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Fuzzy evaluation to parkour social value research based on AHP improved model

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ABSTRACT

Parkour requires better physical quality and psychological quality, its features is continuously overcoming psychological limit and physical limit, self-break, getting passed obstacles. In recent years, it has been rapidly developed in China, and generates larger influences on each aspect of society, especially in the youth group, evaluates its social value is emphasis and direction of present scholars researches. This paper makes analysis and research on parkour social value by documents literature as well as establishing mathematical model. Setting and classifying value system to do comprehensive evaluation, it gets each sub factor weight by analytic hierarchy process, and then it gets parkour social value evaluation by fuzzy mathematical evaluation. Research shows the sport development in China has benefits in whole society culture, economy, body building, and ecology and so on; final evaluated social value result is higher.

KEYWORDS

Parkour;
Fuzzy mathematical evaluation;
Social value;
Analytic hierarchy process.

INTRODUCTION

Parkour is introduced from overseas to China; it is a new sport with regard to Chinese traditional sport events. Whether it can integrate into society or not, whether it possesses higher social value or not, which are the key to the sport can develop or not. Correctly learn parkour social value, and then it can decide whether support the sport or not, correctly guide the sport development orientation, finally propel to social sports progress and promote combination between Chinese sports and international one.

For parkour development research and value, lots of people have made efforts, just by their efforts, not only propel to spread parkour, but also it analyzes development prospects that points out the direction for parkour development. From which, Gu Shi-Xing(2010) made deeply research from parkour Chinese current development status, parkour in Chinese national fitness, school sports, competitive exercises and other aspects, his exploration thought that parkour had higher values in the aspect of sports. Wang Guo-Yong (2010) adopted documents literature, investigation method, expert interview comprehensive analyzing parkour social values contents, he thought it had body building value, heart building value, economic

value, cultural value, ecological value. He discussed parkour values more comprehensive and detailed, which provided general frame for future parkour values research. Zhang Xu (2012) analyzed parkour values by questionnaire survey, starting from body building value, recreational value, business value, artistic value, he got that parkour had certain social values. Zheng Yong etc. (2012) made research and analysis on "parkour" innovation, ornamental value and freedom as well as it special sport values. Meanwhile there are lots of scholars made deepen research on parkour values other aspects.

This paper on the basis of previous researches, makes sorting out and classification of parkour social values, classifies approximate value aspects into one type, comprehensive considers parkour economic value, cultural value, body building value, ecological value, moral quality value. Apply fuzzy mathematics to establish evaluation system mathematical model, analyze and research its social value. Convert language description into quantized value; clearly point out parkour social values sizes.

PARKOUR SOCIAL VALUE ANALYSIS

Parkour is a kind of extreme sports, due to its freedom, innovation, ornamental value; it is well received by the youth from all countries in the world. In 2006, it introduced to China that belonged to newly-developed sport, and it has been rapidly developed in China. Parkour is English word "Parkour" transliteration, which is born in 1980s; the original meaning is crossing obstacles, which is a kind of derived sport during French firefighters training. Its uppermost feature is that not relying on fixed training base; the sport can proceed only in the area with obstacles. But it requires better technology, physical quality and psychological quality as well as exhibit sport beauty in technical motions completion during running, the emergence of parkour to Chinese society influence is the paper researching direction.

Economic value

Parkour economic value including direct economic value that are business activities brought by stimulating its own industrial development; indirect economic value that is achieved economic efficiency by market driving relative industries development. In the view of contents, it includes previous researches business value, brand value, recreational value, exhibition value as well as the aspects that can generate efficiency in short-term.

Cultural value

Parkour cultural value can be divided into external technical value and connotation ideological value. External value evolves into art appreciation, exchanging ideas, propelling to cultural and educational exchanges. In guiding thoughts, it has special ways, such as freedom, creative, innovation, challenge, overcoming fear, which is both idea and cultural composition. It not only is interlinked with China presently proposed innovation ideas, conforming to era features and cultural trends, but also is interlinked with Chinese gymnastics culture, martial arts culture. The contents include communicative value, innovation value, game competitiveness and other aspects.

Body building value

No matter which sport, its starting point and ending point are propelling to people physical and psychological health. Parkour sports features decide it can improve physical quality, strengthen psychological adjustment ability. In value system, the contents include body building value, heart building value, recreational value and so on.

