Techniques and tactics analysis related to personality in table tennis doubles

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Abstract: this research was designed to develop a techniques and tactics analytic model, based on the personality of players in table tennis doubles. The result is hoped to provide a training guideline for coaches and players by understanding the relationship between performed table tennis tactics and victory, and also a very important relationship between different personalities matching and performing successful tactics. The subjects sample included the players who participated in men's doubles in Chao-yang table tennis competition in 2012. 48 questionnaires were distributed, 21 competitions were recorded which involved 10 different universities. The content of questionnaire is enclosed in the appendix. First, a video observation method was used and three doubles competition involving five pairs of players were recorded in a pilot study. In the results, four different combinations of personalities were compared, "self-control vs. self-control, self-control vs. aggressive, intellectual vs. aggressive and aggressive vs. aggressive. This study analyzed for the first ball and the third ball, a total of 131 balls, and took advantage of the research in developing the doubles' techniques and tactics of analytic model prototype for analysis. The following results were found. First of all, there was a significant correlation between the successful implementation of tactics and victory. Secondly, a significant association was also found between different personalities and the number of successful tactics implementations, which implies that the matching between personality and the successful implementation of tactics is crucial. Finally, the techniques and tactics analytic model in doubles, using a personality method developed in this research is feasible and practical.

Keywords: table tennis, personality, techniques and tactics, analytic model, multimedia database.

1. INTRODUCTION

1.1 Research background and motivation

Seemiller and Holowchak [1] indicated that balls techniques and actions are closely related, but also techniques and tactics can't be separated. In the items of ball sports, techniques are the basis of tactics and tactics are organized by the techniques, the quality of techniques decides the quality of the tactics, it may directly affect an athlete's competition results. This shows that technical training must be based on actual needs in the competition, if practice with the consciousness of tactics in usual training, it can organize better in techniques, and meet with the requirements of tactics in order to bring into the competition more efficient.

There are two information of table tennis on techniques and tactics: one is the explanations and analysis of techniques and tactics in academic theory; the other is the accumulation from table tennis practical experience, and gradually form into a set of training mode. Athletes can slowly explore out their suitable techniques and tactics while training. In addition, in many studies, there are more and more scholars who began to explore the techniques and tactics in table tennis singles, but there is not much research about the doubles. There are seven official games in table tennis, which include male and female teams, singles, doubles and mixed. Doubles accounted for three of them, and are also included in the team and individual competition. The doubles in 5 points of 3 singles and 2 doubles accounted for 40% of winning rate, therefore, doubles in men's doubles and women's doubles accounted respectively for 29% and 20% winning rate, so the doubles in the team and individual competition are very important. Li et al. [2] pointed out that table tennis doubles shows the connotation of fast, changeable, nervous, irritation and intense, but also can fully shows the team spirit of the unity, progressive and assistance, and noted that the doubles, which occupies a decisive position in the result, is important in the team competition. Tu et al. [3] indicated that to gain advantage in the doubles competition, in addition to practical training, strategy and tactics of concepts and applications should be studied in order to play the perfect effect of one plus one being greater than one. As to the coach, he must clearly and fully understand and control the athletes' techniques and tactics situation, the advantages and disadvantages of techniques and tactics in a team, but also the team's preparation for the competition. Especially the doubles matches in the team competition, because the doubles holds most of the opportunities and responsibilities for the team, and if you can win 1 point or 2 points in doubles, then you will be able to get the winning percentage of 20% to 40% for the team, so doubles in team competition is very important.

There is a close relationship between training and competition. Particularly, it is very common to use technology for training in this information age. It allows athletes and coaches to improve the training methods by scientific research, but also can induce the athletes to combine the concept of training and the competition rapidly, instead of to practice for practice. Coaches and athletes can be faster and more specific understanding and acceptance by the data in order to enhance the effectiveness of the training and the use of competition, so that it can bring out the best in each other, but also

yield twice the result with half the effort. Based on this concept, analyze the techniques and tactics in the doubles competition. According to the features of techniques and tactics which developed by different personality traits, find out each athlete's status of techniques and tactics in doubles, and then offer more efficient matches and suitable training courses while training, to carry out the most efficient techniques and tactics in doubles, in order to achieve the purpose of improving the result.

