

Article

The Rebirth of Industrial Heritage: How the Regeneration of Historical Spaces Impacts People's Mental and Physical Health Through Restorative Perception

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Abstract

This study aims to explore how industrial heritage regeneration spaces influence employees' physical and psychological health through restorative perception. With the rapid urbanization and increasing emphasis on sustainable development, the adaptive reuse of industrial heritage sites has become a vital strategy in urban renewal. However, the impact of such spaces on people's health remains underexplored, especially in terms of how the work environment and restorative psychological mechanisms interact. Using a cross-sectional survey design, data from 486 employees in adaptive reuse projects across major cities in China were analyzed through Structural Equation Modeling (SEM). Employees were chosen as the target population because they represent a group with stable, repeated, and long-term exposure to the regenerated environment during daily routines. Compared with visitors, whose exposure duration, activity purposes, and spatial routes are highly variable, employees provide a more consistent context to test the proposed restorative mechanisms. The results revealed that industrial heritage attribute perception (IHAP), including scale, materiality, historical presence, and functional transformation, significantly predicted restorative perception ($\beta = 0.546, p < 0.001$), which in turn positively influenced both psychological health ($\beta = -0.647, p < 0.001$) and physical health ($\beta = 0.688, p < 0.001$). Instrumental variable analysis using "building age" and "green coverage rate" confirmed the robustness of these findings, showing that restorative perception still significantly improved mental ($\beta = -2.295, p < 0.001$) and physical health ($\beta = 0.528, p < 0.001$) after addressing endogeneity issues. Furthermore, individual differences such as work tenure ($\beta = 0.239, p < 0.001$) and environmental sensitivity ($\beta = 0.054, p > 0.05$) moderated these effects. This study extends Attention Restoration Theory (ART) by applying it to historical industrial environments, offering both theoretical insights and practical guidance for designing adaptive reuse spaces that promote employee well-being.

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Keywords: industrial heritage; adaptive reuse; restorative perception; employee health; psychological well-being; physical health; Attention Restoration Theory; urban renewal; individual differences

1. Introduction

In the context of rapid urban development worldwide, urban governance faces a fundamental challenge: how to balance economic growth with the well-being of the public [1]. This tension is particularly evident in the process of reusing industrial heritage. In recent years, with the widespread promotion of sustainable development, more and

more historical industrial buildings are being transformed into modern office spaces [2,3]. As a space that blends historical culture with modern functionality, industrial heritage regeneration spaces not only help reduce resource consumption and environmental burden but also serve as an important vehicle for driving urban cultural renewal and economic transformation [4]. Current research offers limited understanding of how these spaces associate with the health of the people working within them. Addressing this gap is vital for inclusive governance of urban renewal. In the international scientific literature, heritage value is increasingly viewed as co-created through the daily experiences of users. Accordingly, we treat employee perception as a core indicator of heritage value-in-use. This bottom-up approach complements traditional expert-led physical audits by prioritizing human-centered outcomes. Although this study focuses on employees as long-term occupants, the mechanisms identified may also provide a theoretical template for understanding industrial heritage as a public health asset for the broader community.

While extensive research has explored the economic value and cultural significance of industrial heritage, treating it as both an economic asset and a cultural symbol of urban development [5,6], the potential long-term impact of such spaces on the health of employees as their daily work environment is often overlooked. This research gap reflects a deeper issue: environmental psychology has long focused on the positive effects of natural environments on individual recovery and health [7,8], but has not systematically addressed the potential of built environments, particularly industrial heritage spaces with historical and cultural features, to facilitate restorative perception and psychological regulation.

Although Attention Restoration Theory offers a foundational framework for understanding the environment–health relationship, its core logic is primarily based on the restorative qualities of natural environments. It is limited in explaining the unique restorative mechanisms that may exist within historical industrial spaces [9,10]. This not only weakens the theory’s applicability but also leads to a disconnect between theory and practice: on one hand, industrial heritage renovation projects often lack space intervention strategies focused on employee health; on the other hand, urban renewal policies lack scientific evidence to support their public health value, affecting the overall advancement of healthy cities.

Of particular note is the growing trend of businesses choosing to locate their offices in repurposed industrial heritage spaces as knowledge economies and creative industries gather momentum [11]. The users of these spaces—employees who work there long-term—are not only direct beneficiaries of adaptive reuse but also key carriers of the health impact mechanisms associated with these buildings [12]. However, there is currently no systematic theoretical explanation or empirical validation regarding how industrial heritage spaces influence employee health through environmental perception, psychological mechanisms, and physiological pathways. This knowledge gap hinders scientific decision-making in both corporate office location choices and employee health management and limits the evidence base for public policies supporting health-oriented urban renewal.

In response to the theoretical and practical challenges outlined above, this study seeks to answer the following core question: How do the multidimensional spatial characteristics (scale, material, history, function) of industrial heritage regeneration spaces influence employees’ mental and physical health through restorative perceptions and psychological mechanisms? In this process, how do individual differences, such as years of employment and environmental sensitivity, play a moderating role? This study, based on Attention Restoration Theory, constructs an integrated model to reveal how the spatial characteristics of industrial heritage regeneration spaces stimulate restorative perceptions, and in turn, affect employees’ physical and mental health through various pathways and mechanisms.

The theoretical contributions of this study are threefold. First, by systematically analyzing the multidimensional structure of industrial heritage attribute perception (IHAP) and examining its association with restorative perception, this study extends Attention Restoration Theory from natural environments to culturally meaningful built environments [13–15]. Second, by testing a full mediation chain—spatial attribute perception → restorative perception → health outcomes—we clarify the mechanism through which built environments may associate with well-being and confirm restorative perception as a key psychological mediator [16]. Third, by introducing individual-difference variables (work tenure and environmental sensitivity), we identify boundary conditions of restorative effects and improve the contextual explanatory power of the model. Practically, our findings provide evidence to inform industrial heritage design strategies, workplace site selection, employee well-being management, and health-oriented urban renewal policies.

2. Theoretical Foundation and Literature Review

2.1. Evolution of Environment–Health Relationship Theories

Theoretical explanations of the environment–health relationship in environmental psychology have evolved from biologically oriented accounts to cognitively and socio-culturally informed frameworks. Early propositions such as the biophilia hypothesis and the savanna hypothesis emphasized humans’ innate preferences for certain natural settings, implying that restorative benefits are rooted in evolutionary predispositions. While foundational, such biologically deterministic views are often insufficient for explaining restoration processes in complex contemporary urban and architectural environments.

A major shift occurred with the introduction of Attention Restoration Theory (ART). Kaplan (1995) conceptualized restoration as a cognitive process and proposed four key dimensions—being away, fascination, extent, and compatibility—through which environments may support recovery from directed attention fatigue [13]. Empirical research has strongly supported ART in natural contexts, showing substantial restorative effects on attention and psychological well-being [9,15]. Nevertheless, the direct transfer of ART from nature-based settings to built environments remains debated, since the theory has been primarily developed and validated in relation to natural environments [9].

Recent studies have extended the discussion to urban and built settings and suggest that some non-natural environments can also be restorative, although the underlying mechanisms may differ from those in nature [17–19]. In particular, the restorative potential of built environments appears to depend not only on physical form but also on cultural meaning, historical value, and symbolic attributes [20,21]. These insights collectively indicate a theoretical and practical need for a contextualized interpretation of ART when studying non-natural environments, where restoration may be driven by meaning-based and culturally mediated experiences rather than predominantly by “soft fascination” from natural stimuli.

This need is especially salient for industrial heritage, which represents a distinctive built environment combining physical structure with collective memory and cultural narratives [22]. In industrial heritage settings, ART’s dimensions may take context-specific forms: “being away” may reflect temporal distancing rather than purely spatial escape; “fascination” may arise from historical narratives and cultural symbols rather than sensory pleasure; “extent” may be linked to the legibility and coherence created through adaptive reuse and functional reconstruction; and “compatibility” may manifest as value identification and cultural resonance between users and place. Therefore, while ART provides a robust conceptual foundation [13], applying a nature-centered logic without contextual adaptation risks overlooking the uniqueness of industrial heritage as a restorative environment.

In light of the above, three gaps motivate the present study. First, much research on urban restoration still relies heavily on frameworks developed for natural environments, which may not fully capture the distinctive attributes of artificial settings [9,17,19]. Second, existing work often emphasizes direct environmental effects while offering limited articulation of how culturally saturated architectural cues translate into restorative perception [20,21]. Third, restoration is frequently treated as universal, with insufficient attention to contextual and individual boundary conditions that may shape restorative outcomes across different non-natural environments. Addressing these gaps, this study advances a contextualized ART perspective for industrial heritage by examining how perceived industrial heritage attributes relate to restorative perception and, subsequently, to health-related outcomes.

2.2. *The Transformation of Industrial Heritage Value Perception and Spatial Features*

Industrial heritage, as an important part of urban renewal, has undergone a shift in value recognition, evolving from “waste” to “cultural asset” and now to “social resource.” Early studies primarily focused on the historical value and economic development potential of industrial heritage [23], viewing it as an economic asset for urban development. As awareness of cultural heritage preservation grew, scholars began to examine the cultural significance and identity-building functions of industrial heritage [24]. In recent years, the rise of sustainable development has led researchers to pay more attention to the environmental benefits and social values of industrial heritage [3].

