

Survey on the Effects of Frequency of Experiencing Water Environments on Moods in China

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Abstract. This study describes findings of the impacts of water area on environmental factors including ocean, rivers, lakes and so on, and how these affected human mood in China. We used a short version of Sakano et al.'s Mood Inventory to measure tension and excitement, fatigue, depressive, anxious, and refreshed moods. 207 people (121 males and 86 females) were randomly selected from a Chinese university, and categorized into three groups according to different frequencies (high, medium, and low frequencies) of experiencing water area environment views. We found that a high frequency of experiencing water environment views had a more significant effect on mood than did medium and low frequencies. There were vast differences in scores on the subscales assessing depressive and refreshed moods among the three frequencies, and (2) for males, the differences in the mood inventory scores among the high, medium, and low frequencies were more pronounced and significant than they were for females. The effects of water environment on mood had large variations and substantial effects, especially on depressive and refreshed moods. These findings may provide new insights for future living environment and design guidelines for structuring more water-enriched environments.

1. Introduction

“A quarter of individuals suffer from mental or behavioural disorders both in developed and developing countries” reported in the World Health Organization in 2001 [1]. Many studies that have evaluated similar aspects have frequently shown that natural environments play an important role in mood [2]-[5]. Living in a natural environment was associated with fewer stress-related illnesses [6] [7]. On the basis of these findings, Peng et al. [8] confirmed that compared to Japanese residents who lived inland, those who lived by the seaside showed higher positive psychological effects. Furthermore, Peng et al. [9] reported that a high degree of enthusiasm for beach-going has a greater significant effect on mood and mental health than did lower degrees of enthusiasm for beach-going in Japan. Ashbully et al. [10] reported that approximately 15 families had a major improvement in health and well-being that was related to being in beach environments. The qualitative and quantitative relaxing effects of living by the ocean were confirmed by visits to the beach [11]. In general, ocean views are believed to influence humans and result in positive psychological effects such as calmness and feeling relaxed [12] [13].

According to this theory, aquatic settings showed positive impacts on individuals' well-being compared to those without exposure to such surroundings [14]. In particular, environments with water – positively referred to as natural “blue spaces” – are associated with higher preferences, greater positive effects and higher perceived restorativeness [15]. Tajima et al. [16] reported that people who



live near a waterfront area had positive, high moods. In general, waterfront areas have come to be utilized more and more by an increasing number of people for feeling the freedom and carefree. Depression and negative moods may be outcomes of the psychosocial stress from living in adverse environments that can increase the risk for poor health outcomes and other diseases. As more and more individuals are moving to and living in cities, the mental health burden of illness is rising. This raises the question of how to prevent, mitigate or reduce the effect of urban stress on individuals living in cities. The Chinese government was making great efforts to strengthen the water environment; however, no studies had evaluated the effects of water treatment on human mood by water environment in China. The present article made an attempt to examine the correlation between water environment and mood in China. We premised our investigation on the following two hypotheses: (1) that there were mutually reinforcing linkages between water area environment and human mood in China; (2) that for both males and females, water environment had a positive influence on mood. Furthermore, in males, there was a higher significant influence than females. We aimed to evaluate three groups by university students' frequency (high frequency, medium frequency, and low frequency) of water area environment views to investigate differing effects on mood, and to examine the three frequencies of water area environment experiences on the basis of gender.

2. Methods

Subjects

207 people (121 males and 86 females) were recruited from university students in China to participate in this survey. The subjects were categorized into three groups by their frequency of water area environment views: (1) high frequency (more than ten times a year); (2) medium frequency (less than ten times a year, more than once a year); (3) low frequency (once a year or not at all). We explained the aim of the study to the participants. In this questionnaire answers, there was no right and wrong, good or bad to any of the items.

Questionnaire

In this study, the self-administered questionnaire included questions about socio-demographics (gender, age and birthplace), the frequency of water area environment views (e.g., ocean views, river views, lake views, etc.) and a mood inventory.

We used a short version of the original Mood Inventory developed by Sakano et al. [17]. The mood inventory is a self-administered questionnaire designed to measure an individual's state of mood. The questionnaire had five subscales: tension and excitement, fatigue, depressive mood, anxious mood, and refreshed mood, and each subscale comprised three items. The participants were required to respond each item on a 4-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Agree, and 4 = Strongly Agree). The score on each subscale was calculated by taking the mean of the item responses.

