

Full Length Research Paper

Tactics on badminton: Synergy analysis for Racketlon

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This study aims to analyze sports in Racketlon events. Racketlon involves table tennis, badminton, squash and tennis. According to the documentation, it is found that, except for squash, all the other Racketlon sports are played with a net and are about challenging opponents. Therefore, attention should be paid to servers to obtain information and process it in order to respond to balls served. In addition, the learning migration theory should be applied to these 4 sports with rackets/paddles to find out their common grounds, to practice unique skills, train lower limbs, increase explosive force and improve the ability to handle pressure through sports psychology skill training methods. This way, Taiwan may have a chance to shine in Racketlon events.

Key words: Racketlon, learning migration, information process.

INTRODUCTION

Racketlon is a competition with 4 racket sports. Challengers must be great at these 4 sports. Fred Perry, a European, is believed to be the person who first promoted Racketlon. He won the world table tennis championship in 1929, and he had won 3 Wimbledon championships from 1934 to 1936. He had participated in several world-wide table tennis competitions and tennis competitions. Surprisingly, his performances had all being outstanding. All the sports he had played are played with rackets/paddles. The Swedish people admired his achievements in these sports and further promoted these 4 independent sports (table tennis, badminton, squash and tennis) by combining them in one event, for they all require various skills and they have a lot in common. In Racketlon, the 4 sports are combined into 1 competition with four 21-point games (one game for each sport). The final winner is the participant with the highest total score instead of the one with the most winning games. Since these 4 sports can be combined, they must have something in common or

be highly related. For example, for sports with rackets/paddles, you can usually determine to which direction a ball is going according to the information regarding the contact of the ball and the racket/paddle. In the aspect of training methods, some sports psychologist addressed that sports practice principles can be categorized so that sports learners and teachers can take advantage of the common points of these sports and apply their previous experiences to new sports fields more efficiently. Generally, applying previous experiences to learning of new things is called "transfer". There are positive transfer, negative transfer and zero transfer (Chung-Hsing, 1984). In the case of positive transfer, previous experiences may positively influence learning of new skills and situations. In the case of negative transfer, previous experiences may cause difficulties in the learning of new things. In the case of zero transfer, previous experiences and learning of new things are independent. In Racketlon, an event combining 4 sports, it is particularly important to find out how to improve sports learning effectiveness through positive transfer. Therefore, this study aims to explore the synergy of Racketlon from the aspects of information processing and learning transfer by analyzing the sports included in Racketlon.

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Figure 1. Information processing sequence for badminton serving.

INFORMATION PROCESSING

Mechanical motion plays an important role for physical action (Lu, 2003; Chen et al., 2004, 2005a, b, 2006a, b, c, 2007a, b, c, d, e, f, 2008a, b, c, d, e, 2009a, b, c, d, e, f, g, 2010a, b, c, d, e, f, g, h, i, 2011a, b, c, d, e; Hsiao et al., 2005a, b, c, d, e; Hsieh et al., 2006; Chen, 2006, 2009a, b; Tsai et al., 2008; Yang et al., 2008a, 2008b; Yeh et al., 2008; Lin et al., 2009a, b; Lin and Chen, 2010a, b; Chen and Chen, 2010a, b; Chen, 2010a, b, c; Hsu, 2010; Lee et al., 2010a, b; Chiang et al., 2010; Kuo, 2010; Shih et al., 2010a, b, c, d; Tsai, 2010; Yeh, 2010; Shih et al., 2011; Chen and Huang, 2011; Chen, 2011a, b, c, d; Lin, 2011; Liu, 2011; Kuo, 2011; Kuo and Chen, 2011a, b; Shen, 2011; Tang, 2011; Tsai, 2011; Tseng, 2011; Yeh, 2011). According to the information processing model, human bodies respond to external stimulations received through sense organs. Therefore, we react because we received some messages which stimulate us. The time from stimulation to reaction is called reaction time. Reaction time plus action time equals to overall reaction time. Reaction time depends on individuals' cognitive processes, while action time depends on individuals' physiological factors. In addition, Schmidt (1975) proposed the "schema theory". He believed that, in a movement, hypothetical structure concept of generalized motor programs would be developed. That means one single motor program can control all the movements in the corresponding category. A motor program consists of a set of invariant features and a set of variable parameters. "Invariant features" represent the invariant features of a generalized motor program, such as relative force and order of events. "Variable parameters" represent the parameters of the actions controlled by a motor program which can be modified, including overall time, overall force and muscle selection. Racketlon is a combination of 4 sports. However, the most important skills required to win are different for these sports.