In doubles, the cooperation of two individuals is the combination which is based on the techniques and tactics in singles. But an outstanding single player does not represent an outstanding double player, or the matching of two outstanding single players do not represent an outstanding team. Doubles needs to be coordinated by two individuals. On the use of the techniques and tactics must be cooperate with each other or create winning chances for partners, this needs the tacit but also relies on the usual systematic training. In doubles, both athletes must reach a consensus ideologically, and trust, encourage and understanding each other to show the best matching in the competition. Gee et al. [4], Morgan et al. [5] and Piedmont et al. [6] have examined that there is a positive correlation between personality and sports performance. But do different personalities lead to the different use of techniques and tactics in table tennis doubles? In the past psychological research pointed out that thought, motivation and emotion can describe the differences between people, and personalities are also defined as the characteristics of psychological, which is an important that led to the unique emotional, thinking and behavior [7]. Tohănean [8] indicated that personality traits divided human behavior into multiple details and conceptualization. Personality traits including physical, psychological and teamwork, which will affect sports performance. Aidman and Schofield [9] and Vealey [10] also pointed out that personality traits will affect the process of competition and the results. Therefore, incorporating the personality traits into the analytic model of techniques and tactics in table tennis doubles can improve the degree of application of the model, to provide references for athletes and coaches. In order to find out the correlation among the matches of athletes' personalities, the successful execution of tactics and the winning rate, this study obtained the athletes' personality by using questionnaire investigation, and videotaped the doubles competition, analyzed different personalities of athletes' techniques and tactics by the analytic model of first- three hit to generate the analytic table, and build a set of technical and tactics matching system. Through this study, we hope it can provide a more efficient reference to athletes and coaches, but also increase the winning rate in order to get better results in the competition.

1.2 Purposes

The purposes are as follows:
(1) Whether the successful execution of tactics leads to the winning rate?
(2) Whether the matches of different athletes' personalities lead to the successful execution of tactics?

2. METHODS

This study collected data and analyzed, then summarized the types of techniques and tactics in table tennis doubles, and created the analytic model depending on the personality traits.

2.1 Analytic model of techniques and tactics in doubles

2.1.1 Data collection and classification

Before creating the analytic model of tactics in first three hits, it was necessary to classify the tactics between partners through the techniques and tactics of table tennis literature review. There are nearly hundreds of table tennis tactics types. After simplification by experts, we sorted out the tactics which will be used in doubles, which is shown in Fig. 1, the tactics combination of first three hits in table tennis doubles.
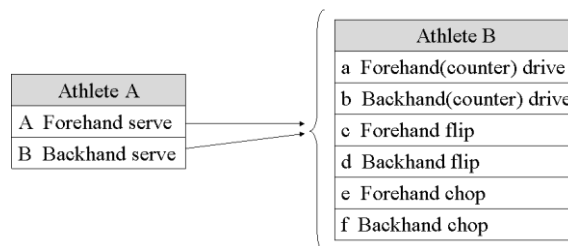

Fig. 1 Tactics combination of first three hits in table tennis doubles

According to each type of techniques in table tennis doubles as structure, we videotaped and explained the structure of tactics in order to create the model for analyzing the tactics. Currently, the classification in the execution of tactics between partners, which divided into athlete A and B, combines a crosstabulation based on the first and the third hit, then generate the tactics combination types which are shown in Table 1 :

Table 1 Tactics combination types of first three hits in table tennis doubles

Athlete B \ Athlete A	a	b	c	d	e	f
A	Initiative	Initiative	Initiative	Initiative	Initiative	Passive
B	Initiative	Initiative	Initiative	Initiative	Initiative	Passive

Table 1 shows that the combination of forehand serve (A) and forehand drive (a) is an initiative tactic; backhand serve (B) and backhand chop (f) is a passive tactic, and so on.

