

ORIGINAL ARTICLE

Research on the Evaluation of Communication Activities Space in City Park

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Abstract

With the methodology of AHP, this paper focuses on communication activities and their constituents in city parks, selecting 11 constituents, natural or artificial, and establishes an evaluation model on the basis of the analysis of the characteristics of tourists' communication activities in order to obtain the weight and order of importance of the constituents of communication activities space. First-grade indicators influence weight and the order of the constituents of communication activities space are: artificial constituents (0.6614) > natural constituents (0.3386). The weight and order of five secondary indicators attached to natural constituents: private space (0.1538) > shade tree (0.0955) > gentle slope mound (0.0474) > beautiful waterscape (0.0270) > sunshine lawn (0.0149); the weight and order of six secondary indicators attached to artificial constituents: field boundary (0.2865) > Leisure chairs (0.1843) > resting areas (0.0795) > appropriate square (0.0533) > tree-lined road (0.0352) > landscape sketch (0.0227). Using modern decision analysis methodology to research the relationship of environment constituent elements has great theoretical and practical significance for the scientific design and construction of suitable environment for human needs.

Key words : City parks, Communication activities, The methodology of AHP, Evaluation model

1. Introduction

Communication is a basic need in people's lives. Parks are important places for outdoor communication activities of people. In general, the form of communication activities in the park is that when people stroll for a rest; they may meet bilateral communication activities with others, such as greeting, chatting, dating and passive contacting brought by

seeing, hearing and meeting (Marcus et al., 2001). Jan Gehl, a Danish scholar, points out in his *Life between Buildings* that colorful activities and events together with inspiration and passion are one of the most important qualities of public space (Gehl, 2002). Therefore, it is clear that park space is one essential condition for park quality's improvement and environment attraction's creation.

Current studies have obtained some achievements

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concerning landscape creation methodologies of communication space in park. However, how can it be in line with reality to improve utilization efficiency of communication activities' space in park? This problem can be solved only by going to parks having been built and being used to investigate real tourists to know about deeply their behavior characteristics and psychological demands with mathematical methodologies for statistical analysis. At present, it is obvious that there are few similar researches in China. With the methodology of AHP, this paper analyzes the relationship between communication activities' space constituents and tourists' demands in order to inspect environmental quality of parks being put into service and to provide basis for communication space designs of new-built parks.

2. Materials and Methods

2.1. Investigation methodologies

Tourists investigation in the three representative and comprehensive parks of Tai'an city in Shandong Province is carried out in April and May, 2012, Table 1. The basic situation of survey park (Zhang and Piao, 2012). To obtain scientific research findings, this investigation is divided into two steps. The first step is a preliminary investigation which is to verify

the accuracy of questionnaire in formal investigation. 50 citizens are selected at random for questionnaire and intensive interview. Questionnaire will become more detailed and scientific through revision according to aggregating analysis of citizens' answers and interview records. The second is a formal investigation which is to conduct questionnaire investigation for tourists on sites and ask interviewees to do questionnaire face-to-face in communication activities space of parks. Questionnaire involves in interviewees' personal attribute information (gender, age, educational level, cultural level, etc.), communication activities' category, preferences for communication activities' category and so on. 900 questionnaires are distributed, 837 of which are get back effectively, and the effective recovery is 93% in formal investigation.

Experts are investigated in September and October, 2012. Expert investigation is one kind of investigation which makes use of experts' knowledge and experience to acquire information. More authoritative information can be achieved through their judgment, evaluation and predication. Respondents are 25 teachers, postgraduates and experts engaged in garden planning design for a long period. The first investigation is to consult suggestions for primary evaluation factors to define scientific and reasonable evaluation indicators of space constituents; the second

Table 1. The basic situation of survey park

Name of park	Location	Area (hm ²)	Type	Number and category of facilities	Surrounding situation
Nanhu Park	Nearby Lingshan Street in Tai'an city	17.4	Comprehensive park at the city level	Neutral	Commercial land Residential land
Donghu Park	Intersection of Lingshan Street and Hushan Road in Tai'an city	9.8	Comprehensive park at the city level	Very	Residential land Commercial land
Longtan Park	Tiandi Square and its north of Dazhong Bridge East Road in Tai'an city	5.3	Comprehensive park at the district level	Few	Residential land, lawn

Note: the numbers of facility and its type are compared in a relative sense according to the three parks, which are divided into neutral, very and few.

is to request experts interviewed to carry out comparison of indicator factor important for defined constituents in pairs in order to determine relative important degree of these indicator factors and make preparation for data analysis. Questionnaires are distributed in two times. 25 questionnaires are given out and get back every time and the recovery ratio is 100%.

