Study of the therapeutic effects of Icelandic natural landscape images
A case study of Chinese tourists

Guotai Bao[a] iD

[a] University of Evora (Portugal), Institute for Research and Advanced Training; https://orcid.org/0000-0001-7488-2008;
e-mail: baoguotai@gmail.com

ABSTRACT

The study employs a comprehensive experimental methodology, utilizing a diverse collection of photographs organized into 18 distinct groups. There are three main objectives. First, it explores the cultural and psychological factors that make Icelandic landscapes so therapeutic for the Chinese. Second, it aims to prove how photographs of natural landscapes (two-dimensional images) can have a healing effect on individuals. Third, it strives to create a model for sorting healing photographs and making them useful for selecting images for healing albums.

A Likert-scale questionnaire was distributed to 1,000 participants from China, 500 individuals who have visited Iceland, and 500 who have not. This diverse pool consists of 500 males and 500 females, spanning ages from 10 to 80.

The results reveal the top-ranked landscapes and significant improvements in participants' psychological well-being after viewing the pictures. The findings support the therapeutic nature of the curated collection of forty photographs, providing inspiration and promoting well-being through the beauty and transformative power of nature. This experimental investigation contributes to an understanding of healing landscapes and their potential in assisting psychological therapy and landscape design.

KEYWORDS

healing landscapes, Chinese travelers, Iceland, nature-based tourism, photography

1. Introduction

The exploration of healing landscapes, environments with a profound potential to enhance overall well-being, has gathered significant attention in the realm of medical geography and environmental psychology. These landscapes possess the unique ability to offer restorative experiences, and effectively mitigate stress and anxiety. Pioneering research by the Kaplans and the founders of attention restoration theory (ART) has elucidated that exposure to aesthetically pleasing landscapes fosters mental well-being, aids in recovery from cognitive fatigue, and bolsters mood (Kaplan & Kaplan, 1989). Furthermore, work by Ulrich (1984) underscores the transformative impact of even a simple window view of natural surroundings in clinical settings. Patients provided with such views exhibit shorter hospital stays and demonstrate marked improvements in overall well-being.

In the sphere of therapeutic landscapes, gardens within healthcare facilities are integral components, ranging from modest window boxes to expansive

terrains spanning hundreds of hectares. However, the healing potential of these environments extends beyond mere visual perception. Other sensory experiences, including olfaction, audition and tactile sensations, play pivotal roles in augmenting overall well-being (Ziegler, 2015).

For instance, Cerwén's et al. (2016) research shows that auditory encounters, such as the gentle rustling of leaves, the murmuring of streams, and the melodic calls of birds, exert a profoundly positive influence on both physical and mental well-being. Similarly, Baik's et al. (2018) study delves into the impact of the fragrance of *Abies holophylla* Max. needles on the autonomic nervous system, elucidating its influence on parameters such as blood pressure, heart rate, heart rate variability and vascular function (augmentation index [AIX], flow-mediated dilation [FMD]). Moreover, this study establishes its capacity to alleviate stress and facilitate vascular relaxation.

Studies conducted by Medvedev and colleagues corroborate that natural sounds, including bird songs and the soothing rush of flowing water, exert a notable restorative effect on individuals navigating stressful experiences, emphasizing the relatively less pronounced effect of urban noise (Mantler & Logan, 2015). In a study led by Jo, the scent of pine forests was collected and employed to recreate an authentic pine forest environment for experimental purposes. The findings indicated that the scent of pine trees significantly enhances emotional states, cognitive acuity and perceptual abilities. Additionally, survey results revealed that the fragrance of pine forests engenders positive emotional states and mitigates feelings of confusion (Jo et al., 2010).

Kaplan and Kaplan's (1989) research in environmental psychology has demonstrated that images, films and window views of natural elements engender relaxation, emotional equilibrium, cognitive rejuvenation and psychological and physiological regulation in individuals. Gesler's (2003) findings further emphasize that even the act of gazing at outdoor green landscapes through windows induces feelings of serenity and tranquility. Kahn's research on visual landscapes indicates that individuals in a mildly distressed state, when afforded the opportunity to view natural landscapes through office windows, experience a swifter reduction in heart rate compared to participants with views limited to white walls. Furthermore, with an extended duration of observation, the effectiveness of heart rate recovery escalates (Kahn et al., 2008).

In synthesizing the Kaplans' (Kaplan & Kaplan, 1989) content interpretation methodology (CIM) environmental psychology research method, Medvedev's comparative research method, and Jo's straightforward survey questionnaire analysis, this study deploys a quantitative analysis approach to ascertain the positive impact of two-dimensional visual perception on healing. Additionally, a mathematical model has been formulated to evaluate and predict the influence of specific photographs on healing, and the efficacy of this model has been successfully demonstrated. This paper embarks on a comprehensive investigation into whether photographs of natural landscapes wield a discernible impact on human mental health.