However, most of these studies explore the social value of industrial heritage from a macro perspective. In the context of participatory urban renewal, the “social value” of a site is fundamentally linked to the psychological feedback of its users. Although this study focuses solely on the employee population, the spatial features identified, such as grand scale and historical presence, function as universal psychological affordances. These features likely trigger similar, albeit perhaps more acute, restorative perceptions for visitors and the general public [25,26]. These features include:

1. The grand scale: Industrial buildings, designed to meet production needs, often have large, open spaces that can evoke a sense of awe and psychological impact [27].
2. The roughness of materials: Exposed reinforced concrete, weathered brick walls, and rusted steel structures create strong tactile and visual impacts, potentially leading to unique aesthetic experiences [28].
3. The presence of history: Industrial heritage holds rich historical memories and cultural symbols, offering users opportunities to engage with the past [21].
4. The transformation of function: The conversion of production spaces into creative spaces creates a unique atmosphere of blending the old and the new.

How these spatial features influence users’ psychological states and health remains insufficiently addressed in existing research. Some scattered studies suggest that historical building environments may affect users’ well-being through mechanisms of cultural identity and that the spatial scale of industrial buildings may influence users’ emotional states [29]. However, these studies lack systematic theoretical integration and empirical validation.

2.3. *Multilayered Mechanisms of Restorative Environments on Health*

Numerous theoretical pathways have been proposed to explain how environments affect health, encompassing cognitive, emotional, and physiological levels. Cognitive-level studies, based on dual-process theory [30], suggest that restorative environments activate unconscious attention, reducing directed attention fatigue [13]. Emotional-level studies emphasize that environmental experiences may enhance individual well-being and psychological stability by evoking positive emotions, nostalgia, or a sense of awe [31,32]. Physiologically, research has shown that exposure to restorative environments can lower

stress hormone levels, reduce heart rate, and lower blood pressure [33], suggesting that restorative environments influence not only mental health but also physical well-being.

However, existing research has largely focused on natural environments, with limited attention given to the mechanisms in historical built environments like industrial heritage [34]. Additionally, the interaction between different levels of mechanisms remains unclear. For example, whether cognitive restoration enhances health effects through emotional experiences or whether emotional responses manifest in physiological indicators remains underexplored. These gaps make it difficult to fully understand the multilayered mechanisms of restorative environments, particularly in the unique context of industrial heritage.

2.4. Individual Differences and Boundary Conditions

Existing environmental psychology research often assumes the universality of environmental effects, suggesting that restorative environments offer similar health benefits to all individuals [35]. However, this assumption overlooks the important role of individual differences. To better understand how individual differences affect restorative perceptions and health, this study proposes the moderating role of individual differences and boundary conditions in this relationship.

First, work experience, as an important moderating variable, has a theoretical basis. According to career development theory and environmental adaptation theory, employees' professional identity, environmental adaptability, and health needs change significantly with increasing years of work experience. Specifically, employees with longer work tenure are more sensitive to environmental quality differences, thus having a greater need for restorative environments [36]. Furthermore, accumulated work experience enables these employees to better utilize environmental resources to alleviate work-related stress [37].

Second, environmental sensitivity, as another key moderating variable, is grounded in sensory processing sensitivity theory. This theory suggests that individuals vary in their sensitivity to environmental stimuli, with highly sensitive individuals being more attuned to environmental cues and displaying stronger emotional reactions. In the context of industrial heritage, individuals with high sensitivity are more likely to be moved by its unique aesthetic features and historical atmosphere, leading to stronger restorative perception [38].

However, the moderating effects of individual differences are not always linear. Excessive environmental sensitivity may lead to overstimulation, resulting in negative effects on health. For employees with prolonged work experience, environmental sensitivity may decline due to factors like burnout, which further affects their perception of restorative environments. Therefore, when examining the moderating effects of individual differences, it is important to consider these complex factors to develop a more refined theoretical model for empirical testing.

Based on the literature review, we propose the following hypotheses:

Hypothesis 1: *The spatial characteristic perception of industrial heritage attribute perception (IHAP)—including scale, material, history, and function—significantly and positively predicts employees' restorative perception (PR).*

Hypothesis 2: *Restorative perception (PR) significantly improves employees' mental and physical health.*

Hypothesis 3: *Restorative perception (PR) mediates the relationship between industrial heritage spatial characteristics and employee health.*

Hypothesis 4: Work tenure moderates the relationship between “industrial heritage spatial characteristics → restorative perception,” with longer work tenure strengthening this effect.

Hypothesis 5: Environmental sensitivity moderates the relationship between “restorative perception → mental health” and “restorative perception → physical health,” with higher sensitivity strengthening these effects.

Based on Attention Restoration Theory and integrated environmental psychology, this study will construct a comprehensive structural equation model, as shown in Figure 1, to reveal the mechanisms and boundary conditions of the impact of industrial heritage spatial characteristics on employee health. This research will deepen the application of restorative environment theory in built environments and provide scientific evidence for the adaptive reuse, spatial design optimization, and employee health promotion in industrial heritage.

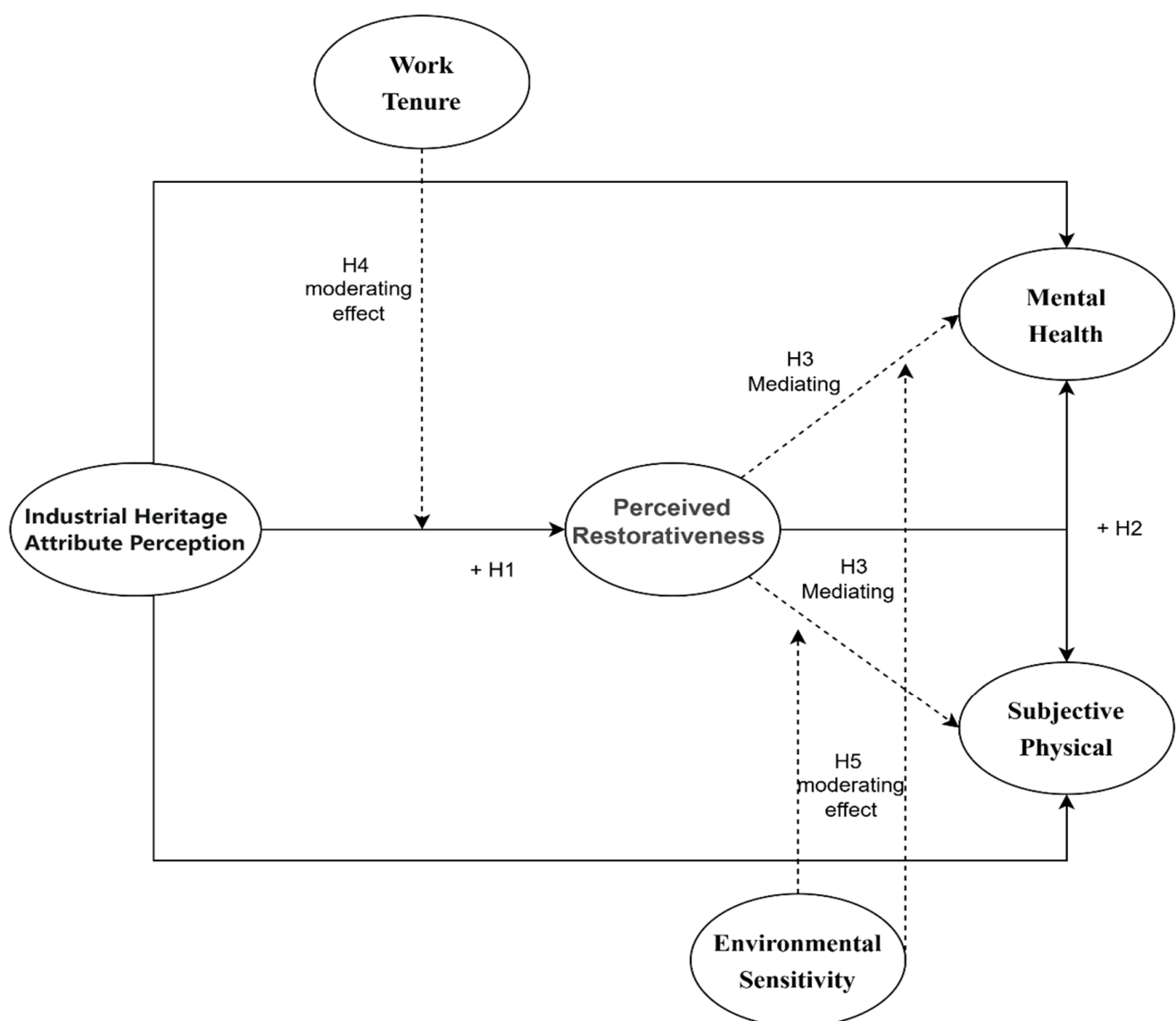


Figure 1. Theoretical framework diagram.

3. Research Methodology

3.1. Research Design and Sample

This study employs a cross-sectional survey design and selects 8 typical industrial heritage adaptive reuse projects located in first-tier cities (Beijing, Shanghai, Shenzhen, Guangzhou) and key second-tier cities (Hangzhou, Chengdu, Wuhan, Xi'an) in China as the research sites. These projects include creative industry parks, tech incubators, cultural and art centers, and other functional types, all of which have been in operation for over 2 years with a stable employee population. The selected projects and their historical sites are as follows:

1. Xi'an: Xihua 3511 (former site of Xihua 3511 Factory)
2. Beijing: 798 Art District (former site of 718 United Factory)
3. Shenzhen: Overseas Chinese Town Creative Cultural Park (former site of Eastern Industrial Zone of OCT)
4. Chengdu: Dongjiao Memory Cultural and Arts Center (former site of Hongguang Electronics Tube Factory)
5. Shanghai: Changyang Chuanggu Technology Incubator (former site of China Textile Machinery Factory)
6. Hangzhou: City Star (former sites of Hangzhou Oxygen Machine Factory and Hangzhou Boiler Factory)
7. Wuhan: Sunac Wuhan 1890 (former site of Hanyang Arsenal)
8. Guangzhou: Pearl River Pati Beer Cultural Creative Art District (former site of Pearl River Brewery).