2.2. Analysis methodologies

This research is to analyze space constituent indicator impacting communication activities of park and its relative importance. The specific operation methodology is, at first, questionnaire investigation for experts is conducted to make subjective judgment to objective trend according to their experience, give quantitative description to indicator factors with 1-9 ratio scale in the methodology of AHP, and compose a judgment matrix. Then the weight value of indicator factors with mathematical methodologies is worked out and, at last, the important order of indicator factors is defined.

3. Results and Discussions

3.1. Communication activities' type and preference of tourists

The result of questionnaire investigation shows that communication activities type in park citizens of Tai'an city participation everyday includes social contact, dating, friends' party, club activity, festival gathering, sitting and chatting, reading books and newspapers, sitting and watching, taking photo, feeding dove and others. The five most popular activities are sitting and chatting, club activity, dating, sitting and watching, and friends' party, the proportion accounting for of which are 23.6%, 16.1%, 14.2%, 9.8%, and 9.4% (Fig. 1). The observation result in park indicates that communication activities display the difference in age. Children, under the age of 18, have strong curiosities and like playing with children at the same

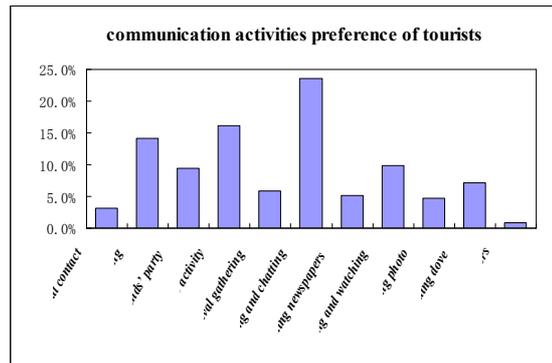


Fig. 1. Communication activities preference of tourists.

age, showing strong sense of group. They interact while playing together in club activities such as festival gatherings and feeding animals; young people, between the age of 19 and 34, are in the stage of having a love affair, making friends, getting married and developing their careers. Dating for love accounts for the largest proportion in this age group in which it is obvious that male and female are in pairs. In addition, young students mainly organize communication activities by joining friends' party and club activity, which is also a major feature in this age group. Middle-aged people, between the age of 35 and 54, whose cause is in an important period of development and whose work is relatively busy, accompany their children and families for mainly relaxing themselves in communication activities in park. The aged people over the age of 55 have a lot of leisure time, but they feel lonely easily and thus eager to interact with others. They are inclined to choose familiar places to contact with people of the same age and class mainly for chatting on a seat, which, apparently, has a feature of gatherings of the same sex. The aged people may also divert themselves from loneliness by participating in club activities interested and watching on a seat in park. Nanhu park has a large area and there is a quite long road for walking around the water in the center. Beautiful scenery provides better walking and dating places for young people to be in love and make

friends, and an open area and favorable environment for groups of young students to organize park parties, club activities and friend's gatherings at weekends. Donghu park, next to residential areas, is an important place for old people to dispel loneliness, where they can meet people, with similar tastes and interests, to have a small talk and share their lives. Although they only sit quietly, looking people coming and going, old people can also relieve and relax themselves and enjoy their comfortable lives. Besides, it is beautiful scenery to feed doves in Donghu park at every festival and weekend. The close distance between children and small animals get the relationship of human and nature closer. Children learn to love and be cheerful in curiosities and happiness. Longtan park, located in Mount Tai scenic area, has mountains, water and beautiful natural scenery. Therefore, more people gather there mainly for friend's parties, taking photos and club activities in festivals and holidays. At present, environmental facility needs to be increased in Longtan park which lack of necessary rest facilities and seats is one of reasons of causing fewer communication activities. In one word, although communication activity of park occurs differently with the change of time and place, it still follows a certain regular pattern and constant mode. Researching the relationship between communication activity's behavior characteristics of people in park space and its constituents can explore factors' induction on communication behavior and analyze space constituents and their influence and attraction for communication activity.