Ecological value

Take sports training, it should focus on harmony between people and nature. Parkour relies on natural environment as court to proceed, it will not damage natural environment due to court causes, is a kind of ecological sport event. Value system contents include environment value, input value and so on.

Moral quality value

Different sports refined philosophical thoughts are different, it will effect on individual moral quality. Parkour based on group performance, though introduces from western, it hasn't mixed up with western individualism thought. Parkour moral quality includes exchange value, group consciousness, self-value and so on.

The above five values are mutually effected to certain degrees in practice. To simple and efficient solve parkour social value quantity, it will only consider above

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five types, and assume that mutual effects can be ignored.

FUZZY MATHEMATICAL EVALUATION MODEL

Fuzzy mathematics as a brand-new discipline is using mathematical method analyzing and handling with uncertain phenomenon. It is a new mathematical discipline that develops after classical mathematics, statistical mathematics. After short silence and dispute, it has been developing with rapid advances, and its applications become more and more widely. Nowadays, fuzzy mathematics applications have already throughout science, engineering, agriculture, medicine as well as social science every field; it fully shows its powerful vitality and penetration.

Parkour evaluation indicator

Make evaluation on parkour social value's body building value, economic value, cultural value, ecological value, moral quality value and others totally 5 factors. Define judged objects factor domain of discourse U :

$U = (u_1, u_2, u_3, u_4, u_5)$;

Among them, u_1 represents body building value, u_2 represents economic value, u_3 is cultural value, u_4 is heart building value, u_5 is ecological value.

Define level domain of discourse V

Parkour value classifies into 4 levels that are very high, higher, normal, and not high.

$\mathbf{V = (v_1, v_2, v_3, v_4)}$

Among them, v_1 represents very high, v_2 represents higher, v_3 represents normal, v_4 represents not high.

Define membership

According to assignment method, with documents literature's author description of each factor value to define membership, it can refer to TABLE 1.

Establish fuzzy relation matrix

Fuzzy matrix R is:

$$\mathbf{R} = \begin{pmatrix} 0.35 & 0.39 & 0.22 & 0.04 \\ 0.17 & 0.35 & 0.39 & 0.09 \\ 0 & 0.30 & 0.44 & 0.26 \\ 0.09 & 0.22 & 0.30 & 0.39 \\ 0.43 & 0.35 & 0.22 & 0 \end{pmatrix},$$

Among them, r_{ij} is U factor r_i to V level v_j membership function; evaluate parkour social value, take whole amount allocation $A = (a_1, a_2, a_3, a_4, a_5)$,

A is U each factor to social value membership function.

Each factor to social value membership function defining

For each factor social value weight defining, the paper adopts analytic hierarchy process weight defining method to define each factor weight. Analytic Hierarchy Process, is called AHP for short, the method was proposed by American operational research expert professor T. L. Saaty in the earlier period of 1970s. AHP is a kind of simple, flexible and practical multiple criterion decision method, it has unique effects on qualitative problems' quantitative analysis, the method can classify complicated problems' each factor and methodize it, by each layer elements paired comparison, it gets evaluation system quantized description, it can calculate criterion layer each factor weight by zoom matrix.

Due to AHP features, since it was introduced to China in 1982, it has been rapidly and widely applied in each field of social economy. With development of com-

TABLE 1: Ordered pair (u_i, v_j) assigned membership

v u	$\mathbf{v_1}$ very high	$\mathbf{v_2}$ higher	$\mathbf{v_3}$ normal	$\mathbf{v_4}$ not high
u_1	0.35	0.39	0.22	0.04
u_2	0.17	0.35	0.39	0.09
u_3	0	0.30	0.44	0.26
u_4	0.09	0.22	0.30	0.39
u_5	0.43	0.35	0.22	0

puter technology, mathematical professional software Matlab functions are gradually getting powerful, it can more accurate, more quickly, more professional make calculation on AHP model.

Regard social value as objective layer, factor domain of discourse as criterion layer, parkour as measure layer. Their hierarchical relations are as Figure 1 show:

Among them, criterion layer weight and objective layer weight relationship is: $a_1 + a_2 + a_3 + a_4 + a_5 = 1$;

In criterion layer, factors respectively cover certain weights, and weights are not surely the same. Define criterion layer one factor proportion in entirety; the key is to quantify these weights.