The survey was conducted anonymously, and participants signed informed consent forms, with the option to withdraw from the questionnaire at any time. Although some of the selected adaptive-reuse sites are open to the public, this study focuses on employees as the target population because they represent a group with stable, repeated, and long-term exposure to the regenerated environment during daily routines. Compared with visitors whose exposure duration, activity purposes, and spatial routes are highly variable, employees provide a more consistent context to test the proposed restorative mechanism (IHAP → PR → health) under real-world occupational settings.

A stratified sampling method was used, with strata based on different cities, functional types, and job positions. The survey was distributed via the Wenjuanxing platform and shared through social media. Participants voluntarily completed the survey. Only employees currently working at the selected industrial heritage sites were included, and basic demographic questions were used to identify participants' cities, project types, and job positions (e.g., Beijing/Shanghai/Guangzhou, creative industry parks, tech incubators, cultural and art centers, and job types such as administrative management, R&D, marketing, logistics support).

In the data cleaning phase, we removed questionnaires with significant missing data or abnormal answering patterns, resulting in 486 valid samples. The sample composition is as follows: 241 male participants (49.59%) and 245 female participants (50.41%); ages 18–35 account for 32.1%, 36–50 for 34.4%, and 51 and above for 33.5%; work experience of 2–4 years accounts for 40.1%, 5–8 years for 34.8%, and more than 9 years for 25.1%; 64.9% have a bachelor's degree or higher. For more detailed information, please refer to Appendix A, Table A1.

3.2. Measurement Tools

Industrial Heritage Attribute Perception Measurement: To address the uniqueness of the research context and accurately measure employees' perceptions of the distinctive spatial attributes of industrial heritage, this study developed the "Industrial Heritage Attribute Perception Scale" (IHAP) to operationalize employees' industrial heritage attribute percep-

tion (IHAP) based on literature review and relevant heritage value assessment tools. In consultation with three professors specializing in industrial heritage architecture, the scale was finalized. The scale consists of four dimensions: the grandeur of scale (e.g., “The large space makes me feel awe”), the ruggedness of material (e.g., “Exposed industrial textures have a unique aesthetic”), the presence of history (e.g., “I can feel the historical memory of the building”), and the transformation of function (e.g., “The blending of old and new functions is interesting”). After expert validity assessment and pre-testing ($N = 120$), 12 items were retained. Exploratory factor analysis (EFA) revealed that the four factors explained 84.40% of the total variance, indicating good reliability and validity of the scale.

Restorative Perception Measurement: The Perceived Restorative Scale (PRS), developed by Hartig et al. (1997), was used to measure restorative perception [39]. It includes four dimensions—being away, fascination, extent, and compatibility—comprising 16 items. A 7-point Likert scale was used (1 = strongly disagree, 7 = strongly agree). The Chinese version of the scale underwent rigorous translation-back translation and pre-testing.

Mental Health Measurement: The General Health Questionnaire (GHQ-12) developed by Goldberg (1972) was used to assess psychological distress levels over the past two weeks [40]. A 4-point Likert scale was used for scoring (0-0-1-1 scoring method), with a total score range of 0–12, where higher scores indicate poorer mental health. The Chinese version of the GHQ-12 has good reliability and validity in the Chinese population.

Subjective Physical Health Measurement: The SF-12, developed by Ware et al. (1996), was used to assess subjective physical health [41]. The scale includes 8 dimensions: physical functioning, role functioning, bodily pain, general health perception, vitality, social functioning, emotional role functioning, and mental health. The Chinese version of the SF-12 has been thoroughly validated.

Appendix A Table A2 shows the exploratory factor analysis results. The KMO value was 0.918, indicating high factor analysis suitability; Bartlett’s Test of Sphericity was significant ($p < 0.001$), showing correlation between the variables, suitable for factor analysis. The Cronbach’s alpha coefficient for the four common factors was 0.948, well above the acceptable standard of 0.70, indicating excellent internal consistency. All factor loadings exceeded 0.75, well above the minimum standard of 0.50, showing that each item strongly represents its corresponding factor. This structure is consistent with the four dimensions of IHAP (scale, material, history, and function) proposed in Hypothesis 1.

3.3. Data Analysis

Statistical analysis was conducted using SPSS 28.0 and Amos 26.0. Descriptive statistics and correlation analysis were performed first, followed by testing the hypothesized model using structural equation modeling (SEM). Maximum likelihood estimation was used, with fit indices including χ^2/df , CFI, TLI, RMSEA, and SRMR. Moderation effects were analyzed using the PROCESS macro.

4. Research Results

4.1. Descriptive Statistics and Correlation Analysis

Table 1 shows that the average score for IHAP was 4.96 ($SD = 0.91$), and the average score for restorative perception was 4.17 ($SD = 1.14$), indicating a moderate-to-high level of restorative perception by employees regarding industrial heritage regeneration spaces. The average GHQ-12 score was 6.14 ($SD = 5.20$), and the average SF-12 physical health score was 3.47 ($SD = 1.01$).

Table 1. Descriptive Statistics and Correlation Matrix.

Variable	M	SD	1	2	3	4	5	6
1. IHAP	4.96	0.91	1					
2. Restorative Perception	4.17	1.14	0.529 ***	1				
3. Mental Health (GHQ-12)	6.14	5.20	−0.385 ***	−0.615 ***	1			
4. Physical Health (SF-12)	3.47	1.01	0.267 ***	0.625 ***	−0.407 ***	1		
5. EnvSens	3.36	1.00	0.080	0.054	−0.082	0.045	1	
6. Work Tenure	1.85	0.79	0.035	0.239 ***	−0.101	0.092	−0.062	1

Note: The values in parentheses are standard errors; *** indicates $p < 0.001$.

Regarding Hypothesis 1, IHAP was moderately and positively correlated with PR ($r = 0.529, p < 0.001$), indicating that the stronger the employees' perception of industrial heritage space features, the stronger their restorative perception. For Hypothesis 2, PR was strongly negatively correlated with mental health ($r = -0.615, p < 0.001$), indicating that stronger PR leads to less psychological distress, i.e., better mental health. PR was strongly positively correlated with physical health ($r = 0.625, p < 0.001$), suggesting that restorative perception significantly improves both mental and physical health. For Hypothesis 3, the correlation between IHAP and mental health ($r = -0.385, p < 0.001$) was much weaker than the correlation between PR and mental health ($r = -0.615$), suggesting that restorative perception likely mediates the relationship between IHAP and mental health. Furthermore, work tenure showed a significant positive correlation with PR ($r = 0.239, p < 0.001$), providing preliminary support for Hypothesis 4. Environmental sensitivity had weak correlations with all variables ($|r| < 0.10$), indicating that it mainly affects the model through moderation rather than direct effects.

4.2. Measurement Model Validation

Confirmatory factor analysis was conducted to test the goodness of fit of the measurement model. Table 2 the fit indices for the 8-factor model for IHAP and restorative perception were as follows: $\chi^2/df = 1.045$, CFI = 0.999, TLI = 0.998, RMSEA = 0.010, SRMR = 0.016, indicating good model fit.

Table 2. Confirmatory Factor Analysis.

Model	χ^2	df	χ^2/df	CFI	TLI	RMSEA	SRMR
One-Factor Model	5452.946	350	15.58	0.733	0.712	0.173	0.169
Two-Factor Model	2569.451	349	7.362	0.884	0.874	0.114	0.050
Eight-Factor Model	336.427	322	1.045	0.999	0.998	0.010	0.016

4.3. Structural Equation Modeling Analysis

A structural equation model (SEM) was constructed to examine the impact of restorative perception on employee health. Table 3 presents the path analysis results for the SEM.

First, industrial heritage attribute perception (IHAP) significantly positively predicted restorative perception (PRS) ($\beta = 0.546, p < 0.001$), with a 95% confidence interval [0.541, 0.764] that does not include 0. This indicates that the stronger the employees' perception of industrial heritage in terms of scale, material, history, and function, the deeper their psychological restoration experience, supporting Hypothesis 1.

Table 3. Structural Equation Model Path Coefficients.

Path Relationship	β	S.E.	z	p	95% CI
IHAP $\rightarrow$ PR	0.546	0.057	11.473	<0.001	[0.541, 0.764]
PR $\rightarrow$ (GHQ-12)	−0.647	0.062	−11.970	<0.001	[−0.869, −0.624]
IHAP $\rightarrow$ (GHQ-12)	−0.067	0.060	−1.534	0.125	[−0.209, 0.025]
PR $\rightarrow$ (SF-12)	0.688	0.064	11.817	<0.001	[0.628, 0.878]
IHAP $\rightarrow$ (SF-12)	−0.108	0.063	−2.238	<0.05	[−0.265, −0.018]

In terms of health outcomes, restorative perception demonstrated a strong health-promoting effect. PR significantly negatively predicted psychological distress (GHQ-12, reverse scoring) ($\beta = -0.647$, $p < 0.001$), indicating that the stronger the restorative perception, the better the psychological health of employees. Additionally, PR significantly positively predicted physical health (SF-12) ($\beta = 0.688$, $p < 0.001$). These two path coefficients were the most significant in the model, fully confirming the core role of restorative perception in improving both mental and physical health, validating Hypothesis 2.

