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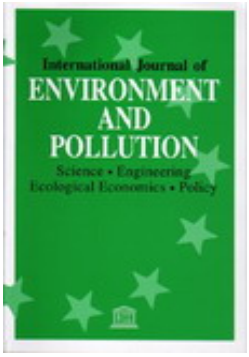

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Study on the influence of residents' well-being on the use of urban parks and emotional recovery under air pollution environment

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Abstract: With the acceleration of urbanisation, the incidence of mental diseases is increasing year by year due to the continuous pressure of social environment. Urban parks can relieve pressure, stimulate positive emotions and produce positive psychological effects. Life happiness refers to the individual's overall perception and evaluation of life, which is related to the intensity and

frequency of the occurrence of positive emotions. Through the questionnaire survey of users in Xigu Park in Tianjin (N = 226), correlation analysis, multiple correspondence analysis and other methods were used to explore the relationship between life satisfaction and environmental perception, park activities and emotional recovery. The results indicate that park activities enhance positive emotions and life happiness, happier individuals are more attentive to their environment and increased happiness leads to greater interest in park activities, resulting in a more relaxed atmosphere and better emotional recovery. Therefore, park activities can not only temporarily promote emotional recovery, but also bring lasting happiness experience.

Keywords: urban park; life happiness; emotional recovery; environmental perception; social environment; positive emotions; correlation analysis; relaxed atmosphere; satisfaction.

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1 Introduction

With the acceleration of urbanisation, the continuous social environmental pressure has led to an increase in the incidence of mental illness in my country year by year. Urbanisation has an impact on mental health by increasing stresses and variables such as an overcrowded and polluted environment, high levels of violence, and a lack of social support. Furthermore, urban environments are associated with several risk factors for mental illness, such as noise, toxic pollution, crime, and social overstimulation, although these effects are reducing or may be eliminated with design optimisation. The "2018 White Paper on Mental Health of Chinese Urban Residents" pointed out that 73.6% of urban residents in my country are currently in a sub-health state, and mental health problems have become an important factor restricting the health of urban residents

(Chinese Medical Association Health Management Branch, 2018). In 2019, the National Health and Health Commission formulated the 'Healthy China' Action (2019–2030)" proposed the overall goal of national health in 2022 and 2030, and put forward specific requirements for the level of national physical fitness and mental health literacy (National Health Commission, Healthy China Initiative, 2019–2030). Urban parks are an important type of green space to meet the daily life of residents. Numerous studies have shown that urban parks have a restorative effect on residents' mental health, relieve stress, improve concentration, and generate positive emotions.

Looking at the relevant literature at home and abroad, many scholars have studied the psychological recovery effect of parks from the aspects of green space types, environmental preferences, park attributes, and perception dimensions. Psychological recovery refers to the process of returning to a state of well-being after experiencing a mental health challenge or trauma. The environment in which an individual recovers can significantly impact their recovery process. Supportive environments that provide access to appropriate resources, such as therapy or support groups, and promote a culture of empathy and understanding can aid in psychological recovery. In contrast, stressful, unsupportive, or chaotic environments can hinder the recovery process and exacerbate mental health symptoms. For example, Liisa et al. (2006) compared the effects of street, park and forest on participants' emotions, and found that urban forest had the greatest recovery potential, followed by urban park and urban street, and the exposure of urban park and forest would lead to perceived emotions equivalent improvement. However, some scholars have pointed out that people's preference for the type of environment affects psychological recovery. For example, Wilkie and Clouston (2015) believed that there is consistency between environmental preference and environmental effect, and conducted research on preference type, environmental type and psychological recovery, and proved that the consistency of preference type and environmental type would affect the effect of psychological recovery, but was not affected by the natural environment. The relationship between an individual's preference for certain environments and the environmental type they are placed in can affect the effectiveness of psychological recovery. When there is consistency between an individual's preference type and their environmental type, the positive effects of psychological recovery can be enhanced. However, the natural environment itself is not affected by environmental type and has inherent qualities that can positively impact mental health and well-being, regardless of individual preferences or the specific environment within the natural setting. The Impact of the Urban Green Space Dichotomy. Liisa Tyrvainen et al. proposed that the characteristics of urban green space that bring positive experience to people are tranquility, nature and forest. Grahn and Stigsdotter (2010) have shown that perceived environmental characteristics are related to psychological recovery, and proposed 8 perception dimensions (PSD) that affect psychological recovery. Then Karin Kragsig Peschardt et al. combined the Perceptual Restoration Scale with the Perceptual Perception Dimension (PSD) to concretise the characteristics of the restorative environment, and applied the research results to the design of small parks (International City Mangers' Association, 1948). Chinese researchers such as Tan and Peng (2016) conducted a comparative study on the natural factors, perceptual factors, design factors and environmental factors that affect the recovery of community parks, and believed that natural factors had a significant effect on psychological recovery. Colour, type, and quantity play an important role in the recovery of small gardens; the revitalisation and restoration of a small garden require careful consideration of colour, type, and quantity.