Statistical Analysis

Questionnaires with missing or incomplete data were excluded from analysis. In our statistical analysis, the three groups of high frequency, medium frequency, and low frequency of water area environment views were examined, and the gender associated with different frequencies of water area environment views were also calculated.

The data were entered and analyzed using the Statistical Package for Social Sciences (SPSS, 2007) software. A one-way analysis of variance (ANOVA) and Tukey HSD post-hoc analysis for multiple comparisons were conducted in order to summarize and interpret the descriptive data. Statistical significance was set at $p < .05$, $p < .01$.

3. Results and Discussion

We received completed questionnaires from 207 participants, 121 males and 86 females. The proportion of frequency of water area environment views: (1) 65 participants who having water area environment views more than ten times a year were classified as the high frequency group; (2) 129 participants who having water area environment views less than ten times and more than once a year

were classified as the medium frequency group; (3) 13 participants who having water area environment views once a year or not at all were classified as the low frequency group.

3.1. The effect of three frequencies of experiencing water environment views on moods

The data in Table 1 show that there were significant differences in increase ($p < .05$) in scores between the high and medium frequency groups on the depressive mood and refreshed mood subscales. There were no significant differences with regard to variations in the participants' scores between the high and medium frequency groups on the tension and excitement ($p = 0.89$), fatigue ($p = 0.25$), and anxious mood ($p = 0.61$) subscales. Between the high and low frequency groups, there were strong significant differences in crease ($p < .01$) in scores on the depressive mood and refreshed mood subscales, and significant differences in crease ($p < .05$) in scores on the fatigue and anxious mood subscales. No significant difference was found with regard to tension and excitement ($p = 0.89$). Moreover, between the medium and low frequency groups, only refreshed mood subscale had a significant difference ($p < .05$). There were no significant differences in term of the tension and excitement ($p = 0.97$), fatigue ($p = 0.81$), depressive mood ($p = 0.88$), and anxious mood ($p = 0.48$).

Figure 1 show that there was a tendency for the average mood scores to improve as the frequency of experiencing water area environment increased. The mean scores on the fatigue, depressive mood and anxious mood subscales showed an ascending trend, and the refreshed mood scores showed a descending trend among the high, medium, and low frequencies groups; in other words, fatigue, depressive mood, anxious mood and refreshed mood improved for those who had a higher frequency of water environment. Obviously, the participants with high frequency of experiencing water area environment showed stronger significantly than did the lower frequency of experiencing water environment, on the depressive mood, refreshed mood, fatigue and anxious mood. Specifically, from among all the subscales, vast differences in scores were obtained on the depressive mood and refreshed mood. This suggests that a high frequency of water area environment had a greater influence on participants' moods than did a lower frequency of water environment.

Table 1. Three frequencies of having water environment views
Means, SE, and p-values from the ANOVA and Tukey HSD post-hoc analysis.

Subscales	High-Medium			High-Low			Medium-Low		
	M1	SE1	p	M2	SE2	p	M3	SE3	p
Tension and excitement	0.16	0.08	0.89	0.02	0.10	0.89	-0.05	0.01	0.97
Fatigue	-0.15	0.09	0.25	-0.21	0.10	*	0.04	0.13	0.81
Depressive mood	-0.24	0.11	*	-0.41	0.10	**	-0.17	0.11	0.88
Anxious mood	-0.13	0.11	0.61	-0.21	0.12	*	-0.19	0.21	0.48
Refreshed mood	0.26	0.12	*	0.39	0.14	**	0.26	0.17	*

* $p < .05$, ** $p < .01$ M1 = M (high) – M (medium) M2 = M (high) – M (low) M3 = M (medium) – M (low)

It is important to note that people who had higher frequency of experiencing water environment had reduced odds of depression mood and mental distress. Depression mood may be outcomes of the psychosocial stress from living in complex environments that can increase the risk for poor health outcomes and other diseases. People in a relax environment tend to be in a refreshed mood, and have better mental health. Water area environments including pleasant blue sea, calm lake, sunshine waterfront, and these views can enhance the feeling of being comfortable. Many Chinese people would like to go to the ocean, river, or lake to do some sports, such as swimming, fishing, and boating. These types of sports make their time much more sacred as well as enjoyable. In addition, many Chinese people would like to live on or near the sea, because the sea gives them some sense of openness and freedom. In this study, it has been confirmed that water area environment promoted

Chinese people's moods. This survey suggests that the more frequently Chinese people have the experiencing of water environment, the better their improving moods and mental health.