3.2. Space constituent analysis of communication activity in park

Communication space in park is an activity place formed by a space being carrier, people's behavior being content and incidents being medium (Liu et al., 1996). Obviously, it is one of important criteria to

evaluate park's utilization efficiency and tourists' fondness degree that if a park can provide activity space suitable for different communication activities. However, the key problem, making communication behavior appropriate for its space feature in park, can be resolved by correctly selecting space constituent indicators of park and establishing an evaluation system in a scientific way.

3.2.1. Principles of selecting space evaluation indicator of communication activity of park

The primary condition, of conducting scientific evaluation for park's communication space, is to define specific evaluation indicators on the basis of objects' objective nature and evaluation purpose. A scientific and reasonable system of evaluation indicator can only be composed by finding comprehensive and correct evaluation indicators to reflect objects and quantizing differences between defining factors with the methodology of combining qualitative and quantitative analysis. Consequently, evaluation factors, as the basic measure of evaluating objects, are selected with comprehensive consideration of materials and subjective and objective factors, which are associated with objects. The basic principles of selecting specific indicators are:

(1) Comprehension principle: park environment's space constituents are multifunctional in landscape, multi-dimensional in space and complex in evaluation objects. The selection of indicator factors should, from tourists' psychological tendency to space utilization of communication activity, objectively reflect the real utilization situation of communication activity space, avoid producing one-sided indicator-orientation and complicated quantity because of conflicts in value and aesthetics of different tourists and aimless pursuit for comprehensive information, analyze data in a scientific and correct way, and really and objectively reflect objects' features.

(2) Definition principle: it refers to that specific

indicators having been made should have definite meanings. Environment indicator of park may have different meanings due to the influence brought by region, culture, history, economy and other factors. Defining indicator' meanings can make indicators compared conveniently to know their degree concerning relative advantages and disadvantages, which is helpful for obtaining accurate and practical results and enhancing comparability of evaluation results in park environment of different period, type and region.

(3) Operability principle: indicator system shall have strong operability. Therefore, information should be collected on site in park and authoritative references and normative materials, collected easily, should be used as far as possible in order to choose indicator factors with objectivity, practicality and simplicity. Data, difficult to collect or without universal representative significance, is not included in indicator system, which is to more intensively reflect functional characteristics of activity space of park.

3.2.2. Selection and description of evaluation indicator of communication activity space in park

3.2.2.1. Evaluation indicator's definition and evaluation system's establishment

Physical environment, of communication activity in park, needs to be constituted by different landscape elements. The way in which it has an effect on people's behavior is that environment subject and object display in a specific form of space and time through internalization and integration first. Moreover, people's psychological environment mainly shows recessive and indirect forms. So the selection of indicator of communication activity space in park, is more direct and operable from the aspect of physical environment. This research selects originally 18 space constituent indicators divided into two types on the basis of deep observation into communication activity and its space environment of tourists in park, and classification and conclusion for evaluation

indicator with a lot of investigation of authoritative references. After that, deep discussions with garden professors, postgraduates and experts engaging in gardening for a long time are carried out in order to guarantee indicators' scientificity, accuracy and authority, then their proposals and suggestions for revision are accepted. At last, evaluation system is constructed with 11 indicator factors selected finally through comprehensive arrangement of investigation results of experts. The specific operation process is as follows:

(1) Primary selection of evaluation indicator. On the basis of previous questionnaire investigation to tourists, indicator selection of evaluation in communication activity space of park, is mainly based on on-site observation in park with supplement of reference research to obtain comprehensive and objective evaluation factors with particular emphasis. Indicators selected shall, as far as possible, reflect all natural and artificial factors associated with tourists' communication activity in park and try to have a guiding function on the construction of park space. Since the factors of physical environment in park is comparatively complex, they must be summed up and analyzed with a scientific methodology, which can get indicator factors closely connected with activity space, providing a base for correct evaluation. Through a questionnaire investigation' to three typical parks in Tai'an city, this paper first shows that daily communication activities participated by Tai'an citizens include 12 main projects such as social contact, dating, friends' party and club activity. Among those activities, sitting and chatting, club activity, dating, sit-watching and friends' party are the five most popular communication activities. They have the most participants and account for 78% of all communication activities in the park. With the in-depth and careful observation on the space the above five communication activities of the park need, this paper then records the relationship between

