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Taijiquan movement cultural inheritance system game theory analysis and research

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ABSTRACT

Taijiquan contains China's 5000 years essence; it includes great Confucian and Taoist thought. It is China's precious culture heritage, so China is necessary to establish Taijiquan movement cultural inheritance system. By firstly establishing analytic hierarchy process model, the paper solves Taijiquan movement cultural inheritance folk, school gym and modern mass media transmission respectively proportions are respectively 0.432, 0.366 and 0.202 when inherit Taijiquan movement culture in case considering cultural protection, social influence, thinking of inheritance and yield returns as well as other influence factors, and gets that in Taijiquan movement cultural inheritance aspect, modern mass media companies are mostly with purposes of getting profits, therefore it needs government external force interference. After that, according to game analysis and evolution game analysis, it solves that in government and modern mass media Taijiquan movement cultural inheritance problems, the best strategy is that modern mass media companies should make contributions to inherit Taijiquan movement culture, and government should positive support and monitor modern mass media companies inheritance on Taijiquan movement culture.

KEYWORDS

AHP; Game theory; Cultural inheritance; Taijiquan.



INTRODUCTION

Taijiquan was originated above 3000 years ago, King Wen of Zhou Dynasty created “The Book of Changes” wrote that *I* had Tai Chi, and then had two ways. From which word “Tai” meant maximum, “Chi” meant furthest. Tai Chi represents a kind of philosophical thought; our ancient people thought that Tai Chi was the source of all things generation, and starting point of changes. And Taijiquan as legacy left by China’s ancestors, it always adheres to principles of regulating of body, heart and breathing, and highlights practicers should harmonize Yin and Yang, subdue activity with serenity, alternate activity with serenity, simultaneous train body and heart, make integration of body and spirit. Since new China was founded, Taijiquan was enrolled in gymnastics event, and listed into heritage application lists since 2008. Taijiquan not only is a kind of event of national people body building, but also contains lots of great thoughts, it extracts Confucian and Taoist thoughts, and thinks that individual not only should keep physical health, but also should cultivate character, and highlights that people should treat each other sincerely and live in harmony. So inherit Taijiquan type event culture is very necessary to Chinese construction of a socialist harmonious society, and then the paper makes analysis and studies on Taijiquan type movement cultural inheritance issues.

MODEL ESTABLISHMENT

Hierarchical structure establishment

In order to analyze China’s Taijiquan movement cultural inheritance pattern, firstly it should find out Taijiquan movement cultural inheritance main paths, and look for most influential unit, therefore the paper firstly makes quantization on Taijiquan movement cultural inheritance based on analytic hierarchy process. Establish target layer, criterion layer and scheme layer relations.

Target layer: Inheritance of Taijiquan culture.

Criterion layer:scheme influence factors, E_1 is cultural protection, E_2 is social influence, E_3 is thinking of the inheritance, E_4 is yield returns.

Scheme layer: A_1 is folk heritage, A_2 is the school gym inheritance, A_3 is modern mass media transmission, it gets hierarchical structure as Figure 1 shows.