1.1. Enchanted journeys: Exploring the healing landscapes of Iceland through the eyes of Chinese travelers

Chinese travelers are drawn to the natural beauty of Iceland, which aligns with the Kaplans' theory of healing landscapes. This theory emphasizes qualities like fascination, coherence, legibility, compatibility, complexity and mystery (Kaplan & Kaplan, 1989). Iceland's enchanting glaciers, majestic waterfalls, geysers, volcanic eruptions and vibrant Northern Lights captivate their senses, creating a sense of wonder and fascination. Stepping into this Nordic realm feels like entering a magical sanctuary, providing a break from everyday routines and a source of psychological rejuvenation.

To understand the cultural significance behind the Chinese fascination with the natural landscapes of Iceland, it is important to delve into their appreciation for natural harmony and for poetic and mystical imagery.

In Tao Yuanming's *The Peach-blossom Fountain* from 421 (Gems of Chinese Literature / T'ao Yüan-ming – The Peach-blossom Fountain, 2016) the author portrays the landscape of such a spring, characterized by meandering streams, abundant wildlife and the melodious chorus of birdsong. The protagonist stumbles upon a hidden utopia filled with breathtaking natural beauty. This concept of an idyllic, harmonious landscape has its roots in Chinese culture where nature is often revered and celebrated for its transformative and rejuvenating qualities Iceland's natural landscapes resonate with Chinese travelers' cultural appreciation for the restorative power of nature, making it a highly sought-after destination.

Furthermore, in Yu's (2011) article *Poetic dwelling*, the author explores the rooted Chinese appreciation for natural landscapes, encompassing imagery of mountains, water bodies and lush vegetation. These captivating and enchanting images closely align with certain natural landscapes found in Iceland.

Additionally, the historical novel *The story of Mu Tianzi* from the Warring States Period (476 BC to 221 BC) exemplifies the allure of natural landscapes.

This depiction is widely acknowledged in landscape architecture, particularly in the highly regarded academic work *Chinese classical garden history* (Zhou, 1990). It serves as a paradigmatic example of the breathtaking panoramas found within palaces, representing the quintessential essence of Chinese classic gardens.

Within the pages of this literary work, a mesmerizing panorama unfolds, extending far beyond the boundaries of the "Queen Mother of the West's" palace. Nestled within its confines lies a resplendent jade pool, embraced by emerald-green waters, and accessible only to winged chariots traversing swift currents. The surroundings are adorned with a tapestry of lush foliage, creating an awe-inspiring spectacle. In perfect harmony with this landscape, the palace of the Yellow Emperor flourishes with an abundance of blossoms, plants and majestic trees, evoking the essence of wetland landscapes that grace verdant mountains. Pristine springs, revealing their crystalline depths, and gentle zephyrs caress the environment, providing solace for numerous avian and terrestrial creatures seeking sanctuary within these revered grounds (Zhou, 1990). Such ethereal splendor evokes profound serenity, akin to the enchanting vistas found in certain realms in Iceland.

The allure of Iceland's natural landscapes for the Chinese can be attributed to their longing for tranquility, harmony and beautiful healing vistas, as well as their affinity to poetic and mystical imagery. These cultural factors and concepts contribute to the special appeal that these landscapes hold in the hearts of Chinese tourists.

Anecdotes from Chinese tourists exemplify their experiences in Iceland. One tourist described the Skogafoss waterfall as a place of wonder and vitality:

> As I stepped into this magnificent waterfall, the mist of water spread all around. The rainbow continuously danced in the interplay of sunlight and water mist. In just one hour at this waterfall, I witnessed more rainbows than I had seen in my entire life. Is it the Penglai Fairy Island[1] (蓬莱仙岛) or the enchanted realm of the Western Kunlun Mythology's Queen Mother's Yaochi[2] (王母瑶池)? The natural aura here will surely keep me healthy and full of youthful vitality.

Another marveled at the vastness and the healing effect of the glaciers in Jökulsárlón:

> I feel incredibly small in the face of their vastness. The sheer magnificence of the glaciers has a profound healing effect on my heart. The skies are teeming with an abundance of birds, and the presence of seals adds to the enchantment. My love for nature runs deep. Can you witness the tears of joy streaming down my face? I am overwhelmed with happiness.

Within the embrace of Iceland, Chinese travelers can personally experience the power and serenity of nature, feeling transported to another realm where the complexities and wonders of the landscape bring a sense of tranquility and rejuvenation. This longing for the natural landscapes of Iceland represents the sincere expression of the Chinese people's pursuit of pure, unique and mystical natural beauty, fulfilling their desire for a healing and transformative experience.

1.2. Chinese tourism in Iceland: Exploring nature-based tourism and bilateral relations

Chinese tourism in Iceland has experienced significant growth in recent years. In 2006, Chinese tourists accounted for 1.1% of Iceland's international visitors, with approximately 10,000 visiting the country (Ferðamálastofa Icelandic Tourist Board, n.d.; Lanteigne, 2010). However, starting in 2015, there was a noticeable increase in Chinese visitors. By 2017, the number had grown by 80% (Ferðamálastofa Icelandic Tourist Board, n.d.). In 2019, the number reached nearly 100,000, representing a tenfold increase compared to 2006 (Ferðamálastofa Icelandic Tourist Board, n.d.; Lanteigne, 2010). However, the COVID-19 pandemic had a significant impact on tourism (see Figure 1), with the number of Chinese visitors dropping to 26,400 in 2022 (Ferðamálastofa Icelandic Tourist Board, n.d.; Hafstað, 2020; Statista, n.d.a, n.d.b).