Colour selection is critical to create a visually appealing and emotionally uplifting atmosphere, with warm colours providing energy and cool colours creating a calming effect. The selection of plants and flowers should be well-suited to the climate and soil conditions of the garden, with varying heights, textures, and shapes adding visual interest. Quantity should also be carefully planned to avoid overcrowding or underutilisation of the available space. Song et al. (2018) studied the relationship between perceived environmental characteristics, activity types and psychological recovery in urban parks, and found that the most psychologically recovering environmental characteristics are tranquility and nature. Xu (2016) conducted a comprehensive analysis of the restorative value of green space types such as high-density urban community parks and rehabilitation gardens, and believed that in high-density cities, the restorative research of green space parks should be combined with social interaction space to form a support for healthy life and positive environment. Liu et al. (2019) constructed a psychological model of urban park restorative evaluation, and proposed two urban park restorative evaluation paths: environmental preference, restorative evaluation and environmental preference, place dependence, place identity, and restorative evaluation.

Summarising the existing literature, the research on the promotion of psychological recovery by the park environment is becoming more and more diversified, but few literatures discuss whether the positive emotions generated by park activities can have a sustainable positive impact on people. This lasting impact can be noticed through the well-being of residents' lives. Life well-being is considered to be an important part of positive psychology research and has important implications for health. Many researchers have pointed out that positive emotions and evaluation of life can reduce the risk of illness and injury; it can promote faster recovery of immune function (Kobau et al., 2010). Shin and Johnson (1978) proposed that life well-being refers to an individual's overall perception evaluation of life, including the expression of positive and negative emotions. Argyle (1987) pointed out that life well-being can be understood as an assessment of life conditions. These responses affect positive emotions with varying frequency and intensity. Simply put, happiness is an individual's subjective experience and the result of an overall evaluation of life (Cheng and Lu, 2016). Subjective wellbeing (SWB) refers to the perception of one's own level of happiness, contentment, and satisfaction as an individual. One approach to understand what this means to various people is through SWB. Individuals with a high level of subjective well-being are happier, more creative, and more productive. They have stronger connections, and they are frequently healthier and more successful than unsatisfied people. From the perspective of residents' life well-being, this paper studies the overall psychological state of urban residents' life, and explores the relationship between residents' life happiness and park activities, environmental charm, the relationship between environmental perception and emotional recovery.

2 Research methods

Xigu Park and Comprehensive Park are two popular parks in China, each offering unique cultural experiences. Xigu Park and Comprehensive Park provide distinct cultural experiences for visitors. Xigu Park showcases China's rich cultural and historical

heritage, while Comprehensive Park represents China's modernisation while preserving traditional culture. Xigu Park, located in Lanzhou, Gansu province, is rich in cultural and historical significance dating back to the Tang Dynasty. The park features several historical sites, such as the Xigu Pagoda and the Gansu Provincial Museum, as well as traditional Chinese gardens, rock formations, and a lake. These features make Xigu Park a popular destination for visitors interested in Chinese history and culture. Comprehensive Park in Chongqing, on the other hand, represents modern China's urbanisation and development. The park offers modern attractions like a skating rink, a rollercoaster, and a ferris wheel, attracting younger crowds. The park also includes a section dedicated to traditional Chongqing culture, such as local folk customs and traditional architecture.

2.1 Research content

This study takes Xigu Park in Tianjin as an example. Xigu Park is located in the northeast of Hongqiao District, Tianjin. It is a comprehensive park with a long history and strong cultural characteristics. Architectural and archaeological treasures, culinary activities, festivals or events, historic or historical sites, monuments and landmarks, museums and exhibitions, national parks and ecological sanctuaries, religious venues, temples and churches are all examples of cultural tourist experiences. It is one of the four major parks in Tianjin and a popular urban green space for citizens to relax and entertain. The research uses questionnaires to collect information on residents' life well-being, park activities, park perception and emotional recovery, and uses SPSS23 software to carry out descriptive statistics and Kendall correlation analysis and statistics on the data. Kendall's rank correlation gives a test of independence and a measure of the magnitude of dependency between two variables that is not dependent on distribution. Kendall's rank correlation assesses the degree and direction of connection (determines if a monotonic relationship exists) between two variables. Multiple correspondence analysis (MCA) is a statistical method that can identify patterns and relationships between categorical variables in the context of emotional recovery and life well-being related to urban parks. This analysis can provide theoretical support for designing and managing urban parks that promote a pleasant and relaxing environment for people with different levels of life well-being, by identifying the specific categories that are most closely related to emotional recovery and life well-being.

