# Evaluation of skills and tactics based on TOPSIS in table tennis

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**Abstract**: the author set up the skills and tactics evaluation system of table tennis. It is based on data collected from Zhang Jike's 14 matches, using the TOPSIS method to calculate each match's closing degree from positive and negative ideal solutions. According to these closing degrees, the research compares and analyses the whole series of matches. The results indicate there is a certain practicability in the assessment index system and assessing model.

**Keywords:** table tennis, evaluation, skills, tactics, TOPSIS.

## 1. INTRODUCTION

The object of traditional table tennis analysis is usually about an isolated individual match only, and there is no systematic comparison with the quality differences between series of matches. It makes the skills and tactics analyze unable to reflect athlete's performance fluctuation. The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) is a multi-criteria decision analysis method, which was originally developed by Hwang and Yoon in 1981 [1] with further developments by Yoon in 1987 [2] and Hwang et al. in 1993 [3]. TOPSIS is based on the concept that the chosen alternative should have the shortest geometric distance from the positive ideal solution and the longest geometric distance from the negative ideal solution. It is a method of compensatory aggregation that compares a set of alternatives by identifying weights for each criterion, normalizing scores for each criterion and calculating the geometric distance between each alternative and the ideal alternative, which is the best score in each criterion. The research tries to introduce TOPSIS model to carry on the efficiency assessment to the skills and tactics of the table tennis matches.

## 2. INDEX OF EVALUTION SYSTEM

Table 1 The index system.

| Name | Definition |
|---|---|
| ACE rate | ACE number ÷ Serve number × 100 |
| Receivescore rate | Receive score number ÷ Receive number × 100 |
| Attacking after Serve score rate | Attacking after serve score number ÷ 3rd bat number × 100 |
| 4th bat score rate | 4th bat score number ÷ 4th bat number × 100 |
| Stalemate score rate | Stalemate score number ÷ stalemate number × 100 |
| Fault rate | Fault number ÷ Serve number × 100 |
| Receivelose rate | Receive lose number ÷ Receive number × 100 |
| Attacking after Serve lose rate | Attacking after serve lose number ÷ 3rd bat number × 100 |
| 4th bat lose rate | 4th bat lose number ÷ 4th bat number × 100 |
| Stalemate lose rate | Stalemate lose number ÷ stalemate number × 100 |

## 3. RESEARCH OBJECT AND METHOD

### 3.1 Research object

Table 2 Information of matches

| ID | ZHANG Jike's matches |
|---|---|
| 1 | 2010QatarTournament vs WANG Liqin |
| 2 | 2010ChinaCivalMatch vs MA Long |
| 3 | 2010 Moscow World Championships vs KISHIKAWA |
| 4 | 2010 Moscow World Championships vs SUSS |
| 5 | 2010 World Cup Final vs WANG Hao |
| 6 | 2011 China Cival Match vs MA Lin |
| 7 | 2011 Qatar Tournament vs MIZUTANI |
| 8 | 2011 China Tournament vs ZHANG Yu |
| 9 | 2011 AustriaTournament vs MA Long |
| 10 | 2011 China Tournament vs MA Long |
| 11 | 2011Rotterdam World Championships vs JOO Saehyuk |
| 12 | 2011Rotterdam World Championships vs WANG Liqin |
| 13 | 2011Rotterdam World Championships vs BOLL |
| 14 | 2011Rotterdam World Championships vs WANG Hao |

### 3.2 Research method

The first step is collecting skills and tactics index data of 14 matches and calculating win or lose rate respectively. Then constructing quality evaluate-on matrix. In this article, the whole quality matrix can be expressed as follows: m = 14, n = 10.

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix}$$

The third step is using the TOPSIS method to carry on efficiency assessment. In this step, first is to standardize the data of matrix. Then, using AHP to calculate the weight of different index (n) of matrix. After that is selecting best and worst solution. Then calculate the distance from the best and the worst solutions, calculating relatively closing degree. Details are shown in Fig.1.
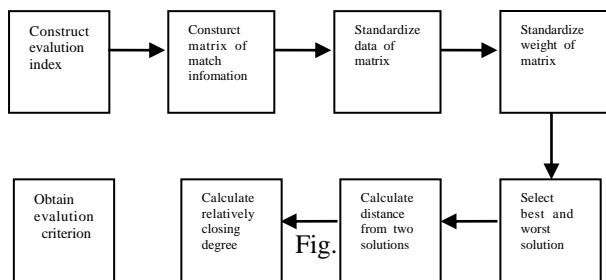
Fig.1 The evaluation system.