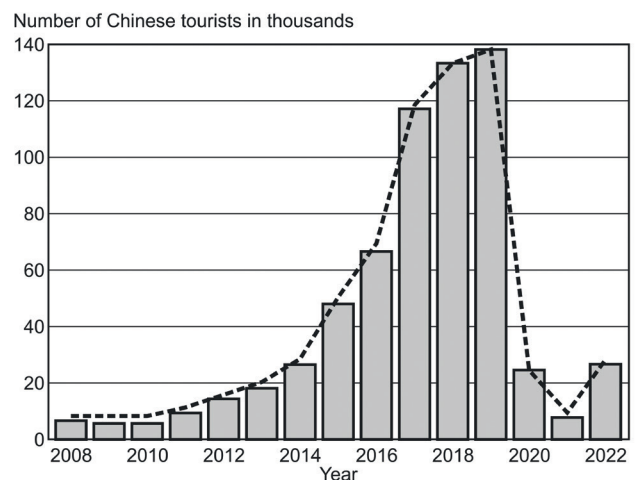Number of Chinese tourists in thousands

Figure 1. The number of Chinese tourists that travelled to Iceland between 2008 and 2022
Source: Ferðamálastofa Icelandic Tourist Board (n.d.)

Chinese tourists are increasingly drawn to the healing power of nature and the opportunity to explore Iceland's unique landscapes and cultural experiences. This growing interest in nature-based tourism aligns with the broader trend of Chinese travelers seeking meaningful and rejuvenating experiences (Li et al., 2011). Moreover, the strong bilateral relations between

China and Iceland have played a significant role in facilitating the growth of Chinese tourism to Iceland. The establishment of direct flights, favorable visa policies, increased media attention and cultural exchange initiatives have all contributed to the increasing flow of Chinese tourists to the country (Þórhallsdóttir & Ólafsson, 2017).

Chinese tourists are increasingly attracted to nature-based tourism in Iceland, aligning with the trend to seek meaningful experiences (Li et al., 2011). Bilateral relations between China and Iceland, including direct flights, favorable visa policies, and cultural exchange initiatives, have facilitated the influx of Chinese tourists (Þórhallsdóttir & Ólafsson, 2017). The rise in Chinese tourism can be attributed to factors such as the increased affordability of travel, improved transportation links and relaxed visa regulations. The pristine natural landscapes of Iceland, offering activities like glacier hiking, exploring volcanic landscapes, bathing in hot springs and witnessing the Northern Lights, appeal to Chinese travelers seeking awe-inspiring and rejuvenating experiences.

2. Methodology

This study employed a comprehensive methodology to investigate the impact of Icelandic landscapes on individuals' well-being. A diverse collection of photographs was utilized, encompassing pictures captured by the researcher as well as sourced from online platforms and books. Based on category-identifying methodology as a specific aspect of CIM from environmental psychology in *The experience of nature: A psychological perspective* by Rachel and Stephen Kaplan (Kaplan & Kaplan, 1989). The category identification method is a specific aspect of the content interpretation methodology (CIM). In this approach, researchers focus on identifying and categorizing scenes or environments based on participants' preferences. Determining the number and types of instances to include in a study involves considering various factors. When selecting study scenes, researchers need to articulate clear criteria, taking into account factors such as photo quality, detail, seasonal variation, and climate variation. The richness and usefulness of preference procedures depend on the types of sampled environments. In terms of data analysis, calculating the average rating for each scene is a common method.

Our hypothesis is that specific types of natural landscape image have a positive impact on individuals' mental well-being and mood. These photographs were organized into 18 distinct groups, each comprising eight pictures, to cover a wide range of iconic landscapes in Iceland. The themes explored included volcanic eruptions, auroras, moss-covered lava fields, tundra landscape, glaciers, ice caves, waterfalls, geothermal areas and geysers, the Blue Lagoon and natural hot springs, wildflower fields, dramatic cliffs and coastal formations, tranquil lakes and ponds, peaceful rivers and streams, serene forests and woodlands, mountain peaks and panoramic views, remote highland areas, charming traditional villages and pristine black sand beaches.

2.1. Photograph selection

The process of selecting photograph involves a shift from large-scale to small-scale spaces and from images with multiple landscape elements to a focus on single elements. The emphasis is on green, blue and white landscapes. This choice is driven by the known positive impact of greenery and water bodies on physical and mental well-being (Douglas, 2012; Wood et al., 2017; Ziegler, 2015). Additionally, white landscapes have also been found to have therapeutic effects (Brooke & Williams, 2021), a consensus reached by five landscape professionals and five industry experts. This results in a total of 18 categories, each comprising eight photographs:

– the green category includes scenes like moss-covered lava fields, tundra landscapes, wildflower fields, serene forests, charming traditional villages and remote highland areas;
– the blue category features scenes such as waterfalls, the Blue Lagoon, natural hot springs, tranquil lakes, peaceful rivers, streams and pristine black sand beaches;
– lastly, the white category encompasses ice caves and glaciers;
– the remaining category encompasses dramatic cliffs, mountains, auroras and volcanic eruptions.

