground cover plant model 5



Note. Created by the author (2025)

Figure 88
Ground cover plant model 6



Note. Created by the author (2025)

4.4.2 Scene Content Creation

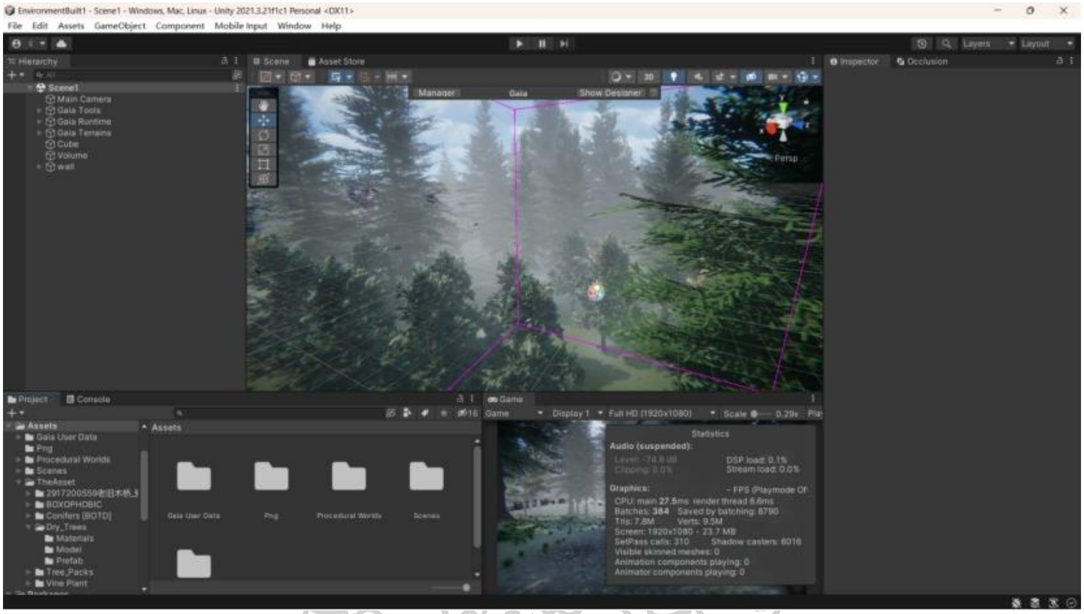
Following the design sense of the storyboard, once the plant model was finalized, researchers and designers began landscape rendering and scene assembly. Functional zoning and narrative development showed that the terrain design included three forms: lakeside mountains, stream swamps, and primitive rainforests.

4.4.2.1 Primitive Jungle Scene

High-density foliage covers the primitive jungle area and includes environmental components such as fog effects to replicate the immersive quality of a perfect ecosystem. Low-slope, fairly flat terrain treatment was selected in the terrain design to reduce motion sickness. Click here to view Figures 89-91.

Figure 89

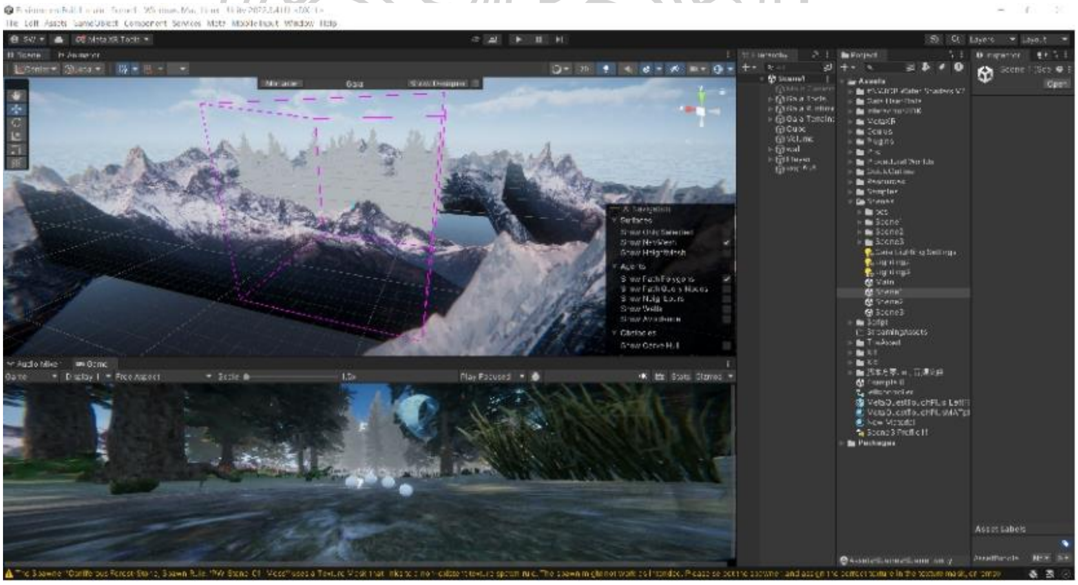
Original jungle scene special effects setting interface



Note. Created by the author (2025)

Figure 90

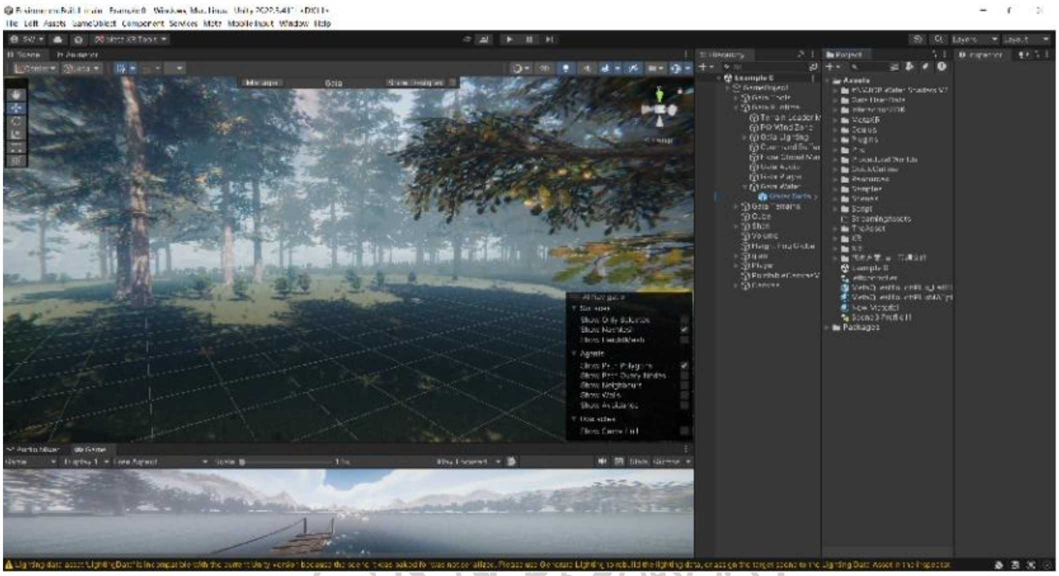
Creation of the original jungle scene



Note. Created by the author (2025)

Figure 91

Original jungle scene plant setting interface



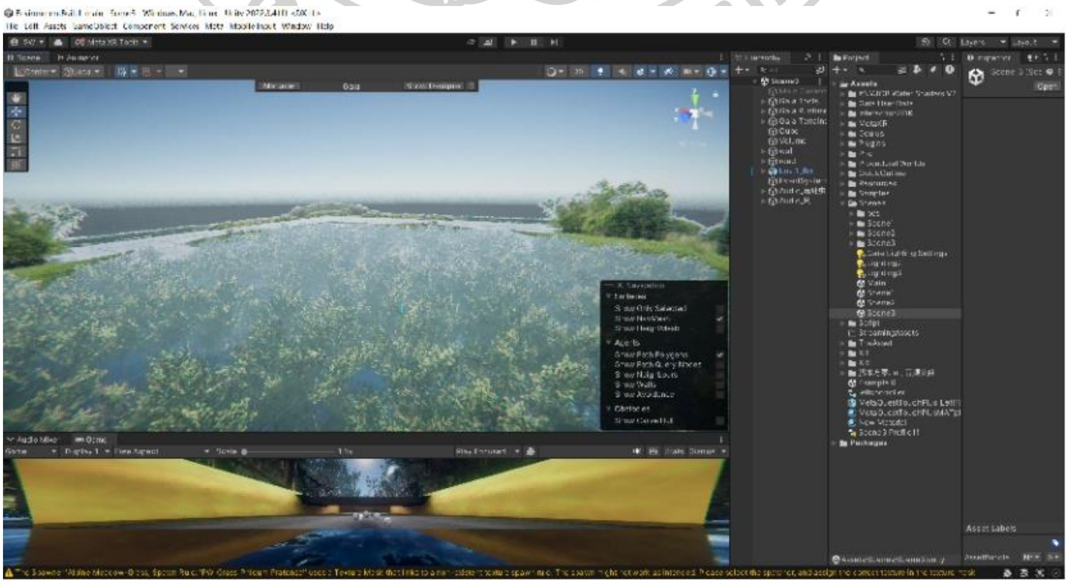
Note. Created by the author (2025)

4.4.2.2 Stream Wetland Scene

The stream wetland area combines vegetation with water bodies. By adjusting the water body material and animation, as well as the strategic layout of wetland plants, a dynamic and vivid ecological interactive landscape is presented. This allows consumers to gradually relax and control their emotions in an immersive experience. See Figures 92-94.

Figure 92

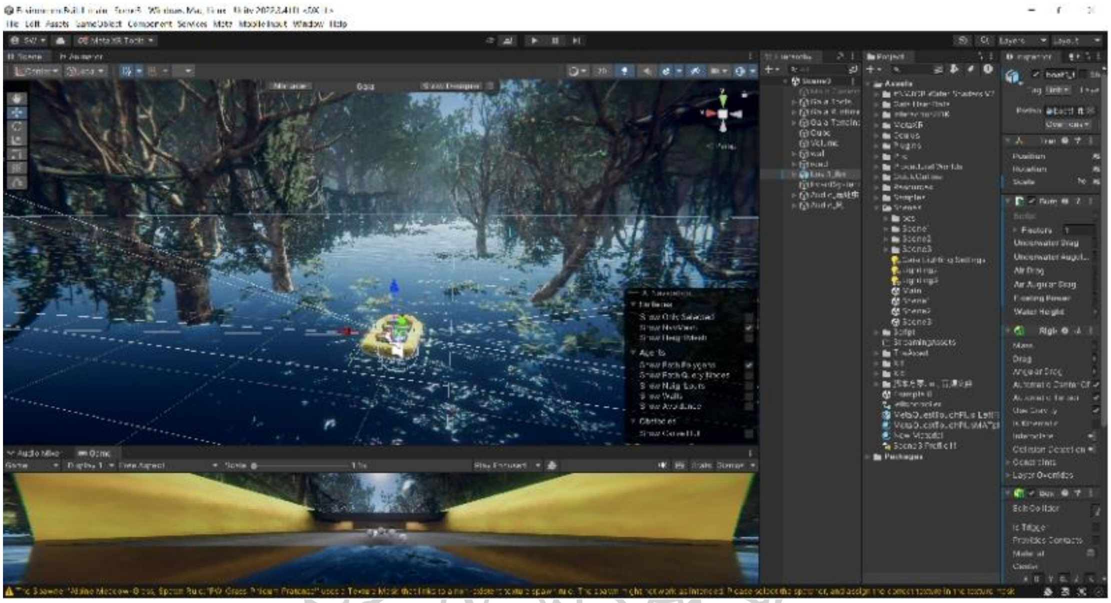
Stream wetland scene setting interface



Note. Created by the author (2025)

Figure 93

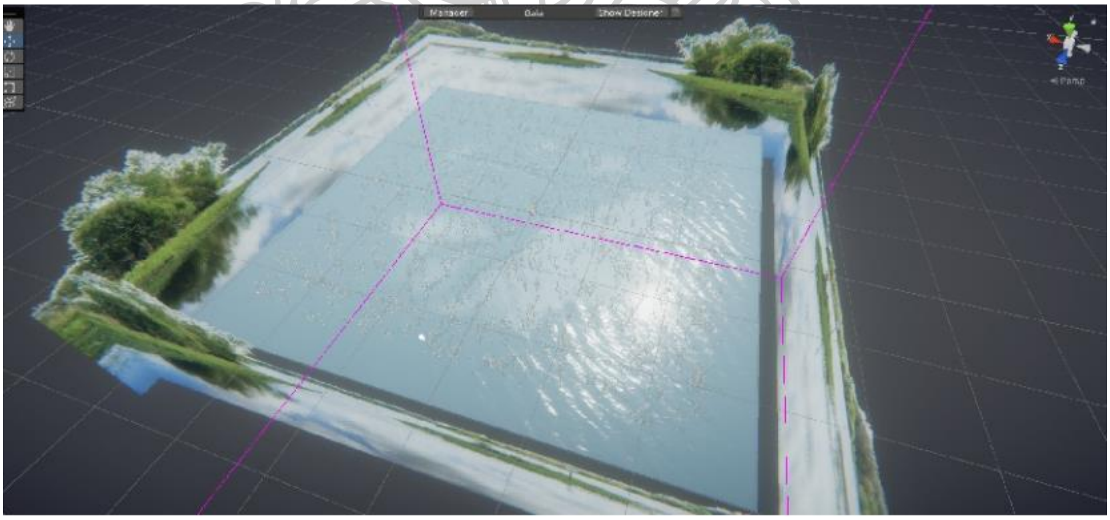
Stream wetland scene element setting interface



Note. Created by the author (2025)

Figure 94

Stream wetland scene water body setting interface



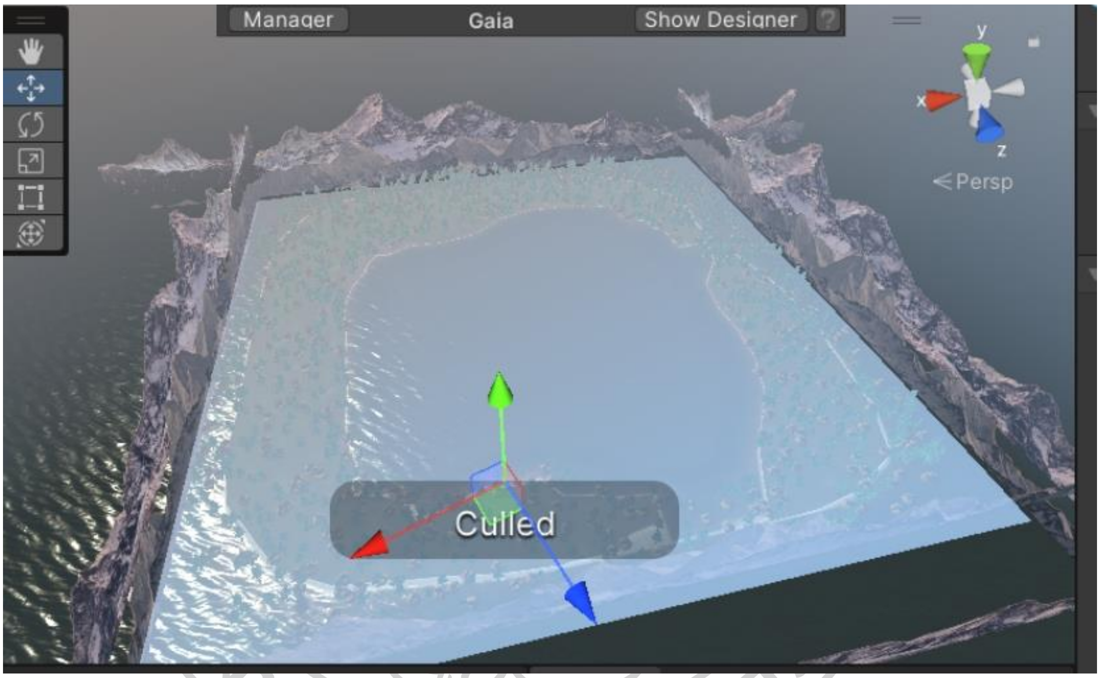
Note. Created by the author (2025)

4.4.2.3 Lakeside Scene

The impression of open terrain and open vision is more important in lakeside mountainous areas. Through the carefully selected hill contours and lake layout, the extension of spatial perspective and deeper emotional relaxation are achieved, further strengthening the overall therapeutic effect. Refer to Figures 95-97.