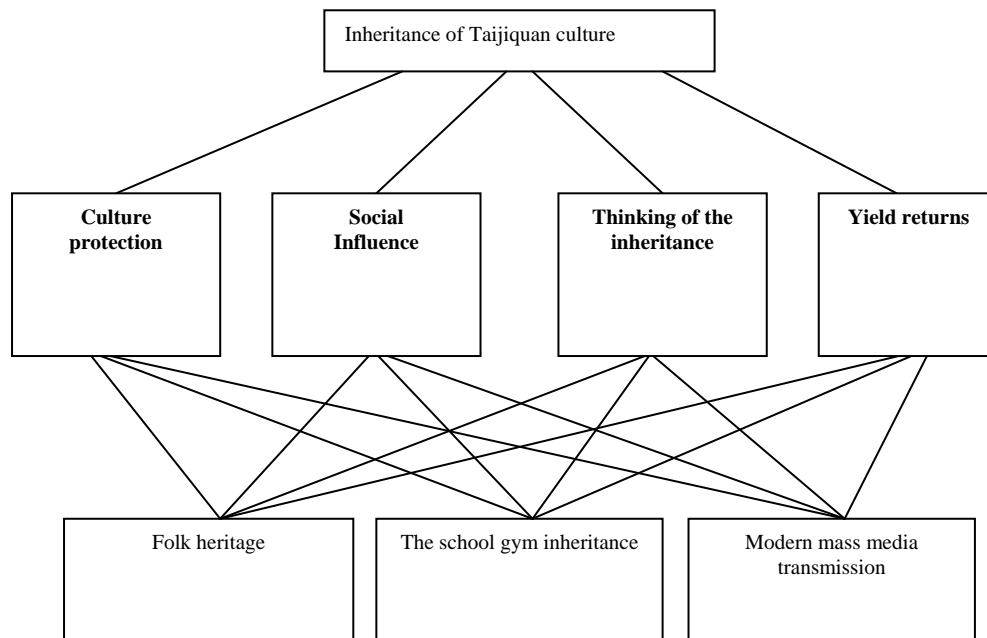


Figure 1 : Hierarchical structure

Construct judgment matrix

According to lots of experts experiences and referencing lots of documents as well as 1~9 scale setting, it gets paired comparison matrix that is judgment matrix as TABLE 1-5.

TABLE 1: Comparison matrix

G	E_1	E_2	E_3	E_4
E_1	1	1/5	4	3
E_2	5	1	6	5
E_3	1/4	1/6	1	1
E_4	1/3	1/5	1	1

TABLE 2 : Comparison matrix

E_1	A_1	A_2	A_3
A_1	1	1	1/4
A_2	1	1	1/4
A_3	4	4	1

TABLE 3 : Comparison matrix

E_2	A_1	A_2	A_3
A_1	1	3	5
A_2	1/3	1	3
A_3	1/5	1/3	1

TABLE 4 : Comparison matrix

E_3	A_1	A_2	A_3
A_1	1	8	7
A_2	1/8	1	5
A_3	1/7	1/5	1

TABLE 5 : Comparison matrix

E_4	A_1	A_2	A_3
A_1	1	5	4
A_2	1/5	1	3
A_3	1/4	1/3	1

Consistency test

Use consistency test formula as : $CI = \frac{\lambda_{\max} - n}{n - 1}$. Among them, λ_{\max} is maximum feature root value of comparison matrix, n is comparison matrix order. It is clear that judgment matrix and CI value are in inverse proportion.

$$C = \begin{Bmatrix} 1 & 1/5 & 4 & 3 \\ 5 & 1 & 6 & 5 \\ 1/4 & 1/6 & 1 & 1 \\ 1/3 & 1/5 & 1 & 1 \end{Bmatrix}$$

$$\xrightarrow{\text{Column vector normalization}} \begin{Bmatrix} 0.214 & 0.192 & 0.3 & 0.3 \\ 0.075 & 0.577 & 0.5 & 0.5 \\ 0.121 & 0.115 & 0.1 & 0.1 \\ 0.201 & 0.115 & 0.1 & 0.1 \end{Bmatrix}$$

$$\xrightarrow{\text{Solve sum by line}} \begin{Bmatrix} 1.066 \\ 2.22 \\ 0.386 \\ 0.386 \end{Bmatrix}$$

$$\xrightarrow{\text{Normalization}} \begin{Bmatrix} 0.5322 \\ 0.1003 \\ 0.3145 \\ 0.0530 \end{Bmatrix} = Y^{(0)}$$

$$CY^{(0)} = \begin{Bmatrix} 1 & 1/5 & 4 & 3 \\ 5 & 1 & 6 & 6 \\ 1/4 & 1/6 & 1 & 1 \\ 1/3 & 1/6 & 1 & 1 \end{Bmatrix} \begin{Bmatrix} 0.5322 \\ 0.1003 \\ 0.3145 \\ 0.0530 \end{Bmatrix} = \begin{Bmatrix} 3.634 \\ 0.456 \\ 2.768 \\ 0.343 \end{Bmatrix}$$

$$\lambda_{\max}^{(0)} = \frac{1}{4} \left(\frac{3.634}{0.5322} + \frac{0.456}{0.1003} + \frac{2.768}{0.3145} + \frac{0.343}{0.0530} \right) = 4.12$$