Regarding direct path analysis, a more complex environmental effect mechanism emerged. IHAP's direct effect on mental health was not significant ($\beta = -0.067$, $p = 0.125$), suggesting the possibility of a full mediation effect. However, IHAP demonstrated a significant negative direct effect on physical health ($\beta = -0.108$, $p < 0.05$), which contrasts with its positive indirect effect through PR ($0.546 \times 0.688 \approx 0.376$). This result reveals the presence of a “suppression effect”: although IHAP shows a small but significant negative direct association with physical health, the strong positive indirect effect operating through restorative perception more than compensates for this pathway, resulting in a net positive total effect.

4.4. Dimensional Analysis

Table 4 reveals the differentiated contributions of different spatial features of industrial heritage to restorative perception. The results show that grandeur of scale ($\beta = 0.217$, $p < 0.001$) and historical presence ($\beta = 0.214$, $p < 0.001$) are the core driving factors for activating restorative perception, with their standardized regression coefficients being highly similar and the most significant. This suggests that the “therapeutic effect” of industrial heritage largely stems from the sublime experience triggered by its towering and expansive spatial structure, as well as the sense of temporal detachment (Being Away) evoked by its historical symbols. These two macro-level perceptual experiences form the primary psychological resources for attention restoration.

Table 4. IHAP Sub-Dimensions' Predictive Power for PR.

IHAP Sub-Dimension	β (SE)	t	p
History	0.214 (0.055)	3.928	<0.001
Scale	0.217 (0.056)	3.881	<0.001
Function	0.116 (0.059)	1.967	<0.05
Texture	0.096 (0.056)	1.720	>0.05

The transformation of function ($\beta = 0.116$, $p < 0.05$) shows a weaker but significant positive impact, indicating that the suitable integration of old and new functions (the “compatibility” in ART) is an essential support for restorative perception, though its driving force is weaker than the sensory impacts of the spatial and temporal dimensions.

Roughness of material ($\beta = 0.096$, $p > 0.05$) did not reach statistical significance. This non-significant result may suggest that in a multivariable model, the weathered material textures are often linked to historical presence and that their independent explanatory power is absorbed by the historical presence factor. Alternatively, it may indicate that, for general employees, the grand spatial atmosphere and historical narrative are more likely to directly evoke psychological restoration than the microscopic details of materials.

4.5. Mediation Effect Analysis

Table 5 further explores the mediation mechanism of restorative perception in the relationship between “industrial heritage attribute perception (IHAP) → employee health.”

Table 5. Mediation Effect Test of Restorative Perception.

Path	Coefficient	S.E.	Z	p	Bootstrap 95% CI
GHQ					
Indirect Effect	−1.724	0.152	−11.328	<0.001	[−2.019, −1.471]
Direct Effect	−0.444	0.297	−1.492	0.136	[−1.105, 0.189]
Total Effect	−2.168	0.214	−10.145	<0.001	[−2.739, −1.809]
SF					
Indirect Effect	0.400	0.031	12.991	<0.001	[0.332, 0.475]
Direct Effect	−0.115	0.052	−2.231	<0.05	[−0.265, −0.028]
Total Effect	0.285	0.048	5.959	<0.001	[0.148, 0.355]

In terms of mental health, the indirect effect of IHAP through restorative perception was significant and robust (Effect = −1.724, SE = 0.152, $p < 0.001$), while the direct effect was not statistically significant (Effect = −0.444, $p = 0.136$). This indicates that restorative perception plays a full mediating role, meaning that the improvement in mental health due to industrial heritage features is almost entirely achieved by stimulating employees’ restorative perception.

For physical health, the results showed a unique “suppression effect”: the indirect effect of IHAP through restorative perception was significantly positive (Effect = 0.400, $p < 0.001$), while its direct effect on physical health was significantly negative (Effect = −0.115, $p = 0.025$). This may reflect environmental discomfort associated with certain physical characteristics of industrial heritage spaces, while the psychological relaxation and stress relief induced by restorative perception exert a stronger compensatory effect on physical recovery. (Total effect = 0.285, $p < 0.001$). This reveals a complex mechanism: although direct exposure to industrial heritage may create some physical strain, its restorative psychological function is more effective in promoting overall physical and mental health, fully supporting Hypothesis 3.

4.6. Moderation Effect Analysis

This study used the PROCESS macro to test the moderating effect of work tenure in the “IHAP → restorative perception (PR)” relationship (Table 6).

Model 1 shows that after controlling for demographic variables, IHAP significantly positively predicted restorative perception ($\beta = 0.659$, $p < 0.001$). In Model 2, after introducing the moderating variable, the main effect of work tenure was significant ($\beta = 0.317$, $p < 0.001$), and the explanatory power of the model significantly improved (R^2 increased to 0.331), suggesting that the longer the work tenure, the higher the employees’ baseline restorative perception.

Model 3 further included the interaction term (IHAP $\times$ work tenure), and the interaction term coefficient was significantly positive ($\beta = 0.201$, $p < 0.001$), with R^2 further increasing to 0.349, indicating that work tenure significantly moderated the relationship between IHAP and PR. As work tenure increases, the effect of IHAP on restorative perception becomes stronger. Compared to newer employees, those with longer work experience

are more likely to experience stronger restorative effects when encountering the same industrial heritage features. This may result from the deeper place attachment and cultural identity accumulated by long-term employees in spatial interactions, allowing them to more effectively use environmental features for psychological restoration. Hypothesis 4 is supported.

Table 6. Moderation Effect of Work Tenure.

Variable	Model 1	Model 2	Model 3
Control Variables			
Gender	−0.057 (0.088)	−0.072 (0.085)	−0.080 (0.084)
Age	−0.006 (0.054)	−0.002 (0.052)	−0.005 (0.052)
Education Level	0.041 (0.053)	0.032 (0.051)	0.043 (0.050)
Income Level	−0.013 (0.031)	−0.013 (0.030)	−0.013 (0.030)
Main Effects			
IHAP	0.659 (0.048) ***	0.649 (0.047) ***	0.650 (0.046) ***
Work Tenure		0.317 (0.053) ***	0.307 (0.053) ***
Interaction Effect			
IHAP × Work Tenure			0.201 (0.056) ***
Model Statistics			
R ²	0.282	0.331	0.349
ΔR ²	0.274	0.322	0.339
F	37.69 ***	39.476 ***	36.536 ***

Note: The values in parentheses are standard errors; *** indicates $p < 0.001$. Both IHAP and work tenure were centered.

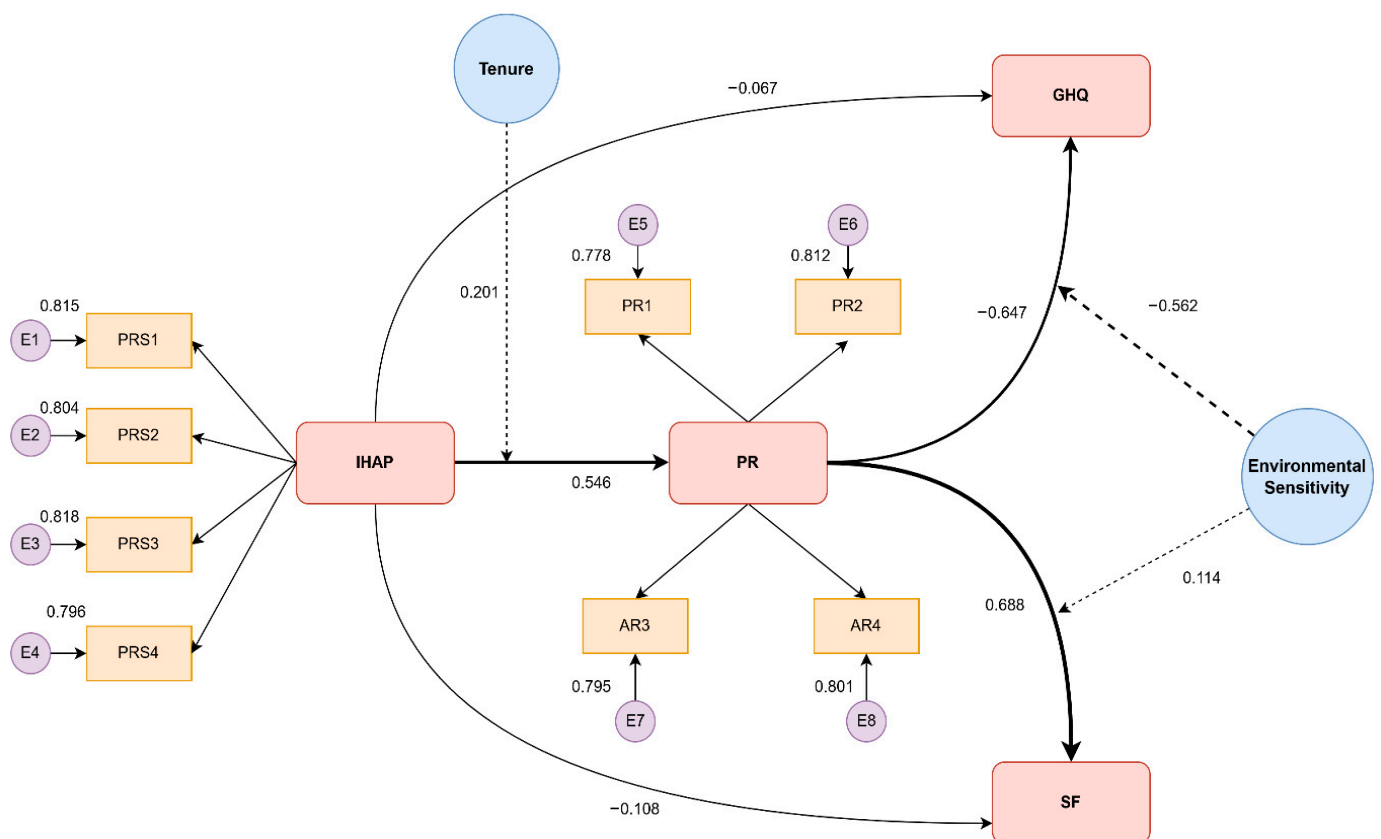
Table 7 further reveals the moderating effect of environmental sensitivity in the “restorative perception → employee health” path. The results show that environmental sensitivity significantly enhanced the positive effect of restorative perception on mental health (interaction $\beta = -0.562$, $p < 0.001$) and also strengthened its positive effect on physical health (interaction $\beta = 0.114$, $p < 0.001$). This indicates that environmental sensitivity is an important boundary condition for individuals to obtain health benefits from the environment: employees with high sensitivity traits tend to have finer sensory processing capabilities, allowing them to more acutely perceive and internalize the unique historical aesthetics and cultural atmosphere of industrial heritage spaces. This deep environmental immersion enables them to more fully utilize the restorative potential of the space, thereby gaining enhanced physical and mental health benefits. Hypothesis 5 is fully validated.