different types of communication behavior and the constituents of their space environment and summarizes 18 typical evaluative indicators combining with document consulting. The natural constituents include: ①sunshine lawn, ②beautiful waterscape, ③gentle slope mound, ④shade tree, ⑤animal community ⑥ private space; artificial constituents include: ① landscape sketch, ②tree-lined road, ③appropriate square, ④resting areas, ⑤field boundary, ⑥beautiful pavement, ⑦leisure chairs, ⑧reasonable road, ⑨field security, ⑩garden architecture, plant landscape and viewing platform.

(2) Determination of the evaluation indicator. After the primary indicators are determined, considering the differences existed in how professionals and ordinary tourists understand the meaning of environment and their different evaluation principles and starting points, experts are still need to be consulted to guarantee the authority, typicality and operability of the indicators. Experts consultation is carried out with a questionnaire investigation by a process of elimination, during which 25 teachers, postgraduates and experts engaged in garden planning design for a long period are invited to eliminate seven factors they think to have minimal effect on communication

activities of the park and 11 indicators are ultimately kept after stripping out and synthesizing the survey results of each expert information. Thus, the 11 evaluation factors which have significant effect on people's communication activities of park are determined and an evaluation system is established accordingly.

(3) The evaluation system of communication activities space of city park is established by selecting the “target- indicator hierarchy” according to the analytic hierarchy process (AHP) (Jin et al., 2004). Evaluation system is composed of three levels in which of evaluation target is the first level. According to characteristics of park landscape environment constituents, it can be seen that communication activities space of city park is evaluated from two aspects--natural constituents and artificial constituents and these two all-around evaluation indicators constitute the second level of the evaluation system. The third level of evaluation system was composed by indicator factors which are determined and selected according to operation of the above two steps to reflect typical characteristics of activity space. The details are shown in Fig. 2.

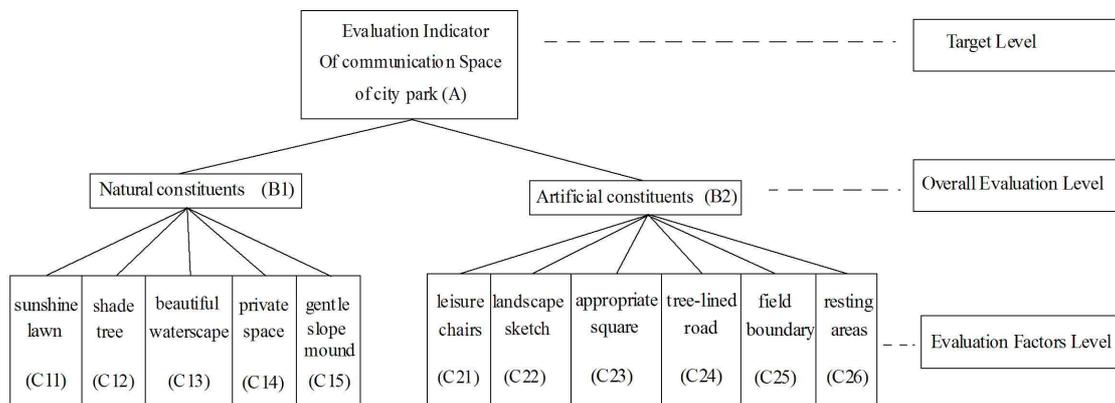


Fig. 2. The evaluation system of communication activities space of city park.

3.2.2.2, Evaluation indicator model and factor meaning description

The details of evaluation indicator and factor meaning description (Tan, 2011) are shown in the following table (Table2).