Construct judgment matrix

Construct judgment matrix, the paper adopts factors paired comparison to establish paired matrix such method. In criterion layer, factor u_i and u_j using c_{ij} to represent former to latter influence level. Let all comparison results express by matrix C that is judgment matrix. Influence levels values are using number 1 to 9 as well its reciprocal. Every numbers definition is as TABLE 2 and TABLE 3 show.

From above TABLE 3, it can get judgment matrix:

$$C = \begin{pmatrix} 1 & 1 & 2 & 5 & 7 \\ 1 & 1 & 2 & 5 & 7 \\ 1/2 & 1/2 & 1 & 3 & 3 \\ 1/5 & 1/5 & 1/3 & 1 & 1 \\ 1/7 & 1/7 & 1/3 & 1 & 1 \end{pmatrix}$$

Judgment matrix consistency test

For weight vector A solution, due to decide by objective things complex and people generated cognition diversity, in judgment matrix construction process, it will not seriously at work, when calculating single criterion weight vector, it should also carry out consistent test. Take matrix A as an example to make algorithm design, as following show.

It solves matrix A maximum feature value $\lambda_{\max}$, its computational method is as following:

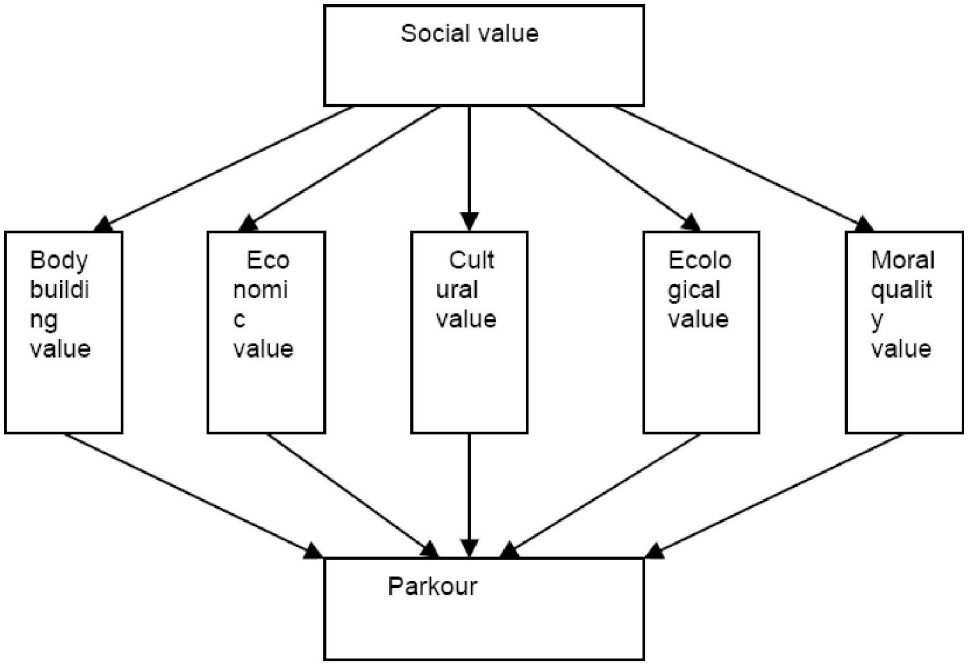

Figure 1 : Hierarchical relations figure

$$\lambda_{\max} = \mathbf{B} \bullet \mathbf{A} = \begin{pmatrix} b_1 & b_2 & b_3 & b_4 \end{pmatrix} \begin{pmatrix} a_1 \\ a_2 \\ a_3 \\ a_4 \end{pmatrix}$$

Calculate consistency indicator CI, its computational method is as formula show: $CI = \dfrac{\lambda_{\max} - n}{n-1}$

In formula, n represents the number of criterions, which is also the number of factors, so to A matrix,

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TABLE 2 : Number definition table

Level value	Definition
1	Indicates two factors have equal importance by comparing
3	Indicates the former is slightly more important than the later by comparing two factors
5	Indicates the former is obviously more important than the later by comparing two factors
7	Indicates the former is intensely more important than the later by comparing two factors
9	Indicates the former is extremely more important than the later by comparing two factors
Reciprocal	Two factors comparison, the compare orders are opposite, then comparison value is in reciprocal relationships
Even number	Indicates middle value of above adjacent judgment