2.2 Data collection

The research mainly adopts the questionnaire survey method. Questionnaire surveys are a methodology for collecting statistical information on a population's characteristics, emotions, or behaviours using a structured series of questions. It is mostly used for collecting fundamental information. The questionnaire is the primary data collection instrument in survey research. It is essentially a sequence of standardised questions, generally referred to as items, that follow a predetermined design in order to collect individual data about one or more specified categories. The content of the questionnaire mainly includes four parts:

1 Personal attribute information, including: gender, age, occupation, average daily working hours, etc.

2 Survey's purpose and objectives, as well as instructions on how to complete the questionnaire: may also contain information on the park and its facilities, as well as a statement that responses will be maintained anonymous and confidential.

3 Park perception and evaluation include: environmental quality, environmental perception, environmental charm evaluation, etc. Among them, environmental quality includes five measurement indicators: facility quality, facility quantity and type, sanitation, safety, and greening effect. Species richness, shelter and sociality are 8 perception dimensions; environmental charm is the two indicators of environmental interest and environmental attractiveness;

4 Emotional health evaluation, including: self-assessment of life well-being evaluation, emotional recovery evaluation, etc. The research on happiness in life is based on the SWLS 5-item scale of happiness in life proposed by Ed Diener (Pavot and Diener, 2008).

Each item is divided into 5 levels from very happy to very unhappy, and assigns 1–5 points, and calculates the total score of life happiness for each tester. Emotional recovery is measured as anxiety and pleasure. Park perception and evaluation, and emotional health were all measured using a 5-level Likert scale. Due to the large area of Xigu Park, in order to investigate and cover the main landscape nodes and various activity areas of the park as much as possible, according to the principle of proximity and the types of activities on the site, the whole park is divided into seven areas, including open squares, there are 7 types of activity units under forest activity venues, tree-lined garden roads, riverside areas, sports fields, buildings and surrounding areas, corridors or pavilions. There are four types of Gestalts grouping principles: similarity, proximity, continuity, and closure. Similarity refers to the proclivity to group things together based on how similar they are. In that "items or shapes that are close to one another appear to form groups," according to the Gestalt law of proximity. The items will seem as a group if they are near together, even though their forms, sizes, and compositions are significantly different. The questionnaire survey started in early September 2019 and ended at the end of October 2019. On working days and weekends, covering 7 areas of the whole park, paper questionnaires will be distributed at the same time in different time periods to avoid the influence of external factors such as climate and temperature as much as possible. During the investigation period, a total of 280 questionnaires were distributed, and some of the questionnaires had unanswered options. A total of 226 complete and valid questionnaires were collected, and the questionnaire recovery rate was 81%.

3 Results and discussion

3.1 Reliability and validity test

The statistical software SPSS 23 was used to organise and analyse the data, and the reliability and validity test of the data was carried out. SPSS (Statistical Package for the Social Sciences) is a software package used by researchers across several fields to do quantitative analysis on large amounts of data. It is frequently employed in healthcare,

marketing, and educational research. The types of data evaluated by SPSS are different. Results from surveys, company customer databases, Google Analytics, findings from scientific study, and server log files are common sources. The Cronbach's Alpha value was 0.813, which was greater than 0.8, indicating that the reliability of the factors in the questionnaire was high; the KMO value was equal to 0.801 (KMO > 0.8), significant. The performance was 0.000 ($P = 0.000 < 0.05$); the model had good validity.

3.2 Comprehensive evaluation of life well-being of different residents

Descriptive statistical analysis was carried out on residents' happiness satisfaction according to personal attributes. In this survey, a total of 20 people were lower than the average life happiness, 44 people had an average life happiness, and a total of 162 people had a high or very high happiness. Happiness is important for both emotional and physical health. A greater feeling of pleasure and well-being has been demonstrated to improve relationships, promote social connection and contribution to the lives of others, as well as improve one's physical well-being. At the same time, there was no self-assessment that life was extremely unhappy.