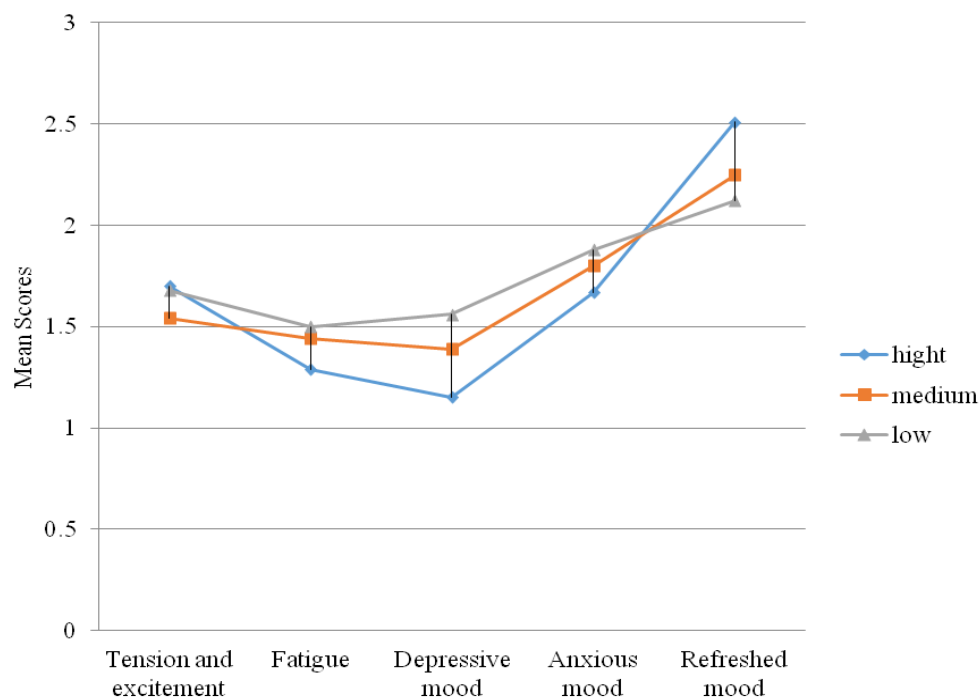


Figure 1. Mean scores for moods influenced by the three frequencies of having water environment views

Associating gender and three frequencies of experiencing water environment views on moods

The data in Table 2 present the results pertaining to the association between three groups by the frequency of water area environment views and gender. In term of males, there were significant differences ($p < .05$) on depressive mood and refreshed mood subscales between the high and medium frequency groups, and no significant differences on the tension and excitement ($p = 1.00$), fatigue ($p = 0.26$), and anxious mood ($p = 0.15$). Regarding the differences between the high and low frequency groups, there were strong significant differences in crease ($p < .01$) on the depressive mood and refreshed mood subscales, and significant differences in crease ($p < .05$) on the fatigue and refreshed mood. With regard to the mean tension and excitement ($p = 0.11$) was no significant difference. In the case of the medium and low frequency groups, tension and excitement ($p = 0.32$), fatigue ($p = 0.21$), depressive mood ($p = 0.11$), anxious mood ($p = 0.71$) and refreshed mood ($p = 0.21$) had no significant differences.

In term of females, the only significant difference ($p < .05$) was with regard to the depressive mood between the high and low frequency groups. With regard to the tension and excitement ($p = 1.00$), fatigue ($p = 0.55$), depressive mood ($p = 0.87$), anxious mood ($p = 0.15$) and refreshed mood ($p = 1.01$) were no significant differences between the high and medium frequency groups. Moreover, between the high and low frequency groups, tension and excitement ($p = 0.13$), fatigue ($p = 0.99$), anxious mood ($p = 0.16$) and refreshed mood ($p = 0.70$) were no significant differences. With regard to the tension and excitement ($p = 0.11$), fatigue ($p = 0.71$), depressive mood ($p = 0.21$), anxious mood ($p = 0.55$) and refreshed mood ($p = 0.69$) were no significant differences between the medium and low frequency groups. In particular, the mean mood scores of females were lower than males.