2.1.2 Modeling

Collect each category of techniques and built into files, then analyze the classified data and videos. The tactics combination types table can be extended to the prototype model of tactics of first three hits in table

tennis doubles, so we combined the types, tactics and the techniques combinations as Table 2:

Table 2 Prototype model of tactics of first three hits in table tennis doubles

Type	Tactics	Tehniques combinations
Initiative	A	Forehand serve
	Aa	Forehand serve + Forehand(counter) drive
	Ab	Forehand serve + Backhand(counter) drive
	Ac	Forehand serve + Forehand flip
	Ad	Forehand serve + Backhand flip
	B	Backhand serve
	Ba	Backhand serve+ Forehand(counter) drive
	Bb	Backhand serve+ Backhand(counter) drive
	Bc	Backhand serve+ Forehand flip
	Bd	Backhand serve + Backhand flip
Passive	Ae	Forehand serve + Forehand chop
	Af	Forehand serve + Backhand chop
	Be	Backhand serve + Forehand chop
	Bf	Backhand serve + Backhand chop

2.2 Techniques and tactics classification of personality classification in doubles

WTCAIA [11] is a self-report of personality measuring tool which includes 8 categories. Because of table tennis is complicated, and some personalities have high similarity, or not suitable for table tennis. For example, table tennis more belongs to one on one battle, so sociability doesn't meet the demands; self- controlled is good at control their own feelings, and neuroticism has stable emotion, two types of traits were similar; flexibility can quickly adapt to the competitors tactics and adjust their own tactics immediately, and intellectuality is good at analyzing, these two types were similar; aggressiveness has strong motivation of achievement and competitive, also similar with the hyper performance of excitatory. Therefore, by deleting unneeded ones and merging the similar types, the revised classification is toughness, intellectuality, self-controlled and aggressive as shown in Table 3:

Table 3 Table tennis athletes' personality traits

Personality	Characteristics
Toughness	Able to endure fatigue or pain, and persist training and competing for a long time.
Intellectuality	Able to adapt to the environment quickly; can adjust their techniques and tactics in any situations.
Self-controlled	Good at controlling their emotions and behavior; Can overcome the impact of negative emotions.
Aggressiveness	Proactive; Full of confidence; Competitive.

2.3 Participants

The population in this study included athletes in men's doubles who participated in the table tennis championship in Chao-yang in December 2012. Ten schools participated; we recorded 21 competitions, and handed out 48 questionnaires. First, we analyzed three videos of doubles competition; there were five teams, a total of 10 as a pilot test. After carried out the analytic

results of the questionnaire, we took out four personality combinations, which were self-controlled + self-controlled, self-controlled + aggressiveness, intellectuality + aggressiveness and aggressiveness + aggressiveness, and conducted the comparative analysis of the videos. In the analyses of the first and the third hit, there were a total of 131 balls, and they have been analyzed with the development of the techniques and tactics analytic model.

3. PERSONALITY TRAITS IN DOUBLES AND TECHNIQUES AND TACTICS MODELING

3.1 Feasibility of personality traits in doubles and techniques and tactics model

The techniques and tactics model of the doubles have been neglected in previous studies, and coupled with a very few personality traits studies used in table tennis doubles competition. Therefore, this study conducts a feasibility study on the techniques and tactics analytic model. Moreover, the relationship between tactics and winning rate is not clear, so the purposes of this study are to explore two issues. First, to find out the relationship between the successful execution of tactics and the winning rate; second, to find out the relationship between the matches of different athletes' personalities and the successful execution of tactics. The importance of this study is to find out the correlations between the issues.

3.2 Data analysis

Before analyzing the two issues, we conducted the questionnaire investigations for data collection, after that we calculated each table tennis athletes' personality, then classified them. We analyzed athletes' tactics by using Interact 9, which is a video analysis software, and then we carried out the feasibility analysis on two issues.