The respondents' life well-being showed significant differences in terms of gender, age, occupation, and educational level. Among them, the average score of women's happiness in life is 17.6, which is lower than the average score of men's happiness of 18.3; in terms of occupation, the average score of students' life happiness is the lowest 16.2 points, and the average life satisfaction score of retirees is the highest 19.5 points. In terms of educational level, the score of life well-being with a master's degree or above is the lowest at 16.4 points, and with the increase of educational background, the average value of life well-being shows a downward trend; in terms of the frequency of visiting the kindergarten, showing a trend that the more the number of park weeks, the higher the happiness satisfaction; in terms of the way of visiting the park, those who can reach the park by walking or cycling have the highest average score of 18.2 points in life happiness; in terms of the length of stay in the park, Except within 10 min of coming to the park (mostly passing through the park on the way), the rest of the subjects showed a trend that the longer the stay time, the higher the happiness in life. In general, residents who come to Xigu Park have an average score of life happiness above 15 points (average score of life happiness), and the overall life happiness of the respondents is relatively high (Table 1). The score of life well-being is a composite measure that combines responses to multiple questions related to various aspects of life satisfaction. After scoring each question on a scale, the scores are averaged to produce an overall score for each respondent. Researchers found that individuals with a master's degree or above had the lowest average score of life well-being. The reasons for this finding are complex and could be influenced by factors such as job stress, work-life balance, financial pressures, or other socio-economic factors.

3.3 Life well-being and regional preference analysis

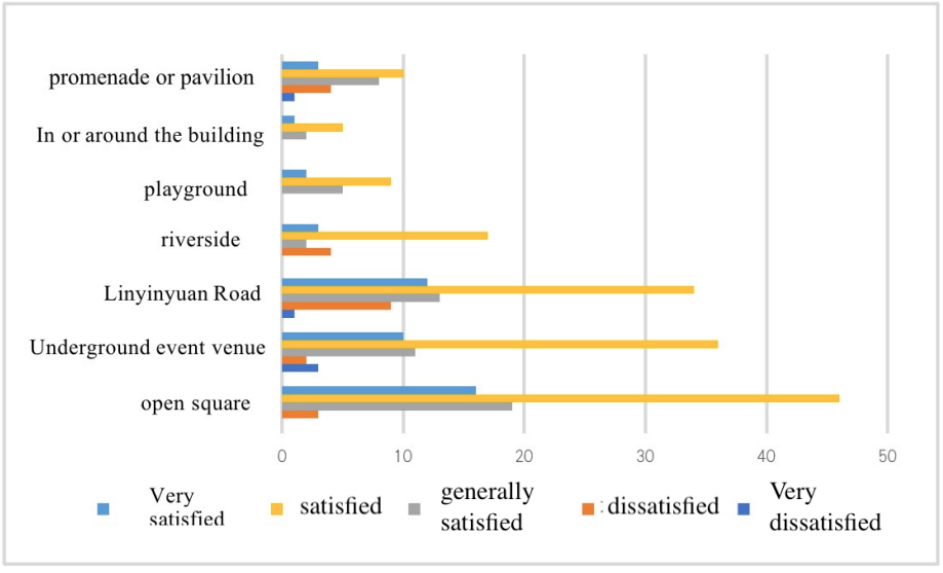
Life well-being had a significant effect on regional preference (see Figure 1). The ultimate objective of community and development programs, as well as public policy, is increasingly being recognised as well-being. This raises issues not only about what is beneficial for people and groups, but also about what constitutes a stable society. Its characteristic attitude is positive, comprehensive, and person-centered. Among them, the

most popular activity venues for residents with an average or above life happiness are open squares, tree-lined activity venues, and tree-lined garden roads, accounting for 87% of the total; riversides, sports fields, in and around buildings, promenades or the popularity of kiosks has no obvious trend relative to the average. 50% of the residents whose life happiness is lower than the average prefers to take activities on the tree-lined garden road, and the activity venues, promenades or pavilions under the forest are equally popular. Among all kinds of people with a sense of well-being in life, the understory venue and Linyinyuan Road have shown high popularity among the two groups of people.

Table 1 Personal attribute description statistics

Project	*Options*	*Average life happiness*	*Number of people*	*Percentage*
Gender	Male	18.3	112	49.6
	Female	17.6	114	50.4
Age	Under 16	15.3	6	2.7
	17–28	16.3	60	26.5
	29–45	17.6	45	19.9
	46–55 years old	18.5	43	19.0
	55+	19.6	72	31.9
Profession	Student	16.2	59	26.1
	Full time	17.8	34	15.0
	Freelancers	17.6	32	14.2
	Retirees	19.5	87	38.5
	Other	17.4	14	6.2
Educational level	Junior high school and below	18.4	33	14.6
	High school	19.0	51	22.6
	Vocational school	18.1	32	14.2
	Undergraduate	17.4	100	44.2
	Graduate and above	16.4	10	4.4
Weekly visit frequency	0 times	15.5	19	8.4
	1 time	16.8	49	21.7
	2 times	18.2	36	15.9
	3 times	17.9	39	17.3
	4 times	18.5	30	13.3
	5 times or more	19.5	53	23.5
Dwell time	Within 10 min	17.5	6	2.7
	10–30 min	15.4	27	11.9
	30 min–2 h	18.2	152	67.3
	2–3 h	18.2	28	12.4
	3–5 h	20.3	8	3.5
	More than 5 h	20.6	5	2.2