Figure 2 and Figure 3 show that the frequency of experiencing water area environment affected males' mood, and didn't affect females' mood. Both for males and females, among the high-medium frequencies, high-low frequencies, and medium-low frequencies of water area environment, only depressive mood had a significant effect. In term of males, the changes in scores for fatigue,

depressive mood, and anxious mood showed an ascending trend, and the scores for refreshed mood showed a descending trend as the frequency of experiencing water area environment increased. However, in term of females, there was no obvious change as the frequency of experiencing water area environment increased.

Table 2. Three frequencies of having water environment views and gender Means, SE, and p-values from the ANOVA and Tukey HSD post-hoc analysis.

	Subscales	High-Medium			High-Low			Medium-Low		
		M1	SE1	<i>p</i>	M2	SE2	<i>p</i>	M3	SE3	<i>p</i>
Males	Tension and excitement	0.15	0.25	1.00	0.33	0.25	0.11	0.18	0.25	0.32
	Fatigue	-0.21	0.25	0.26	-0.44	0.16	*	0.20	0.17	0.21
	Depressive mood	-0.43	0.14	*	-0.69	0.14	**	0.32	0.18	0.11
	Anxious mood	-0.35	0.18	0.15	-0.40	0.19	*	0.19	0.28	0.71
	Refreshed mood	0.43	0.22	*	0.57	0.22	**	0.22	0.22	0.21
Females	Tension and excitement	-0.01	0.14	1.00	-0.36	0.17	0.13	-0.34	0.20	0.11
	Fatigue	0.07	0.18	0.55	-0.03	0.23	0.99	-0.13	0.13	0.71
	Depressive mood	-0.04	0.23	0.87	-0.41	0.43	*	-0.28	0.20	0.21
	Anxious mood	0.21	0.17	0.71	-0.29	0.17	0.16	-0.39	0.16	0.55
	Refreshed mood	0.28	0.16	1.01	0.25	0.37	0.70	0.23	0.26	0.69

* $p < .05$, ** $p < .01$ M1 = M (high) – M (medium) M2 = M (high) – M (low) M3 = M (medium) – M (low)

The gender-based prevalence of moods was compared among the three frequencies of water area environment. In China, as more and more individuals are moving to and living in cities, the moods and mental health burden of illness is rising. This raises the question of how to reduce the effect of urban stress on individuals living in cities as the populating continues to rise. Having water environment like ocean, rivers and lakes, to be the most relaxing of all types of space, followed by looking out of windows at natural spaces. Chinese men engaged in more sports such as fishing, swimming, and surfing, which improved their mental health and released their stress. Males who enjoyed engaging in different types of sports had better moods as well as mental health. It could also be that males with more time and money to visit the beach are happier. For females, large quantities of Chinese women need to work, raise children, and do housework, so they couldn't really concentrate on relaxation. Even though, Chinese females are on a scenic and beautiful waterfront, it is difficult to unwind and let go. Furthermore, a lot of Chinese women don't like sports, they prefer to stay at home, watch TV rather than do some sports outside. So they couldn't experience the fun of swimming, boating and fishing. In sum, the main finding revealed that the water area environments could improve males' moods much more than it could in the case of the females.