To visually present the interrelationships of the core variables in this study, we generated a clear path diagram, shown in Figure 2.

Table 7. Moderation Effect of Environmental Sensitivity.

Variable	Model 1	GHQ Model 2	Model 3	Model 1	SF Model 2	Model 3
Control Variables						
Gender	0.292 (0.374)	0.263 (0.375)	0.220 (0.371)	−0.197 (0.072) **	−0.196 (0.072) **	−0.187 (0.071) **
Age	0.054 (0.230)	0.050 (0.230)	0.037 (0.228)	0.007 (0.044)	0.007 (0.044)	0.010 (0.044)
Education Level	−0.248 (0.224)	−0.240 (0.224)	−0.195 (0.222)	−0.047 (0.043)	−0.047 (0.043)	−0.056 (0.043)
Income Level	0.031 (0.132)	0.041 (0.132)	0.039 (0.131)	0.005 (0.025)	0.005 (0.025)	0.006 (0.025)
Main Effects						
PR	−2.800 (0.165) ***	−2.789 (0.165) ***	−2.768 (0.163) ***	0.554 (0.032) ***	0.554 (0.032) ***	0.549 (0.031) ***
ES		−0.243 (0.187)	−0.289 (0.185)		0.007 (0.036)	0.016 (0.036)
Interaction Effect						
PR × ES			−0.562 (0.165) ***			0.114 (0.032) ***
Model Statistics						
R ²	0.380	0.382	0.397	0.401	0.401	0.417
ΔR ²	0.374	0.375	0.388	0.395	0.394	0.408
F	58.906 ***	49.442 ***	44.957 ***	64.294 ***	53.476 ***	48.825 ***

Note: The values in parentheses are standard errors; *** indicates $p < 0.001$; ** indicates $p < 0.01$. PR and environmental sensitivity were centered.

**Figure 2.** Conceptual structural equation model illustrating the relationships among industrial heritage attribute perception (IHAP), restorative perception (PR), and employee health outcomes.

4.7. Robustness Checks

4.7.1. Robustness Checks with Categorical Controls and Reuse-Type Subsamples

To address concerns regarding heterogeneity across cities, heritage reuse types, and job positions, we conducted two robustness checks.

First, we re-estimated the SEM by adding Job Type, Project Type, and City as categorical control variables. All three variables were dummy-coded with the first category as the reference group (details omitted for brevity). The key structural paths remained highly consistent with the baseline model, indicating that the IHAP–PR–health relationships are not driven by differences in job composition, reuse functions, or city contexts. The full results are reported in Appendix A, Table A3.

Second, we performed a grouped (subsample) robustness check by heritage reuse type (Creative Park, Tech Incubator, Art Center, Office). In each subgroup model, the path IHAP → PR and PR → psychological distress (GHQ-12) remained statistically significant and directionally consistent, supporting the stability of our core mechanism under more homogeneous reuse-type contexts. Detailed subgroup results are reported in Appendix A, Table A4.

4.7.2. Instrumental Variable Analysis

To mitigate potential endogeneity issues and strengthen the robustness of our findings, this study utilized “building age” and “green coverage rate” as instrumental variables. The theoretical defense for the exogeneity of “building age” rests on the institutional framework of industrial heritage adaptive reuse. While the age of a neglected structure might typically be associated with negative physical health via biological stressors such as mold or dust, the projects analyzed in this study represent stabilized, renovated environments.

Under contemporary urban renewal standards, all industrial heritage sites are legally mandated to undergo comprehensive “professional remediation”—including deep cleaning, toxic material stripping, and structural sealing—prior to being certified for modern occupancy [2,42]. This mandatory renovation process effectively decouples the physical age of the shell from direct pathological pathways. Consequently, in an operational workspace, the age of the building serves primarily as a symbolic carrier of historical authenticity and “time depth,” satisfying the exclusion restriction by influencing health outcomes primarily through the cognitive–psychological channel of restorative perception.

Appendix A, Table A5, shows the first-stage regression showed that these instrumental variables were significantly associated with restorative perception ($F = 11.697$, $p < 0.001$), indicating no weak instrument problem. The second-stage results suggest that even after accounting for endogeneity, the perceived restorative perception remains a significant predictor of both mental health ($\beta = -2.295$, $p < 0.001$) and physical health ($\beta = 0.528$, $p < 0.001$). These results reinforce the empirical association between the industrial environment and employee well-being within our sample.

4.7.3. Propensity Score Matching

To further validate the causal effects and robustness of restorative perception on employee health, this study employed propensity score matching (PSM) to simulate a quasi-experimental design. The sample was divided into high and low restorative perception groups based on the median of PRS and tested using three matching algorithms: 1:1 nearest neighbor, 1:3 nearest neighbor, and radius matching.

Appendix A Table A6 results showed that all three algorithms yielded highly consistent conclusions. In terms of GHQ-12, the high PRS group had significantly lower psychological distress than the low PRS group, with a difference of -5.277 ($p < 0.001$) under 1:1 matching, representing an 81% reduction. For physical health (SF), the high PRS

group had significantly better health levels than the control group, with a difference of 1.022 ($p < 0.001$), showing a 29% improvement. The estimates from the three matching methods were nearly identical, indicating a high degree of robustness. Overall, the average treatment effect (ATE) provided by the PSM analysis strongly corroborated the conclusion that “high restorative perception significantly improves employee physical and mental health,” and this finding was consistent with the SEM and instrumental variable regression results, providing strong empirical support for Hypotheses 2 and 3.

5. Discussion

This study constructs a moderated mediation model and suggests that the spatial characteristics of industrial heritage regeneration spaces (IHAP) are significantly associated with employees’ physical and mental health by triggering restorative perception. This finding not only responds to concerns about public health in urban renewal but also indicates the possibility of achieving “healing” through human-made built environments via unique psychological cognitive mechanisms. These mechanisms appear to differ significantly from the restorative pathways in traditional environmental psychology focusing on natural settings.

First, the study found that historical presence and grand scale are the strongest associates of restorative perception, providing a new perspective on the applicability of Attention Restoration Theory (ART) in non-natural contexts. Kaplan (1995) pointed out that the restorative quality of natural environments primarily stems from “soft fascination [13]”. However, the results suggest that the restorative mechanism of industrial heritage is not necessarily based on a biological affinity response but may originate from a “cognitive sublime” and “cultural attraction” (Cultural Fascination). The large scale of industrial buildings evokes a sense of “awe”, which potentially pushes individuals beyond the cognitive limitations of daily life, leading to psychological “being away”. At the same time, weathered materials and historical symbols invoke deep reflections on the passage of time, creating a meaning-driven “extent”. Unlike natural environments, which restore attention by reducing cognitive load, industrial heritage environments may restore attention by offering deep cognitive content, replacing work anxiety with cultural engagement [43]. While observed in employees, these cognitive mechanisms specifically awe and cultural fascination, likely extend to visitors and the general public, suggesting that industrial heritage serves as a universal restorative resource beyond the workplace.

Second, the “suppression effect” observed in the physical health pathway reveals a complex relationship between the built environment and psychological perception. It is crucial to emphasize that physical health in this context refers to “Perceived Physical Health,” reflecting the subjects’ subjective bodily sensations and environmental comfort rather than clinical medical indicators. While IHAP features show a direct negative association with perceived physical health—likely due to well-documented constraints like insufficient thermal insulation or acoustic reverberation [2,42]—the stronger positive indirect association through restorative perception reveals a buffering mechanism. The negative path reflects a reduction in subjective comfort (thermal or acoustic strain) rather than pathological damage. This mechanism is similar to Antonovsky’s (1979) “Salutogenesis” theory [44]: the environment provides a sense of coherence. As discussed in our instrumental variable defense, because mandatory remediation filters out direct biological pathogens (mold or dust), the negative sensation is primarily a matter of physical comfort. The psychological fulfillment derived from the historical narrative effectively counteracts this physical stress, ultimately leading to positive health outcomes.