Figure 1 Regional preference (see online version for colours)



3.4 Well-being and park activities

The types of activities in the park are divided into four categories. These are leisure activities, fitness activities, social entertainment activities, quiet activities. Parks provide a diverse range of activities suitable for people of all ages and interests. There are different types of parks, each designed to serve specific purposes. Leisure parks offer opportunities for relaxation, picnicking, playing games, or engaging in light physical activities. Fitness parks, on the other hand, provide exercise equipment and spaces for people who want to engage in more intense physical activities. Social entertainment parks offer various amusement park-style rides, arcade games, and other amenities to entertain visitors. Quiet parks, in contrast, are designed to offer visitors a serene environment to escape the city's chaos and enjoy the tranquility of nature. Overall, parks are an excellent option for individuals and families looking to engage in physical activities, socialise, relax, or enjoy quiet time in a natural setting. Life well-being did not show significant differences in various activities, and most people prefer to do fitness-type activities and quiet-type activities in the park. Walking is the most popular among fitness activities (see Figure 2), accounting for 75% of the total number of people; among quiet activities, enjoying the scenery and sitting in a daze are the activities people prefer (see Figure 3). At the same time, the cross-analysis of life well-being, emotional recovery, and activity types found that most of the respondents had positive emotions during various activities, but there were also some activities that produced negative emotions, such as: walking, martial arts activities (See Figure 4), flying kites, enjoying the scenery, etc., and the generation of negative emotions is weakly correlated with happiness in life. Encouraging positive emotions can be achieved through various activities such as spending time with loved ones, practicing gratitude, engaging in hobbies, and physical exercise, among others. An individual's level of happiness in life does not necessarily impact their experience of positive emotions. Positive emotions can arise from specific experiences or

moments in time, and can be experienced even if an individual's overall life satisfaction is low. For instance, a person may feel unhappy with their life situation, but still experience positive emotions in daily life, such as feeling happy after spending time with friends or feeling grateful for small acts of kindness.

Figure 2 Fitness activities (see online version for colours)

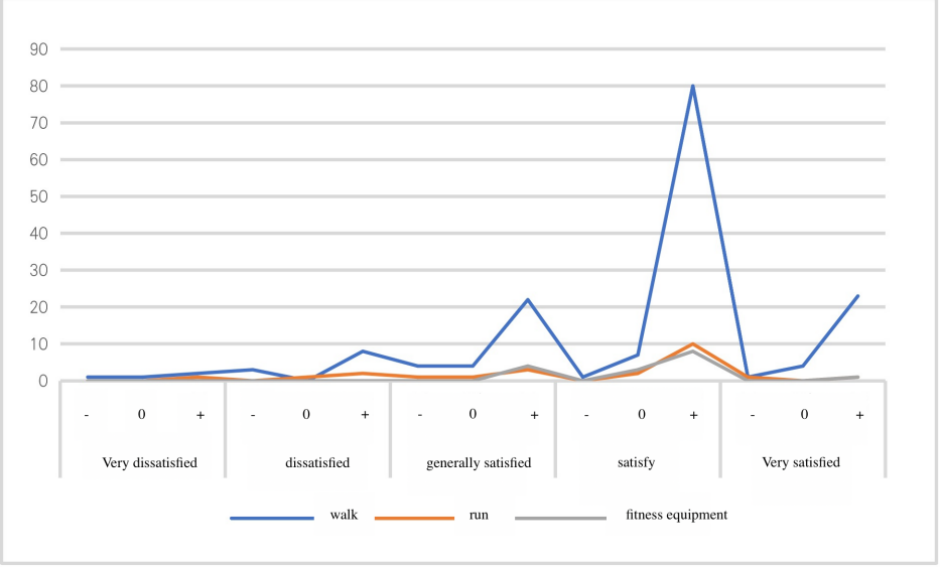


Figure 3 Leisure activities (see online version for colours)