$$u^{(0)} = \begin{Bmatrix} 0.413 \\ 0.103 \\ 0.332 \\ 0.152 \end{Bmatrix}$$

Judgment matrix is

$$C_1 = \begin{Bmatrix} 1 & 1 & 1/3 \\ 1 & 1 & 1/3 \\ 3 & 3 & 1 \end{Bmatrix}, C_2 = \begin{Bmatrix} 1 & 5 & 5 \\ 1/5 & 1 & 5 \\ 1/5 & 1/5 & 1 \end{Bmatrix}, C_3 = \begin{Bmatrix} 1 & 5 & 8 \\ 1/5 & 1 & 5 \\ 1/8 & 1/5 & 1 \end{Bmatrix}, C_4 = \begin{Bmatrix} 1 & 5 & 8 \\ 1/5 & 1 & 5 \\ 1/8 & 1/5 & 1 \end{Bmatrix}$$

Corresponding maximum feature value and feature vector are in order as:

$$\lambda_{\max}^{(1)} = 3.56, y_1^{(1)} = \begin{Bmatrix} 0.244 \\ 0.244 \\ 0.512 \end{Bmatrix}$$

$$\lambda_{\max}^{(2)} = 3.29, y_2^{(1)} = \begin{Bmatrix} 0.656 \\ 0.255 \\ 0.087 \end{Bmatrix}$$

$$\lambda_{\max}^{(3)} = 3.31, y_3^{(1)} = \begin{Bmatrix} 0.650 \\ 0.212 \\ 0.137 \end{Bmatrix}, \lambda_{\max}^{(4)} = 3.12, y_4^{(1)} = \begin{Bmatrix} 0.604 \\ 0.248 \\ 0.148 \end{Bmatrix}$$

According to $CI = \frac{\lambda_{\max} - n}{n - 1}$, it gets RI value that can refer to TABLE 6.

TABLE 6 : RI value

n	1	2	3	4	5	6	7	8	9	10	11
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51

For judgment matrix C , $\lambda_{\max}^{(0)} = 5.120, RI = 1.12$

$$RI = \frac{5.120 - 4}{4 - 1} = 0.038$$

$$CR = \frac{CI}{RI} = \frac{0.038}{1.12} = 0.034 < 0.1$$

It represents C inconsistency extent is within permissible range, now it can use C feature vector to replace weight vector.

Similarly, to judgment matrix C_1, C_2, C_3, C_4 , utilize above principle, all pass consistency test. Therefore target layer to scheme layer computational result can refer to Figure 2.