Figure 95

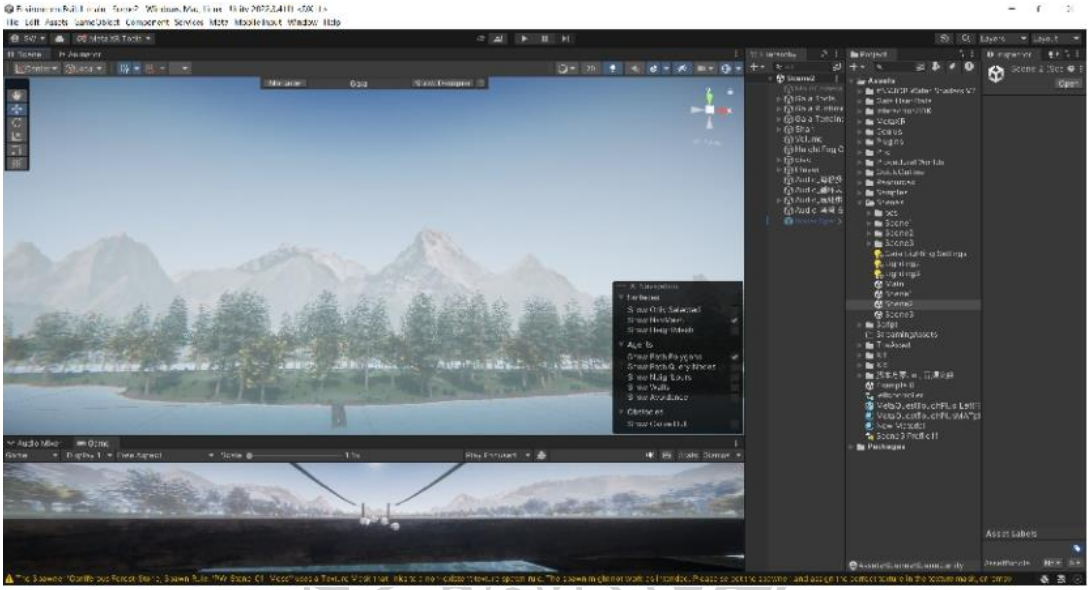
Lakeside scene element water body setting interface



Note. Created by the author (2025)

Figure 96

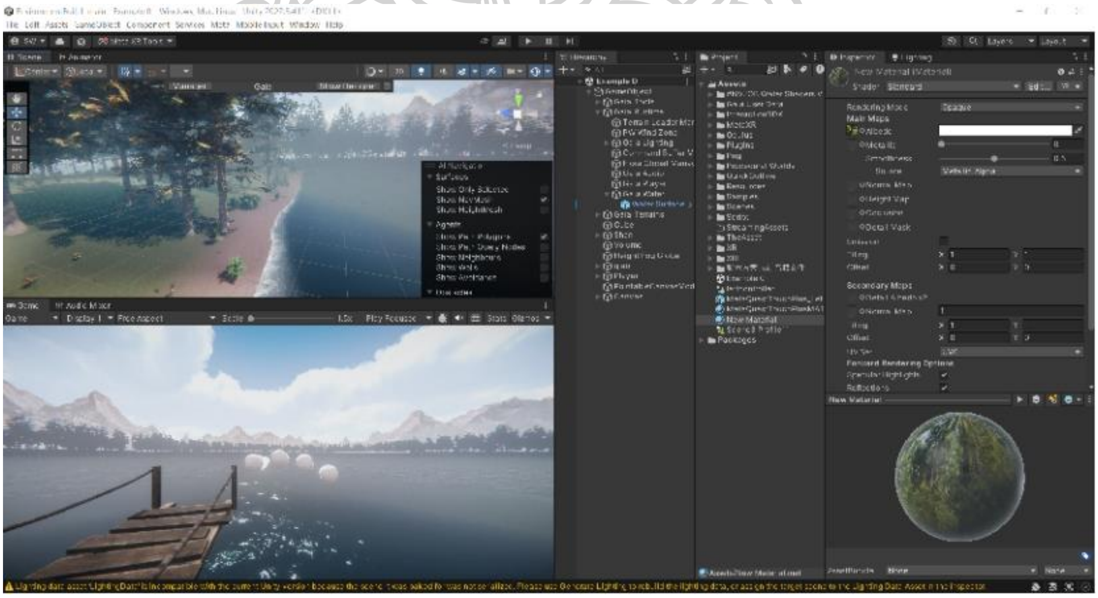
Lakeside scene special effects setting interface



Note. Created by the author (2025)

Figure 97

Lakeside scene element debugging interface

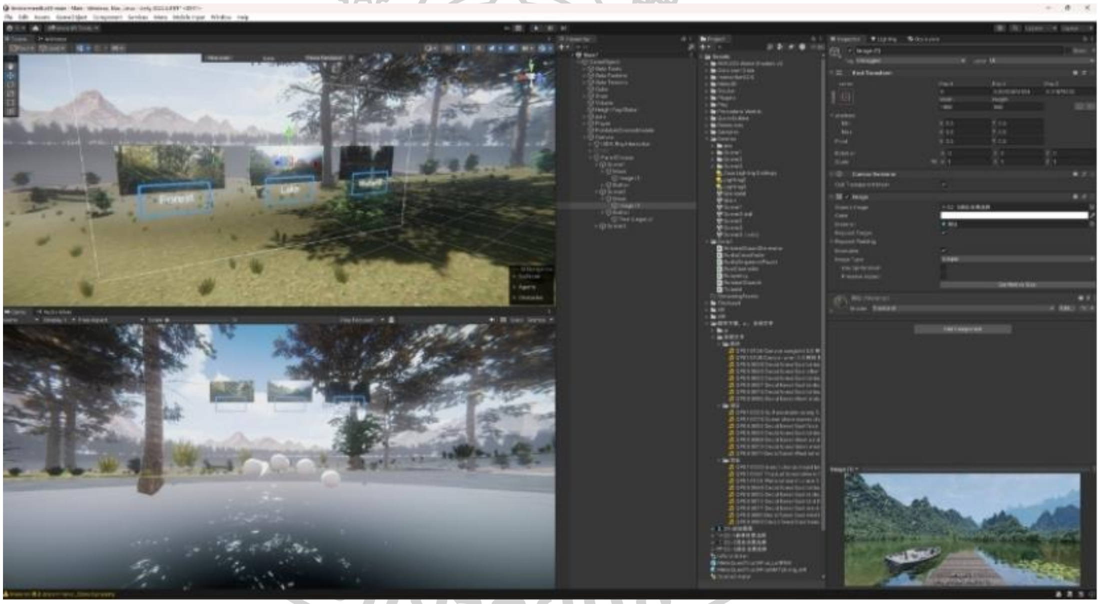


Note. Created by the author (2025)

4.4.3 Platform Development

After the landscape design, the entire experience flow is constructed using predefined narratives and interactive routes displayed on the storyboard. This process focuses on the user experience emotional rhythm and operation flow. The purpose is to ensure that users have a seamless and coherent sensory experience in the virtual world through means such as UI module development, adaptation and calibration of spatial audio within the scene, plant layout, and generation of interactive element animation scripts. See Figures 98-103.

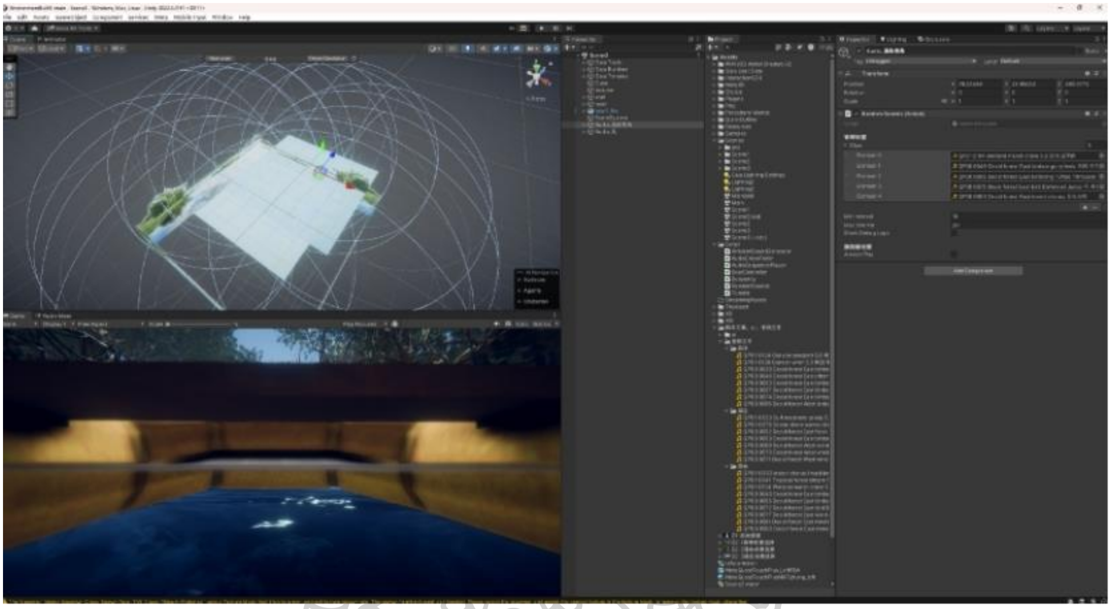
Figure 98
UI interface production



Note. produced by the author (2025)

Figure 99

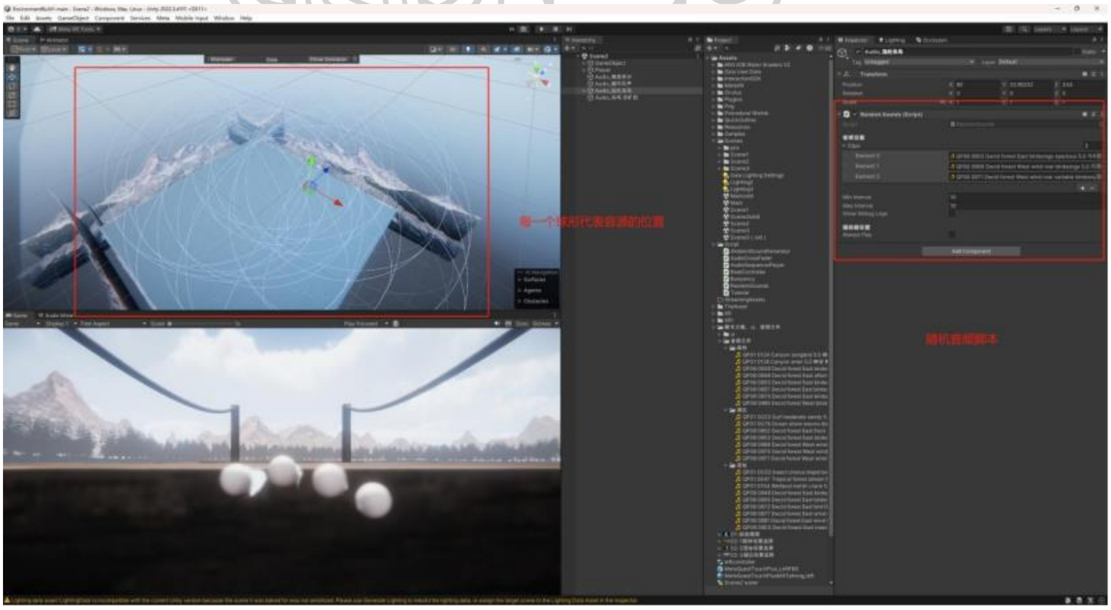
Scene lighting debugging



Note. Made by the author (2025)

Figure 100

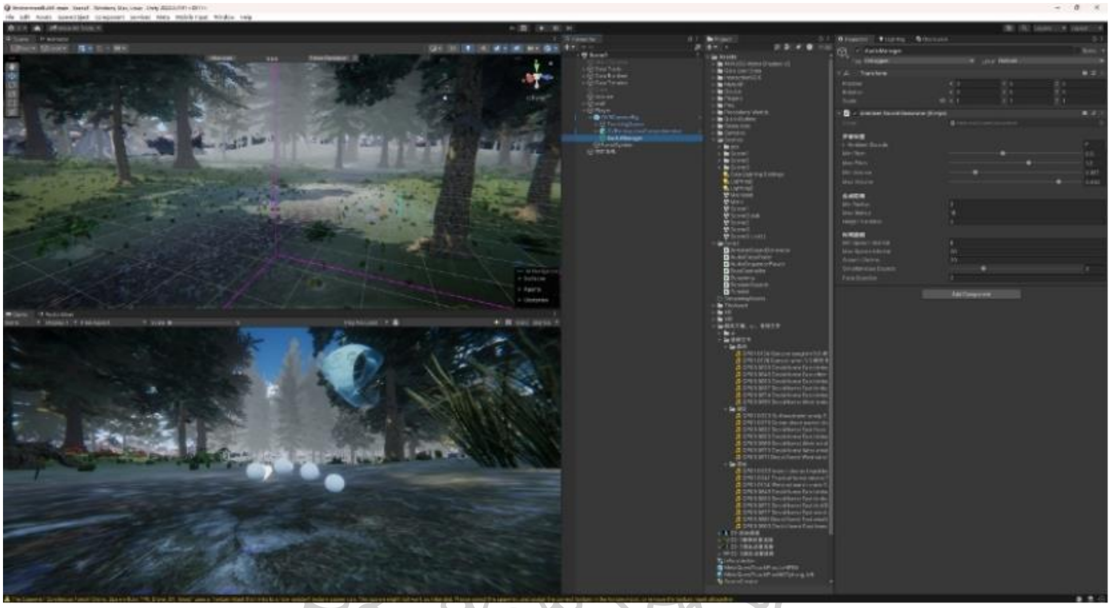
Audio script production and debugging of the lakeside scene