A Likert-scale survey was conducted to evaluate the impact of Icelandic landscape pictures on participants' well-being. Participants used a 1 to 7 rating scale to score their perceptions. The survey questions were crafted in line with Kaplan and Kaplan (1989) and Marcus and Barnes's (1995) healing landscape standards, along with Lynch's (1960) criteria for spatial safety and legibility. These standards covered attributes like being away, extent, fascination, compatibility, readability and a sense of security. Lynch stressed that spatial legibility, which involves ease of understanding and navigation, enhances a sense of security. Kaplan argued that spaces with high readability reduce uneasiness from environmental confusion. Factors like familiarity and 'prospect refuge' contribute to a sense of security. The survey questions were designed to comprehensively address various elements of psychological healing in natural landscapes.

Following the selection, the 40 pictures were printed and shared both in physical form and online to gather feedback from the local Chinese population. During March 2023, over a period of ten days, 100 participants per day were selected, amounting to a total of 1,000 participants, 500 had been to Iceland and 500 had not. To ensure data accuracy and mitigate any potential duplication or abnormalities, five additional questionnaires were added to each daily group as safety data.

The participants were requested to provide detailed feedback on their experience of viewing the pictures and their perceived level of health and well-being after exposure. To differentiate between participant groups, they were categorized based on their prior visits to Iceland: those who had visited before and those who had never been. This categorization aimed to distinguish the impact of the Icelandic landscape pictures from the influence of participants' recollections of their previous trips.

The collected data underwent both semantic and statistical analyses. The semantic analysis involved categorizing the participants' responses according to their perceptions of the Icelandic landscape pictures and their corresponding levels of health and well-being. The statistical analysis included appropriate tests to analyze the quantitative data and identify any significant relationships or patterns.

If the 40 pictures are found to have a positive impact on well-being, they will be compiled into a healing landscape album of Iceland. This will feature quotations from the viewers of the albums, making it a self-guided and self-chosen collection of healing landscapes created by individuals themselves, rather than by the researcher or any external influence. The objective of this book is to tap into the inner healing power within individuals and leveraging the beauty and love deeply rooted in their hearts, as well as the transformative power of nature. It is anticipated that readers will discover healing and inspiration from the enchanting and poetic world of Iceland. Furthermore, these findings can provide theoretical support for incorporating natural elements in landscape design, fostering wellness and vitality.

3. Results

3.1. Sample data descriptive statistics

The following is a description of the characteristics of 1,000 surveyed individuals, comprising 500 who have been to Iceland and 500 who have not been to Iceland:

1. Gender distribution is equal.
2. The majority of respondents are young, with 33.21% falling in the 18–30 age group, and 27.08% in the 31–40 age group.
3. Enterprise employees constitute the largest occupational group, accounting for approximately 44.04%.
4. Many individuals work extended hours, with 47.29% working 8–10 hours per day, and 16.25% working over 10 hours.
5. Monthly income levels are relatively high, with most earning around 1300 euros or more.
6. Educational attainment is notable, with nearly half of respondents holding a university degree or higher.

Table 1 presents descriptive statistics of the surveyed individuals' demographic characteristics, showcasing key insights into gender distribution, age groups, occupations, working hours, educational levels, and monthly income.

Table 1. Sample data descriptive statistics

Demographic variables		Number of respondents	Percent
Gender	male	500	50.00
	female	500	50.00
Age	10–18	77	7.74
	18–30	332	33.21
	31–40	271	27.08
	41–50	120	12.01
	51–60	93	9.31
	61–70	81	8.12
	71 and above	25	2.53
Occupation	student	65	6.50
	government or public sector employee	322	32.21
	private sector employee	440	44.04
	freelancer	115	11.50
	full-time homemaker / stay-at-home parent	58	5.75
Daily working hours	0–3 hours	100	10.01
	4–6 hours	144	14.45
	7–8 hours	303	30.28
	9–10 hours	170	17.01
	more than 10 hours	283	28.25
Educational level	elementary school or below	31	3.14
	middle school	155	15.52
	high school	322	32.21
	college	490	49.01
	graduate school or above	11	1.12

Table 1 (cont.)

Demographic variables		Number of respondents	Percent
Monthly income (living expenses)	less than 1000 RMB	25	2.51
	1000–5000 RMB	32	3.21
	5001–10000 RMB	395	39.50
	10001–15000 RMB	512	51.20
	more than 15000 RMB	36	3.58

Source: author.