Because there are too many independent skills used in these sports, this study focuses on only the more decisive ones: serving and receiving skills, to explore the importance of information processing in sports, such as tennis, table tennis, badminton and squash, and discuss the possibility of synergy of all the sports.

One of the sports in Racketlon is badminton. Cho-Mou Won (2003) once further explored badminton players' serving and receiving skills. He found that outstanding badminton players usually first place their focuses on servers' chests. Then, the focuses move to servers' rackets/paddles and contact points along their dominant hands. When servers pull their rackets/paddles, focuses move to their other arms and stay between their arms and their rackets/paddles. If a server plans to send balls toward outside, their bodies may slightly move toward outside. And pull tracks are related to landing points of balls. Longer tracks suggest balls may go very high and far with more speed changes. Short serves are related to smooth pulling with uniform speed. All these can be used as basis for information processing. In other words, outstanding badminton players usually watch their opponents' body and arm movements while swinging to find out if there is any intention to serve a ball toward sideline. Then, outstanding badminton players would analyze their opponents' pull tracks and stableness of pull to determine where balls might land.

As for tennis, Ching-Ho Lin (2006) categorized tennis serving skills into: holding rackets/paddles, standing, posture, tossing a ball, pulling a racket/paddle back, swinging, contacting the ball and completing the movement. Serving is a fast and offensive skill in sports. To serve or receive a ball, one must react within 0.32 to 0.33 s. Therefore, prediction in serving/receiving balls is particularly important. Ri-Yi Chang (2008) believed that the information obtained from the period of swinging a racket/paddle to hitting a ball is essential to predict tennis serving. In addition, outstanding tennis players focus more on opponents' heads, shoulders, bodies and waists more than arms, hands, legs, feet and rackets/paddles. Also, he believed that outstanding tennis players' focuses may change in different stages of serving. He defined tennis serving into 3 stages: ritual period (Figure 2), in which players perform ritual movements (e.g. wiping perspiration, toying with the ball), preparation period (from bending knees to getting ready to hit the ball) (Figure 3) and execution period (hitting the ball) (Figure 4). In the ritual period, compared with novices, outstanding players usually watch their opponents' heads, shoulders and bodies. In the preparation period, all respondents focus on balls and where balls are tossed. In the execution period, outstanding players usually stop visual pursuit after balls are hit. To predict where balls are going, receivers must interpret servers' ritual movements as early as possible. For example, they should find out after how many times of bouncing balls servers will serve or where more likely, served balls are going to land. Then,



Figure 2. Ritual period.



Figure 3. Preparation period.



Figure 4. Execution period.

Then, in the preparation period, they should predict their opponents' positions and postures and observe which parts of rackets/paddles hit balls. As for table tennis, due to the change of rules, servers can no longer use their hands to block their opponents' views of balls when serving. Thus, receivers are not in disadvantage anymore. Efficiently receiving balls helps players to actively take advantages in games. Wei-Cheng and Yaw-Feng (2006) had studied table tennis players' receiving and serving movements. The reaction time of players of perception type is shorter than that of players of movement type. Players of perception type usually place their focuses on simulative signals from serving balls, while players of movement type place theirs on responding, while receiving balls. The experiment also shows that the right-side movement time of players whose dominant hands are right hands is shorter than that of those whose dominant hands are left hands. In other words, to dominate a game in the serving stage, one must first understand the forms of serving to create long-term memory. And when the opponent is about to serve, focus should be placed on his racket/paddle and contact point of the ball. For example, the angle between the racket/paddle and the table is nearly 90° for a flat serve. The server mainly uses his forearm. For topspin serve, the server must hit the ball from its upper right side. The surface of his racket/paddle may lean forward. Since the rule was changed to forbid visual blocking while serving, paying attention to the aforementioned signals helps to be on the initiative more easily while receiving a served ball in a game. As for squash, a served ball must go over the service line on the front wall and fall on a spot behind the receiving line. The receivers must hit the ball back to the front wall within 2 bounces, or he may hit the ball after the ball hit the rear wall, or he may also hit the ball toward one of the other 3 walls so that the ball can bounce back to the effective area on the front wall (above the foul line). Distance control is the key for squash. After hitting the ball, a player must return to the center position right away. With various hitting skills, rhythm of a game can be controlled by a player, so that odds would be in his favor, for his opponent has to run all over the court. Bruce (1990) discussed squash novices' and old hands' abilities to predict how balls are coming. They found that the most important predictor is contact point between the ball and the racket. Novices' retina systems ignore over 30% of important information from contact points, and some information ignored is extremely important. However, most squash novices make judgments according to flight tracks of balls. In addition, squash players also watch their opponents' positions and which directions their front feet point and their bodies face to predict coming balls.