Note. produced by the author (2025)

Figure 101

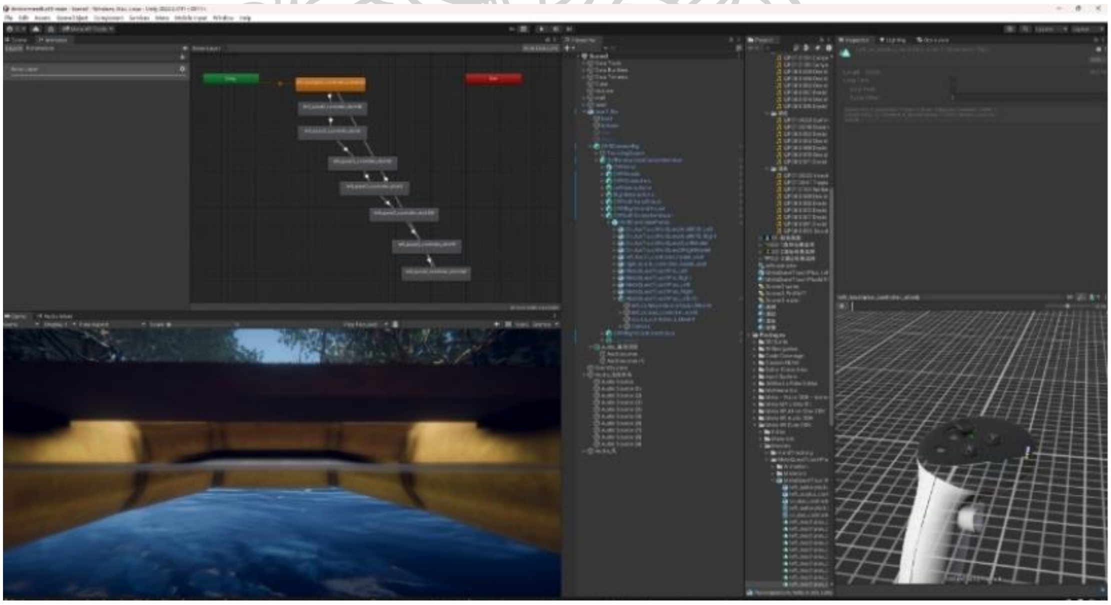
Original jungle scene audio script production and debugging



Note. produced by the author (2025)

Figure 102

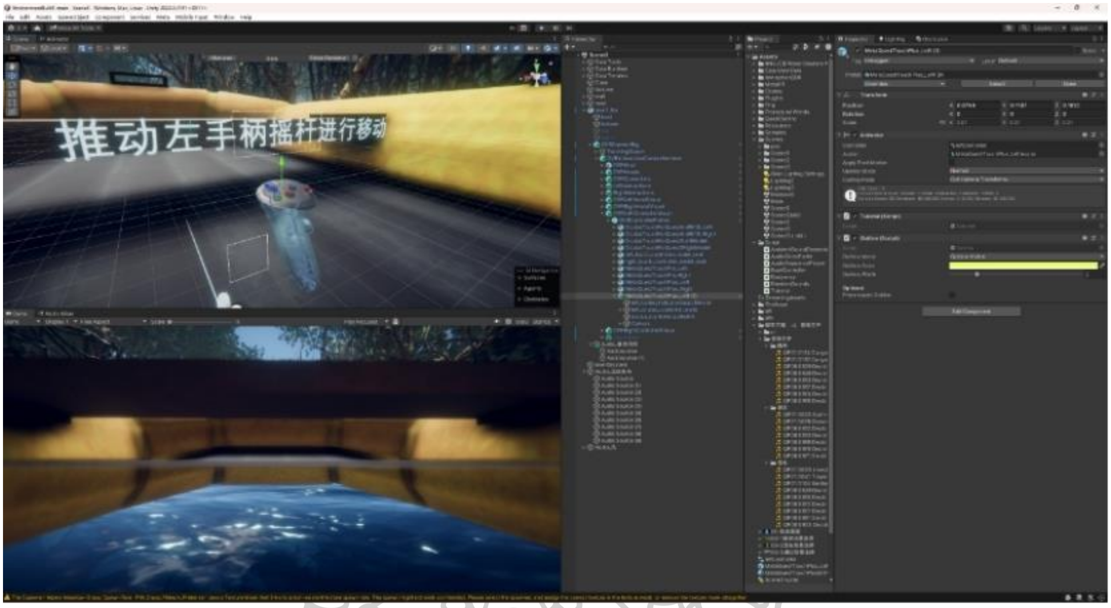
Handle controller tutorial animation script production



Note. produced by the author (2025)

Figure 103

Hand controller tutorial animation debugging



Note. Made by the author (2025)

4.5 Testing

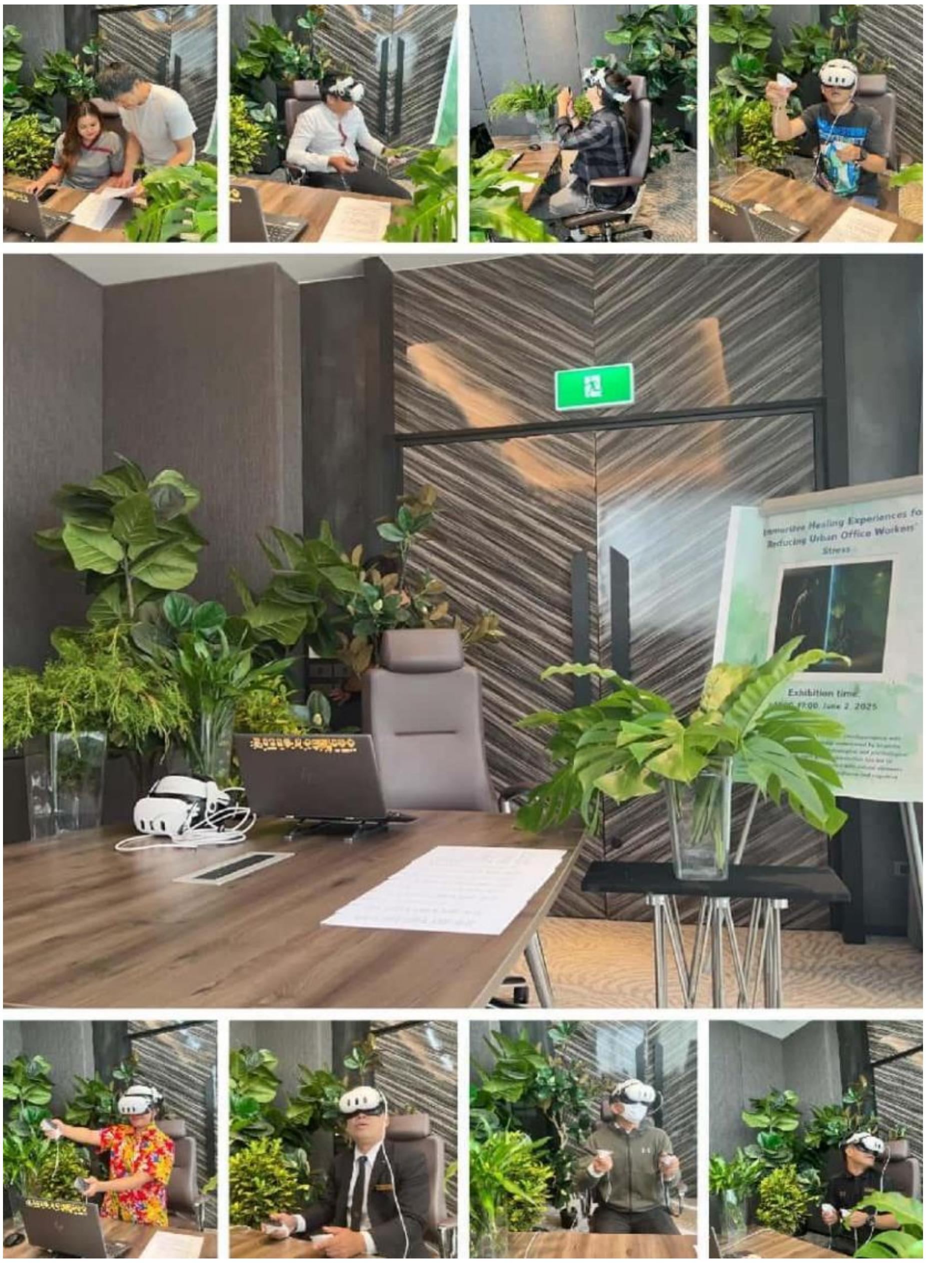
At the exhibition site, researchers recreated an office environment. Large plants (Monstera Deliciosa, Areca Palm, Ficus Elastica), medium plants (Lucky Bamboo, Sansevieria Trifasciata, Japanese Cypress), and small plants (Pothos, Parlor Palm, Mint) were placed around the desks to immerse participants in a miniature forest-like space. These plants gave off a subtle fragrance throughout the space, gently creating a natural atmosphere through sight, touch, and smell, building a context for the immersive experience.

Based on Don Norman's Seven-Stage Model of Behavior (NSTA), our user testing adopted a two-round, two-group structure to comprehensively verify each stage from goal setting to outcome evaluation. The first small cohort (n=10) will focus on the stages of intention formation, action identification, and action execution to verify the usability and procedural smoothness of the interaction prototype in early engagement. The second large group (n=30) will use mixed methods to confirm the reliability and repeatability of the immersive healing experience, going further into the stages of system state perception, perception interpretation, and outcome evaluation. This bifurcated test layout allows us to quickly identify interaction problems in the early stages while at the same time providing detailed insights into users' Multisensory immersion and psychological responses in the later stages, aiding in the iterative refinement and comprehensive evaluation of design solutions.

4.5.1 First Group Test

The first user testing round consisted of 10 participants (Figure 104) and focused on the immediate therapeutic effects and usability of the prototype system with real Internet company employees. Before and after the experience, participants generally made consistently positive comments, which provided both quantitative and qualitative support for subsequent feature modifications and scene expansion.

Figure 104
The first set of tests



Note. Photographed by the researcher (2025)

Before the experiment, participants arrived at the exhibition hall exhausted and tense from a morning's work. The average subjective stress level of participants was 8.1 on a 10-point scale. 80% rated their stress level between 8 and 9, indicating a clearly high stress state across the sample (Table 16). Consistent with the mental fatigue typically associated with long periods of sedentary office work, emotions were mainly defined by anxiety and tension (60%), followed by drowsiness (40%). After a short immersive experience, all participants reported a reduction in stress. On a 5-point scale, the average relaxation depth was 3.8, reaching a psychological level of "medium to high efficacy". Approximately one-third of participants highlighted that the natural scent emanating from indoor plants provided an additional relaxation effect, suggesting a positive effect of low-threshold Olfactory stimulation, although Visual and Auditory elements remained the primary therapeutic pathway. Full marks were given to both the perception of naturalness of the surroundings and the simplicity of interaction, indicating a good balance between hardware load and user engagement. In terms of willingness to continue using the app, over half said they would like to continue using it, with a further 30% saying they would use it sporadically, suggesting high retention potential. Users generally expect more themed scenes, as well as the introduction of individualized adjustments and relaxation coaching, pointing a clear path forward for the next phase of content development and enhancements.

Table 16

Summary table of the first set of questionnaire results (n = 10)

No	Question dimension	Main indicators/Options,	Result summary
Q1	Initial stress score (1–10)	8-9 points: 8 people 6-7 points: 2 people	Mean ≈ 8.1, overall high pressure
Q2	Emotional state before experience	Anxiety/nervousness: 6 people Drowsiness: 4 people	Negative emotions account for 100%
Q3	Self-evaluation after experience	Improved: 10 people	All employees perceive positive changes
Q4	Deepness of relaxation (1–5)	3 points: 3 people 4 points: 6 people 5 points: 1 person	Mean ≈ 3.8
Q5	Key senses	Vision + hearing: 10 people Smell bonus: 3 people	Audio-Visual is the core, and smell has gains
Q6	Naturalness of scene	“Very natural and harmonious” 10 people	Unanimous recognition of cognition
Q7	Ease of use	“Relatively easy” 10 people	0 Learning threshold

			feedback
Q8	Willingness to use in the future	Use frequently: 5 people Use occasionally: 3 people Unsure: 2 people	Potential retention rate 80%
Q9	Functional expectation ①	Add scene themes: 10 people	Content breadth is the strongest demand
Q10	Functional expectation ②	Personalized adjustment/extra guidance: 6 people	Depth and guidance are equally important

Note. Collected and compiled by the researchers. (2025)

Despite the small sample size of 10 participants, the data showed highly consistent statistical trends in subjective stress levels, emotional states, sensory preferences, and usage motivations: high stress – anxiety/fatigue – Audio Visual dominance – immediate improvement – high acceptability – content expectation. This coherent chain supports the study's premise that rapid stress relief in urban work environments can be achieved through multimodal immersive experiences. It also highlights important directions for design enhancements, such as expanding the scene library, building adjustable parameters, and introducing hierarchical guidance mechanisms, to further stimulate long-term user engagement and evaluate the persistence of therapeutic effects in the next large-scale experiment.

In the first pilot test (n=10), participants uniformly reported significant stress reduction after the Multisensory immersive healing session, self-rated relaxation depth increased to an average of 3.8/5, and qualitative feedback highlighted strong appreciation for the integration of touch and smell in the virtual leaf. The researchers' observations in this round revealed that excessive verbal guidance at certain points risked unintentionally encouraging participants to rely on instructions and undermining the reliability of interaction with the native interface. Therefore, in the second phase of the study, the protocol was streamlined by reducing unnecessary verbal prompts and leaving only minimal operation hints. This adjustment was intended to prevent excessive guidance, capture more realistic user behavior and physiological responses under natural conditions, and increase the validity and reliability of the evaluation.