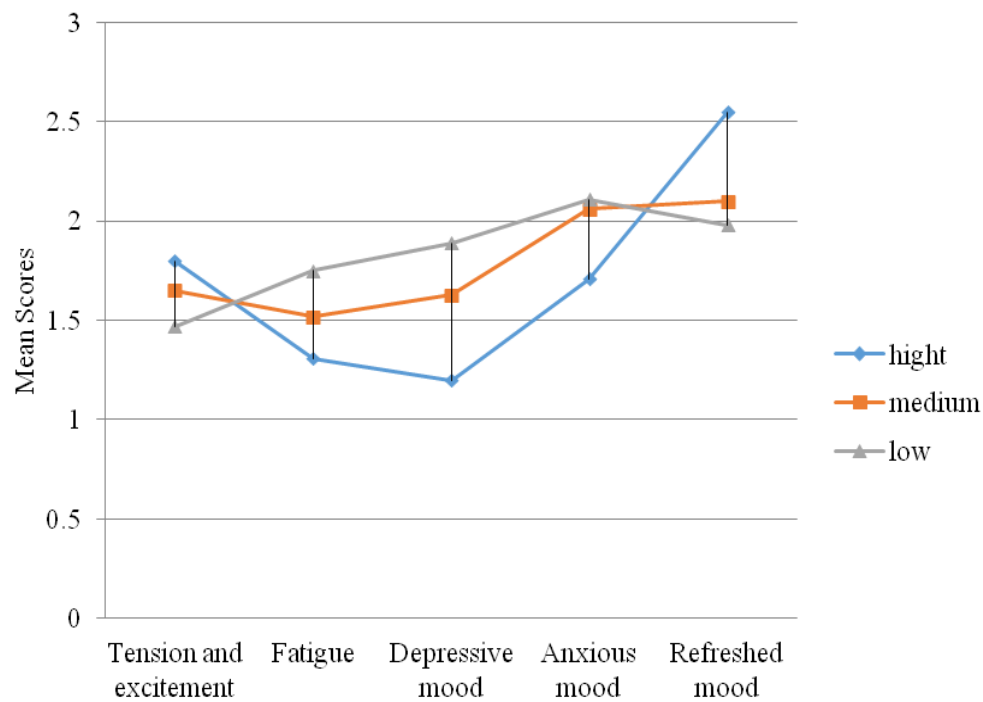


Figure 2. Mean Scores of males for moods influenced by the three frequencies of having water environment views

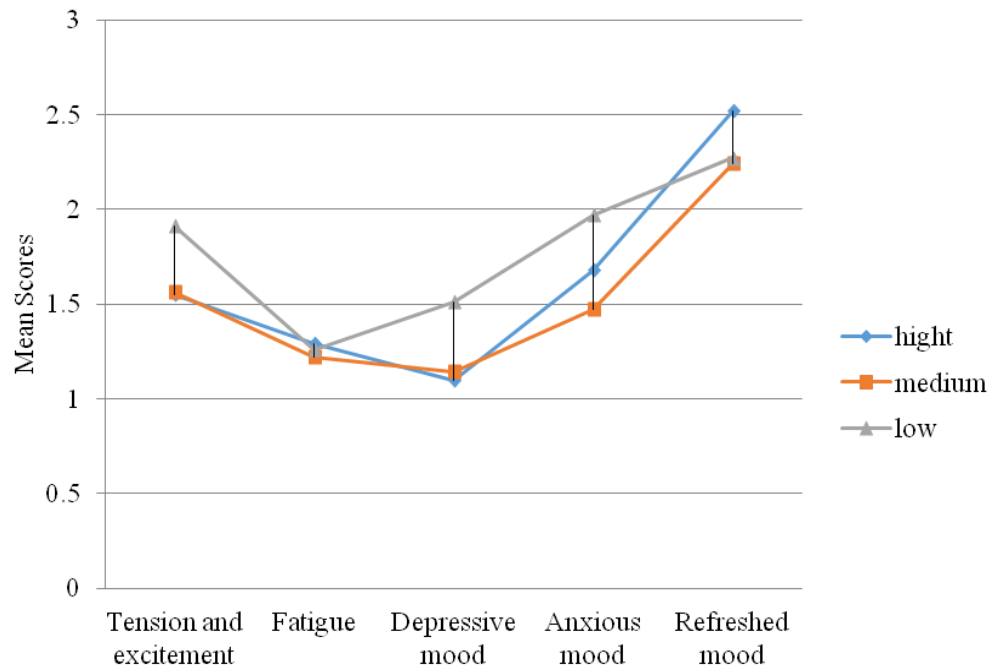


Figure 3. Mean Scores of females for moods influenced by the three frequencies of having water environment views

4. Conclusions

The results of our study suggested that water environment views improved human mood in China. In particular, the impact of the water environment on mood was more pronounced for men than for

women. We found a significant gender difference with regard to the effects of the water environment on mood. Our results were as follows:

1. From among the three frequencies of having water environment views, a high frequency of experiencing water environment views had a more significant effect on mood than did medium and low frequencies. In particular, there were vast differences in scores on the subscales assessing depressive and refreshed moods the subscales measuring among the three groups with varying frequencies. As a result, it can be considered that the frequency of experiencing water environment improves the mood of Chinese people.