3.3 Questions and hypotheses

Q1: whether the successful execution of tactics leads to the winning rate?

This issue would like to know whether the successful execution of tactics will lead to the higher winning rate, if so, then execution of tactics is very important in doubles, so we set the following hypothesis:

H1: the successful execution of tactics will lead to the winning rate.

Q2: whether matching different athletes' personalities leads to the successful execution of tactics?

This issue would like to know whether matching different athletes' personalities will affect the successful execution of tactics, if so, then personality matching is very important, so we set the following hypothesis :

H2: matching different athletes' personalities will lead to the successful execution of tactics.

4. RESULTS AND DISCUSSION

4.1 Hypothesis 1

The higher chance of successful tactics, the higher the winning rate of the ball. A Chi-square test has been conducted on the results of the execution of tactics (success: 1; fail: 0) and the results of the ball (win: 1, lose ball: 0), as shown in Table 4~7.

Table 4 Table tennis tactics execution results

Tactics	Successful execution	Winning balls
Aa Forehand serve + Forehand(counter) drive	1	1
Aa Forehand serve + Forehand(counter) drive	1	0
Ae Forehand serve + Forehand chop	1	1
A Forehand serve	1	1
Aa Forehand serve + Forehand(counter) drive	1	1
A Forehand serve	1	1
Ab Forehand serve + Backhand(counter) drive	1	1
A Forehand serve	0	0
Bc Backhand serve+ Forehand flip	1	1
A Forehand serve	1	1
A Forehand serve	1	1
Bc Backhand serve+ Forehand flip	0	0
Aa Forehand serve + Forehand(counter) drive	0	0
Ad Forehand serve + Backhand flip	1	1
Aa Forehand serve + Forehand(counter) drive	1	1
Aa Forehand serve + Forehand(counter) drive	0	0
⋮	⋮	⋮
Aa Forehand serve + Forehand(counter) drive	0	0
Aa Forehand serve + Forehand(counter) drive	0	0
A Forehand serve	1	1
A Forehand serve	1	1
B Backhand serve	1	0
Ad Forehand serve + Backhand flip	1	1

According to Table 4, we carried out the correlation analysis between the execution of tactics and the winning rate in 131 balls; they are shown in Table 5~6:

Table 5 Successful tactics and winning balls crosstabulation

Number		Winning balls		Total
		0	1	
Successful execution	0	53	0	53
	1	19	59	78
Total		72	59	131

Table 6 Chi-Square tests of successful tactics and winning balls

	Value	df	Sig. (2-tailed)	Precise Sig. (2-tailed)	Precise Sig. (2-tailed)
Pearson Chi-Square	72.941[a]	1	.000		
Correction for continuity[b]	69.917	1	.000		
Likelihood Ratio	93.704	1	.000		
Fisher's exact test				.000	.000
Linear-by Linear Association	72.384	1	.000		
N of Valid Cases	131				

Table 7 Successful tactics and winning balls symmetric measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.746	.000
	Cramer's V	.746	.000
N of Valid Cases		131	

From Table 7, we can see the value of Phi and Cramer's V is 0.746, which is close to 1, and $p < 0.05$. From this result, it appears that the relationship between the successful execution of tactics and the winning rate is significant, but also the correlation is high, so the hypothesis 1 matched the case: the higher chance of successful tactics, the higher the winning rate of the ball.

4.2 Hypothesis 2

Matching different athletes' personalities will lead to the successful execution of tactics. The four personality combinations were: 1. self-controlled + self-controlled; 2. self-controlled + aggressiveness; 3. intellectuality + aggressiveness; 4. aggressiveness + aggressiveness). In Table 8 the results show the tactics execution and the frequency of hits: successful execution of tactics = 1, failure execution of tactics = 0.

Table 8 Statistics of different personalities and successful execution of tactics

Personality ID	Successful	Frequency
1	1	17
1	0	6
1	1	19
1	0	9
2	1	15
2	0	13
3	1	15
3	0	9
4	1	12
4	0	16

According to Table 8, we carried out the correlation analysis between the frequency of successful tactics execution and the different personality matches in 131 balls; they are shown in Table 9.

