Research on the Post Occupancy Evaluation of Urban Park based on internet reviews—Take Saihan Tara City Park in Inner Mongolia as an example

Honghong Zhang 1, Guangpu Wei 1*, Haowen Fan 1, Jinfeng Li 1, Kang Yu 1

1Department of Landscape Architecture, Inner Mongolia University of Science and Technology, Baotou014010, China;

*Correspondence: weigp2007@imust.edu.cn

Abstract: From the perspective of users, the post-occupancy evaluation of Saihan Tara City Park in Inner Mongolia is carried out. This article analyzes the landscape quality and social benefits of various scenic spots in the park, provides a theoretical basis for the construction and development of urban parks in the later period, and plays an exemplary role in the evaluation of other city parks in Baotou and the later operation strategies. We use online comments for data collection and dig deeper into user comment text information. This article using semantic network analysis, analyzes Saihan Tara attraction's popularity, landscape quality, basic facilities, and other aspects of multi-dimensions and shows its deficiencies. The results show that the internal scenic spots of Saihan Tara City Park have Mongolian characteristics, which are the main factors that attract tourists to come to play; abundant scenic spots and various recreation methods are the main reasons for the high satisfaction of tourists; and at the same time, many problems have also arisen, such as poor interconnection between scenic spots, low accessibility of park entrances and internal scenic spots, relatively monotonous amusement modes, and unreasonable consumption levels in the park...Therefore, this research not only evaluates the post-use condition of urban parks, but also can be widely used in the evaluation of urban public green space using conditions, and provides the evaluation results to the government as a guide for the construction of urban public green spaces in the future.

1. Introduction
Post Occupancy Evaluation (POE) is a combination of questionnaires, interviews, behavioral observation methods, participatory observation, image analysis methods, and quasi-experimental methods from the perspective of users. At present, research on POE evaluation of urban parks in China is still at the stage of exemplary exploration. In 2004, Ying Si-ai et al. first applied POE to the post-use evaluation of residential parks [1], and the POE evaluation method has been paid attention to year by year and is increasingly used in urban park research.

Baotou city is located in the central and western part of Inner Mongolia Autonomous Region and is an important grassland steel city in China [2]. The Saihan Tara Ecological Urban Park in the central area of Baotou metropolitan area is the largest urban grassland in all of Asia [3]. However, there is a gap in the existing studies on the usage status of Saihan Tara Urban Park, and there is no systematic evaluation research method. In this paper, web reviews are used as the basic analysis data for evaluating Saihan Tara urban park, and a scientific, systematic, and reasonable post-use evaluation is made with users as the core, which provides a theoretical basis for the later construction and development of the urban park.
2. Introduction of network comment data in city park POE

2.1 Disadvantages of contact data acquisition

(1) Restricted data content, the breadth and depth of data collected depend on the investigators' knowledge of the scope of survey-related issues.

(2) Restricted data authenticity. Obtaining contact data requires contact between the investigator and the evaluator, whether it is a communication interview or supervising the completion of a questionnaire, which will have an impact on the reviewer to some extent.

(3) Data volume limitation. Contact data is usually acquired in the field on a case-by-case basis. This collection method is difficult, laborious, time-consuming, small in volume, and difficult to organize and analyze later, resulting in a limited amount and scope of data.

2.2 Non-contact data acquisition and its introduction

Non-contact data acquisition distinguishes itself from traditional, mainstream sampling statistics and relies on all previous data acquired by information technology [4]. The emergence of non-contact data acquisition is a powerful complement to traditional manual interventions to obtain data [5].

With the development of online ticketing and open information technologies. Since the information is collected anonymously, tourists can speak freely on these open platforms and spontaneously share their true feelings and evaluations after their visit. Non-contact data acquisition has the advantages of being more realistic, more accessible, more stable data sources, and a larger database than data obtained through traditional methods [6].