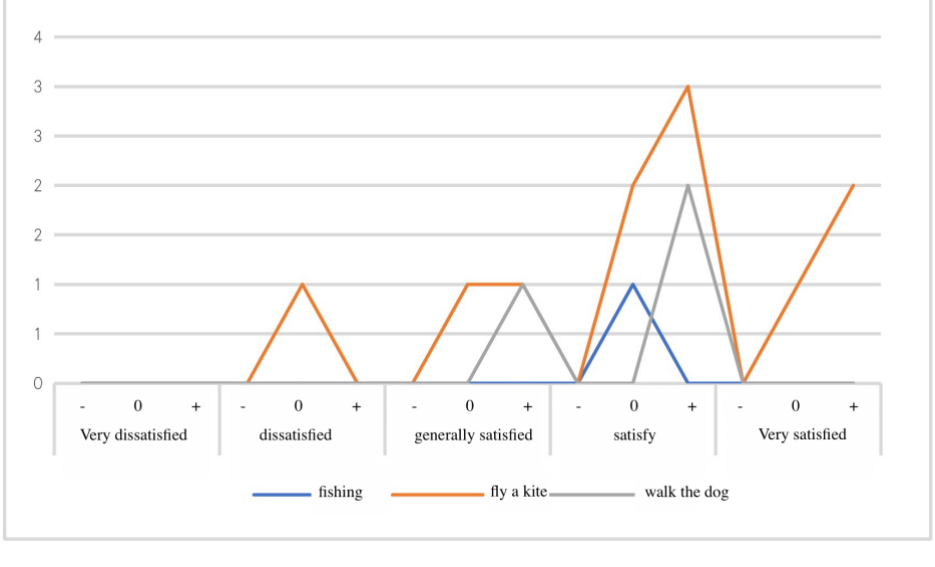
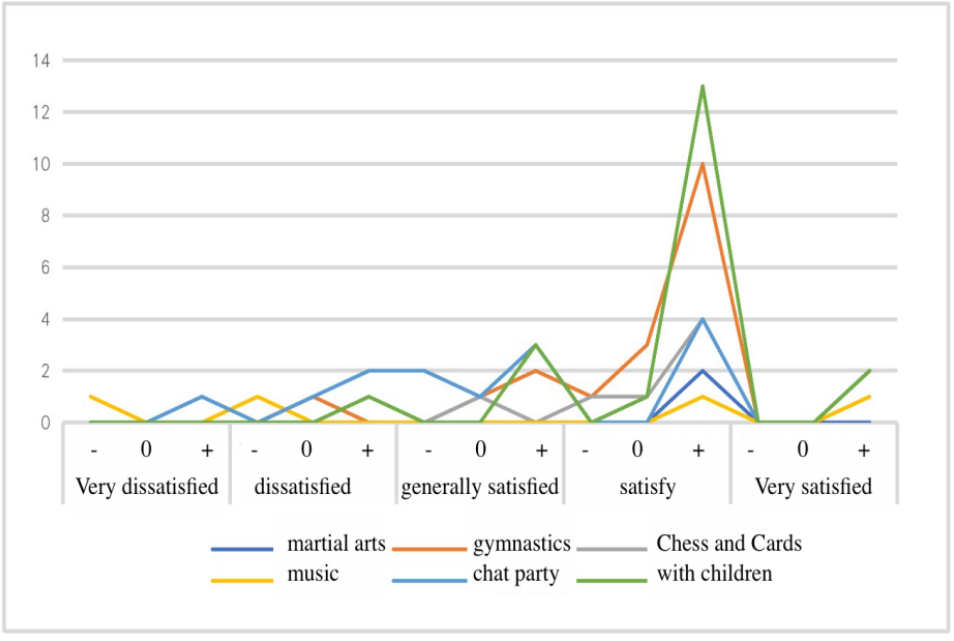


Figure 4 Social entertainment activities (see online version for colours)



3.5 The influence of life well-being and environmental perception on emotional recovery

3.5.1 Correlation analysis of emotional state

The correlation analysis between life well-being and emotional recovery showed that life well-being (0.166, $p = 0.000$) was weakly correlated with emotional recovery, that is, life well-being would affect the emotional recovery of residents' park activities to a certain extent. Continue to carry out Kendall correlation analysis on the measurement indicators of life well-being and environmental quality, environmental perception, and environmental charm to understand the relationship between life well-being and environmental perception. It can be seen from Table 2 that, except for the cultural nature (0.073, $p = 0.084 > 0.05$), there is no significant correlation between life well-being and other measurement indicators, which shows that the level of life well-being has a significant impact on environmental quality evaluation and environmental impact. Perception, environmental characteristics have a certain positive impact. Similarly, Kendall's correlation analysis was conducted on the measurement indicators of emotional recovery and environmental quality, environmental perception, and environmental charm. There was no significant correlation. Among the variables of environmental charm, the degree of interest (0.528, $p = 0.000$) and the degree of attraction (0.449, $p = 0.000$) were strongly correlated with emotional status, indicating that the charm of the environment has an important impact on emotional recovery.