3.2.3. Weight of evaluation indicators of communication space of city park and its consistency check

The indicators weight is the quantitative numerical value which can reflect the importance of different evaluation indicators and their different proportions, and its determination is a process of unity of subjectivity and objectivity. The status and role each constituent plays in target level and the impact extent it has to total indicators can be reflected by making

clear the weights of each indicator in the whole evaluation system which is an important part of this paper. Firstly, because establishing the evaluation system is very professional work, when the experts are invited to make comparison and assignment to indicator factors in different levels, they need fully understand the investigators' intention and judge more professionally according to the evaluators' own experience to determine the difference of each evaluation factor's importance (Liu et al., 2012). The details of the evaluation criteria are shown in Meaning of scale 1-9 (Qu et al., 2005) (table 3). Then, the judgment matrix is established and weights of indicators in each level are calculated by processing the data collected from the experts' questionnaires which evaluate between every two

Table 2. Indicators of communication space of city park and their description

Target level A	indicators Level		
	First indicators B	Secondary indicators C	indicators Meaning Description
Evaluation indicators of communication Space of city Park (A)	Natural constituents (B1)	sunshine lawn (C11)	To cover the surface and beautify the open space, for people to have a rest, implying space in the plane
		shade tree (C12)	Shade trees in enclosed top surface can define space range and form cohesion space
		beautiful waterscape (C13)	Beautiful waterscape cause aesthetic pleasure feeling of sight,hearing and touch
		private space (C14)	The space formed by the elements such as landforms and plants has a strong sense of territory and is suitable for intimate communication
		gentle slope mound (C15)	There are altitude changes in the dynamic topographic relief and inside and outside view changes formed by the space limit
	Artificial constituents (B2)	leisure chairs (C21)	Table and chair and other facilities satisfy the activities such as outdoor resting, chatting and watching
		landscape sketch (C22)	Facilities in scenic spot are flexibly distributed with sketches in suitable scale and rich shapes such as sculptures and flower beds
		appropriate square (C23)	The square which is paved in flatness and has appropriate size, has features of attracting people and facilitating group activities and parties
		tree-lined road (C24)	Enclosed shade space on the top surface with a keen sense of direction can limit and lead traffic streamline
		field boundary (C25) resting areas (C26)	The limited field scale is featured with liquidity and permeability forming a small-scale construction space People can have a brief rest and communicate with each other in small-scale man-made building and facilities space

indicators with weighted average technique. The calculation methodology is as follows:

Suppose the largest eigenvalue of P the judgment matrix of order n is λ_{max} , the corresponding feature vector is ω , find the solution of P's eigenvalue. Weight vector set of the relative importance the corresponding factors of the first indicator level to the factors in target level after ω we got is normalized is $\omega = (\omega_1, \omega_2, \dots, \omega_n)$. The calculating formula of indicators weight is:

$$\omega_i = \left(\prod_{j=1}^m P_{ij} \right)^{1/n} / \sum_{i=1}^n \left(\prod_{j=1}^m P_{ij} \right)^{1/n}$$

Weight W of each indicator level ordered in single level can be obtained by using EXCLE software. indicators weight of constituents of recreation space of city park in single level is as follows:

Matrix A-B : $W=(0.3386, 0.6614)^T$

Matrix B1-C : $W=(0.0441, 0.2820, 0.0797, 0.4542, 0.1400)^T$

Matrix B2-C : $W=(0.2786, 0.0344, 0.0806, 0.0532, 0.4331, 0.1201)^T$

In order to avoid the understanding disagreement caused by subjective factors, consistency check of the above Weight vector is still needed. Saaty and other people defined CI as the indicator which can check consistency of the matrix, CI is obtained by formula

$CI=(\lambda_{max}-N)/(N-1)$ (Saaty, 2000). λ_{max} in the formulas is the largest eigenvalue of matrix, N is the order of the matrix. Evaluating formula of calculating CR the ratio of CI consistency indicator of judgment matrix and RI averaged stochastic consistency indicator in the same order is: $CR=CI/RI$. When $CR<0.1$, it is supposed to have passed the consistency check. The calculation suggests the consistency ratio of each indicator level is satisfied (Table 4) which indicates the weights are reasonably distributed.

Table 4. Consistency check of indicators weight

	λ_{max}	CI	RI	CR
B1-C	5.3093	0.0733	1.12	0.0690
B2-C	6.4095	0.0819	1.24	0.0661

$CR_{B1}=0.0690 < 0.10$; $CR_{B2}=0.0661 < 0.10$;
judgement matrix B1 and B2 had passed the consistency check

3.2.4. Combination weight and its order of importance

Combination weight means the weight all factors in each level of indicator system have relative to total target. The combination weight vector in each level can be obtained on the base of single level order (Table 5), and the importance order of indicator factors in each level is shown in Table 5.