RACKETLON LEARNING MIGRATION

Since Racketlon is a racket/paddle sport and a net sport

for most parts of it, the effect of learning migration on Racketlon must be very important. According to the aforementioned information processing for the 4 sports, the first thing to do is to get to know the characteristics of rackets/paddles and balls (Figure 1). The relative relations between racket surfaces and directions of balls are consistent in different sports. The more a player pulls back his racket/paddle, the faster/longer the ball goes. In addition, serving posture is also an important predictor. If a server wants to hit the ball toward the outside, his body may lean toward outside. This is an important message for receivers. Among sports, the more characteristics they have in common, the stronger the effect of learning migration would be. Net sports are about ball speed, flexibility, coordination, explosive force, skills and strategies. A top-notch racket/paddle sport player must have his muscles and nerves work very well together. Tz-Chung and Yi-Fu (2005) also believed that the characteristics players of net sports, such as tennis, table tennis and badminton, should possess, include not only lower limb flexibility and upper limb explosive force for swinging, but also excellent sense of ball and good ability to react, in order to play against opponents with complex and various tactics. Therefore, trainings of flexibility for lower limbs and explosive force for upper limbs are particularly important. In the aspect of sports psychology, in a net sport game, losing one point usually results in the opponent getting another point. In other words, losing one points almost means falling two more points behind. Players sometimes lose games because of their careless mistakes. Therefore, when scores are close, the psychological ability against opponents is very important. To improve this ability, confidence is required. Otherwise, getting cold feet often leads to regrets. Brewer et al. (1991) explored sportsmen's psychological perception and found 5 key factors, including (1) high confidence, (2) clear focus, (3) not caring about results, (4) change of perception and (5) not having to spend strenuous effort. To help sportsmen develop self confidence, it is necessary to offer them some trainings related to psychological practices. So-called psychological skill training helps with sportsmen's improvement in performances and to personal growth through psychological techniques, such as pressure management, self-control and target setting. The central purpose of psychological skill training is self-challenge. This training is based on the concept that self-improvement equals winning. It aims to help sportsmen in the field to perform as usual while developing more potential. The principles of psycho-logical skill training for sportsmen include (1) long-term training: psychological skill training is a long-term mental training process without immediate results. Sportsmen go through psycho-logical training processes in their daily practices; (2) educational orientation: the main orientation is educational, for it is to teach sportsmen to overcome their psycho-logical processes; (3) focusing on personali-zation: the subjects of psychological skill training for sportsmen

include individual sportsmen, individual members of sports teams and teams. Emphases are placed on personalized trainings. Personalization is like "customization" for a person or a group. This training helps with an independent person's or a sports unit's own problems; and (4) trust and support between coaches and players: in a sport, coaches and players work together to pursue the same goal. Therefore, they depend on each other. In the process of a coach teaching a player, there has to be trust. Psychological skill training helps to improve sportsmen's confidence. Although, Racketlon players may be in different sports games, they can categorize these occasions to increase their confidence in the games.

Conclusion

Racketlon is a unique sports event, combining the basic abilities and concepts from several net sports. Based on the basic concepts of information processing, served balls can be analyzed so that reaction time can be reduced, and the features of the basic physical requirements of net sports, such as flexibility of lower limbs and explosive force of upper limbs, are enhanced, with supports from psychological skill training courses. Racketlon integrates these common concepts and similar elements to create significant synergy effect.

Moreover, advanced techniques in soft computing and artificial intelligence have been successfully applied to various fields, such as robot manipulation, engineering application and managements on leisure and tourism industries (Amini and Vahdani, 2008; Chang et al., 2008; Omurlu et al., 2008; Trabia et al., 2008; Tu et al., 2008; Yildirim et al., 2009; Zhao et al., 2009).

Future research should extend advanced techniques in soft computing and artificial intelligence by including other factors that may affect the extent of knowledge management. In any case, much remains to be learned regarding knowledge transfer within badminton teams, and we hope this study provides an impetus to future researchers in this area.

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