4.5.2 Second Round of Testing

Based on the first preliminary survey (n = 10), a second round of field testing was conducted on 30 employees of an Internet company (Figure 105). To verify the repeatability and robustness of the prototype with a larger sample size, the testing process, equipment settings, and questionnaire configuration were not changed. After the first test, the researchers increased the number of plants placed. With the increase in plants, the second group of participants experienced a significantly improved overall comfortable and relaxed state after entering the exhibition space compared to the first group of participants. The results of the second group were basically consistent with the trends of the first group. However, more subtle changes were observed in baseline stress levels, willingness to use, and feature requirements, providing further quantitative support for the next steps of design iteration.

Figure 105

Second set of tests

*Note.*Photographed by the researcher (2025)

First, as shown in Table 16, baseline stress levels (Q1) indicate that high intensity workload remains the primary determinant. Eighteen participants (60%) reported scores between 8 and 9 points. This is slightly lower than the 80% of the first group, but overall stress levels remain high. The remaining 12 participants (40%) scored between 6 and 7 points, indicating moderate stress. Correspondingly, momentary emotional states (Q2) showed a polarized distribution. “Anxiety/tension” was reported by 18 participants (60%), and “fatigue/exhaustion” by 12 participants (40%). This is consistent with the commonly observed phenomenon of the coexistence of mental fatigue and emotional anxiety caused by prolonged screen work. After 10 minutes of Multisensory immersion (presenting three themes), the self-assessed effectiveness (Q3) confirmed the validity of the prototype with a larger sample, as 29 participants (96.7%) reported “some improvement” in physiological or emotional indicators, and only one participant showed “no significant change”. Respondents focused on four points (20 participants, 66.7%), and in the comfort rating (Q4, scale of 1 to 5), 4 participants (13.3%) chose a perfect 5 and 6 participants (20%) chose a 3. Software and hardware improvements (lighter headset, fine-tuning of spatial audio) significantly increased the proportion of positive ratings compared to the first group. Vision and hearing remained central to the preference of the sensory configuration (Q5). All participants chose “high-density natural scenery + spatial audio”, and 12 participants (40%) also chose “olfaction: scent of houseplants”, confirming that Olfactory stimulation enhances the relaxation effect. The second group did not perceive any additional cognitive load in understanding the interface logic or interaction flow, and therefore maintained 100% positive responses for the naturalness of the environment (Q6) and the accessibility of the interaction (Q7): "Very natural and harmonious/relatively easy to operate." Regarding future usage intention (Q8), 15 participants (50%) answered "Very likely to use it/regularly," 10 participants (33.3%) answered "Sometimes likely to use it," and 5 participants (16.7%) answered "Not sure." Overall acceptance increased slightly compared to the first group (80% positive, 20% unclear), suggesting that the scaling effect did not diminish the appeal of the system.

Functional requests (Q9 and Q10) became more specific, with all participants reiterating the need for "more scene themes." Among them, 18 participants (60%) wanted to add "personalized parameter adjustment + meditation/breathing guidance." This indicates that users are moving from the "curiosity trial" stage to the "continuous use" stage, and expectations for content updates and adaptation mechanisms are increasing.To better fit the scattered time periods of real workplace work processes, the majority of participants (22 people, 73.3%) chose "rhythmic relaxation guidance" and "task division reminders".

Table 17

Summary Table of Second Group Test Results (n = 30)

(Percentages are calculated based on a total of 30 participants, with a rounding margin of ±0.1%.)

No	Problem Dimensions	Number of people	Percentage	Summary of Results
1	Subjective stress score before experience	19 〈High Pressure 8–9 points〉 11 〈Medium Pressure 6–7 points〉	63.3 % 36.7 %	High-stress people account for 2/3, and the verification sample has the necessity of intervention
2	Immediate emotion before experience	20 Anxiety/Tenseness10 Drowsiness/Distraction	66.7 % 33.3 %	Anxiety is the main emotion, followed by sleepiness
3	Self-evaluation improvement after experience	30 Improved	100 %	All employees reported positive improvement (attention or emotion)
4	Wearing comfort score	18 Score 45 Score 57 Score 3	60.0 % 16.7 % 23.3 %	76.7% of them have medium and high comfort; 23.3% still need to reduce their burden
5	Sensory preference	20 Vision+Audition10 Vision+Audition+Smell	66.7 % 33.3 %	Vision/Auditory is the core, and 1/3 hope to introduce plant smells
6	Natural harmony of scene	30 “Very natural, helps to relax”	100 %	The scene simulation is recognized by all employees
7	Ease of operation	30 “Relatively easy”	100 %	The interactive process is friendly and the learning cost is low
8	Willing to use	14 Frequently used11 Occasionally used5 Unsure	46.7 % 36.7 % 16.6 %	>80% show positive intentions, and commercial implementation is

				feasible
9	Function expansion requirements	30 More scene themes18 Personalized adjustment25 Additional relaxation guidance	100 % 60.0 % 83.3 %	The diversity of themes is a rigid demand; highly appealing for adjustability and professional guidance
10	Subsequent improvement suggestions	22 Enriched theme scenes18 Added relaxation guidance10 Incorporated social elements	73.3 % 60.0 % 33.3 %	Users expect a dual improvement in content depth and social level

Note. Collected and compiled by the researchers. (2025)

The results of the second group of 30 participants not only reaffirmed the positive role of immersive Multisensory therapy in relieving work stress, but also revealed a shift in user needs - as the scale increases - from the novelty of the experience to a focus on "content depth + personalized service". Future design work should focus on: (1) a hierarchical scene library with a stress matching algorithm, (2) a refined integration of Olfactory and Tactile modules, and (3) adaptive guidance driven by physiological feedback to meet the continuous treatment needs of different stress spectra and lay the foundation for the next stage of large-sample controlled experiments.

4.5.3 Test Analysis

The high stress state of the first and second group test participants before the experience was measured through questionnaire data: the average subjective stress score of the first group was about 8.1 (out of 10 points), and 80% scored between 8-9 points; in the second group, the proportion of high-stress individuals was 63.3%. This high-stress baseline is consistent with Hans Selye's stress theory, which holds that stress is a nonspecific response of the organism to internal and external pressures and is formed under continuous high-load activities, thereby severely consuming mental and physiological resources. Environmental psychology research further confirms the high stress phenomenon seen in real office environments, indicating that factors such as office layout, lighting, and background noise can significantly affect an individual's stress perception and mental health.

Anxiety/tension dominated the short emotional state before the activity; in the first group, 60% of participants self-identified as anxious/tension, and in the second group, the proportion was 60%, while sleepiness/mental fatigue accounted for 40% and 40%, respectively. This emotional distribution is consistent with the characteristics of directed attention fatigue and emotional dysregulation reported by the attention restoration theory (ART) and the stress recovery theory (SRT), both of which emphasize the important role of involuntary attention and emotional regulation in reducing cognitive load and restoring psychological energy. In the design context, this study introduces Multisensory natural elements into the virtual scene, activating the restoration pathway through the synergistic stimulation of vision, hearing, and smell, thereby quickly reducing anxiety and fatigue in short, dispersed work intervals, achieving a balance between "usability" and "immersion".

Participants in the immersive experience participated in the scene control, thus reflecting the synergy of design aspects centered on humans, machines, and Nature. Users particularly valued the ability to interact with and change scenes directly through the controller: When pushing the joystick in slow motion, participants could view the virtual scene in 360°, just like being "immersed in a real jungle", accompanied by the smell of indoor plants, which greatly enhanced the sense of presence. This multi-sensory immersive experience technology gently guides attention to restorative natural stimuli, thus reflecting the "charm" characteristics of attention restoration theory.

Users can quickly switch between simulation themes - original jungle, stream wetlands, and lakeside mountains in a two-step confirmation interface, thereby reducing cognitive conflict during the interaction process. This low-threshold, high-responsive design follows the usability and contextual fit concepts of user experience (UX), so that users can quickly re-enter the immersive state even in a fragmented work schedule.

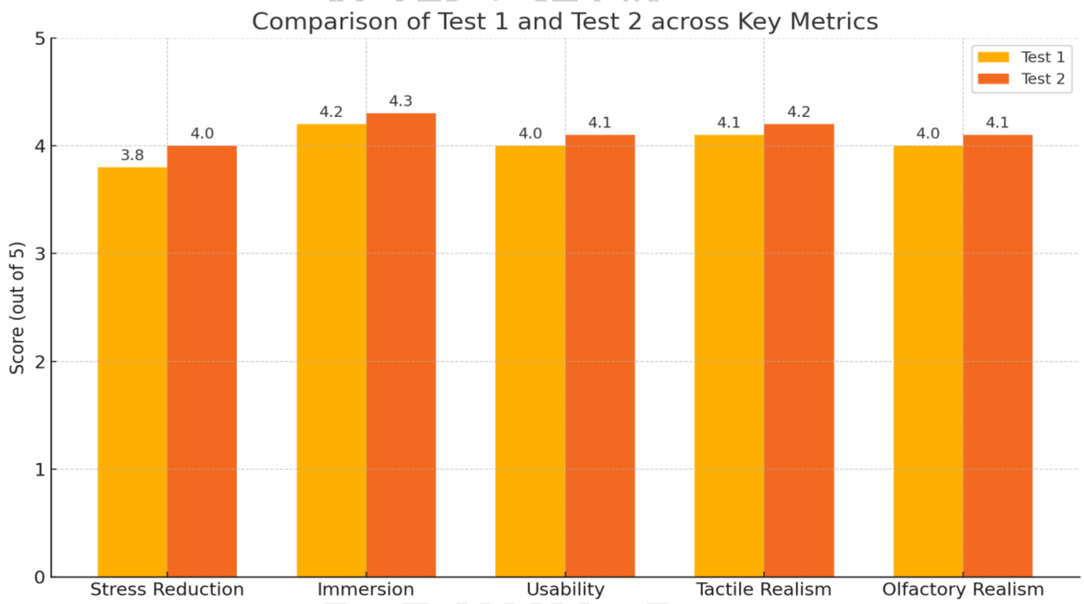
Users also gave good comments on the interaction with the actual space of real plants. Several participants noted: "Even after taking off the headphones, the smell of plants and soil lingered, creating a seamless emotional continuity between the digital and real worlds. This reflects the ecological aesthetics' focus on the spirit of place, mixing digital Nature with tangible objects to enhance a harmonious therapeutic environment."

After the short multi-sensory immersive experience, participants in the first test group generally reported a significant reduction in subjective stress: all subjects selected "improved" in the post-experience questionnaire, and the depth of relaxation averaged 3.8/5 points, equivalent to moderate to high psychological relief. 100% of participants self-reported positive improvements after the experience and expressed more scene immersion and emotional relief in the post-test interview. The second test group followed this trend on a larger sample. This result is very consistent with the core assumptions of the attention restoration theory (ART) and stress recovery theory (SRT) proposed in the literature review in Chapter 2: Multisensory natural stimulation triggers involuntary attention through "soft fascination", thereby promoting the rapid recovery of cognitive resources; at the same time, according to the two-way physiological-psychological interaction mechanism described by SRT, the cross-modal input of natural soundscapes and plant scenes effectively reduces the arousal of the autonomic nervous system, resulting in immediate emotional regulation (Figure 106). This "body-mind fusion" therapeutic experience provides a new approach for design research to achieve psychological intervention and rehabilitation in urban work environments using space and interactive technologies.

Both Test 1 and Test 2 showed slight improvements in stress relief, immersion, ease of use, Tactile realism, and Olfactory realism, verifying the continuous optimization effect of design iteration on immersive therapeutic experience. Among them, the enhancement of immersion and Tactile reality is particularly significant, reflecting that in the framework of Multisensory synchronous narrative, enhancing interactive details and physical feedback can further deepen the user's sense of presence and emotional connection.

Figure 106

Comparison chart of core evaluation dimensions of two user tests



Note. Illustrated by the researcher. (2025)

4.6 Chapter Summary

In this chapter, the specific implementation path and effect of Multisensory integrated design and naturopathy for stress reduction in the office environment are thoroughly investigated using questionnaire surveys, interviews with experts, and empirical research. The data survey results reveal that employees of Internet companies are very receptive to naturopathy technology, especially showing a clear tendency toward highly immersive Virtual Reality experiences. It also shows that Multisensory design technology, especially technology integrating vision, hearing, and smell, is practical and has high user satisfaction. Expert evaluation cites its high reality, richness, and delicate interactive experience as the reasons why users most prefer realistic Visual design.

By designing a novel Virtual Reality environment integrating a Multisensory naturopathy system, we were able to verify the practicality and user experience value of the proposed technological solution in the office environment during the empirical research stage. Participants' comments reveal that the Virtual Reality environment not only faithfully reproduced the real-world natural environment, but also significantly reduced work-related stress and psychological anxiety, improving overall health. In addition, the combination of Multisensory elements such as scent and sound created a more immersive and comprehensive sensory experience, promoting psychological relaxation and emotional improvement. At the same time, this study revealed that in the future, when integrating Multisensory digital technologies with Nature-based healing approaches, it is necessary to more fully consider the needs of individual users, such as differences in age, gender, and occupation, and incorporate cross-cultural adaptability into the design to further enhance the universality and effectiveness of the therapeutic experience.

Through the integration of theory and practice, this chapter essentially reveals efficient strategies and concrete application models for combining Multisensory integration design with Nature Therapy, providing practical references and guidance for future design activities.

Chapter 5

Conclusion, Discussion, and Recommendations

5.1 Conclusion

The high-intensity work pace and extended working hours in modern metropolitan offices have seriously affected the physical and mental health of employees. Through an in-depth investigation of questionnaire surveys and experimental data, this study found that the main causes of stress among employees of metropolitan Internet companies include unclear task goals, heavy workload, communication barriers, and anxiety about career development. These factors together form a complex stress network, and there are obvious differences in stress perception and coping mechanisms between occupational types and age groups. The 30-35 age group has the highest sensitivity to stress and the most diverse needs for stress relief, which reflects the specific psychological and behavioral characteristics of mid-career individuals facing high levels of occupational stress.

At the same time, the study highlights the shortcomings and ineffectiveness of current stress relief strategies in office environments, as many traditional programs cannot meet the needs of the fast pace of the workplace. Therefore, the combination of digital immersive experiences, especially those using Virtual Reality (VR), Augmented Reality (AR), and Multisensory design, shows great potential in reducing stress among employees of urban Internet companies. In this work, experimental results show that digitally modeled natural healing environments can greatly improve users' attention recovery and emotional control. In particular, immersive natural experiences, including synchronized Visual, Auditory, and Olfactory stimulation, showed better user satisfaction and therapeutic effects than traditional stress relief techniques.