Table 3. Meaning of scale 1-9

Scale	Definition	Meaning
1	equally important	two indicators have equal importance
3	slightly important	one indicator is slightly more important than the other one
5	obviously important	one indicator is obviously more important than the other one
7	highly important	one indicator is highly more important than the other one
9	extremely important	one indicator is extremely more important than the other one

Note: 2, 4, 6, 8 indicate the intermediate levels of above adjacent indicators judgment which is usually used when some compromises are required.

Reciprocal:
Indicating
If
the ratio of indicator i' s importance and indicator j 's importance is a ij,
Then
the ratio of indicator j' s importance and indicator i 's importance a ji=1/a ij.

Table 5. Weight of evaluation indicators of communication space of city park

Target Level A	Indicators level				
	First Indicators B	Integrated weights	Secondary indicators C	Single indicator weight	Combination weight
Evaluation indicator of communication Space Of City Park (A)	Natural constituents (B1)	0.3386	sunshine lawn (C11)	0.0441	0.0149
			shade tree(C12)	0.2820	0.0955
			beautiful waterscape(C13)	0.0797	0.0270
			private space (C14)	0.4542	0.1538
			gentle slope mound (C15)	0.1400	0.0474
			leisure chairs (C21)	0.2786	0.1843
	Artificial constituents (B2)	0.6614	landscape sketch (C22)	0.0344	0.0227
			appropriate square (C23)	0.0806	0.0533
			tree-lined road (C24)	0.0532	0.0352
			field boundary (C25)	0.4331	0.2865
			resting areas (C26)	0.1201	0.0795

4. Conclusions

Based on the research for constituents of communication space of city park, this paper does a quantitative analysis with scientific rigor to relevant experts' qualitative evaluations by adopting AHP fundamental to obtain the weight relationship of indicator factors in each level. The following conclusion can be drawn according to the research findings:

(1) Through calculating and analyzing to weight of two indicators' in the overall evaluation level of communication space of city park, the order of impact is as follows: artificial constituents(0.6614) > natural constituents(0.3386), which indicates artificial constituents are obviously more important in communication space of city park than natural constituents. This means transforming natural environment should be paid more attention to when establishing the interactive field of park to make environment space more appropriate for promoting people's communication activities.

(2) Through analyzing to weight of indicators' in the second level of communication space of city park, impact order of five secondary indicators attached to natural constituents is: private space (0.1538) > shade tree (0.0955) > gentle slope mound (0.047

4) > beautiful waterscape (0.0270) > sunshine lawn (0.0149). Among those constituents, Among those constituents, private space and shade tree have the most impact. This means the space formed by natural constituents such as landforms and plants with a strong sense of territory has obvious positive impact on promoting the people's communication activities in the park which is concerned and accepted by experts.

(3) Through analyzing to weight of indicators' in the second level of communication space of city park, impact order of six secondary indicators attached to artificial constituents is : field boundary (0.2865) > leisure chairs (0.1843) > resting areas (0.0795) > appropriate square (0.0533) > tree-lined road (0.0352) > landscape sketch (0.0227). Among those constituents, field boundary has the most impact which means making full use of limited boundary of landscape and forming small-scale space can realize constant segmentation and combination to space to create space environment that is appropriate for communication activities. Besides, leisure chairs and resting areas are also important because they provide necessary environment and facilities for communication behavior. The analyzing result is consistent with people's behavior characteristics.

In conclusion, the establishment of park environment is the combination of landscape art and science. It is more important and requires much attention in current construction that landscape environment and space of attractive parks can not only satisfy people's visual aesthetic but also be able to attract, retain people and be not forgotten by people. By adopting analytic hierarchy process (AHP), qualitative analysis built on perceptual basis and quantitative analysis based on mathematical model are combined. It is a very good research idea to analyze constituents' weight of park space and sort orders to their importance. Evaluating constituents of the space is the basis of scientific design and park space establishment. By evaluating the constituents of communication space of park, this paper provides data framework and reference to sort out attribute property of space which is appropriate. This paper also gives new ideas about the creation methodology for communication activities of park.

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