3.2. Analysis of related results

The study employed a two-group design, dividing the participants into group A (those who had been to Iceland) and group B (those who had not visited Iceland). The average scores for different landscapes, as ranked by the participants, were collected from each group. The scores were calculated by summing the individual ratings for each landscape and dividing it by the total number of participants in that group. For example, the score for "Jökulsárlón, a large glacial lake" in group A was determined by summing the ratings for each participant and dividing it by the total number of participants in group A, resulting in a score of 6.45. This was calculated as follows: ((7+6+6+7+6+7)/5 + (6+5+6+7+7)/5 + … + (6+7+6+7+7)/5) / 500, resulting in a score of 6.45.

Table 2 presents the ranking and scores for the top landscapes in both group A and group B. The landscapes are listed in descending order based on their average scores. These range from 1 to 7, with higher scores indicating a greater preference for a landscape.

Table 2. Average participants' ratings for categorized Icelandic landscape images

Landscape	Group A ranking	Group A score	Group B ranking	Group B score
Glacial lake	1	6.45	1	6.46
The Blue Lagoon	2	6.44	2	6.45
Ice caves	3	6.44	3	6.35
Serene forests	4	6.35	9	5.90
Peaceful rivers	5	6.34	5	6.24
Auroras	6	6.23	6	6.23
Mountains	7	6.21	10	5.89
Wildflower fields	8	5.92	8	5.91
Waterfalls	9	5.82	4	6.34
Cliffs and coastal formations	10	5.81	7	5.92

Note: Feedback on psychological well-being: group A – 89% of 445 participants reported feeling happier after viewing the pictures; group B – 88.4% of 442 participants reported feeling happier after viewing the pictures. Scores are based on a scale of 1 to 7, with higher scores indicating greater preference.

Source: author.

In both group A and group B, the top-ranked landscapes were similar, with "glacial lake" and "the Blue Lagoon" occupying the first two positions. Other highly ranked landscapes included "ice caves", "serene forests", "peaceful rivers" and "auroras". However, there were slight variations in the rankings between the two groups, indicating some differences in preferences.

Furthermore, feedback regarding the improvement of psychological well-being was collected from the participants in both groups. In group A, 89% of the 445 participants reported feeling happier after viewing the pictures, while in group B, 88.4% of the 442 participants reported a similar improvement. These findings suggest that exposure to the selected landscapes, regardless of prior visitation to Iceland, had a positive impact on the participants' psychological well-being.

The Pearson correlation coefficient formula was applied to calculate the similarity matrix between the two groups, resulting in a similarity value of 0.95. This indicates a high degree of similarity in landscape preferences and ratings between group A and group B, suggesting a significant level of agreement in their choices and evaluations of landscapes.

To further investigate the healing effects of photographs and the impact of different landscape categories on these effects, this study utilized a questionnaire analysis to gather data for processing, modeling and result analysis. The following steps were undertaken.

Firstly, a questionnaire analysis was employed to explore the healing effects of various landscape categories. The collected data underwent preprocessing, which involved removing outliers and filling in missing values. Normalization was then applied to ensure data compatibility for analysis. The preprocessed data was input into SPSS, and a stepwise regression method was utilized to select the influencing factors. Through this process, the number of influencing factors was reduced from 7 to 5.

Based on the selected influencing factors, a regression model was established using SPSS to predict whether a photograph possesses therapeutic effects. The model is as follows: healing effect of photographs = 0.62 + 0.33 question A + 0.24 question B + 0.19 question C – 0.08 question D + 0.12 question E. In this model, the independent variables are normalized as question A, question B, question C, question D and question E. The dependent variable represents whether the photograph has a healing effect: denoted as 1 if it does and 0 if it does not.

The coefficients of the stepwise regression model indicate the strength and direction of the relationship between each question (independent variable) and the healing effect of the photographs. According to the results of this model, the interpretations of the impact of each question on the healing effect are as follows:

1. Question A: This question evaluates whether the photo provides a sense of escape from the everyday

environment and from stress. The coefficient of 0.33 suggests that when respondents believe the photograph can deliver this feeling, there is a higher likelihood of it having a healing effect. The *p*-value of 0.002 indicates that the impact of question A on the healing effect is statistically significant, suggesting an association between respondents' answers to this question and the healing effect of the photographs.

2. Question B: This question assesses whether the open and spacious environment depicted in the photograph brings a sense of freedom and relaxation. The coefficient of 0.24 suggests that when respondents perceive the environment in the photograph to possess these characteristics, there is a higher likelihood of it having a healing effect.

3. Question C: This question examines whether the visual elements in the photograph capture attention and stimulate interest. The coefficient of 0.19 indicates a correlation between respondents' level of attention and interest in the visual elements of the photograph and its healing effect.

4. Question D: This question explores whether the depicted landscape aligns with personal preferences and needs. The coefficient of −0.08 suggests that when respondents perceive the depicted landscape to be incongruent with their personal preferences and needs, the likelihood of the photograph having a healing effect is lower.

5. Question E: This question investigates whether the photograph evokes a sense of security. The coefficient of 0.12 indicates that when respondents feel a sense of security from the photograph, there is a higher likelihood of it having a healing effect.