The above in-depth investigations led this study to the following main conclusions: The Multisensory digital Nature-based rehabilitation system developed and designed in this study can effectively reduce the stress of Internet company employees and significantly improve their physical and mental health. This outcome not only provides a useful design method and application model for the optimization of future workplace space, but also strengthens the theoretical exploration of the combination of natural therapy and digital technology within the design discipline.

5.1.1 Conclusion on Research Objectives

First, this study helps to clarify the sources of stress and rehabilitation requirements of employees of urban Internet companies. Through questionnaires, expert interviews, and data analysis, it fully reveals the complex occupational stress framework experienced by urban workers, including several variables such as workload, interpersonal communication, and career development anxiety. At the same time, it also reveals individual differences in stress perception and coping mechanisms, thereby emphasizing the special treatment needs of different age groups and employment backgrounds. These results provide an accurate basis and comprehensive data support for the next step of design intervention.

Secondly, this study investigates and verifies effective methods for combining Multisensory digital technology with natural therapy based on an examination of the office environment. Through empirical research and user comments, it reveals a design method that combines Visual, Auditory and Olfactory sensory aspects, thus highlighting the great advantages of extreme immersive experience in improving treatment effects. The results show that by combining natural therapy with Multisensory technology, the shortcomings of traditional stress relief techniques can be effectively offset and a richer and more accurate treatment experience can be provided.

Finally, the study effectively created and constructed a new immersive treatment experience method, and the actual user experience and result evaluation verified its effectiveness in reducing stress. The inspiring comments of the participants confirmed the practicality and value of this new treatment method for user experience. In addition, the study also emphasized that personalization and cross-cultural adaptation are needed in future design and implementation to maximize the overall practical effect of immersive treatment methods. The realization of these research goals provides Important theoretical contributions and useful references to the field of design research.

5.1.2 Conclusions on Multisensory Experience Design in Office Spaces

This study basically demonstrated the multimodal experience design in the office environment and was well received. According to the results of the study, the spatial design including multimodal stimulation such as vision, hearing and smell can greatly improve the physical and mental comfort of employees while effectively reducing work stress. In particular, the combination of VR technology and natural environment enhances the user experience in the office because it provides a more realistic, immersive and attractive environment.

At the same time, the study shows that the multi-sensory experience design in the office environment needs to be precisely planned and executed according to actual needs to ensure that it meets the multiple needs of people and corporate cultural environment. According to the user tests of this study, a well-designed multi-sensory setting can successfully improve the psychological state of employees, improve work efficiency and increase overall satisfaction. In addition, the study emphasizes the requirements for continuous optimization and tailored adaptation in the next step of design to better meet the various dynamically changing psychological needs and preferences of users.

5.2 Discussion

This study conducted practical investigation and theoretical verification on the theme of stress reduction in urban work environments, bringing new perspectives and useful experience to design research. It highlights the necessity and feasibility of designing Nature-based therapy environments using Multisensory integration and digital immersive technologies, especially in Virtual Reality. The results are consistent with prior theoretical research, providing strong theoretical support and practical foundations for the broader application of such intervention strategies, and supporting the remarkable effect of Multisensory integration in improving the mental health of Internet company employees.

According to this study, one of the main challenges in the design process is how to properly balance technical complexity and ease of use in actual implementation. Although the experimental results of this study were very good, factors such as the cost of the equipment, users' knowledge of technology, and the degree of support from management may affect the speed and effectiveness of actual application. In addition, the findings showed that users' acceptance of digital therapy experiences is greatly influenced by individual differences and cultural backgrounds. Therefore, future research and implementation should focus on incorporating cross-cultural adaptability to further strengthen the individualized design strategy and increase the overall effectiveness of the proposed solution.

Although this study confirmed the effectiveness and potential of combining multimodal digital technology with natural therapy, more in-depth research is needed in areas such as large-scale application, customized adaptation, and cross-cultural design. These efforts are essential to ensure the long-term viability of new methods and constantly improve consumer approval.

5.3 Research Limitations

Although this study has provided important insights into the use of natural therapy and Multisensory integrated design in the workplace, there are some notable limitations. First, the study sample mainly consisted of employees of Internet companies in urban areas working in specific regions, especially Internet companies, which may limit the generalizability and scalability of the study results. Corporate culture and employee demands may vary significantly across industries and regions. Therefore, the relevance of the study results in more general social and professional environments requires further validation.

Second, in terms of technology costs and user experience in real-world applications, the Virtual Reality (VR) and Augmented Reality (AR) technologies addressed in this study still have challenges. Even if the equipment and user experience receive great reviews in the experimental environment, large-scale deployment in real-world office environments will require addressing issues such as high device prices, complex maintenance, and short user learning curves. These difficulties may limit the rapid spread and general use of such technologies.

In addition, due to the lack of comprehensive tracking and evaluation of the effects of long-term use and physiological markers, the evaluation of user experience in this study relies heavily on subjective questionnaire surveys and short-term feedback. As a result, it is not possible to fully evaluate the long-term effects of continued use of multimodal immersive therapeutic technologies on employees' mental and physical health and job performance. In addition, this study does not fully investigate how to precisely control the intensity and duration of sensory input to obtain optimal therapeutic effects, i.e., detailed optimization of interaction design including Multisensory experiences and natural elements.

Therefore, future studies can lower the barrier to technology adoption by investigating more cost-effective and user-friendly technological solutions, expand sample scope to enhance coverage across different geographies and industry backgrounds, and conduct long-term longitudinal studies using more objective physiological and psychological measurement indicators to fully and thoroughly evaluate the long-term effects and practical effectiveness of Multisensory digital therapeutic solutions.

5.4 Recommendations

Based on the aforementioned conclusions and research constraints, this study puts forward the following recommendations to maximize the usefulness of the research findings and maintain them over the long term. First, to increase the universality and applicability of the research conclusions, future studies are recommended to broaden the scope of the research sample from specific regions and establishments to include more diverse occupations. This will not only allow for a deeper verification of the effectiveness and acceptability of multimodal immersive therapy, but also provide a deeper understanding of the stress characteristics and treatment needs of employees in many industries and fields. Second, Multisensory Immersive Technology solutions that are more cost-effective, easier to operate, and can lower the application hurdle of related technology should be actively explored. The development of this technology should focus not only on economic feasibility, but also on the ease of use and convenience of the equipment to better meet the actual needs of enterprises and users. In addition, it is recommended to increase the diversity of applications by adding modules that guide users to actively interact. Continuous optimization of the technology should also focus on smoother integration with the existing office environment to promote the wider application and dissemination of the technology. At the same time, it is recommended to conduct long-term longitudinal studies to thoroughly monitor and evaluate the long-term effects of multimodal therapy events. To ensure the validity and reliability of the research results, such investigations should incorporate multidimensional data collection that integrates long-term trends in physiological indicators, psychological states, and job performance.

Finally, multimodal therapy design should be further strengthened theoretically by emphasizing interdisciplinary collaborative research to improve its practical effectiveness. To organize an interdisciplinary research team, it is recommended to combine knowledge from fields such as psychology, ergonomics, interaction design, and technology development. This method will provide more accurate answers to difficult problems in design and technology practice, and promote the continuous innovation and deepening of multimodal therapy design in office spaces in both theory and practice.

5.5 Future Outlook

With the continuous development of digital technology and multimodal design, therapy design in the future workplace environment has more possibilities and application possibilities. Emerging digital technologies, such as Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), are expected to play a more important role in workplace therapy. As urban Internet company employees prioritize their mental health and physical comfort, they are expected to meet users' growing expectations for high-quality immersive experiences. Future research and implementation should focus particularly on technological innovation and the creation of new application models to accelerate the spread of digital therapy solutions in real office environments.

In parallel with this, future multimodal therapy design should place more emphasis on maximizing individual user experience. The combination of big data analysis and artificial intelligence technologies will make it possible to accurately detect and dynamically adapt to the psychological needs and stress situations of various users, allowing therapy to be adjusted in real time. In addition, the cross-cultural adaptability of Multisensory design is a topic that calls for further research in the design field to ensure that therapy techniques and approaches are truly promoted on a global scale and meet the specific needs of consumers from diverse backgrounds.

From the perspective of academic research, the future field of therapeutic design in office environments will increasingly rely on interdisciplinary cooperation models that integrate knowledge from fields such as psychology, design, ergonomics, and sociology to jointly develop effective, practical, and economically feasible office space solutions. Such interdisciplinary cooperation will promote the rapid development of related businesses, constantly expand the application scope and possibilities of design in practice, provide a more comprehensive and in-depth theoretical foundation for therapeutic technology in office environments, and form a new standard for healthy, comfortable, and efficient office environments.

APPENDIX

Appendix A.
IOC Invitation Letters

No.8610/ 6456

Faculty of Decorative Arts, Silpakorn University
Na Phra Larn Rd., Phra Borom Maha Ratchawang
Phra Nakhon, Bangkok 10200 Thailand

23 December 2024

Subject: Request for Information and an Interview

Dear Assoc. Prof. Wannaporn Chujitarom

Mr. Shijie WU, Student ID 660420036, a doctoral student student in Design at the Faculty of Decorative Arts, Silpakorn University. who is currently working on the dissertation titled "The Immersive Healing Experiences to Alleviate Office Workers' Stress in Urban Environments.", would like to request some information and request an interview with in order to collect data as a part of her dissertation research.

On behalf of the Faculty of Decorative Arts, Silpakorn University, we kindly request your cooperation and assistance in providing information and participating in an interview. For additional details, please contact Mr. Shijie WU at telephone number 083-9708057, who will serve as a direct coordinator.

Yours faithfully

(Assoc.Prof. Arwin Intrungsi)
Dean of Faculty of Decorative Arts,
Silpakorn University

Contact to : info.decsu@gmail.com
Tel. +662-221-5874, +662-221-5832

No.8610/ 6455

Faculty of Decorative Arts, Silpakorn University
Na Phra Larn Rd., Phra Borom Maha Ratchawang
Phra Nakhon, Bangkok 10200 Thailand

23 December 2024

Subject: Request for Information and an Interview

Dear Asst. Prof. Donlaporn Srifa

Mr. Shijie WU, Student ID 660420036, a doctoral student student in Design at the Faculty of Decorative Arts, Silpakorn University. who is currently working on the dissertation titled "The Immersive Healing Experiences to Alleviate Office Workers' Stress in Urban Environments.", would like to request some information and request an interview with in order to collect data as a part of her dissertation research.

On behalf of the Faculty of Decorative Arts, Silpakorn University, we kindly request your cooperation and assistance in providing information and participating in an interview. For additional details, please contact Mr. Shijie WU at telephone number 083-9708057, who will serve as a direct coordinator.

Yours faithfully

(Assoc.Prof. Arwin Intrungsi)
Dean of Faculty of Decorative Arts,
Silpakorn University

Contact to : info.decsu@gmail.com
Tel. +662-221-5874, +662-221-5832

No.8610/ 6454

Faculty of Decorative Arts, Silpakorn University
Na Phra Larn Rd., Phra Borom Maha Ratchawang
Phra Nakhon, Bangkok 10200 Thailand

23 December 2024

Subject: Request for Information and an Interview

Dear Dr. Pakinee Plengdeesakul

Mr. Shijie WU, Student ID 660420036, a doctoral student student in Design at the Faculty of Decorative Arts, Silpakorn University. who is currently working on the dissertation titled "The Immersive Healing Experiences to Alleviate Office Workers' Stress in Urban Environments.", would like to request some information and request an interview with in order to collect data as a part of her dissertation research.

On behalf of the Faculty of Decorative Arts, Silpakorn University, we kindly request your cooperation and assistance in providing information and participating in an interview. For additional details, please contact Mr. Shijie WU at telephone number 083-9708057, who will serve as a direct coordinator.

Yours faithfully

(Assoc.Prof. Arwin Intrungsi)
Dean of Faculty of Decorative Arts,
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Appendix B.
Expert Invitation Letters

No.8610/ 1261

Faculty of Decorative Arts, Silpakorn University
Na Phra Larn Rd., Phra Borom Maha Ratchawang
Phra Nakhon, Bangkok 10200 Thailand

4 March 2025

Subject: Request for Information and an Interview

Dear Dr.Sun Tong

Mr. Shijie WU, Student ID 660420036 student in Design at the Faculty of Decorative Arts, Silpakorn University. who is currently working on the dissertation titled "The Immersive Healing Experiences to Alleviate Office Workers' Stress in Urban Environments.", would like to request some information and request an interview with in order to collect data as a part of her dissertation research.

On behalf of the Faculty of Decorative Arts, Silpakorn University, we kindly request your cooperation and assistance in providing information and participating in an interview. For additional details, please contact Mr. Shijie WU at telephone number 083-9708057 , who will serve as a direct coordinator.

Yours faithfully

(Assoc.Prof. Arwin Intrungsi)
Dean of Faculty of Decorative Arts,
Silpakorn University

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พิมพ์ปภาภ์
ฉ52
4/3/68

No.8610/ 1260

Faculty of Decorative Arts, Silpakorn University
Na Phra Larn Rd., Phra Borom Maha Ratchawang
Phra Nakhon, Bangkok 10200 Thailand

4 March 2025

Subject: Request for Information and an Interview

Dear Dr. Ma Xiaolan

Mr. Shijie WU, Student ID 660420036 student in Design at the Faculty of Decorative Arts, Silpakorn University. who is currently working on the dissertation titled "The Immersive Healing Experiences to Alleviate Office Workers' Stress in Urban Environments.", would like to request some information and request an interview with in order to collect data as a part of her dissertation research.

On behalf of the Faculty of Decorative Arts, Silpakorn University, we kindly request your cooperation and assistance in providing information and participating in an interview. For additional details, please contact Mr. Shijie WU at telephone number 083-9708057 , who will serve as a direct coordinator.

Yours faithfully

(Assoc.Prof. Arwin Intrungsi)
Dean of Faculty of Decorative Arts,
Silpakorn University

Contact to : info.decsu@gmail.com
Tel. +662-221-5874, +662-221-5832

พิมพ์/ทาน
4/3/68

No.8610/ 1262

Faculty of Decorative Arts, Silpakorn University
Na Phra Larn Rd., Phra Borom Maha Ratchawang
Phra Nakhon, Bangkok 10200 Thailand

4 March 2025

Subject: Request for Information and an Interview

Dear Professor Qi Yanling

Mr. Shijie WU, Student ID 660420036 student in Design at the Faculty of Decorative Arts, Silpakorn University. who is currently working on the dissertation titled "The Immersive Healing Experiences to Alleviate Office Workers' Stress in Urban Environments.", would like to request some information and request an interview with in order to collect data as a part of her dissertation research.