3. Saihan Tara City Park and its online reviews

3.1 Overview of Saihan Tara City Park

Saihan Tara City Park (109.88-109.91; 40.54-40.60) is the largest original grassland wetland city park in Asia, also known as "Saihan Tara City Grassland" ("Saihan Tara" in Mongolian means "beautiful grassland"). It is located in the center of five urban areas in Baotou, with a total area of 7,700,000 m², including 1,500,000 m² of woodland and 5,000,000 m² of grassland, with a narrow north-south length of about 4,100 m and an east-west width of about 2,200 m. The elevation of the park is 1034 m to 1058 m. The west side of the park is close to Wanqing Road, which is a strip of the terrace, rising gradually from south to north, with a height difference of 8-10 m from north to south. It is the largest urban natural grassland park in Asia.

3.2 Saihan Tara City Park Web Review Collection

Using crawler software Houyi Collector (V3.5.4), a total of 513 online reviews of Saihan Tara City Park were collected up to 00:00 hours on April 1, 2021. Web reviews were collected from several websites, including "Qunar", "Ctrip", "Mafengwo", and "Dianping" etc. The publication time was distributed in 2013-2021 (Table 1). The data of online reviews mainly included the release website, release time, and review content (Table 2). After comparison and keyword interpretation, invalid advertising campaigns and completely duplicated text information were removed, and a total of 501 valid text data were obtained.

Table 1 List of web comment release time

| Year | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Aggregate |
|------|------|------|------|------|------|------|------|------|------|-----------|
| Count | 11   | 66   | 99   | 100  | 93   | 50   | 49   | 31   | 2    | 501       |
Table 2 Statistical table of online comment text data

| Index | URL | Date | Content |
|-------|-----|------|---------|
| 001   | Ctrip | 2021 | It's really great to have such a big grassland in the city! But it seems to come at a bad time, the grass is withered, my friend said it's a bit like a loess plateau. But I think it's okay, it's big inside, and I suggest renting a bike at the entrance. |

4. Post-use evaluation of Saihan Tara City Park based on web reviews

The content text analysis method was used to analyze the multidimensional data, which are online reviews [7]. The content text analysis method is a systematic quantitative approach to analyzing the content of text data [8]. The starting point is qualitative semantic classification, and the text is systematically processed using quantitative theoretical methods and statistical tools to convert objective information into visual language based on theoretical rules, including word frequency statistics, building co-occurrence matrices, drawing semantic network diagrams, etc., and then summarizing qualitative conclusions through quantitative data, showing the implicit information in the text, and making an objective evaluation of things for the current situation and guiding suggestions for future development. We then summarize the quantitative data to draw qualitative conclusions, present the implicit information in the text, and make an objective evaluation of the current situation and suggestions for future development.

4.1 High-frequency word statistics and its semantic network relationship mining

Text mining and analysis based on ROST CM6 software user comments. The software is a social computing platform for text information mining and analysis, which is capable of performing a series of text analysis operations on text content such as word separation, word frequency statistics, word filtering, and social and semantic network analysis [9]. Based on the existing reference lexicon of the software, the content about Saihan Tara City Park was expanded by adding emotional and landscape-related words. All the acquired text information was divided into words and counted to obtain high-frequency words, and the top 600 high-frequency words were intercepted as reference words for analysis (Figure 1).

![Figure 1 Statistical chart of the frequency of Internet comment words](image)

Fit the matrix frequency with a logarithm to get it.

\[ y = \lg P(x) = 46.619 - 5.896\ln(x) \]

Where the coefficient of determination \( R^2 = 0.805 > 0.7 \) indicates that the co-occurrence word frequency conforms to the Zipf distribution.

A text co-occurrence matrix was created based on the statistics of high-frequency words, and the matrix of the top 2000 frequencies was used as the basis for the network analysis chart (Table 3).
co-occurrence matrix was coded into the format of "word A + word B + co-occurrence frequency C", and the semantic network was visualized using Rhino+Grasshopper software (Figure 2).