Table 2 Correlation analysis of environmental perception factors with life happiness and emotional recovery

		Life satisfaction		*Emotional recovery*	
		Kendall correlation coefficient	*Significance (two-tailed)*	*Kendall correlation coefficient*	*Significance (two-tailed)*
Environmental quality	Facility quality	–0.123**	0.003	0.035	0.354
	Number and type of facilities	0.193**	0.000	0.173**	0.000
	Hygiene situation	0.156**	0.000	0.125**	0.001
	Safety	0.199**	0.000	0.158**	0.000
	Greening effect	0.147**	0.000	0.233**	0.000
Environmental awareness	Naturalness	0.161**	0.000	0.093*	0.013
	Spatiality	0.150**	0.000	0.183**	0.000
	Cultural	0.073	0.084	0.072	0.062
	Peaceful	0.120**	0.004	0.137**	0.000
	Visibility	0.132**	0.002	0.140**	0.000
	Species richness	0.104*	0.013	0.094*	0.014
	Shelter	0.182**	0.000	0.114**	0.003
	Social	0.223**	0.000	0.180**	0.000
	Degree of interest	0.175**	0.000	0.528**	0.000
	Attractiveness	0.161**	0.000	0.449**	0.000

3.5.2 Multiple correspondence analysis of life happiness, environmental charm and environmental perception

On the basis of correlation analysis, continue to explore the relationship between emotional recovery, environmental charm, and life well-being. The MCA method was used to reflect life well-being, environmental charm, and emotional recovery into a continuous list. Through the different degrees of proximity between the categories of each variable, the relationship between the different categories of the three variables was explored. The degree of proximity between categories of a variable is determined by the measurement scale used to measure the variable. There are four main measurement scales – nominal, ordinal, interval, and ratio – and each scale provides different information about the categories being measured. In the nominal scale, the proximity between categories is based on the similarity or dissimilarity of their labels. In the ordinal scale, categories are ranked or ordered based on some attribute or criterion, and proximity is determined by the order or ranking of categories. In the interval scale, the proximity between categories is determined by the numerical difference between them, while in the ratio scale, proximity is determined by the numerical difference and the true zero point.

The corresponding analysis of life well-being and environmental charm is shown in Figure 5. It can be seen from the figure that people who are satisfied and very satisfied with life pay more attention to whether the surrounding environment is attractive, and the higher the sense of happiness in life, the more attention they pay to the charm of the environment; the people whose sense of life happiness reaches the average level or below, pay less attention to environmental charm.

Figure 5 Quiet activities (see online version for colours)