TABLE 3 : Each factor influence degrees list

Factor	Body building value	Economic value	Cultural value	Ecological value	Moral quality value
Body building value	1	1	2	5	7
Economic value	1	1	2	5	7
Cultural value	1/2	1/2	1	3	3
Ecological value	1/5	1/5	1/3	1	1
Moral quality value	1/7	1/7	1/3	1	1

$n = 5$

Calculate consistency proportion CR, its computational method is as formula show: $CR = \dfrac{CI}{RI}$

In formula RI represents Random Consistency Index value, as TABLE 4 show.

Consistency judgment, when $CR > 0.1$, judgment result outputs "it shows significant non-consistency", when $CR < 0.1$, judgment result outputs "it shows considerable consistency".

Matrix consistency test indicator CI :

$$\mathrm{CI} = \frac{\lambda_{\max} - n}{n-1} = \frac{5.23-5}{5}$$

Among them, n is matrix order, $\lambda_{\max}$ represents matrix maximum feature value.

When $n = 5$, $\mathrm{CI} \le 1.12$ is passing consistency test. Above calculation show, it passes consistency test. $\lambda_{\max} = 5.23$ corresponding feature vector

TABLE 4 : RI representative value

n	1 2	3	4	5	6	7	8	9	10
RI	0 0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

$A = (0.35 \quad 0.35 \quad 0.18 \quad 0.07 \quad 0.05)0$

To sum up, by above mathematical model calculation, it gets body building value, economic value, cultural value, ecological value, moral quality value weight coefficients are respectively 0.35 ,035,0.18,0.07 0.05.

Compound A and R , it gets: B =($b_1, b_2 \cdots b_n$),

Select evaluation composition operator M ($\bullet$,$\oplus$),

$$\mathbf{B = AOR = (a_1, a_2 \cdots a_n) O} \begin{pmatrix} \mathbf{r_{11}} & \mathbf{r_{12}} & \cdots & \mathbf{r_{1m}} \\ \mathbf{r_{21}} & \mathbf{r_{22}} & \cdots & \mathbf{r_{2m}} \\ \mathbf{r_{31}} & \mathbf{r_{32}} & \cdots & \mathbf{r_{3m}} \\ \cdots & \cdots & \cdots & \cdots \\ \mathbf{r_{n1}} & \mathbf{r_{n2}} & \cdots & \mathbf{r_{nm}} \end{pmatrix}$$

Among them, $b_j = \sum_{i=1}^{n} (a_i * r_{ij})$, $j = 1,2 \cdots m$.

By calculation, it gets vector B :

$$\mathbf{B = AOR = (0.35,\ 0.35,\ 0.18,\ .0.07,\ 0.05)\ O} \begin{pmatrix} \mathbf{0.35} & \mathbf{0.39} & \mathbf{0.22} & \mathbf{0.04} \\ \mathbf{0.17} & \mathbf{0.35} & \mathbf{0.39} & \mathbf{0.09} \\ \mathbf{0} & \mathbf{0.30} & \mathbf{0.44} & \mathbf{0.26} \\ \mathbf{0.09} & \mathbf{0.22} & \mathbf{0.30} & \mathbf{0.39} \\ \mathbf{0.43} & \mathbf{0.35} & \mathbf{0.22} & \mathbf{0} \end{pmatrix}$$

B = (0.15, ,035,0.32,0.12) ,

Thereupon, it is clear that parkour social value should be evaluated as higher.

CONCLUSIONS

By analytic hierarchy process, it defines body building value, economic value, cultural value, ecological value, moral quality value weight, further gets a quantization value by fuzzy mathematical evaluation model calculation, successively defines parkour values evaluation. It makes sure that parkour social value is higher. Parkour has certain values in economy, culture, body building, ecology and other aspects. Parkour economic value, cultural value, ecological value, and moral quality value, all are pulled by parkour body building value. Therefore the sport social value is also up to parkour body building value, that is to say, sport cannot exist and develop without body building value. Parkour higher body building value decides lots of mass participating, and thereupon drives other aspects values promoting, and further promotes social value.

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