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Yours faithfully

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No.8610/ 1264

Faculty of Decorative Arts, Silpakorn University
Na Phra Larn Rd., Phra Borom Maha Ratchawang
Phra Nakhon, Bangkok 10200 Thailand

4 March 2025

Subject: Request for Information and an Interview

Dear Dr. Hao Junyi

Mr. Shijie WU, Student ID 660420036 student in Design at the Faculty of Decorative Arts, Silpakorn University. who is currently working on the dissertation titled "The Immersive Healing Experiences to Alleviate Office Workers' Stress in Urban Environments.", would like to request some information and request an interview with in order to collect data as a part of her dissertation research.

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Yours faithfully

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4/3/68

No.8610/ 1263

Faculty of Decorative Arts, Silpakorn University
Na Phra Larn Rd., Phra Borom Maha Ratchawang
Phra Nakhon, Bangkok 10200 Thailand

4 March 2025

Subject: Request for Information and an Interview

Dear Mr.Li Xinpeng

Mr. Shijie WU, Student ID 660420036 student in Design at the Faculty of Decorative Arts, Silpakorn University. who is currently working on the dissertation titled "The Immersive Healing Experiences to Alleviate Office Workers' Stress in Urban Environments.", would like to request some information and request an interview with in order to collect data as a part of her dissertation research.

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Yours faithfully

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No.8610/ 1272

Faculty of Decorative Arts, Silpakorn University
Na Phra Larn Rd., Phra Borom Maha Ratchawang
Phra Nakhon, Bangkok 10200 Thailand

4 March 2025

Subject: Request for Information and an Interview

Dear Assoc. Prof. Guo Jie

Mr. Shijie WU, Student ID 660420036 student in Design at the Faculty of Decorative Arts, Silpakorn University. who is currently working on the dissertation titled "The Immersive Healing Experiences to Alleviate Office Workers' Stress in Urban Environments.", would like to request some information and request an interview with in order to collect data as a part of her dissertation research.

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Yours faithfully

(Assoc.Prof. Arwin Intrungsi)
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No.8610/ 1259

Faculty of Decorative Arts, Silpakorn University
Na Phra Larn Rd., Phra Borom Maha Ratchawang
Phra Nakhon, Bangkok 10200 Thailand

4 March 2025

Subject: Request for Information and an Interview

Dear Dr. Xiang Shichao

Mr. Shijie WU, Student ID 660420036 student in Design at the Faculty of Decorative Arts, Silpakorn University. who is currently working on the dissertation titled "The Immersive Healing Experiences to Alleviate Office Workers' Stress in Urban Environments.", would like to request some information and request an interview with in order to collect data as a part of her dissertation research.

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Dean of Faculty of Decorative Arts,
Silpakorn University

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Appendix C
Publications

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MHESI 75 91 90 00/13167

College of Graduate Studies
Walailak University
Nakhonsithammarat 80160

July 2 , 2025

Letter of Acceptance (ID: 283180)

Dear Shijie Wu,

We are pleased to inform you that your manuscript entitled **"A Literature Review and Case Analysis of Nature-Based Healing and Multisensory Digital Technology in Open-Plan Office Spaces"** (Author: Shijie Wu and Atithep Chaetnalao) has been accepted for publication in the Asia Social Issues.

Your manuscript will now be prepared for the production process. If any issues arise we will contact you; otherwise your manuscript will be forwarded directly to our production section. Please do not send a revised manuscript or figures at this time unless requested.

Yours sincerely,

(Asst.Prof.Dr.Siriporn Somboonboorana)

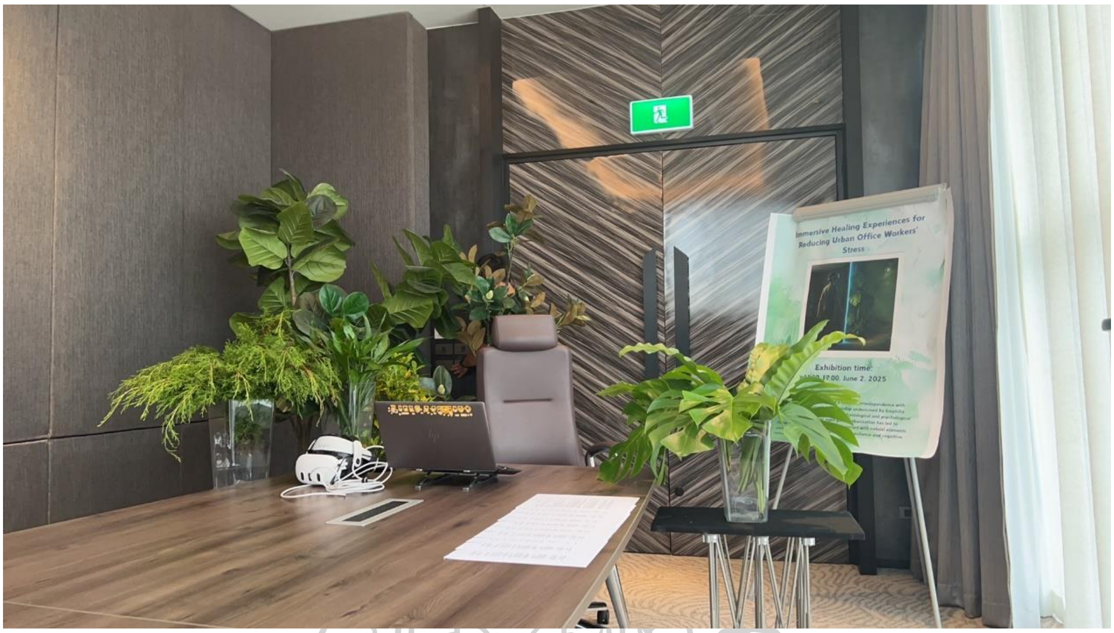
Assistant Professor - ไม่มีข้อมูล -

2025/7/2 Time 9:51:36 Personal PKI-LN

Signature Code : Z97IS-cSzpv-gpnAb-GTK5w

Asia Social Issues
Website: https://so06.tci-thaijo.org/index.php/asi
ISSN (online): 2774-0315

Appendix D
Exhibition and testing


Immersive Healing Experiences for
Reducing Urban Office Workers'
Stress
Exhibition time


Immersive Healing Experiences for
Reducing Urban Office Workers'
Stress
Exhibition time:
11:00-17:00, June 2, 2025
Introduction











REFERENCES

Abbott, D. (2020). Intentional learning design for educational games: a workflow supporting both novices and experts.

Al-Ansi, A. M., Jaboob, M., Garad, A., & Al-Ansi, A. (2023). Analyzing Augmented Reality (AR) and Virtual Reality (VR) recent development in education. *Social Sciences & Humanities Open*, *8*(1), 100532. https://doi.org/https://doi.org/10.1016/j.ssaho.2023.100532

Ali, F. (2022). *Sound Healing: How to Use Sound to Beat Stress and Anxiety*.

Ambrosio, A. P., & Fidalgo, M. I. R. (2020). Past, present and future of Virtual Reality: Analysis of its technological variables and definitions. *Culture & History Digital Journal*, *9*(1), e010-e010.

Antonaci, F. G., Olivetti, E. C., Marcolin, F., Castiblanco Jimenez, I. A., Eynard, B., Vezzetti, E., & Moos, S. (2024). Workplace Well-Being in Industry 5.0: A Worker-Centered Systematic Review. *Sensors*, *24*(17), 5473. https://doi.org/10.3390/s24175473

Antonelli, M., Barbieri, G., & Donelli, D. (2019). Effects of forest bathing (shinrin-yoku) on levels of cortisol as a stress biomarker: a systematic review and meta-analysis. *International Journal of Biometeorology*, *63*(8), 1117-1134. https://doi.org/10.1007/s00484-019-01717-x

Aristizabal, S., Byun, K., Porter, P., Clements, N., Campanella, C., Li, L., Mullan, A., Ly, S., Senerat, A., Nenadic, I. Z., Browning, W. D., Loftness, V., & Bauer, B. (2021). Biophilic office design: Exploring the impact of a Multisensory approach on human well-being. *Journal of Environmental Psychology*, *77*, 101682. https://doi.org/https://doi.org/10.1016/j.jenvp.2021.101682

Arpaia, P., D'Errico, G., De Paolis, L. T., Moccaldi, N., & Nuccetelli, F. (2022). A Narrative Review of Mindfulness-Based Interventions Using Virtual Reality. *Mindfulness*, *13*(3), 556-571. https://doi.org/10.1007/s12671-021-01783-6

Awada, M., Becerik-Gerber, B., Liu, R., Seyedrezaei, M., Lu, Z., Xenakis, M., Lucas, G., Roll, S. C., & Narayanan, S. (2023). Ten questions concerning the impact of environmental stress on office workers. *Building and Environment*, *229*, 109964. https://doi.org/https://doi.org/10.1016/j.buildenv.2022.109964

Ba, A. (2016). Investigating the potential of applying vertical green walls to high-rise residential buildings for energy-saving in sub-tropical region. *Building and Environment*, *97*, 34-39. https://doi.org/10.1016/j.buildenv.2015.11.028

Bahremand, A., Manetta, M., Lai, J., Lahey, B., Spackman, C., Smith, B. H., Gerkin, R. C., & Likamwa, R. (2022, 2022). The Smell Engine: A system for artificial odor synthesis in virtual environments.

Bai, Z., & Zhang, S. (2024). Effects of different natural soundscapes on human psychophysiology in national forest park. *Scientific Reports*, *14*(1). https://doi.org/10.1038/s41598-024-67812-1

Bao Jinsong, W. D. (2023). *Virtual Reality and Augmented Reality*. Tsinghua University Press.

Bergefurt, L., Weijs-Perrée, M., Appel-Meulenbroek, R., & Arentze, T. (2022). The physical office workplace as a resource for mental health – A systematic scoping review. *Building and Environment*, *207*, 108505. https://doi.org/10.1016/j.buildenv.2021.108505

Berger, J., Essah, E., & Blanusa, T. (2024). The impact of plants on the humidity of naturally-ventilated office indoor environments. *Journal of Building Engineering*, *86*, 108814. https://doi.org/https://doi.org/10.1016/j.jobe.2024.108814

Bhandarkar, S., Salvi, B. V., & Shende, P. (2024). Current scenario and potential of music therapy in the management of diseases. *Behavioural Brain Research*, *458*, 114750. https://doi.org/https://doi.org/10.1016/j.bbr.2023.114750

Bolliger, L., Lukan, J., Colman, E., Boersma, L., Luštrek, M., De Bacquer, D., & Clays, E. (2022). Sources of Occupational Stress among Office Workers—A Focus Group Study. *International Journal of Environmental Research and Public Health*, *19*(3), 1075. https://doi.org/10.3390/ijerph19031075

Bordegoni, M., Carulli, M., & Spadoni, E. (2023). Multisensory Interaction in Extended Reality. In M. Bordegoni, M. Carulli, & E. Spadoni (Eds.), *Prototyping User eXperience in Extended Reality* (pp. 49-63). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-39683-0_4

Browning, M. H. E. M., Mimnaugh, K. J., Van Riper, C. J., Laurent, H. K., & Lavalle, S. M. (2020). Can Simulated Nature Support Mental Health? Comparing Short, Single-Doses of 360-Degree Nature Videos in Virtual Reality With the Outdoors. *Frontiers in Psychology*, *10*. https://doi.org/10.3389/fpsyg.2019.02667

Chen, H., Liu, C., Zhang, A., Lu, W.-Q., Wu, K., & Chiou, W.-K. (2024). How flow and mindfulness interact with each other in mindfulness-based Augmented Reality mandala coloring activities. *Frontiers in Psychology*, *14*. https://doi.org/10.3389/fpsyg.2023.1301531

Chen, X., Liu, Y., Li, S., & Sun, W. (2022). Sensory Perception Mechanism for Preparing the Combinations of Stimuli Operation in the Architectural Experience. *Sustainability*, *14*(13), 7885. https://doi.org/10.3390/su14137885

Chulvi, V., Agost, M. J., Felip, F., & Gual, J. (2020). Natural elements in the designer's work environment influence the creativity of their results. *Journal of Building Engineering*, *28*, 101033. https://doi.org/https://doi.org/10.1016/j.jobe.2019.101033

Collier, L. (2018). Multisensory environmental therapy (Snoezelen) for job stress reduction in mental health nurses: a randomized trial. *International Journal of Complementary & Alternative Medicine*, *11*(2). https://doi.org/10.15406/ijcam.2018.11.00346

Comsa, I.-S., Saleme, E. B., Covaci, A., Assres, G. M., Trestian, R., Saibel Santos, C.

A., & Ghinea, G. (2019). Do I Smell Coffee? The Tale of a 360° Mulsemedia Experience. *IEEE MultiMedia*, 1-1. https://doi.org/10.1109/mmul.2019.2954405

Cooley, S. J., Jones, C. R., Kurtz, A., & Robertson, N. (2020). 'Into the Wild': A meta-synthesis of talking therapy in natural outdoor spaces. *Clinical Psychology Review*, *77*, 101841. https://doi.org/https://doi.org/10.1016/j.cpr.2020.101841

Cui, J., Li, Z., Zhang, W., Wang, L., Liu, H., & Liu, H. (2025). Integrating aromatic plants into indoor biophilic environments: Species selection based on psychophysiological effects and bioactive volatile compounds. *Building and Environment*, *267*, 112169. https://doi.org/https://doi.org/10.1016/j.buildenv.2024.112169

Di Giuseppe, E., Marcelli, L., Latini, A., & D'Orazio, M. (2024). Evaluating Biophilic Design strategies in Immersive Virtual Indoor Environments: A systematic review on the implications for buildings occupants. *Journal of Building Engineering*, *98*, 111127. https://doi.org/https://doi.org/10.1016/j.jobe.2024.111127

Doherty, T., Artman, S., Homan, J., Keluskar, J., & White, K. E. (2024). Environmental identity-based therapies for climate distress: applying cognitive behavioural approaches. *The Cognitive Behaviour Therapist*, *17*. https://doi.org/10.1017/s1754470x24000278

Dutta, S. (2024). *Immersive Realm of Extended Reality*. BPB Publications.