## 4. RESULT

After having carried on the efficiency assessment from 14 matches of Zhang Jike, the result as shown in Table 3, indicates that the top quality match was 2011 Rotterdam world championships against Joo S., the second was 2011 Rotterdam world championships against Boll.

Table3  Result information.

| MATCH  ID | CI | RANK |
|---|---|---|
| 1 | 0.2791 | 13 |
| 2 | 0.2866 | 12 |
| 3 | 0.3259 | 5 |
| 4 | 0.3187 | 7 |
| 5 | 0.3047 | 9 |
| 6 | 0.3098 | 8 |
| 7 | 0.2675 | 14 |
| 8 | 0.3223 | 6 |
| 9 | 0.3540 | 3 |
| 10 | 0.2901 | 11 |
| 11 | 0.5256 | 1 |
| 12 | 0.2991 | 10 |
| 13 | 0.4317 | 2 |
| 14 | 0.3486 | 4 |

According to Fig. 2 Zhang Jike's performance is stable before 2011 Rotterdam world championships, basically maintained at about 0.3. But since the world championship begins, it has risen to more than 0.5. Especially in the match against Joo Saehyuk, he played very well, and the quality was on the top, considering Zhang doesn't preponderate at chopping style player. In the following match of singles, except the match quality with teammates of national team is barely satisfactory, its quality of match against Boll also rises to more than 0.4. After this hard fighting, Zhang Jike met Wang Hao in final smoothly. It is obvious that Zhang Jike is a big heart player, its ability that defeats the foreign players in important match is stressed very much.
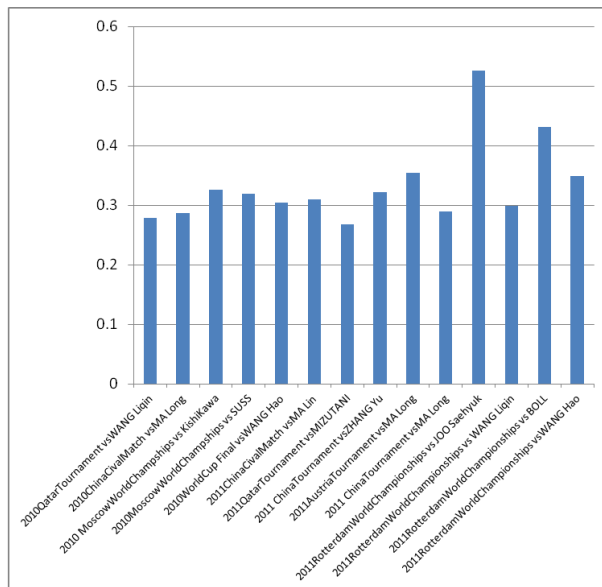


Fig. 2 Evaluation result .

## 5. DISCUSSION

Although the applying of TOPSIS in this research can compare each game's different quality and give the ranking of whole games, it still has two major problems. The first is its erratic accuracy. When the author uses some other evaluation algorithm to analyze the same matches, the ranking is different from the TOPSIS result, but the best and worst games are still identical. We must improve the algorithm to make better result. The second is not considering the different rivals. It's very difficult to list the different weight of different rivals. But it provides the possibility of intensive study .

## 6. CONCLUSION

The analysis used has some imperfections. We should know there is no comparison among matches. That is why we apply the TOPSIS method to calculate the differences of matches, giving the ranking of matches.

The purpose of our research was quality assessment of matches. The comparison of selected matches has showed the fluctuation of quality of matches. The gathered data and the information should facilitate the planning of the training process of table tennis players, and help to change and adjust the players in the game.

## REFERENCES

[1]  Hwang, C.L. and Yoon, K. *Multiple Attribute Decision Making: Methods and Applications*. New York: Springer-Verlag, 1981.

[2]  Yoon, K. A reconciliation among discrete compromise situations. *Journal of Operational Research Society*, 38, 277-286, 1987.

[3]  Hwang, C.L., Lai, Y.J. and Liu, T.Y. A new approach for multiple objective decision making. *Computers and Operational Research*, 20, 889–899, 1993.