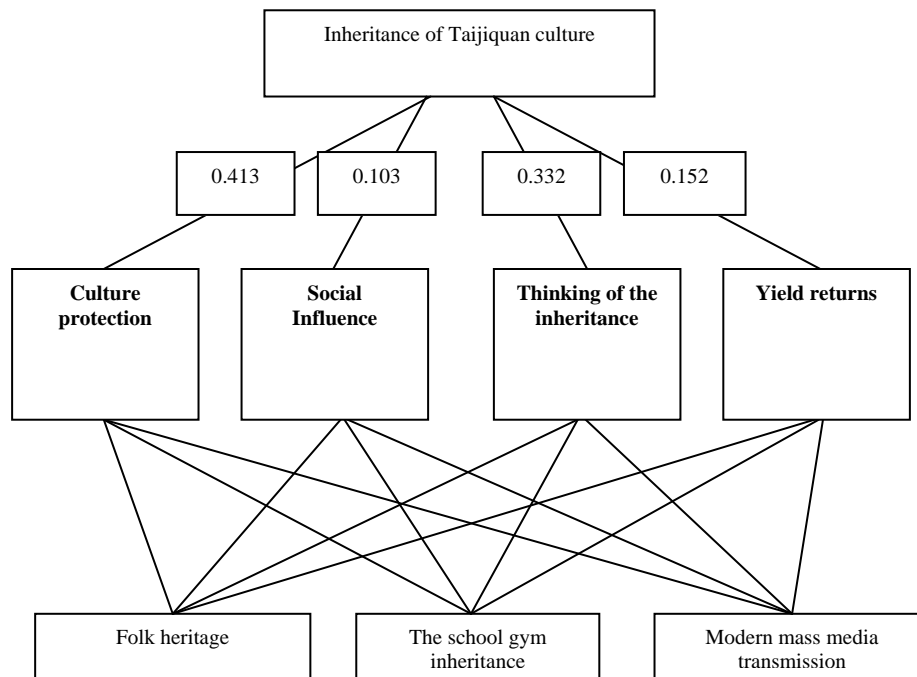


Figure 2 : Target layer to Scheme layer calculation result

$$\left\{ \begin{matrix} 0.252 \\ 0.089 \\ 0.66 \end{matrix} \right\}, \left\{ \begin{matrix} 0.575 \\ 0.286 \\ 0.139 \end{matrix} \right\}, \left\{ \begin{matrix} 0.624 \\ 0.240 \\ 0.136 \end{matrix} \right\}, \left\{ \begin{matrix} 0.185 \\ 0.240 \\ 0.575 \end{matrix} \right\}$$

Calculation structure is as following:

$$y^{(1)} = (y_1^{(1)}, y_2^{(1)}, y_3^{(1)}, y_3^{(1)}) = \left\{ \begin{matrix} 0.624 & 0.185 & 0.252 & 0.575 \\ 0.234 & 0.240 & 0.089 & 0.286 \\ 0.136 & 0.575 & 0.66 & 0.139 \end{matrix} \right\}$$

$$\begin{aligned}
 y &= y^{(1)}y^{(0)} \\
 &= \begin{Bmatrix} 0.252 & 0.575 & 0.624 & 0.185 \\ 0.089 & 0.286 & 0.240 & 0.240 \\ 0.66 & 0.139 & 0.136 & 0.575 \end{Bmatrix} \begin{Bmatrix} 0.577 \\ 0.066 \\ 0.124 \\ 0.253 \end{Bmatrix} \\
 &= \begin{Bmatrix} 0.432 \\ 0.366 \\ 0.202 \end{Bmatrix}
 \end{aligned}$$

Taijiquan movement cultural inheritance system game analysis

By above analytic hierarchy process, it is clear that in the aspect of Taijiquan movement cultural inheritance, it should take folk heritage and the school gym inheritance as subjects. And modern mass media transmission is mostly with purposes of profit-making. So in order to improve such kind of inheritance system, it needs government support and monitoring to play external force roles. In the following, according to game analysis, it can roughly regard government and mass media as game main parts, its implemented strategies are two types, government strategy is support and nonsupport. Set that in case government supports inheritance and mass media do not inherit, government profit is U_1 , media profit is 0; on the contrary media makes transmission while government don't play supporting roles, enterprises profit is U_1' , government profit is U_2 , causes is though government don't play supporting role, mass media transmission is beneficial to harmonious socialist society construction. When both government and mass media are with positive attitudes, government earnings is U , mass media is U' ; If both government and mass media are not positive, then the two earnings are 0. TABLE 7 is government and modern mass media transmission earnings matrix.

TABLE 7 : Government and modern mass media transmission earnings matrix

		Modern mass media	
		Inherit	Don't inherit
Government	Support	U, U'	$U_1, 0$
	Non-support	U_2, U_1'	$0, 0$

Among them, $U > U_1 > U_2$, but size of U', U_1' cannot define, therefore the paper will adopt evolution game analysis to analyze government and modern mass media practical status of Taijiquan movement cultural inheritance, and make respectively strategies adjustment.

Taijiquan movement cultural inheritance evolution game analysis

Due to government and modern mass media strategies positive and non-positive selection in Taijiquan movement cultural inheritance is independent and random, and can carry on repeated games. Therefore, set government supporting mass media transmission probability as p , non-support probability as $1-p$; mass media inheritance probability is q , probability that don't inherit is $1-q$. According to Malthusian theorem, it is clear that government strategies support times selection growth

rate should be differences between $\frac{p}{p}$ fitness $E_w H \{f, 1-q\}^T$ and average fitness $\{p, 1-p\} H \{q, 1-q\}^T$.