Egger, J., Gsaxner, C., Luijten, G., Chen, J., Chen, X., Bian, J., Kleesiek, J., & Puladi, B. (2024). Is the Apple Vision Pro the Ultimate Display? A First Perspective and Survey on Entering the Wonderland of Precision Medicine. *JMIR Serious Games*, *12*. https://doi.org/https://doi.org/10.2196/52785

Felgueiras, F., Cunha, L., Mourão, Z., Moreira, A., & Gabriel, M. F. (2022). A systematic review of environmental intervention studies in offices with beneficial effects on workers' health, well-being and productivity. *Atmospheric Pollution Research*, *13*(9), 101513. https://doi.org/https://doi.org/10.1016/j.apr.2022.101513

Felgueiras, F., Mourão, Z., Moreira, A., & Gabriel, M. F. (2023). Indoor environmental quality in offices and risk of health and productivity complaints at work: A literature review. *Journal of Hazardous Materials Advances*, *10*, 100314. https://doi.org/https://doi.org/10.1016/j.hazadv.2023.100314

Feng, J., Jiang, H., Shen, X., Lei, Z., Li, L., Zhu, Y., Zhang, M., Yang, T., Meng, X., Di, H., Xia, W., Lu, Z., & Gan, Y. (2022). Occupational stress and associated factors among general practitioners in China: a national cross-sectional study. *BMC Public Health*, *22*(1). https://doi.org/10.1186/s12889-022-13484-3

Feng, Z. (2024). *Virtual Reality and Interactive Applications*. Tsinghua University Press.

Finck, C., Avila, A., Jiménez-Leal, W., Botero, J. P., Shambo, D., Hernandez, S., Reinoso-Carvalho, F., & Andonova, V. (2023). A Multisensory mindfulness experience: exploring the promotion of sensory awareness as a mindfulness practice. *Frontiers in Psychology*, *14*. https://doi.org/10.3389/fpsyg.2023.1230832

Fleury, S., & Chaniaud, N. (2024). Multi-user centered design: acceptance, user experience, user research and user testing. *Theoretical Issues in Ergonomics Science*, *25*(2), 209-224. https://doi.org/10.1080/1463922x.2023.2166623

Flies, E. J., Pryor, A., Henderson-Wilson, C., Turner, M., Roydhouse, J., Patrick, R., O'Shea, M., Norris, K., Martin, A., Marsh, P., Bartlett, L., Azghadi, M. R., & Neil, A. (2024). Bridging the evidence gap: A review and research protocol for outdoor mental health therapies for young Australians. *Journal of Outdoor and Environmental Education*, *27*(1), 37-56. https://doi.org/10.1007/s42322-023-00143-3

Frost, S., Kannis-Dymand, L., Schaffer, V., Millear, P., Allen, A., Stallman, H., Mason, J., Wood, A., & Atkinson-Nolte, J. (2022). Virtual immersion in Nature and psychological well-being: A systematic literature review. *Journal of Environmental Psychology*, *80*, 101765. https://doi.org/https://doi.org/10.1016/j.jenvp.2022.101765

Furuichi, W., Shimura, A., Miyama, H., Seki, T., Ono, K., Masuya, J., & Inoue, T. (2020). <p>Effects of Job Stressors, Stress Response, and Sleep Disturbance on Presenteeism in Office Workers</p>. *Neuropsychiatric Disease and Treatment*, *Volume 16*, 1827-1833. https://doi.org/10.2147/ndt.s258508

Gaekwad, J. S., Sal Moslehian, A., & Roös, P. B. (2023). A meta-analysis of physiological stress responses to natural environments: Biophilia and Stress Recovery Theory perspectives. *Journal of Environmental Psychology*, *90*, 102085. https://doi.org/https://doi.org/10.1016/j.jenvp.2023.102085

Gao, W., Jin, D., Wang, Q., & Zhu, P. (2023). Integrating User-Centered Design and Biophilic Design to Improve Biophilia and Intelligentization in Office Environments. *Buildings*, *13*(7), 1687. https://www.mdpi.com/2075-5309/13/7/1687

Gao, Y., Yao, K., Jia, S., Huang, Y., Zhao, G., Zhang, B., Liu, Y., & Yu, X. (2024). Advances in materials for haptic skin electronics. *Matter*, *7*(9), 2826-2845. https://doi.org/https://doi.org/10.1016/j.matt.2024.06.010

Georg Jensen, M., Goode, M., & Heinrich, M. (2024). Herbal medicines and botanicals for managing insomnia, stress, anxiety, and depression: A critical review of the emerging evidence focusing on the Middle East and Africa. *PharmaNutrition*, *29*, 100399. https://doi.org/https://doi.org/10.1016/j.phanu.2024.100399

Globa, A., Beza, B. B., & Wang, R. (2022). Towards multi-sensory design: Placemaking through immersive environments – Evaluation of the approach. *Expert Systems with Applications*, *204*, 117614.

https://doi.org/https://doi.org/10.1016/j.eswa.2022.117614

Goebert, C., Greenhalgh, G., & Dwyer, B. (2022). A whole new ball game: Fan perceptions of Augmented Reality enhanced sport broadcasts. *Computers in Human Behavior*, *137*, 107388. https://doi.org/https://doi.org/10.1016/j.chb.2022.107388

Goto, E., Ishikawa, H., Okuhara, T., Ueno, H., Okada, H., Fujino, Y., & Kiuchi, T. (2020). Presenteeism among workers: health-related factors, work-related factors and health literacy. *Occupational Medicine*, *70*(8), 564-569. https://doi.org/10.1093/occmed/kqaa168

Gougeh, R. A., De Jesus, B. J., Lopes, M. K. S., Moinnereau, M.-A., Schubert, W., & Falk, T. H. (2022, 2022). Quantifying User Behaviour in Multisensory Immersive Experiences.

Grim, C. E., & Grim, C. M. (2024). 9 - Office Blood Pressure Measurement. In G. L. Bakris, M. J. Sorrentino, & L. J. Laffin (Eds.), *Hypertension (Fourth Edition)* (pp. 106-122). Elsevier. https://doi.org/https://doi.org/10.1016/B978-0-323-88369-6.00009-8

Gu, B., Tan, Q., & Zhao, S. (2019). The association between occupational stress and psychosomatic wellbeing among Chinese nurses: A cross-sectional survey. *Medicine*, *98*(22). https://journals.lww.com/md-journal/fulltext/2019/05310/the_association_between_occupational_stress_and.57.aspx

Guo, Y., Jiang, X., Zhang, L., Zhang, H., & Jiang, Z. (2022). Effects of Sound Source Landscape in Urban Forest Park on Alleviating Mental Stress of Visitors: Evidence from Huolu Mountain Forest Park, Guangzhou. *Sustainability*, *14*(22).

Guseva Canu, I., Marca, S. C., Dell'Oro, F., Balázs, Á., Bergamaschi, E., Besse, C., Bianchi, R., Bislimovska, J., Koscec Bjelajac, A., Bugge, M., Busneag, C. I., Çağlayan, Ç., Cernițanu, M., Costa Pereira, C., Dernovšček Hafner, N., Droz, N., Eglite, M., Godderis, L., Gündel, H.,…Wahlen, A. (2021). Harmonized definition of occupational burnout: A systematic review, semantic analysis, and Delphi consensus in 29 countries. *Scand J Work Environ Health*, *47*(2), 95-107. https://doi.org/10.5271/sjweh.3935

Gyllensten, A. L., Jacobsen, L. N., & Gard, G. (2019). Clinician perspectives of Basic Body Awareness Therapy (BBAT) in mental health physical therapy: An international qualitative study. *Journal of Bodywork and Movement Therapies*, *23*(4), 746-751. https://doi.org/https://doi.org/10.1016/j.jbmt.2019.04.012

Hillmann, C. (2021). *UX for XR: User Experience Design and Strategies for Immersive Technologies*.

Homrich, P. H. P., Dantas-Filho, F. F., Martins, L. L., & Marcon, E. R. (2020). Presenteeism among health care workers: literature review. *Rev Bras Med Trab*, *18*(1), 97-102. https://doi.org/10.5327/z1679443520200478

Hong, G. N., Sin, B. S., Song, K. J., Son, J. H., Kim, H. S., & Choi, M. J. (2022).

Effects of Kneipp therapy on HRV: the First Preliminary Validation in Forest Environment. *Journal of Naturopathy*, *11*(1), 1-8. https://doi.org/10.33562/jn.2022.11.1.1

Hsieh, C.-H., Yang, J.-Y., Huang, C.-W., & Chin, W. C. B. (2023). The effect of water sound level in Virtual Reality: A study of restorative benefits in young adults through immersive natural environments. *Journal of Environmental Psychology*, *88*, 102012. https://doi.org/https://doi.org/10.1016/j.jenvp.2023.102012

Hung, S.-H., & Chang, C.-Y. (2024). Designing for harmony in urban green space: Linking the concepts of biophilic design, environmental Qi, restorative environment, and landscape preference. *Journal of Environmental Psychology*, *96*, 102294. https://doi.org/https://doi.org/10.1016/j.jenvp.2024.102294

James, K. A., Stromin, J. I., Steenkamp, N., & Combrinck, M. I. (2023). Understanding the relationships between physiological and psychosocial stress, cortisol and cognition. *Frontiers in Endocrinology*, *14*. https://doi.org/10.3389/fendo.2023.1085950

Jeon, J. Y., Jo, H. I., & Lee, K. (2023). Psycho-physiological restoration with audio-Visual interactions through Virtual Reality simulations of soundscape and landscape experiences in urban, waterfront, and green environments. *Sustainable Cities and Society*, *99*, 104929. https://doi.org/https://doi.org/10.1016/j.scs.2023.104929

Jeon, J. Y., Jo, H. I., Santika, B. B., & Lee, H. (2022). Crossed effects of audio-Visual environment on indoor soundscape perception for pleasant open-plan office environments. *Building and Environment*, *207*, 108512. https://doi.org/https://doi.org/10.1016/j.buildenv.2021.108512

Ji, Y. Q., Li, S., Wang, J., Liu, X. M., Ren, J., & Wang, C. (2018). [Association of occupational stress with job burnout and depression tendency in workers in Internet companies]. *Zhonghua lao dong wei sheng zhi ye bing za zhi = Zhonghua laodong weisheng zhiyebing zazhi = Chinese journal of industrial hygiene and occupational diseases*, *36*(4), 241-246. https://doi.org/10.3760/cma.j.issn.1001-9391.2018.04.001

Jim, C. Y., Hui, L. C., & Rupprecht, C. D. D. (2022). Public Perceptions of Green Roofs and Green Walls in Tokyo, Japan: A Call to Heighten Awareness. *Environmental Management*, *70*(1), 35-53. https://doi.org/10.1007/s00267-022-01625-8

Jung, R. D. W. B. P. G. B. (2022). *Virtual and Augmented Reality (VR/AR): Foundations and Methods of Extended Realities (XR)*.

Jutzi, C. A., Möller, J., Hansen, J., Klackl, J., & Jonas, E. (2025). Psychological needs in the built environment. *Journal of Environmental Psychology*, *101*, 102419. https://doi.org/https://doi.org/10.1016/j.jenvp.2024.102419

Kamińska, D., Zwoliński, G., Laska-Leśniewicz, A., Raposo, R., Vairinhos, M., Pereira, E., Urem, F., Ljubić Hinić, M., Haamer, R. E., & Anbarjafari, G.

(2023). Augmented Reality: Current and New Trends in Education. *Electronics*, *12*(16), 3531. https://www.mdpi.com/2079-9292/12/16/3531

Karan, N. B. (2019). Influence of lavender oil inhalation on vital signs and anxiety: A randomized clinical trial. *Physiology & Behavior*, *211*, 112676. https://doi.org/https://doi.org/10.1016/j.physbeh.2019.112676

Khaleghi, A., Narimani, A., Aghaei, Z., Khorrami Banaraki, A., & Hassani-Abharian, P. (2024). A Smartphone-Gamified Virtual Reality Exposure Therapy Augmented With Biofeedback for Ailurophobia: Development and Evaluation Study. *JMIR Serious Games*, *12*, e34535. https://doi.org/10.2196/34535

Kim, C., & Song, C. (2022). Physiological and Psychological Relaxation Effects of Fir Essential Oil on University Students. *International Journal of Environmental Research and Public Health*, *19*(9), 5063. https://doi.org/10.3390/ijerph19095063

Kim, J.-S., Shin, W.-S., & Kim, M.-J. (2021). Analysis of Preference and Psychological Recovery by Sound, Scenery, Soundscape in Healing Forest. *Journal of Environmental Science International*, *30*(3), 267-277. https://doi.org/10.5322/jesi.2021.30.3.267

Korpilo, S., Nyberg, E., Vierikko, K., Ojala, A., Kaseva, J., Lehtimäki, J., Kopperoinen, L., Cerwén, G., Hedblom, M., Castellazzi, E., & Raymond, C. M. (2024). Landscape and soundscape quality promote stress recovery in nearby urban Nature: A Multisensory field experiment. *Urban Forestry & Urban Greening*, *95*, 128286. https://doi.org/https://doi.org/10.1016/j.ufug.2024.128286

Kotera, Y., Richardson, M., & Sheffield, D. (2022). Effects of Shinrin-Yoku (Forest Bathing) and Nature Therapy on Mental Health: a Systematic Review and Meta-analysis. *International Journal of Mental Health and Addiction*, *20*(1), 337-361. https://doi.org/10.1007/s11469-020-00363-4

Kuhail, M. A., Elsayary, A., Farooq, S., & Alghamdi, A. (2022). Exploring Immersive Learning Experiences: A Survey. *Informatics*, *9*(4), 75. https://doi.org/10.3390/informatics9040075

Lei, Q., Yuan, C., & Lau, S. S. Y. (2021). A quantitative study for indoor workplace biophilic design to improve health and productivity performance. *Journal of Cleaner Production*, *324*, 129168. https://doi.org/https://doi.org/10.1016/j.jclepro.2021.129168

Levstek, M., Papworth, S., Woods, A., Archer, L., Arshad, I., Dodds, K., Holdstock, J. S., Bennett, J., & Dalton, P. (2024). Immersive storytelling for pro-environmental behaviour change: The Green Planet Augmented Reality experience. *Computers in Human Behavior*, *161*, 108379. https://doi.org/https://doi.org/10.1016/j.chb.2024.108379

Li, C., Sun, C., Sun, M., Yuan, Y., & Li, P. (2020). Effects of brightness levels on stress recovery when viewing a Virtual Reality forest with simulated natural light. *Urban Forestry & Urban Greening*, *56*, 126865.

https://doi.org/https://doi.org/10.1016/j.ufug.2020.126865

Lindert, J., Paul, K. C., Lachman, M. E., Ritz, B., & Seeman, T. E. (2021). Depression-, Anxiety-, and Anger and Cognitive Functions: Findings From a Longitudinal Prospective Study. *Frontiers in Psychiatry*, *12*. https://doi.org/10.3389/fpsyt.2021.665742

Liu, F., Yan, L., Meng, X., & Zhang, C. (2022). A review on indoor green plants employed to improve indoor environment. *Journal of Building Engineering*, *53*, 104542. https://doi.org/https://doi.org/10.1016/j.jobe.2022.104542