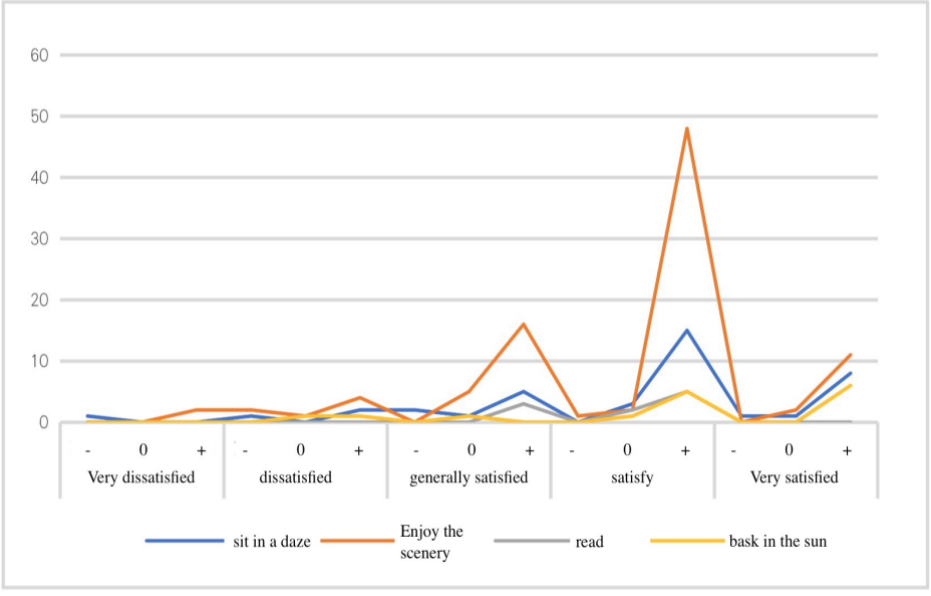
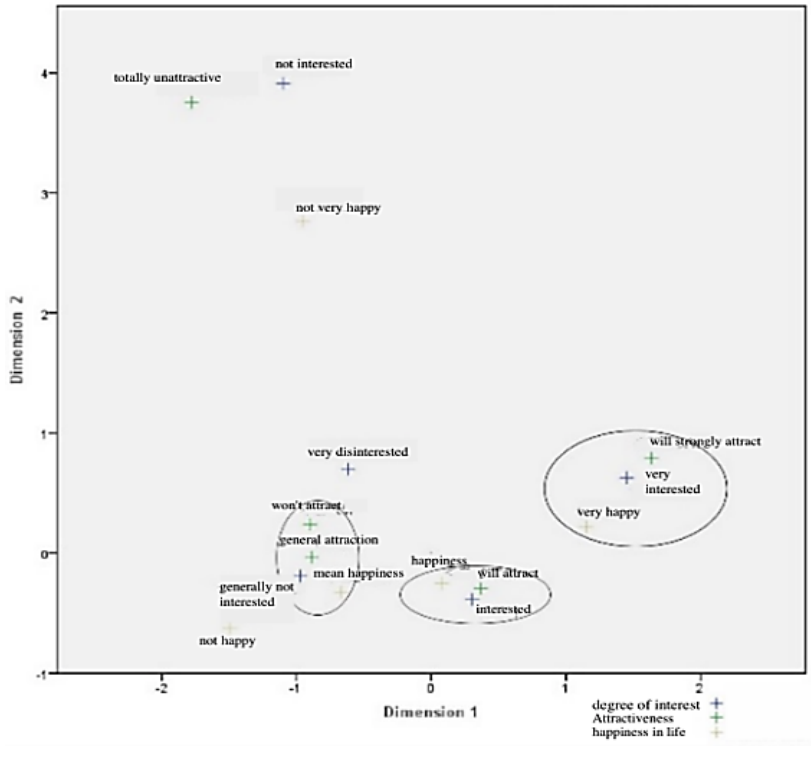


Figure 6 Correspondence analysis between life happiness and environmental charm (see online version for colours)



People who are very satisfied with life are very happy and relaxed when they are active in the park, and do not have the physical symptoms of rapid breathing and sweaty palms when they are anxious; people who are dissatisfied with life, generally satisfied and satisfied, are in Park activities will be accompanied by unpleasant and pleasant emotions, in a state of relaxation, and will not produce physical symptoms of anxiety; and people who are very dissatisfied with their lives will also be in a state of unpleasantness and anxiety during park activities state and accompanying physical representations of anxiety.

The more you can be attracted to the environment, the more you can promote positive emotional recovery, and the better you can achieve a relaxed and happy emotional state.

Life happiness is positively related to emotional status and environmental charm (see Figure 6). The two types of people with the highest life happiness pay more attention to environmental charm. The higher the environmental charm value, the happier people will be in park activities. and relaxation; people with low happiness in life pay less attention to the charm of the environment in park activities, and cannot achieve the effect of emotional recovery well.

4 Conclusion

This study investigated the impact of residents' well-being on park activities, environmental perception, and emotional recovery. The main innovation lies in the analysis of the types of activities, regional preferences, and environmental perception of residents with different levels of life well-being in the park, the longer the stay, the better the life happiness of residents.

1 This suggests that the emotional recovery from activities in the park is a dynamic and sustainable emotional impact that, as Fredrickson states, promotes long-term complete mental health and sustained well-being (Isgett and Fredrickson, 2001).

2 Most people carry out various activities in the park, which can achieve the effect of promoting positive emotions and are not affected by the level of happiness in life. The higher the quality of the environment, the better the effect of promoting positive emotions.

3 Life well-being has a certain influence on emotional recovery in park activities, and has significantly different effects in the two groups of people with high and low life well-being. People with high happiness in life are more likely to acquire positive emotions, while people with low happiness in life are not only difficult to have positive emotions, but also have physical symptoms caused by anxiety.

The above studies show that park activities can generally promote the generation of residents' positive emotions, and can improve residents' life well-being. At the same time, there are certain limitations in the research. For example, most of the respondents are people whose life happiness is above the average. Therefore, the number of samples with low happiness satisfaction obtained is small, which may have a certain impact on the

research results. Future research will use computer simulation, physiological sensor measurement and other technical means and methods to more accurately quantify the park's environmental characteristics, human perception characteristics and emotional recovery effects, and provide a more effective basis for urban park planning and design.

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