Table 3 Co-occurrence matrix of high-frequency words

|        | grassland | in the city | Baotou | park | Pretty good | bicycles | free | Sanhan Tara | many | …… |
|--------|-----------|-------------|--------|------|-------------|----------|------|--------------|------|-----|
| grassland | 138       | 79          | 61     | 58   | 40          | 57       | 52   | 47           | 52   | 20  |
| in the city | 38        | 27          | 23     | 19   | 20          | 27       | 20   | 24           | 20   | 20  |
| Baotou   | 79        | 38          | 28     | 22   | 16          | 20       | 32   | 24           | 20   | 20  |
| park     | 61        | 27          | 28     | 10   | 20          | 27       | 24   | 19           | 20   | 20  |
| pretty good | 58         | 23          | 29     | 10   | 15          | 13       | 9    | 20           | 20   | 20  |
| bicycles | 40        | 19          | 16     | 20   | 15          | 19       | 5    | 15           | 20   | 20  |
| free     | 57        | 20          | 20     | 27   | 13          | 19       | 8    | 18           | 20   | 20  |
| Saihan Tara | 52         | 27          | 32     | 24   | 9           | 5        | 8    | 11           | 20   | 20  |
| many     | 47        | 20          | 24     | 19   | 20          | 15       | 18   | 11           | 20   | 20  |

Figure 2 Semantic network analysis of high-frequency words

4.2 Evaluation of word classification to build a multidimensional framework

The words were manually filtered into five dimensions of semantic words such as Scenic spot, Tour mode, Season, Emotion and Operation (Table 4), duplicate words were removed, valid words were coded, filtered in the high-frequency word co-occurrence matrix, and built a new co-occurrence matrix, and the attraction-emotion network relationship map was made using Rhino+Grasshopper software (Figure 3).

Table 4 List of semantic vocabulary categories

| Category       | Keywords (frequency)                                                                 |
|----------------|---------------------------------------------------------------------------------------|
| Scenic spot    | grassland(444), Yurt(41), OBOO(39), Scenic areas(35), wetlands(32), sika deer(31), grass(22) …… |
| Tour mode      | bicycles(66), walking(30), battery car (18), cycling(18), bicycle(14), run(12), trekking(12), walk(9) |
Season  summer(37), winter(15), season(12)
Emotion  pretty good(95), worth(61), fit(50), beautiful(40), like(24), nice(23), feelings(22), freshness(21) … …
Operation  free(64), tickets(33), quality-price ratio(11), charges(9)

Figure 3 Attractive-emotional network relationship diagram

4.2.1 Overall satisfaction is high
To specifically analyze visitors' satisfaction with the Saihan Tara City Park, the emotional words in all valid texts were first counted, and all reviews were classified into three levels of emotional values using the EmotionCalculator in ROST CM6 software, and the emotional word frequencies were counted (Table 5). According to the statistics, 68% of all the reviews were rated as good, and most of those who gave good reviews thought that the environment of the attraction was good and the scenery was beautiful; 28% of all the reviews were rated as moderate, and generally thought that the parking around and inside the park was convenient, the entertainment and touring facilities inside the park were complete, and the accessibility of the park sights was high; 4% of all the reviews were rated as poor, and a small number of visitors commented that it was tiring to visit the park by walking and that it was not easy to visit the park in winter. A small number of visitors commented that it was tiring to visit the park on foot, that there were too few amusement facilities to protect them from the cold in winter, and that the park was an ecological park with signs of overdevelopment. The majority of the ratings were positive, so visitors were satisfied with the park's installation and management.

| Class       | Keyword (frequency)                                                                 |
|-------------|-------------------------------------------------------------------------------------|
| Good        | well(190), beauty(71), great(8), fragrance(5), be fond of(5), worth(61), beautiful(40), pretty(23) … … |
| Generally   | nice(95), suitable(50), leisure(44), entertainment(18), average(17), recommended(23), convenient(13) … … |
| Bad         | tired(11), little(7), poor(4), pity(7), inadequate(4), bleak(1), bare(1), improved(3), scared(1), monotonous(1) |
4.2.2 Analysis of attraction mentions and their semantic networks