Table 9 Chi-Square tests on different personalities' matches and successful execution of tactics

	Value	df	Sig. (2-tailed)
Pearson Chi-Square	13.037ᵃ	3	.007
Likelihood Ratio	13.243	3	.007
Linear-by Linear Association	4.844	1	.031
N of Valid Cases	131		

Table 10 Different personalities' matches and successful execution of tactics symmetric measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.720	.005
	Cramer's V	.720	.005
	Contingency coefficient	.615	.005
N of Valid Cases		131	

From Table 10, we can see that the value of Phi and Cramer's V is 0.720, which is close to 1, but also the correlation is high, and p < 0.05. From this result, it appears that the relationship between the personalities' matches and the successful execution of tactics is significant, so the relationship between them is very important. Therefore, the hypothesis 2 matched the case: matching different athletes' personalities will lead to the successful execution of tactics.

4.3 Discussion

This study matches the past few studies including Wang et al. [12], Lin [13], Pan [14], Yue [15], Lu [16] and Chiu [17].

Wang et al. [12] pointed out that the variability and complexity is high in table tennis, therefore there are very few practical table tennis analytic systems. After the empirical, the development of the analytic model of techniques and tactics in table tennis is feasible and practical. The system can quickly generate a correct technical and tactical view, the win and lose points and the analytic chart. Coaches and athletes can adjust the training methods according to the information which is generated by the system.

Chiu [17] constructed the database of weight training action classification, but also integrated the weight training action by information processing for classifying and grading. Build the information processing system to provide the database of training action selections. There are four effective applications of the system database: (1) interactive platform for professional communication; (2) standardization of the teaching guidance; (3) professional service become technological; (4) digitization of the teaching materials. Arouse the professionals to emphasize on the application

combination of theoretical and practical according to the weight training classification, for selecting a safe and effective training action, and can contribute to the industry and the academic in the future.

Yue [15] used Microsoft ASP Network Program, part of the database used Microsoft Access 2000 system, which provides a set of track and field score database, offering coaches and athletes and others who cared about sports to inquiry, integrate, compare and mining the scores. In the historical record database, discover the meaningful references for selecting talents and training.

Lu [16] designed the records and query system of baseball tactics motion trajectory based on multimedia database. Using the data of the numbers of balls, outs, and the on base situation, but also the features while searching of the baseball and athletes' motion trajectory from the recording system, which proposed a set of baseball tactics similarity measurement. The results showed that it was efficient to search the tactics that have similar performance while animating on motion trajectory player system, which can provide coaches to analyze and research in order to improve the athletes' learning effect.

Combine with sports and information technology is the inevitable international trend. Using statistical of tactics analysis by the information system, and represent the results by animation for coaches and athletes as references and research in order to enhance the athletes' learning effect, but also know your enemies and know yourself.

5. CONCLUSION

5.1 Conclusion

The establishment of the two hypotheses of this study shows a very important inspiration: (1) tactics execution in table tennis doubles is very important, because the successful execution of tactics will lead to the winning rate, then affecting the final results of the competition; (2) personalities matching in table tennis doubles is very important, because the matches of different athletes' personalities will lead to the successful execution of tactics. The analytic model of techniques and tactics in doubles and the personality analytic methods are feasible and practical.

5.2 Recommendation

There is a close relationship between training and competition. Particularly, it is very common to use technology for training in this information age. Table tennis is a protean competition, many scholars, trainers, athletes and coaches hope to explore the execution of techniques and tactics, and find out the winning points. So we developed an analytic model system of the techniques and tactics from the scientific view, and provided a fast, complete and comparable analytic result in order to improve the domestic coaches' and athletes' training methods, and provide as references to promoters related to table tennis. We recommend the promoters to use these results to enhance the techniques

of our athletes, and to complement each other in order to continue to enhance China's table tennis.

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