The R^2 value of the model is 0.74, indicating that the included questions explain 74% of the variance in the dependent variable. The adjusted R^2 value of 0.70, considering the number of predictive variables in the model, suggests a good fit and the model's ability to make accurate predictions on the test dataset. Additionally, the average difference between the predicted values and the actual observed values in the model is 0.2.

A random 10% of the dataset was reserved for testing purposes, and the model accurately predicted whether photographs had a healing effect with a mean squared error (MSE) of 0.0167.

The study identified the top ten natural landscape types in Iceland. These were glacial lakes, the Blue Lagoon, ice caves, serene forests, peaceful rivers, auroras, mountains, wildflower fields, waterfalls, and cliffs and coastal formations. From each category, the four highest-ranking images were chosen, resulting in a curated collection of forty photographs for the healing Icelandic landscape album. Some examples of the pictures are shown in Figure 2, Figure 3, Figure 4, Figure 5 and Figure 6.

Figure 2. Photographs of pristine mountain, serene forest, a waterfall and a snow cave in Iceland in May 2023
Source: G. Bao

Figure 3. Photographs of a waterfall, pristine black sand beach and geothermal lake in Iceland in May 2023
Source: G. Bao

Figure 4. Icelandic lake in July 2022
Source: F. Foremniak

Figure 5. Photographs of Large Glacier Lake, Jökulsárlón, in July 2022
Source: F. Foremniak

Figure 6. The Blue Lagoon in July 2022
Source: F. Foremniak

4. DISCUSSION

The study identified the top ten natural landscape types in Iceland, which formed a curated collection of forty photographs for a healing Icelandic landscape album. The analysis revealed that landscapes featuring greenery and water as well as auroras and ice caves, received high scores and contributed to the participants' sense of calm, pleasure and fascination. The regression model provided insights into the impact of specific questions on the healing effect of photographs, with factors such as a sense of escape, open and spacious environments, attention-capturing visual elements, personal preferences and a sense of security influencing the healing effect.

This study substantiates the existence of a psychological healing effect of two-dimensional natural landscape images through experimentation. The results demonstrate the potential of specific types of natural landscape, such as water scenes, trees, expansive forests, glaciers, ice caves and blue hot springs, to enhance individual mental well-being and uplift mood. This aligns with Wilson's (1984) biophilia theory, wherein water and green symbolize life and serve as clues to food sources. Vast open natural spaces, particularly sparse grasslands, enable us to observe the activities of predators while providing concealed spaces, in accordance with 'prospect-refuge' theory. Additionally, ice caves offer warmth and protection. People's fondness for landscapes also stems from their need for survival. Landscapes such as the aurora, glaciers and cliffs evoke a strong sense of departure, signifying an escape from everyday life.

We integrated Kaplan and Kaplan's (1989) environmental psychology research methodology, Medvedev's comparative research methodology, and Jo's simple survey questionnaire analysis. Through quantitative analysis, we determined that two-dimensional visual perception positively impacts individual health. The experiment confirmed that natural landscapes have a healing effect on mental health. Furthermore, we constructed a mathematical model to assess and predict the impact of specific photographs on healing effects and demonstrated the effectiveness of the model.

Jo conducted an experiment using simulated pine forest scents to assess the physiological and psychological states of participants, confirming the therapeutic effect of pine forest aromas. This illustrates the healing potential of mimicking natural scents through olfaction (Jo et al., 2010). In contrast, our study visually demonstrated the healing impact of natural landscapes. Koura et al. (2021) employed virtual reality (VR) technology to replicate real natural settings, affirming their therapeutic influence in a three-dimensional virtual context. Our research shows that even two-dimensional images of natural landscapes possess healing properties.

In Sun's (2022) investigation into the healing effects of visual, olfactory and auditory stimuli in green landscapes, she posited that optimal psychological

recovery occurs when all three dimensions are engaged. This suggests that human psychology tends to benefit from comprehensive sensory experiences. Based on Sun's (2022) findings, we can further evaluate healing effects by combining natural landscape imagery, soothing background music and plant-derived aromatic oils. Nonetheless, considering the outcomes of experiments by Sturt (2007), Sun (2022) and James et al. (2015), it is plausible that an environment integrating visual, olfactory and auditory stimuli would yield superior therapeutic outcomes.

Therefore, in addition to a curated collection of healing landscape images, incorporating ambient sounds from diverse natural settings (accessible via a QR code) such as flowing water, birdcalls and rustling leaves, along with naturally fragrant perfume, can form a comprehensive multi-sensory therapeutic landscape product. This amalgamation provides visual, olfactory and auditory stimuli for a more immersive healing experience.

5. Conclusion

This study conducted a controlled experiment to investigate the psychological healing effects of two-dimensional images depicting natural landscapes. The experimental design encompassed distinct variables, including the presentation of specific landscape types and their influence on individuals' mental well-being and mood.

In line with our initial hypotheses, the results affirmed that particular categories of natural landscape image, such as water landscapes, trees, expansive forests, laser lights, ice caves and blue hot springs, positively impact individuals' mental states. This finding provides empirical support for the therapeutic potential of two-dimensional landscape images on human mental health.