Finally, the moderation effect analysis clarifies the boundary conditions of the interaction between employees and industrial heritage. The positive moderating effect of work

tenure suggests that the restorative qualities of industrial heritage are not static but increase in association with the establishment of “place attachment” [45]. Experienced employees are better able to interpret cultural symbols, gaining deeper resonance. The moderating effect of environmental sensitivity indicates that individuals with high sensory processing sensitivity (SPS) traits are more likely to benefit from the rich information and aesthetic features of industrial heritage spaces, fulfilling their need for environmental depth rather than being disturbed by it. This implies that for the broader public, prior cultural knowledge or frequent visitation (analogous to tenure) may similarly enhance the restorative benefits of these spaces, though the intensity of “being away” may vary based on their specific engagement level.

6. Theoretical and Practical Implications

6.1. Theoretical Contributions

This study makes contributions in the following three areas: First, this study expands the application of Attention Restoration Theory (ART), establishing “historical industrial environments” as a type of restorative environment. Previous ART research has focused mainly on natural environments or general urban parks, often overlooking architectural spaces with cultural attributes [9,10]. This study empirically demonstrates that industrial heritage, characterized by “rugged materials” and “historical memory,” can also trigger restorative perception through a “cultural awakening” mechanism that differs from nature. This complements Herzog et al. (2003)’s discussions on the restorative potential of urban environments and extends the elements of restorative environments from “biophilic characteristics” (green spaces, water) to “symbolic features” (history, time), enriching the typology of environmental restoration [14,15,46].

Second, this study constructs and validates a dual-path health impact model of “physical environmental defects—psychological recovery compensation,” deepening our understanding of the relationship between architectural environments and health [34]. Existing environmental health models, such as Evans’ (2003) cumulative risk model, tend to focus on the direct additive effects of physical stressors [47]. The “suppression effect” identified in this study confirms that psychological mediators (restorative perception) are not just transmission variables but serve as key “health filters.” This finding provides a new explanatory framework for environmental psychology [48], emphasizing that strengthening psychological cognitive dimensions through design (such as spatial narrative and aesthetic stimulation) can effectively mitigate potential negative impacts of the physical environment on physical health [16].

Third, this study constructs a contextualized industrial heritage restorative model by introducing individual-difference variables. By validating the moderating effects of work tenure and environmental sensitivity, this study responds to Korpela et al. (2008)’s call for the importance of “person–environment fit” in restorative perception [49]. It shows that the health benefits of industrial heritage are not uniformly distributed but are highly dependent on individuals’ environmental processing tendencies and place experiences. This contribution shifts the focus of restorative environment research from “objective environmental attributes” to the “dynamic interaction between individual and environment,” providing empirical support from real-world workplaces for differentiated environmental psychology theories [35].

6.2. Practical Implications

Based on the empirical finding that grandeur of scale and historical presence are the most significant predictors of restorative perception, spatial interventions should prioritize these macro-perceptual features to maximize psychological benefits. Since our analysis in-

icates that microscopic details like material roughness hold less independent explanatory power when compared to the “cognitive sublime” of expansive spaces, designers should focus on preserving large-span factory volumes rather than over-partitioning them for functional density. The strong association between these attributes and lowered psychological distress suggests that maintaining high ceilings and unobstructed visual domes can facilitate a sense of “awe” and “being away.” By transforming these heritage features into focal points for “cultural fascination,” practitioners can create an environment where the symbolic depth of industrial history serves as a primary resource for attention restoration, replacing work-induced fatigue with deep cognitive engagement.

The identification of a “suppression effect” in the physical health pathway necessitates a targeted engineering strategy to neutralize the direct negative associations between industrial heritage features and subjective bodily sensations. It is important to clarify that the “physical health” analyzed here refers to “Perceived Physical Health,” reflecting the occupants’ subjective comfort rather than clinical pathology. The data suggests that the raw physical attributes of these structures—often characterized by thermal instability or acoustic reverberation—correlate with initial bodily discomfort. To resolve this, a strategy of “explicitly preserving history while implicitly embedding technology” is recommended. For instance, the installation of high-transparency Low-E glass interior skins or integrated acoustic baffles can mitigate these physical stressors without obscuring the historical narrative. By decoupling the negative perception of the physical “shell” from the positive psychological restoration, these technical compensations allow the restorative mechanism to act as a more effective health filter, ensuring a net positive association with overall employee well-being.

Finally, the significant moderating roles of work tenure and environmental sensitivity indicate that the management of industrial heritage spaces should transition toward a “person–environment fit” framework. The positive association between work tenure and restorative perception suggests that the restorative qualities of industrial heritage may strengthen as employees develop deeper place attachment. Consequently, management should implement cultural orientation programs or memory workshops to accelerate the psychological transition from a “strange industrial space” to an “emotional place.” Furthermore, for employees with high environmental sensitivity, who show a stronger correlation between restorative perception and health outcomes, the creation of “environmental sanctuaries” is essential. Utilizing the unique heterogeneous structures of industrial sites such as decommissioned silos or rooftop platforms as dedicated quiet zones can meet the sensory processing needs of highly sensitive individuals. At the macro policy level, urban renewal evaluation systems should shift from purely economic metrics to include “perceived health performance,” recommending the inclusion of restorative perception scales in heritage conservation standards to promote a holistic, human-centered approach to urban regeneration.

6.3. Limitations and Future Outlook

Despite providing strong empirical support for the health value of industrial heritage, this study has the following limitations that should be addressed in future research:

First, potential residual confounding and self-selection bias cannot be fully ruled out. Although we conducted robustness checks by including Job Type, Project Type, and City as categorical controls (dummy-coded) and by running reuse-type subgroup analyses, the survey did not directly measure several potentially influential organizational and work-related factors (e.g., company culture, working hours, daily routines, commuting burden, and detailed compensation structure), nor did it quantify broader contextual exposures (e.g., neighborhood-level urban environment and local cultural conditions) at a fine-grained

level. These unobserved factors may affect self-reported mental and physical health and thus introduce residual confounding, potentially attenuating or inflating the estimated associations between IH spatial perceptions and health outcomes. Moreover, because the questionnaire was disseminated online via social media and participation was voluntary and anonymous, the sample may be subject to self-selection bias and limited verification of respondents' workplace status and exposure intensity. Future studies should incorporate richer work/organizational measures, use more controlled recruitment strategies (e.g., on-site recruitment or verified organizational channels), and ideally adopt multilevel designs (employees nested within firms/sites/cities) to better isolate the independent contribution of spatial characteristics. Future research should extend this framework to public users of adaptive-reuse complexes by combining on-site recruitment with exposure measures (e.g., visit frequency, dwell time, activity type) and comparing employees versus visitors to examine whether the restorative mechanism differs across user groups.

Second, there are limitations in inferring causal relationships and the lack of a time dimension. While this study used instrumental variables and propensity score matching (PSM) to enhance causal inference, cross-sectional data can never fully rule out the possibility of reverse causality (e.g., people with better health might be more inclined to choose to work in creative parks). Furthermore, the phenomenon of "hedonic adaptation" in environmental psychology suggests that employees' sensitivity to the unique beauty of industrial heritage may decrease over time. Future research should adopt longitudinal designs, such as diary methods or multi-time-point measurements, to examine whether restorative perception has long-term stability and whether there is a critical point for aesthetic fatigue.

Third, there may be measurement bias and a lack of objectivity in the physiological indicators. This study used the SF-12 scale to measure physical health, which has good psychometric properties but is still based on self-reports, which may be influenced by current emotional states. Moreover, the "suppression effect" identified in this study involves complex physiological-psychological interactions, and self-report data may not capture specific physiological response mechanisms. Future research should introduce wearable devices or biomarker measurement technologies to collect objective physiological indicators such as heart rate variability (HRV), cortisol levels, or electrodermal activity (EDA), providing more precise evidence to verify the regulatory effects of industrial heritage environments on the autonomic nervous system. In addition, perceived physical health measured by SF-12 reflects subjective comfort and functional limitations rather than clinical biomarkers; therefore, the negative direct association of IH spatial characteristics with physical health should be interpreted primarily as reduced comfort sensations (e.g., thermal discomfort, acoustic disturbance, fatigue) rather than clinical health deterioration. Future studies combining SF-12 with objective physiological measures (e.g., HRV, cortisol, blood pressure) would help distinguish subjective discomfort from physiological stress responses.

Fourth, the uniqueness of the cultural context and cross-cultural generalizability. The samples in this study are all from first- and second-tier cities in China. China's unique rapid urbanization process and collective memory of "industrial modernization" may make Chinese employees have a specific nostalgic or prideful feeling toward industrial heritage, which may differ from the sense of decay associated with "deindustrialization" in the Western context (Rust Belt narrative). Therefore, caution should be exercised when generalizing the findings to Western or other cultural contexts. Future research should conduct cross-cultural comparative studies to explore the perception differences of individuals from different cultural backgrounds regarding "ruins aesthetics" and industrial memory and how these differences impact restorative effects.

Fifth, the “dark side” of industrial heritage and its negative emotions. This study primarily focuses on the positive restorative side of industrial heritage but overlooks its potential negative psychological impact. Some industrial heritage sites, due to their massive scale, dim lighting, or historical associations with hard labor, may evoke feelings of fear, oppression, or the “uncanny valley” effect. Future research should adopt a two-dimensional perspective of positive and negative emotions to explore under what combinations of spatial features or personal traits industrial heritage transforms from a “restorative environment” into a “stress-inducing environment”.