Most of the tourists evaluate the scenic spots in the mode of "attraction+evaluation+emotion". After manually filtering the list of terms and their frequencies (Figure 4), we found that the main keyword of Saihan Tara City Park is "grassland in the city", and the mentioned rate of the word "grassland" is much higher than other sights, so this is the core attraction of Saihan Tara City Park and the initial impression of tourists. This is the core attraction of Saihan Tara Eco Park, and also the initial impression of the visitors.

![Figure 4 Histogram of high-frequency words and their frequencies for names of attractions](image)

According to the nature of the sites in Saihan Tara Eco Park, the sites were divided into two categories: Ecological sights and Recreational sites (Table 6), and the mention rates were 45.6% and 54.4%, respectively. The top three sites mentioned frequently were "yurt", "OBOO" and "wetland", after sifting out general words with unclear meanings such as "sites" and "scenery". As well as the less frequently mentioned sea of flowers, cattle and sheep, and (Mongolian) architecture, with the frequency difference between 23 and 33. The high-frequency words of the sites were filtered out in the high-frequency word co-occurrence matrix and a seasonal-attraction network relationship diagram was established, in which it can be seen that the combination of ecological viewing and recreational play can better meet the expectations of most tourists. However, due to the seasonal differences of ecological sites, the landscape in summer is richer, and most of the words co-occurring with "summer" in the review text are "beautiful", "lush", etc. In winter, the landscape is relatively monotonous, and visitors' comments are mostly negative words such as "monotonous" and "withered", so most of the sites with low mention rate are ecological sites. It can also be observed that although recreational sites are much less affected by seasonal changes than ecological sites, they are still not the main attraction for visitors.

Table 6 Statistical table of categories of attractions

| Category       | Scenic spot (frequency)                                      |
|----------------|-------------------------------------------------------------|
| Ecological     | wetlands(32), sika deer(31), grassland(22), sea of flowers(12), cattle and sheep(11) |
| Recreational   | Yurt(41), OBOO(39), horse farm(17), Grant Camp(16), Archery and Range(14), ski resort(2) |

4.2.3 Infrastructure and project consumption

Since price consumption accounts for a minority of the reviews, "price", "cost", "consumption" and other consumption-related keywords were recorded into a table (Table 7), and all reviews were screened, and the relevant review texts were retained and then manually interpreted. The statistics show that.

(1) Saihan Tara City Park is the largest open park in Baotou, and "free" is a key factor in the price evaluation.
(2) Most of the people think that the price is not good for the many fee items in the park, specifically "the deer park is expensive" and "the yurt is not good for the price, it's expensive", etc.

(3) The comments mentioned many times that snacks are expensive, among which there are 12 comments related to special snacks such as yogurt and mutton skewers, and 8 comments considered expensive.

Table 7 List of keywords for consumer-related comments

| Category | Keyword(frequency) |
|----------|-------------------|
| Operation | consumption(2), charges(10), price(8), expensive(9), free(64), cheap(2), quality-price ratio (11) |

5. Optimization Strategies for Saihan Tara City Park

Based on the above evaluation of the usage condition based on online reviews, we explore the improvement suggestions for Saihan Tara City Park, hoping to improve the operating system of the park through minor adjustments. At the same time, these improvement suggestions are also applied to the pre-design and post-management of other urban parks.

5.1 Establishing interdependent links among regional attractions

There is often a problem of poor connectivity between scenic areas in the park. The main reason for the problem of the large variability in visitor volume despite the compact location of scenic plots is the poor organization between the park and attractive entrances and park tour paths.