Lu, S., Wei, F., & Li, G. (2021). The evolution of the concept of stress and the framework of the stress system. *Cell Stress*, *5*(6), 76-85. https://doi.org/10.15698/cst2021.06.250

Lukan, J., Bolliger, L., Pauwels, N. S., Luštrek, M., Bacquer, D. D., & Clays, E. (2022). Work environment risk factors causing day-to-day stress in occupational settings: a systematic review. *BMC Public Health*, *22*(1). https://doi.org/10.1186/s12889-021-12354-8

Lyu, K., Brambilla, A., Globa, A., & de Dear, R. (2023). An immersive Multisensory Virtual Reality approach to the study of human-built environment interactions. *Automation in Construction*, *150*, 104836. https://doi.org/https://doi.org/10.1016/j.autcon.2023.104836

Ma, J., Wang, Y., Joshi, S., Wang, H., Young, C., Pervez, A., Qu, Y., & Washburn, S. (2024). Using immersive Virtual Reality technology to enhance nursing education: A comparative pilot study to understand efficacy and effectiveness. *Applied Ergonomics*, *115*, 104159. https://doi.org/https://doi.org/10.1016/j.apergo.2023.104159

McCurley, V. (2016). *Storyboarding in Virtual Reality*. https://virtualrealitypop.com/storyboarding-in-virtual-reality-67d3438a2fb1

Melo, M., Goncalves, G., Monteiro, P., Coelho, H., Vasconcelos-Raposo, J., & Bessa, M. (2022). Do Multisensory Stimuli Benefit the Virtual Reality Experience? A Systematic Review. *IEEE Transactions on Visualization and Computer Graphics*, *28*(2), 1428-1442. https://doi.org/10.1109/tvcg.2020.3010088

Moinnereau, M.-A., de Oliveira, A. A., & Falk, T. H. (2022). Immersive media experience: a survey of existing methods and tools for human influential factors assessment. *Quality and User Experience*, *7*(1), 5. https://doi.org/10.1007/s41233-022-00052-1

Moran, D. (2019). Back to Nature? Attention restoration theory and the restorative effects of Nature contact in prison. *Health & Place*, *57*, 35-43. https://doi.org/https://doi.org/10.1016/j.healthplace.2019.03.005

Nitidara, N. P. A., Sarwono, J., Suprijanto, S., & Soelami, F. X. N. (2022). The Multisensory interaction between Auditory, Visual, and thermal to the overall comfort in public open space: A study in a tropical climate. *Sustainable Cities and Society*, *78*, 103622. https://doi.org/https://doi.org/10.1016/j.scs.2021.103622

Niza, I. L., de Souza, M. P., da Luz, I. M., & Broday, E. E. (2024). Sick building syndrome and its impacts on health, well-being and productivity: A systematic literature review. *Indoor and Built Environment*, *33*(2), 218-236. https://doi.org/10.1177/1420326x231191079

Norman-Nott, N., Cashin, A. G., & Gustin, S. M. (2024). Chapter Thirteen - Psychological, physical and complementary therapies for the management of neuropathic pain. In J. Rosner & P. Karlsson (Eds.), *International Review of Neurobiology* (Vol. 179, pp. 431-470). Academic Press. https://doi.org/https://doi.org/10.1016/bs.irn.2024.10.010

Odonkor, S. T., & Adams, S. (2021). Predictors of stress and associated factors among healthcare workers in Western Ghana. *Heliyon*, *7*(6), e07223. https://doi.org/10.1016/j.heliyon.2021.e07223

Ojala, A., Neuvonen, M., Kurkilahti, M., Leinikka, M., Huotilainen, M., & Tyrväinen, L. (2022). Short virtual Nature breaks in the office environment can restore stress: An experimental study. *Journal of Environmental Psychology*, *84*, 101909. https://doi.org/https://doi.org/10.1016/j.jenvp.2022.101909

Organization, W. H. (2024). *Mental health in the workplace: Policy brief.*

Pacchierotti, C., Chinello, F., Koumaditis, K., Luca, M. D., Ofek, E., & Georgiou, O. (2024). Guest Editorial Haptics in the Metaverse: Haptic Feedback for Virtual, Augmented, Mixed, and eXtended Realities. *IEEE Transactions on Haptics*, *17*(2), 122-128. https://doi.org/10.1109/TOH.2024.3369192

Pollmann, K., Loh, W., Fronemann, N., & Ziegler, D. (2023). Entertainment vs. manipulation: Personalized human-robot interaction between user experience and ethical design. *Technological Forecasting and Social Change*, *189*, 122376. https://doi.org/https://doi.org/10.1016/j.techfore.2023.122376

Qi, Y., Chen, Q., Lin, F., Liu, Q., Zhang, X., Guo, J., Qiu, L., & Gao, T. (2022). Comparative study on birdsong and its multi-sensory combinational effects on physio-psychological restoration. *Journal of Environmental Psychology*, *83*, 101879. https://doi.org/https://doi.org/10.1016/j.jenvp.2022.101879

Rauschnabel, P. A., Felix, R., Hinsch, C., Shahab, H., & Alt, F. (2022). What is XR? Towards a Framework for Augmented and Virtual Reality. *Computers in Human Behavior*, *133*, 107289. https://doi.org/https://doi.org/10.1016/j.chb.2022.107289

Rosa, C. D., Larson, L. R., Collado, S., & Profice, C. C. (2021). Forest therapy can prevent and treat depression: Evidence from meta-analyses. *Urban Forestry & Urban Greening*, *57*, 126943. https://doi.org/10.1016/j.ufug.2020.126943

Rousseaux, C. G. (2023). Chapter 4 - Herbal Remedies. In W. M. Haschek, C. G. Rousseaux, M. A. Wallig, B. Bolon, K. M. Heinz-taheny, D. G. Rudmann, & B. W. Mahler (Eds.), *Haschek and Rousseaux' s Handbook of Toxicologic Pathology (Fourth Edition)* (pp. 183-303). Academic Press. https://doi.org/https://doi.org/10.1016/B978-0-443-16153-7.00004-6

Sander, M., Klimesch, A., Samaan, L., Kühn, S., Augustin, J., & Ascone, L. (2025). Natural vs. Built Visual Urban Landscape Elements Around the Home and Their Associations With Mental and Brain Health of Residents: A Narrative Review. *Journal of Environmental Psychology*, 102559. https://doi.org/https://doi.org/10.1016/j.jenvp.2025.102559

Sanfilippo, F., Blazauskas, T., Salvietti, G., Ramos, I., Vert, S., Radianti, J., Majchrzak, T. A., & Oliveira, D. (2022). A Perspective Review on Integrating VR/AR with Haptics into STEM Education for Multi-Sensory Learning. *Robotics*, *11*(2), 41. https://www.mdpi.com/2218-6581/11/2/41

Schiebel, T., Gallinat, J., & Kühn, S. (2022). Testing the Biophilia theory: Automatic approach tendencies towards Nature. *Journal of Environmental Psychology*, *79*, 101725. https://doi.org/https://doi.org/10.1016/j.jenvp.2021.101725

Schott, C., & Marshall, S. (2020). Virtual Reality for Experiential Education: A User Experience Exploration. *Australasian Journal of Educational Technology*, 96-110. https://doi.org/10.14742/ajet.5166

Sheng, Y. (2019). *Virtual Reality: Immerse yourself in a VR dream*. Tsinghua University Press.

Shi Hui, H. L., Huang Yingcui. (2022). *VR/AR Application Development (Unity 3D)*. Tsinghua University Press.

Shiner, L. (2020). *Art Scents: Exploring the Aesthetics of Smell and the Olfactory Arts*.

Siminiuc, R., & Ţurcanu, D. (2023). Impact of nutritional diet therapy on premenstrual syndrome. *Frontiers in Nutrition*, *10*. https://doi.org/10.3389/fnut.2023.1079417

Smith, F. (2022). *Naturopathic Medicine*. https://doi.org/10.1007/978-3-031-13388-6

Snider, P., & Zeff, J. (2019). Unifying Principles of Naturopathic Medicine Origins and Definitions. *Integr Med (Encinitas)*, *18*(4), 36-39.

Song, I., Baek, K., Kim, C., & Song, C. (2023). Effects of Nature sounds on the attention and physiological and psychological relaxation. *Urban Forestry & Urban Greening*, *86*, 127987. https://doi.org/https://doi.org/10.1016/j.ufug.2023.127987

Spence, C. (2020). Using Ambient Scent to Enhance Well-Being in the Multisensory Built Environment. *Frontiers in Psychology*, *11*. https://doi.org/10.3389/fpsyg.2020.598859

Spence, C. (2022). On the use of ambient odours to influence the Multisensory experience of dining. *International Journal of Gastronomy and Food Science*, *27*, 100444. https://doi.org/https://doi.org/10.1016/j.ijgfs.2021.100444

Stier-Jarmer, M., Throner, V., Kirschneck, M., Immich, G., Frisch, D., & Schuh, A. (2021). The Psychological and Physical Effects of Forests on Human Health: A Systematic Review of Systematic Reviews and Meta-Analyses. *International Journal of Environmental Research and Public Health*, *18*(4), 1770. https://www.mdpi.com/1660-4601/18/4/1770

Subri, M. S. M., Arifin, K., Sohaimin, M. F. A. M., & Abas, A. (2024). The parameter of the Sick Building Syndrome: A systematic literature review. *Heliyon*, *10*(12). https://doi.org/10.1016/j.heliyon.2024.e32431

Taye, I., Grace, S., & Bradbury, J. (2022). Empowerment in naturopathy: A qualitative analysis of practitioner perspectives. *Complementary Therapies in Clinical Practice*, *49*, 101652. https://doi.org/https://doi.org/10.1016/j.ctcp.2022.101652

Tekin, B. H., Corcoran, R., & Gutiérrez, R. U. (2023). The impact of biophilic design in Maggie's Centres: A meta-synthesis analysis. *Frontiers of Architectural Research*, *12*(1), 188-207. https://doi.org/https://doi.org/10.1016/j.foar.2022.06.013

Thatcher, A., Adamson, K., Bloch, L., & Kalantzis, A. (2020). Do indoor plants improve performance and well-being in offices? Divergent results from laboratory and field studies. *Journal of Environmental Psychology*, *71*, 101487. https://doi.org/https://doi.org/10.1016/j.jenvp.2020.101487

Vijay, A., Nivethitha, L., Arunthathi, R., & Mooventhan, A. (2024). Impact of yoga and naturopathy on stress, anxiety, heart rate variability, and quality of life of a patient with social anxiety disorder. *Journal of Integrative Medicine and Research*, *2*(4). https://journals.lww.com/imed/fulltext/2024/02040/impact_of_yoga_and_naturopathy_on_stress,_anxiety,.15.aspx

Wilson, E. O. (1984). Biophilia: The human bond with other species. *Harvard University Press*.

Xiao, C., Silva, E. A., & Zhang, C. (2020). Nine-nine-six work system and people's movement patterns: Using big data sets to analyse overtime working in Shanghai. *Land Use Policy*, *90*, 104340. https://doi.org/https://doi.org/10.1016/j.landusepol.2019.104340

Xuan, X., & Zhang, Z. (2024). New perspective of stress on the design characteristics of office indoor restorative environments. *Journal of Building Engineering*, *84*, 108602. https://doi.org/https://doi.org/10.1016/j.jobe.2024.108602

Yang, S., & Chen, J. (2022). Mediating effect of sleep quality on occupational stress and health-related productivity loss in programmers of an Internet enterprise in Shanghai. *Shanghai Journal of Preventive Medicine*, *34*(9), 911-916. https://doi.org/10.19428/j.cnki.sjpm.2022.22070

Yen, M.-H., Li, D., & Chiang, Y.-C. (2024). A systematic review of the relationship between natural environments and physiological and mental health during different stages of the COVID-19 pandemic. *Science of The Total Environment*, *923*, 171392. https://doi.org/https://doi.org/10.1016/j.scitotenv.2024.171392

Yeung, A. W. K., Tosevska, A., Klager, E., Eibensteiner, F., Laxar, D., Stoyanov, J., Glisic, M., Zeiner, S., Kulnik, S. T., Crutzen, R., Kimberger, O., Kletecka-Pulker, M., Atanasov, A. G., & Willschke, H. (2021). Virtual and Augmented Reality Applications in Medicine: Analysis of the Scientific

Literature. *Journal of Medical Internet Research*, *23*(2), e25499. https://doi.org/10.2196/25499

Yildirim, M., Globa, A., Gocer, O., & Brambilla, A. (2024). Multisensory Nature exposure in the workplace: Exploring the restorative benefits of smell experiences. *Building and Environment*, *262*, 111841. https://doi.org/https://doi.org/10.1016/j.buildenv.2024.111841

Yizhe, Z. (2017). *Immersion: The Virtual Reality revolution you can't miss*. Electronic Industry Press. https://baike.baidu.com/item/%E6%B2%89%E6%B5%B8%E6%84%9F%EF%BC%9A%E4%B8%8D%E5%8F%AF%E9%94%99%E8%BF%87%E7%9A%84%E8%99%9A%E6%8B%9F%E7%8E%B0%E5%AE%9E%E9%9D%A9%E5%91%BD/22105093

Yu, C.-P., Lee, H.-Y., & Luo, X.-Y. (2018). The effect of Virtual Reality forest and urban environments on physiological and psychological responses. *Urban Forestry & Urban Greening*, *35*, 106-114. https://doi.org/https://doi.org/10.1016/j.ufug.2018.08.013

Yu, L., Zhang, J., Wang, X., Chen, S., Qin, X., Ding, Z., & Han, J. (2024). Constructing immersive toy trial experience in mobile augmented reality. *Internet of Things and Cyber-Physical Systems*, *4*, 250-257. https://doi.org/https://doi.org/10.1016/j.iotcps.2024.02.001

Zafar, M. S., Nauman, M., Nauman, H., Nauman, S., Kabir, A., Shahid, Z., Fatima, A., & Batool, M. (2021). Impact of Stress on Human Body: A Review. *European Journal of Medical and Health Sciences*, *3*(3), 1-7. https://doi.org/10.24018/ejmed.2021.3.3.821

Zhang, X., Du, J., & Chow, D. (2023). Association between perceived indoor environmental characteristics and occupants' mental well-being, cognitive performance, productivity, satisfaction in workplaces: A systematic review. *Building and Environment*, *246*, 110985. https://doi.org/https://doi.org/10.1016/j.buildenv.2023.110985

Zhong, W., Schröder, T., & Bekkering, J. (2022). Biophilic design in architecture and its contributions to health, well-being, and sustainability: A critical review. *Frontiers of Architectural Research*, *11*(1), 114-141. https://doi.org/https://doi.org/10.1016/j.foar.2021.07.006

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