Furthermore, this study offers valuable insights for practical applications in healing and health interventions. Understanding how specific landscape types influence therapeutic outcomes enables the creation of targeted and effective treatment plans. Incorporating elements like water features, green plants, open green spaces and introducing imaginative features such as ice caves and auroras can be especially beneficial in alleviating anxiety and promoting relaxation, particularly in high-pressure work environments.

Additionally, the research findings illuminate pathways for developing tools and interventions that incorporate Icelandic landscapes into therapeutic environments. Leveraging Iceland's natural landscapes for healing photography, soothing music, visual meditation and virtual reality experiences

can effectively contribute to emotional management, anxiety reduction, stress relief and psychological recovery.

Moreover, the model established in this study forms the foundation for AI-generated healing landscape images. This advancement holds promise for providing the characteristic attributes of healing landscapes, paving the way for an AI-powered collection of therapeutic landscape visuals.

Lastly, these findings carry substantial practical implications for Iceland's tourism industry and nature conservation efforts. The positive impact of Iceland's captivating landscapes on individual mental health may attract a greater number of tourists, ultimately fostering the growth of the tourism sector. Consequently, safeguarding and ensuring the sustainability of Iceland's natural landscapes becomes paramount for their enduring use in healing and intervention endeavors.

In conclusion, this study underscores the influential role of diverse landscape types in Iceland in eliciting healing effects through images, while offering insights for therapeutic and wellness interventions. These findings serve as crucial references and guidance for enhancing individual psychological well-being, tailoring treatment programs and advancing Iceland's tourism industry, all while emphasizing the significance of nature conservation and sustainability.

Prospect
Furthermore, by employing computer software, the photographs were transformed into landscape images imbued with inherent healing qualities. This innovative approach holds the potential to generate landscape visuals with therapeutic properties, presenting a distinctive contribution to the field.

Endnotes

[1] Penglai Fairy Island holds a prominent place in Chinese folklore as a mythical paradise. Described as a captivating and everlasting haven, it is said to be inhabited by immortals and gods. The island is revered for its association with immortality, longevity and spirituality, adorned with enchanting features such as immortal herbs, fruits and rejuvenating springs, bestowing eternal youth upon its visitors. Serving as a symbolic link between the mortal world and the realm of immortals.

Within Chinese culture and literature, Penglai Fairy Island carries profound significance, embodying humanity's aspirations for longevity, happiness and an idyllic paradise. Its allure has permeated various art forms throughout history, appearing in evocative paintings, enchanting poems and captivating theatrical works. Furthermore, Penglai Fairy Island serves as an origin of Chinese classical gardens and landscapes. These meticulously designed gardens draw inspiration from the island's inherent beauty and tranquility, seeking to recreate its serene atmosphere on a smaller scale. The concept of the Chinese classical garden takes root in the vision of Penglai Fairy Island, featuring

thoughtfully arranged natural elements, intricate rock formations, meandering pathways and serene water features. These gardens endeavor to evoke a profound sense of harmony, balance and spiritual connection with nature, reflecting the enduring influence of Penglai Fairy Island on Chinese art, culture, and aesthetics.

[2] The term 'Yaochi' (瑶池) in Chinese mythology refers to mythical paradise where the 'Queen Mother of the West' resides. It is believed to be located on Mount Kunlun. According to Guo Pu's annotated version of the *Shanhaijing* (*Classic of mountains and seas*), the Queen Mother of the West not only has her palace on Mount Kunlun but also possesses separate caves and resting places. The concept of Yaochi extends beyond a specific location and encompasses various heavenly realms. Moreover, Yaochi is considered to be the origin of the concept of the Chinese classical garden.

References

Baik, H.J., Kim, H.J., Jae, S.Y., & Yi, B.Y. (2018). Effects of fragrance components of Abies holophylla Max. on stress relief and improvement of vascular function. *Journal of People, Plants, and Environment*, *21*(3), 223–232. https://doi.org/10.11628/ksppe.2018.21.3.223

Brooke, K., & Williams, A. (2021). Iceland as a therapeutic landscape: White wilderness spaces for well-being. *GeoJournal*, *86*, 1275–1285. https://doi.org/10.1007/s10708-019-10128-9

Cerwén, G., Pedersen, E., & Pálsdóttir, A.-M. (2016). The role of soundscape in nature-based rehabilitation: A patient perspective. *International Journal of Environmental Research & Public Health*, *13*(12), Article 1229. https://doi.org/10.3390/ijerph13121229

Douglas, I. (2012). Urban ecology and urban ecosystems: Understanding the links to human health and well-being. *Current Opinion in Environmental Sustainability*, *4*(4), 385–392. https://doi.org/10.1016/j.cosust.2012.07.005

Ferðamálastofa Icelandic Tourist Board. (n.d.). *Numbers of foreign visitors*. https://www.ferdamalastofa.is/en/research-and-statistics/numbers-of-foreign-visitors#nationalities-for-keflavik-airport-updated-monthly

Gems of Chinese Literature / T'ao Yüan-ming – The Peach-blossom Fountain. (2016, December 15). In *Wikisource*. https://en.wikisource.org/wiki/Gems_of_Chinese_Literature/T%E2%80%98ao_Y%C3%BCan-ming-The_Peach-blossom_Fountain

Gesler, W.M. (2003). Healing landscapes: Perspectives from medical geography. In J.D. Groenewegen, A.E. van den Berg, & R. de Vries (Eds.), *Healthy landscapes: Proceedings of the 20th International Symposium on Theoretical and Applied Karstology, Amsterdam* (pp. 123–136). IOS Press.