$E_w = [1, 0]$, when government supporting probability is 1, its earnings matrix is

$$H = \begin{bmatrix} U & U_1 \\ U_2 & 0 \end{bmatrix}$$

Simplify $\dot{p} = p(1-p)\{1,-1\}H\{q,1-q\}^T$ and get

$$\dot{p} = p(1-p)[(U-U_1-U_2)q+U_1]$$

Similarly, mass media strategies inheritance times' selection growth rate should be differences between $\frac{q}{q}$ fitness $E_jH\{q,1-q\}^T$ and average fitness $\{q,1-q\}M\{p,1-p\}^T \cdot E_j = [0,1]$, When mass media inheritance probability is 1, its earnings matrix is

$$M = \begin{bmatrix} U' & 0 \\ U_1' & 0 \end{bmatrix}$$

Simplify $\dot{q} = q(1-q)\{-1,1\}M\{t,1-q\}^T$ and get

$$\dot{q} = q(1-q)[U_1' + (U' - U_1')p]$$

Therefore when $\dot{p} = 0, \dot{q} = 0, (0,0), (0,1), (1,0), (1,1)$ are balance points of Taijiquan movement cultural inheritance. According to matrix stability, analyze these balance points partial stability, solve partial derivatives of \dot{p} to p , and partial derivatives of \dot{q} to q , matrix is

$$N = \begin{bmatrix} \partial \dot{p} / \partial p & \partial \dot{p} / \partial q \\ \partial \dot{q} / \partial p & \partial \dot{q} / \partial q \end{bmatrix} = \begin{bmatrix} (1-2p)[(U-U_1-U_2)q+U_1] & p(1-p)(U-U_1-U_2) \\ q(1-q)(U'-U_1') & (1-2q)p \end{bmatrix}$$

Among them

$$\det N = (1-2p)(1-2q)[(U-U_1-U_2)q+U_1][U_1' + (U' - U_1')p] - pq(1-p)(1-q)(U-U_1-U_2)(U'-U_1')$$

$$trN = (1-2p)[(U-U_1-U_2)q+U_1] + (1-2q)[U_1' + (U' - U_1')p]$$

TABLE 8 is balance point partial stability

TABLE 8 : Balance point partial stability

Balance point (p, q)	det N		trN		Stability
(0,0)	$U_1 \bullet U_1'$	+	$U_1 + U_1'$	+	unstable point
(0,1)	$-(U-U_2) \bullet U_1'$	-	$U-U_2-U_1'$	Unknown	Saddle point
(1,0)	$-U_1 \bullet U'$	-	$U'-U_1$	Unknown	Saddle point
(1,1)	$(U-U_2) \bullet U'$	+	$-(U-U_2+U')$	-	Stable point

By above table, it is clear $(0,0)$ point is unstable point, $(0,1)$ and $(1,0)$ are saddle points, evolution stable point is $(1,1)$. Figure 3 is strategy evolution graph.

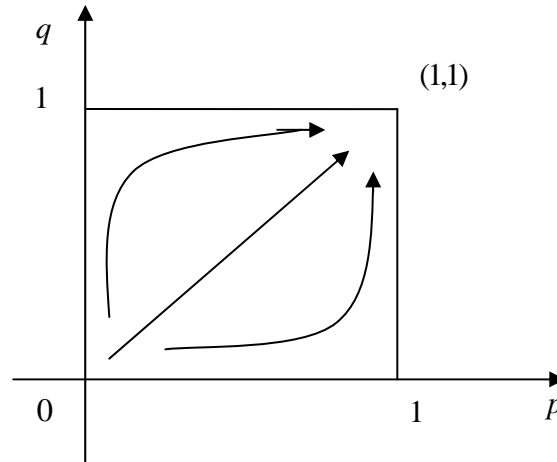


Figure 3 : Strategy evolution graph

By above figure, it is clear that government and modern mass media to Taijiquan movement cultural inheritance optimal strategy is modern mass media companies should make contributions to inherit Taijiquan movement culture, and government should positive support and monitor modern mass media companies to inherit Taijiquan movement cultural.

CONCLUSION

By firstly establishing analytic hierarchy process model, the paper solves Taijiquan movement cultural inheritance folk, school gym and modern mass media transmission respectively proportions are respectively 0.432, 0.366 and 0.202 when inherit Taijiquan movement culture in case considering cultural protection, social influence, thinking of inheritance and yield returns as well as other influence factors, and gets that in Taijiquan movement cultural inheritance aspect, modern mass media companies are mostly with purposes of getting profits, therefore it needs government external force interference. After that, according to game analysis and evolution game analysis, it solves that in government and modern mass media Taijiquan movement cultural inheritance problems, the best strategy is that modern mass media companies should make contributions to inherit Taijiquan movement culture, and government should positive support and monitor modern mass media companies inheritance on Taijiquan movement culture.

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