5.2 Fee perception and transaction volume of park operations

The park operates fee-based products including amusement services and physical goods. A survey of visitors' willingness to pay can provide insight into the acceptability of the products and help with subsequent pricing. Some visitors to the park mentioned that the food prices in the park were too high, and many of the park's sights, such as the Deer Park and Yurts, were generally considered "not very cost-effective". The cost-effectiveness of the park is part of the issues that people consider when choosing to visit the park. Saihan Tara conducted a web-based survey through POE to rationalize pricing and improve cost-effectiveness while improving the quality of the rides to give visitors a better experience.

6. Conclusion

This paper takes the Saihan Tara City Park in Baotou Inner Mongolia as an example, and introduces web review text data, adopts content text analysis method, and studies its post-use evaluation with the help of semantic analysis technology and visualization means. The paper explores and proposes recommendations for the pre-planning and design of urban parks and subsequent park management, and summarizes the advantages, disadvantages, and application of online review text data in urban park POE research. It can be found that the advantages of web review text data in POE research of urban parks are: firstly, a large amount of information in the acquired text data can help researchers break the limitations of thinking and expand the scope of cognition in the preliminary stage of investigating data; secondly, the existence of multiple information such as emotions, mentions, and co-occurrences of sights in the text content is convenient for researchers to study tourists' evaluation of urban parks from different dimensions; thirdly, the non-contact feature of collecting and processing data can restore the most realistic thoughts of visitors to urban parks, and put forward valuable and effective suggestions for the subsequent construction and management of parks. Future research on POE related to urban parks will further explore the implicit content of multidimensional information, focus on the combination of contactless data acquisition methods such as online reviews and other traditional data acquisition methods, and make feedback suggestions for the construction and management of urban parks so that urban parks can bring a better experience to visitors and maximize their comprehensive benefits.
Acknowledgments:
This research was funded by Natural Science Foundation of Inner Mongolia Autonomous Region (2018LH07002) and (2020GG0227).

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

References:
[1] YING Si-ai, WANG Jian-yun."The case study on application of post occupancy evaluation on parks of residential district." Zhejiang university of Technology .03(2004):. doi:.
[2] Li Jing.Baotou City Tourism Image.2013.Beijing Jiaotong University,MA thesis.
[3] Li Yufei, Tian Tian,and Qian Kedun."The Tourism Development Conception of Saihan Tara Ecological Park under the System of Cultural Inheritance."Art Science and Technology 32.05(2019):96. doi:.
[4] WANG Lin,and BAI Yan."Analysis on Online Reviews-based Post Occupancy Evaluation on City Parks——A Case Study of Shushan Forest Park in Hefei."Chinese Landscape Architecture 36.06(2020):60-65. doi:10.19775/j.cla.2020.06.0060.
[5] YANG Jun et al."Research progress on human settlements:From traditional data to big data+."Progress in Geography 39.01(2020):166-176. doi:.
[6] HUANG Shushu,and WANG Hui."Analysis on Online Reviews-based Post Occupancy Evaluation on Urban Comprehensive Parks——A Case Study of Xuanwu Lake Park in Nanjing."Landscape Architecture 38.01(2021):81-87. doi:.
[7] LIN Yu-bin, GUO Wei-feng,and LIN Kai-miao."A Study on the Homestay Experience in World Heritage Site Based on the Network Text Analysis——In the case of Wuyishan Homestay."Journal of Xi'an University of Architecture & Technology(Social Science Edition) 39.04(2020):66-73+87. doi:10.15986/j.1008-7192.2020.04.010.
[8] CHENG Yu, SONG Hang,and CHENG Li."Research on the Image Perception of Film and Television Theme Parks Based on Web Text Analysis: Taking Zhengzhou Jianye·Huayi Brothers Film Town as an example."Market Forum .01(2021):46-52. doi:.
[9] FU Ye-qin, WANG Xin-jian,and ZHENG Xiang-min."Study on Tourism Image Based on Web Text Analysis:Case of Gulangyu."Tourism Forum 5.04(2012):59-66. doi:10.15962/j.cnki.tourismforum.2012.04.015.