7. Conclusions

As global cities shift from incremental expansion to stock-based renewal, the fate of industrial heritage is no longer solely determined by its potential as an economic asset but by its social value as a health asset. This study provides rigorous empirical evidence that industrial heritage regeneration spaces are not cold steel and concrete relics but healing containers with significant public health value. Their unique historical depth and grand scale create a distinctive restorative mechanism that, through the activation of “cultural awe” and “temporal extension,” sets them apart from natural environments.

Importantly, the “suppression effect” revealed in this study proves that restorative perception at the psychological level can act as a powerful compensatory force, overcoming the limitations of old buildings’ physical environments and ultimately promoting employee health. This not only expands the boundaries of Attention Restoration Theory in built environments but also offers a new spatial strategy for the construction of healthy cities: protecting the intrinsic characteristics of industrial heritage is not only about preserving the city’s memory but also about healing the physical and mental well-being of modern urban dwellers in interaction with it. Future urban renewal should go beyond simple functional replacement to a human-centered, in-depth regeneration approach through precise design interventions and management strategies, allowing the dormant industrial civilization to gain true immortality in the practice of public health preservation.

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Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request. To protect participant privacy, individual-level data cannot be publicly shared.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Variable distribution characteristics.

Variable	Category	N I	Percentage
Gender	Male	245	50.41%
	Female	241	49.59%
Age	18–35	156	32.10%
	36–50	167	34.36%
	51 above	163	33.54%
	2–4 years	195	40.12%
	5–8 years	169	34.77%
Work experience	more than 9 years	122	25.10%
	Associate degree or lower	171	35.19%
	Undergraduate	149	30.66%
Education	Postgraduate	166	34.16%
	<5 k	94	19.34%
Income	5–8 k	96	19.75%
	8–12 k	93	19.14%
	12–20 k	104	21.40%
	>20 k	99	20.37%
	Admin	152	31.28%
Job_Type	R&D	127	26.13%
	Marketing	128	26.34%
	logistics Support	79	16.26%
	Creative Park	152	31.28%
Project_Type	Tech Incubator	102	20.99%
	Art Center	114	23.46%
	Office	118	24.28%
	Beijing	88	18.11%
City	Shanghai	61	12.55%
	Guangzhou	55	11.32%
	Shenzhen	38	7.82%
	Hangzhou	62	12.76%
	Chengdu	65	13.37%
	Wuhan	58	11.93%
	Xi'an	59	12.14%

Table A2. Exploratory Factor Analysis of the Industrial Heritage Attribute Perception Scale.

Item	ML2	ML1	ML3	ML4
IHAP_7 Working here, I can strongly feel the historical memories and the passage of time carried by the building.	0.815	0.232	0.262	0.258
IHAP_9 The unique historical atmosphere creates a “slow time” feeling, helping me temporarily forget the troubles of reality	0.804	0.225	0.292	0.257
IHAP_8 The old equipment, slogans, and special symbols preserved in the space make me feel connected to the past.	0.804	0.283	0.225	0.272
IHAP_4 The exposed raw materials in the building (such as red bricks, concrete walls, metal components) have a very tactile and visual appeal.	0.241	0.805	0.267	0.241
IHAP_6 Compared to the refined modern decor, the weathered marks here make me feel more real and natural.	0.224	0.804	0.270	0.265
IHAP_5 The rugged, unrefined industrial textures bring me a unique aesthetic experience.	0.272	0.799	0.248	0.277
IHAP_3 The preserved large-span spaces eliminate the sense of oppression often found in traditional office environments.	0.261	0.270	0.818	0.270

Table A2. *Cont.*

Item	ML2	ML1	ML3	ML4
IHAP_1 Compared to ordinary office buildings, the large and open internal space structure here makes me feel relaxed and at ease.	0.303	0.269	0.793	0.244
IHAP_2 The grand industrial scale of the space (such as high ceilings and large-span structures) evokes a sense of awe and amazement.	0.230	0.259	0.789	0.253
IHAP_11 Working in this space, where old and new functions merge, is more interesting than being in a standardized cubicle.	0.276	0.265	0.229	0.796
IHAP_10 The combination of modern office facilities and the old industrial building structure stimulates my curiosity.	0.277	0.238	0.275	0.793
IHAP_12 The creative transformation of this space (from factory to office) sparks my work inspiration.	0.245	0.294	0.265	0.788
KMO = 0.918 Bartlett $\chi^2 = 6143.810$ Cronbach $\alpha = 0.948$				

Control Variables: Gender, age, education level, income level. Moderating Variables: Work tenure, environmental sensitivity.

Table A3. Structural Equation Model Path Coefficients.

Path Relationship	β	S.E.	z	p	95% CI
IHAP $\rightarrow$ PR	0.544	0.058	11.676	<0.001	[0.566, 0.795]
PR $\rightarrow$ (GHQ-12)	−0.658	0.061	−11.983	<0.001	[−0.857, −0.616]
IHAP $\rightarrow$ (GHQ-12)	−0.052	0.060	−1.204	>0.05	[−0.190, 0.045]
PR $\rightarrow$ (SF-12)	0.702	0.061	12.373	<0.001	[0.633, 0.871]
IHAP $\rightarrow$ (SF-12)	−0.103	0.066	−2.091	<0.05	[−0.266, −0.009]

Table A3 reports SEM path coefficients after controlling for Job Type, Project Type, and City (dummy-coded with the first category as the reference group), alongside baseline Control Variables.

Table A4. Grouped Robustness Check.

Type	Path	Estimate	S.E.	t	p	95% CI
Creative Park	IHAP $\rightarrow$ PR	0.740	0.084	8.753	<0.001	[0.573, 0.907]
	PR $\rightarrow$ (GHQ-12)	−2.836	0.368	−7.698	<0.001	[−3.565, −2.107]
Tech Incubator	IHAP $\rightarrow$ PR	0.539	0.110	4.913	<0.001	[0.321, 0.758]
	PR $\rightarrow$ (GHQ-12)	−2.615	0.466	−5.612	<0.001	[−3.542, −1.689]
Art Center	IHAP $\rightarrow$ PR	0.645	0.113	5.737	<0.001	[0.422, 0.869]
	PR $\rightarrow$ (GHQ-12)	−2.355	0.412	−5.720	<0.001	[−3.172, −1.538]
Office	IHAP $\rightarrow$ PR	0.634	0.103	6.139	<0.001	[0.429, 0.839]
	PR $\rightarrow$ (GHQ-12)	−2.713	0.480	−5.658	<0.001	[−3.665, −1.762]

Table A4 reports grouped (reuse-type) robustness checks. Each subgroup model controls for Job Type, Project Type, and City (dummy variables), ensuring the focal paths are tested under comparable specifications across reuse types.

Table A5. Instrumental Variable Regression Results.

Stage	Variable	Coefficient	SE	t	p
First-Stage Statistics	First Stage (IV $\rightarrow$ PRS)				
	Building Age	0.013 ***	0.003	4.33	<0.001
	Green Coverage	0.012 ***	0.002	6	<0.001
	F	11.697	—	—	<0.001
	Strong Instrument	—	—	—	—
Diagnostic Tests (GHQ-12)	Second Stage (Dependent Variable: GHQ-12)				
	PRS (Mediator)	−2.295 ***	0.534	−4.3	<0.001
	Wu–Hausman	1.357	—	—	0.245
	Sargan	0.528	—	—	0.467

Table A5. Cont.

Stage	Variable	Coefficient	SE	t	p
Second Stage (Dependent Variable: SF-12)					
Diagnostic Tests (SF-12)	PRS (Mediator)	0.528 ***	0.101	5.23	<0.001
	Wu–Hausman	0.034	—	—	0.853
	Sargan	2.385	—	—	0.123

Note: *** indicates $p < 0.001$. The dependent variable for GHQ is reverse-scored mental health.

Table A6. Propensity Score Matching Results.

Outcome Measure	Matching Method	Treatment Group Mean	Control Group Mean	Difference (SE)	t	p	95% CI	N
GHQ-12								
High Distress vs. Low Distress	1:1 Matching	3.525	8.802	−5.277 *** (0.407)	−12.979	<0.001	[−6.07, −4.48]	484
	1:3 Matching	3.525	8.73	−5.205 *** (0.408)	−12.755	<0.001	[−6.00, −4.40]	486
	Radius Matching	3.447	8.486	−5.039 *** (0.477)	−10.563	<0.001	[−5.97, −4.10]	358
SF-12								
High Health vs. Low Health	1:1 Matching	3.982	2.961	1.022 *** (0.080)	12.796	<0.001	[0.87, 1.18]	484
	1:3 Matching	3.982	2.961	1.021 *** (0.079)	12.85	<0.001	[0.87, 1.18]	486
	Radius Matching	4.009	3.069	0.940 *** (0.090)	10.434	<0.001	[0.76, 1.12]	358

Note: *** indicates $p < 0.001$.

Appendix B. Questionnaire on Restorative Landscape Perception in Regenerated Industrial Heritage Spaces and Employee Health

Introduction

Dear Respondent,

Thank you for participating in this survey. This questionnaire aims to understand employee perceptions of the environment and their health status within revitalized industrial heritage spaces. Your input is crucial to our research. This survey is anonymous, and all information will be used strictly for academic research. We are committed to protecting your privacy. Completing the questionnaire should take approximately 15–20 min. Please answer truthfully based on your genuine feelings. Your support and participation are greatly appreciated!