2. The findings also indicate that in both men and women, the water environment has a positive influence on mood. Furthermore, for males, the differences in the mood inventory scores among the high, medium, and low frequencies were more pronounced and significant than they were for females. The effects of water environment on mood had large variations and substantial effects, especially on depressive and refreshed moods. For women, the difference among the high, medium, and low frequencies with regard to mood status was slight and almost not significant.

Unsurprisingly, water environment was positively associated with human mood, and the depressive and refreshed moods had significant corresponding impacts on mood. The effects were stronger for males. Experiencing water environments led to improved mood among Chinese people. The results of this study offer compelling evidence to support the effect of water environment on mood in China. These finding may provide new insights for future living environment and design guidelines for structuring more water environments.

5. References

- [1] World Health Organization WHO 2001 World Health Report Geneva *WHO*
- [2] Rutter M 2005 How the environment affects mental health *The British Journal of Psychiatry* 186 4-6
- [3] Yamazaki S, Inatani F and Nonaka M 2010 Comparison in tendency and frequency of reminiscence between the elderly and the middle-aged relation between quality of reminiscence and psychological well-being *Kurume University Psychological Research* 9 57-61
- [4] Barton J and Pretty J 2010 What is the best dose of nature and green exercise for improving mental health? A multi-study analysis *Environmental Science & Technology* 44 3947-3955
- [5] White MP, Pahl S, Ashbullby K, Herbert S and Depledge MH 2013 Feelings of restoration from recent nature visits *Journal of Environmental Psychology* 35 40-51
- [6] Kawakubo A, Kasahara R and Oguchi T 2015 Effects of natural environmental picture and sound on relieving stress *Rikkyo Psychological Research* 57 11-19
- [7] Thompson Coon J, Boddy K, Stein K, Whear R, Barton J and Depedge M 2011 Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review *Environmental science & technology* 45 1761-1772
- [8] Peng CC, Yamashita K and Kobayashi E 2016 Effects of the coastal environment on well-being *J. Coast Zone Manag* 19 1-7
- [9] Peng CC, Yamashita K and Kobayashi E 2015 An empirical study on the effects of the beach on mood and mental *J. Coast Zone Manag* 18 1-6
- [10] Ashbullby KJ, Pahl S, Webley P and White MP 2013 The beach as a setting for families' health promotion A qualitative study with parents and children living in coastal regions in Southwest England *Health & Place* 23 138-147
- [11] Miyamoto T, Shigeeda M, Sugiyama S, Oshima A and Togashi M 2001 Measurement of Relaxing Effects from a Visit to the Beach *Journal of International Society of Life Information Science* 19 38-46
- [12] Wheeler BW, White M., Stahl-Timmins W and Depledge MH 2012 Does living by the coast improve health and wellbeing? *Health & Place* 18 1198-1201
- [13] White MP, Alcock I, Wheeler BW and Depledge MH 2013 Coastal proximity, health and well-being results from a longitudinal panel survey *Health & Place* 23 97-103
- [14] Wherrett JR 2000 Creating landscape preference models using internet survey techniques *Landscape research* 25 79-96

- [15] White M, Smith A, Humphries K, Pahl S, Snelling D, et al. 2010 Blue space The importance of water for preference, affect, and restorativeness ratings of natural and built scenes *Journal of Environmental Psychology* 30 482-493
- [16] Tajima K, Watanabe H and Kuroyanagi A 1997 A study on effect of urban waterfront area in high density living environment *Journal of Architecture, Planning, and Environmental Engineering* 4 277-284
- [17] Sakano Y, Fukui T, Kumano H, Horie H, Kawahara K, et al. 1994 Development and validation of a new mood inventory *Jpn J Psychosom Med* 34 629-636

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