Hafstað, V. (2020, January 20). *Expecting 130,000 Chinese tourists*. https://icelandmonitor.mbl.is/news/news/2020/01/20/expecting_130_000_chinese_tourists/

James, P., Banay, R.F., Hart, J.E., & Laden, F. (2015). A review of the health benefits of greenness. *Current Epidemiology Reports*, *2*, 131–142. https://doi.org/10.1007/s40471-015-0043-7

Jo, H.-J., Fujii, E., Cho, T.-D. (2010). An experimental study of physiological and psychological effects of pine scent. *Journal of the Korean Institute of Landscape Architecture*, *38*(4), 1–10.

Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. Cambridge University Press.

Koura, S., Ikeda, A., Semba, R., Ito, M., Nagao, K., Higashi, K., Kumura, Y., Yokota, H., Matsutani, S., & Fujioka, Y. (2021). Effectiveness of hand care therapy and garden walks that are conscious of the stimulation of the five senses for recovery of cognitive and mental and physical dysfunction caused by COVID-19. *Open Journal of Therapy and Rehabilitation*, *9*(1). https://doi.org/10.4236/ojtr.2021.91002

Lanteigne, M. (2010). Northern exposure: Cross-regionalism and the China–Iceland preferential trade negotiations. *The China Quarterly*, *202*, 362–380. https://doi.org/10.1017/S0305741010000287

Li, X., Lai, C., Harrill, R., Kline, S., & Wang, L. (2011). When east meets west: An exploratory study on Chinese outbound tourists' travel expectations. *Tourism Management*, *32*(4), 741–749. https://doi.org/10.1016/j.tourman.2010.06.009

Lynch, K. (1960). *The image of the city*. The M.I.T. Press.

Mantler, A., & Logan, A.C. (2015). Natural environments and mental health. *Advances in Integrative Medicine*, *2*(1), 5–12. https://doi.org/10.1016/j.aimed.2015.03.002

Marcus, C.C., & Barnes, M. (1995). *Gardens in healthcare facilities: Uses, therapeutic benefits, and design recommendations*. The Center for Health Design. https://www.healthdesign.org/sites/default/files/Gardens%20in%20HC%20Facility%20Visits.pdf

Þórhallsdóttir, G., & Ólafsson, R. (2017). A method to analyse seasonality in the distribution of tourists in Iceland. *Journal of Outdoor Recreation and Tourism*, *19*, 17–24. https://doi.org/10.1016/j.jort.2017.05.001

Statista. (n.d.a). *Number of international visitor arrivals in Iceland from 1950 to 2021*. https://www.statista.com/statistics/694114/number-of-international-tourists-iceland/

Statista. (n.d.b). *Leading nationalities among international travelers who arrived at Keflavik Airport in Iceland in 2022*. https://www.statista.com/statistics/694160/keflavik-airport-international-visitor-arrivals-iceland-by-nationality/#:~:text=The%20United%20States%20was%20by,the%20United%20Kingdom%20ranked%20second

Sturt, P. (2007). Semantic re-interpretation and garden path recovery. *Cognition*, *105*(2), 477–488. https://doi.org/10.1016/j.cognition.2006.10.009

Sun, J. (2022). *People-oriented "three-dimensional" design theory of modern therapeutic landscape* [Doctoral dissertation, Southeast University]. China Academic Journal Electronic Publishing House.

Ulrich, R.S. (1984, April 27). View through a window may influence recovery from surgery. *Science*, *224*(4647), 420–421. http://doi.org/10.1126/science.6143402

Wilson, E.O. (1984). *Biophilia*. Harvard University Press.

Wood, L., Hooper, P., Foster, S., & Bull, F. (2017). Public green spaces and positive mental health – investigating the relationship between access, quantity and types of parks and mental wellbeing. *Health & Place*, *48*, 63–71. https://doi.org/10.1016/j.healthplace.2017.09.002

Yu, K. (2011, December 15). 诗意栖居 [Poetic dwelling]. *Turenscape*. https://www.turenscape.com/paper/detail/384.html

Zhou, W. (1990). *中国古典园林史* [*Chinese classical garden history*]. Tsinghua University Press.

Ziegler, U. (2015). Multi-sensory design as a health resource: Customizable, individualized, and stress-regulating spaces. *Design Issues*, *31*(1), 53–62. http://www.jstor.org/stable/24267118