Appendix B.1. Part I: Demographic Information

Item	Options
Your Gender:	☐ Male ☐ Female
Your Age:	☐ 18–35 years ☐ 36–50 years ☐ Over 51 years
Your Education Level:	☐ Associate degree or lower ☐ Undergraduate ☐ Postgraduate
Your Monthly Income Level:	☐ Below ¥5000 ☐ ¥5001–¥8000 ☐ ¥8001–¥12,000 ☐ ¥12,001–¥20,000 ☐ Above ¥20,000
Years of employment at your current workplace:	☐ 2–4 years ☐ 5–8 years ☐ Over 9 years
Your Job Nature:	☐ Administration ☐ Technical R&D ☐ Marketing ☐ logistics Support ☐ Other_____
Type of Industrial Heritage Regeneration Project you work in:	☐ Creative Industrial Park ☐ Technology Incubator ☐ Cultural and Art Center ☐ Comprehensive Office Building ☐ Other_____
Your City:	☐ Beijing ☐ Shanghai ☐ Guangzhou ☐ Shenzhen ☐ Hangzhou ☐ Chengdu ☐ Wuhan ☐ Xi'an ☐ Other_____

Appendix B.2. Part II: Perceived Restorativeness Scale (PRS)

Instructions: Please select the option that best reflects your true feelings about your current work environment for each item. (1 = Strongly Disagree, 2 = Moderately Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Moderately Agree, 7 = Strongly Agree).

Dimension	Item	1	2	3	4	5	6	7
Being Away	BA1. In this work environment, I feel I can temporarily escape the pressures of daily life.	☐	☐	☐	☐	☐	☐	☐
	BA2. This place allows me to get away from work worries and troubles.	☐	☐	☐	☐	☐	☐	☐
	BA3. In this environment, I feel I am away from the hustle and bustle of the city.	☐	☐	☐	☐	☐	☐	☐
	BA4. This place provides a haven where I can temporarily rest and relax.	☐	☐	☐	☐	☐	☐	☐
Fascination	FA1. This work environment is interesting and captures my attention.	☐	☐	☐	☐	☐	☐	☐
	FA2. There are many unique things here that attract me to pay attention.	☐	☐	☐	☐	☐	☐	☐
	FA3. In this environment, I want to delve deeper and explore more.	☐	☐	☐	☐	☐	☐	☐
	FA4. The content of this environment is rich and has captivating qualities.	☐	☐	☐	☐	☐	☐	☐
Extent	EX1. There is enough space here for me to explore and engage in activities.	☐	☐	☐	☐	☐	☐	☐
	EX2. The spatial scope of this place is vast and open.	☐	☐	☐	☐	☐	☐	☐
	EX3. This place constitutes a coherent and complete environmental world.	☐	☐	☐	☐	☐	☐	☐
	EX4. This environment extends far in space, giving a sense of openness.	☐	☐	☐	☐	☐	☐	☐
Compatibility	CO1. I can easily do what I want to do here.	☐	☐	☐	☐	☐	☐	☐
	CO2. The environment here supports the activities I want to engage in.	☐	☐	☐	☐	☐	☐	☐
	CO3. This place aligns with my preferences and personal inclinations.	☐	☐	☐	☐	☐	☐	☐
	CO4. In this environment, I can act freely according to my own will.	☐	☐	☐	☐	☐	☐	☐

Appendix B.3. Part III: General Health Questionnaire (GHQ-12)

Instructions: Please think back to the past two weeks and choose the option that best describes your situation.

Item	Option 1	Option 2	Option 3	Option 4
GHQ1. Able to concentrate on things?	☐ Better than usual	☐ Same as usual	☐ Less than usual	☐ Much less than usual
GHQ2. Lost much sleep over worry?	☐ Not at all	☐ No more than usual	☐ Rather more than usual	☐ Much more than usual
GHQ3. Felt that you were playing a useful part in things?	☐ More useful than usual	☐ Same as usual	☐ Less useful than usual	☐ Much less useful than usual
GHQ4. Felt capable of making decisions?	☐ More capable than usual	☐ Same as usual	☐ Less capable than usual	☐ Much less capable than usual
GHQ5. Felt constantly under strain?	☐ Not at all	☐ No more than usual	☐ Rather more than usual	☐ Much more than usual
GHQ6. Felt you couldn't overcome your difficulties?	☐ Not at all	☐ No more than usual	☐ Rather more than usual	☐ Much more than usual
GHQ7. Able to enjoy your normal day-to-day activities?	☐ More so than usual	☐ Same as usual	☐ Less so than usual	☐ Much less so than usual
GHQ8. Able to face up to your problems?	☐ More so than usual	☐ Same as usual	☐ Less able than usual	☐ Much less able than usual
GHQ9. Feeling unhappy and depressed?	☐ Not at all	☐ No more than usual	☐ Rather more than usual	☐ Much more than usual
GHQ10. Lost confidence in yourself?	☐ Not at all	☐ No more than usual	☐ Rather more than usual	☐ Much more than usual
GHQ11. Thinking of yourself as a worthless person?	☐ Not at all	☐ No more than usual	☐ Rather more than usual	☐ Much more than usual
GHQ12. Feeling reasonably happy, all things considered?	☐ More so than usual	☐ Same as usual	☐ Less so than usual	☐ Much less so than usual

Appendix B.4. Part IV: Subjective Physical Health Scale (SF-12)

Instructions: The following questions ask about your views on your health status. Please choose the option that best reflects your situation.

Item	Options
SF1. In general, would you say your health is:	☐ Excellent ☐ Very good ☐ Good ☐ Fair ☐ Poor
During the past 4 weeks, have you had any problems with your work or other regular daily activities as a result of your PHYSICAL health?	
SF2a) Accomplished less than you would like?	☐ Yes ☐ No
SF2b) Were limited in the kind of work or other activities?	☐ Yes ☐ No
During the past 4 weeks, have you had any problems with your work or other regular daily activities as a result of any EMOTIONAL problems (such as feeling depressed or anxious)?	
SF3a) Accomplished less than you would like?	☐ Yes ☐ No
SF3b) Didn't do work or other activities as carefully as usual?	☐ Yes ☐ No
SF4. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?	☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely
During the past 4 weeks, how often did you:	
SF5a. Feel full of pep?	☐ All of the time ☐ Most of the time ☐ A good bit of the time ☐ Some of the time ☐ A little of the time ☐ None of the time
SF5b. Feel calm and peaceful?	☐ All of the time ☐ Most of the time ☐ A good bit of the time ☐ Some of the time ☐ A little of the time ☐ None of the time
SF5c. Feel down in the dumps?	☐ All of the time ☐ Most of the time ☐ A good bit of the time ☐ Some of the time ☐ A little of the time ☐ None of the time
SF5d. Feel tired?	☐ All of the time ☐ Most of the time ☐ A good bit of the time ☐ Some of the time ☐ A little of the time ☐ None of the time
SF6. During the past 4 weeks, how much did your physical health or emotional problems interfere with your normal social activities with family, friends, neighbors, or groups?	☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

Appendix B.5. Part V: Environmental Sensitivity Scale

Instructions: Please choose the corresponding option based on your true feelings.
(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

Item	1	2	3	4	5
ES1. I am sensitive to changes in my surroundings.	☐	☐	☐	☐	☐
ES2. I notice subtle differences in the environment.	☐	☐	☐	☐	☐
ES3. The beauty or ugliness of the environment greatly affects my emotions.	☐	☐	☐	☐	☐
ES4. I often pay attention to the design and layout of my work environment.	☐	☐	☐	☐	☐
ES5. Noisy or cluttered environments make me uncomfortable.	☐	☐	☐	☐	☐
ES6. I enjoy working and living in a pleasant environment.	☐	☐	☐	☐	☐

Appendix B.6. Part VI: Industrial Heritage Atmosphere Perception Scale (IHAP)

Dimension 1: Scale & Monumentality

Instructions: Please answer the following questions based on your feelings in your current work environment.

(1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always)

	Item	1	2	3	4	5	6	7
Scale & Monumentality	IHAP1. After working in this environment, I feel more mentally focused.	☐	☐	☐	☐	☐	☐	☐
	IHAP2. The monumental spatial scale evokes awe and a sense of grandeur.	☐	☐	☐	☐	☐	☐	☐
	IHAP3. The preserved large-span space reduces the sense of oppression typical of standard office settings.	☐	☐	☐	☐	☐	☐	☐
Materiality & Roughness	IHAP4. The exposed original materials (brick, concrete, metal structures) have a strong tactile quality.	☐	☐	☐	☐	☐	☐	☐
	IHAP5. The rough, unpolished industrial textures provide a unique aesthetic experience.	☐	☐	☐	☐	☐	☐	☐
	IHAP6. Compared with refined modern decoration, the worn traces here feel more authentic and natural.	☐	☐	☐	☐	☐	☐	☐
Historicity	IHAP7. I can strongly feel the historical memories and passage of time embodied in this building.	☐	☐	☐	☐	☐	☐	☐
	IHAP8. The preserved old equipment, signs, and symbols make me feel connected to the past.	☐	☐	☐	☐	☐	☐	☐
	IHAP9. The unique historical atmosphere creates a sense of “slow time,” helping me forget real-life concerns.	☐	☐	☐	☐	☐	☐	☐
Functional Contrast	IHAP10. The combination of modern office facilities with old industrial structures stimulates my curiosity.	☐	☐	☐	☐	☐	☐	☐
	IHAP11. Working in this hybrid space is more interesting than being in standardized cubicles.	☐	☐	☐	☐	☐	☐	☐
	IHAP120. The creative transformation of the space (from factory to office) inspires my work.	☐	☐	☐	☐	☐	☐	☐

This concludes the questionnaire. Thank you for your patience in completing it!

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