

Activity organization during top-level competitive interaction in table tennis

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Abstract In a semiological framework based on course-of-action theory, this study analyzes the activity of French top-level tennis players during matches. Three volunteer table tennis players selected for the Olympic Games in Sydney were filmed during international meets. The videotape data was supplemented with verbalization data from interviews in which the players viewed the videotapes and were asked to describe and comment upon their activity. The players' actions and verbalizations were mapped to each other in tables. The analysis consisted of breaking down the course of action into elementary units of meaning, and then documenting each unit by specifying (a) the elements the players took into account in deciding what action to take, (b) the centers of interest underlying their activity, and (c) the knowledge they activated and constructed. The results showed that during games, table tennis players construct and validate new knowledge about the current interactive situation by testing hypotheses, which are necessarily limited in number due to the risk of losing points and the game. The results show that the activity of table tennis players during a match has a learning component and cannot be reduced to the mere performance of skills acquired during practice.

(Key words: table tennis, expertise, performance, knowledge construction)

1 Introduction

The study presented here, is a part of a larger research project of the French Ministry of Youth and Sports concerning the knowledge and professional practice of expert coaches and athletes on different sports. In a semiological framework based on course-of-action theory (Theureau, 1992), this study analyses the activity of French top-level table tennis players during international matches. The purpose of this study was to describe activity organization and knowledge construction during competitive interaction in table tennis. We wanted to identify how knowledge is used and constructed during elite performance.

The present study was a preliminary investigation of the real activity of top-level table tennis players during matches. Data was collected on-site, and a fine-grained analysis of the meaning and organization of the athletes' activity was conducted in an attempt to account for the players' ongoing cognition during matches.

2 Methods

2.1 Participants and procedure

This study was conducted with three volunteer French table tennis players selected for the Olympic Games in Sydney. Four international matches were studied. These matches had taken place on January, 2000 (during the final of the ITTF pro-Tour) and were a three-set-win kind of match (of 21 points).

2.2 Collecting the data

Two types of data were gathered: (a) recording of the match, and (b) verbalizations during a post-match interview. The matches were recorded on an 8-mm video camera. The camera was positioned above and behind the table, and was set for a wide-angle, top view that framed the table and the movement area of both players. This setup allowed for continuous recording of the players' moves during the match.

The verbalization data was collected via an interview with the players conducted after the match. During the interview the searcher and the player viewed the videotape of the match together. The player was asked to describe and comment upon his activity during the match. Either person could stop the tape and backtrack at any time. The interviewer's prompts were related to descriptions of the actions and events as experienced by the player; requests for interpretations and generalizations were avoided (Theureau, 1992). The entire interviews were recorded using a tape recorder.

2.3 Processing the data

The data was processed in three steps: (a) constructing chronicle matches, (b) labeling the elementary units of meaning, and (c) labeling the series.

2.4 Constructing chronicle matches

The descriptions of the players' strokes during the match and the players' verbalizations during the interview were mapped to each other by constructing tables called chronicles matches. The first level of the table pertained to the data recorded during the match. The second level contained the verbatim transcription of the prompted verbalizations (Table 1).

2.5 Labeling the elementary units of meaning

The analysis consisted of breaking down the course of action into elementary units of meaning. Elementary units of meanings are discrete units of activity that are meaningful to the players (Theureau, 1992).

Elementary units of meaning (EUMs) were labeled on the basis of the joint analysis of the chronicle matches and the videotape. The goal was to answer a certain number of questions about player's actions, interpretations, inferences, and feelings, as they appeared in the chronicle matches (Table 2): What is the player doing? What is he thinking? What is he feeling? In all, 501 EUMs were identified in the Match A, 380 in the Match B, 356 in the Match C, and 254 in the Match D.

Table 1. Excerpt from the chronicle match of Set 1, Match A. The score is given in the following order: (1) score of the French player (Chris), (2) score of the opponent (Peter).

Score	Players' actions	Chris's verbalizations
[1 st set] Peter is server 0-0	Peter serves short. Chris returns long to Peter's back hand side. Peter attacks backhand and scores the point	Chris: So here I'm returning Peter's serve. It's the first serve in the match. I can tell what spin it has, but I'm returning the ball too far to his back hand side and he's attacking backhand. So now I already know I have to return the ball closer to the middle of the table. Interviewer: "There you're discovering that?" Chris: No, I knew that before, but I'm going to see what he does anyway when I put the ball there. But here he's attacking so now I know I should stop returning the ball there.
0-1	Peter serves short. Chris returns long to the middle of the table. Peter does a forehand topspin and the ball goes out.	Chris: Here, it's already a lot better. The ball is low and I'm returning it by placing it in the middle of the table. That forces him to play forehand and he misses his topspin. Even if he does succeed on the topspin, the ball is easy to attack.

Table 2. Elementary units of meaning (Set 1, Match A).

Score	Elementary units of meaning (EUM)
0-0	EUM 1. Returns long on the opponent's back hand side to test his bother
0-1	EUM 2. Tells himself not to return the serve long to the opponent's back hand side EUM 3. Returns long on the middle of the table to test the opponent's bother
1-1	EUM 4. Tells himself this return has bothered his opponent
0-2	EUM 5. Attacks against the opponent's serve
1-2	EUM 6. Returns long on the opponent's forehand side to test his bother
2-2	EUM 7. Returns short on the opponent's forehand side to test his bother

2.6 Labeling the series

Elementary units are linked together and nested within larger units that correspond to higher-level meaningful structures. Among these, we shall focus in the present analysis on so-called series.

Series were identified and labeled by finding relationships between the elementary units. Each serie was made up of elementary units that formed a coherent chain around a meaningful preoccupation for the player. For example, EUMs 1, 2, 3, 4, 5, 6 and 7 (Match A) were grouped under the serie labeled "Look for effective serve returns".

3 Results

3.1 Exploration series and execution series

The analysis point out nine series. These series reflect the players' preoccupations during matches. Two kinds of series are distinguished: exploration series and execution series (Table 3).

Table 3. Exploration and execution series

Exploration series	Execution series
1. Look for effective serves	1. Reproduce effective serves
2. Look for effective serve returns	2. Reproduce effective serve returns
3. Look for effective first attacks	3. Reproduce effective first attacks
4. Look for effective game configurations	4. Reproduce effective game configurations
	5. Perturb the opponent

The two kinds of series result from players' two characteristic situated modes of involvement: interpret the opponent's play, and win points. Exploration series are ones in which players' preoccupation, both in their strokes and in their interpretations and inferences, is mainly constructing and validating knowledge likely to help them win. During such exploration series, their actions are associated with an intense interpretation process: players are assessing the particular characteristics of their opponent's play, identifying the strokes that hinder or bother their opponent, and seeking counterattacks to the opponent's strokes they don't like. This involvement mode is apparent in the following interview excerpt.

I'm watching just about everything he does on the serve and return. Here, it's the beginning of the match. You might even say I'm not really playing for points right away, not completely anyway. [3 to 7, Set 1, Match A]

Execution series are ones where players are mainly trying to win points: they reproduce strokes judged effective based on the outcome of their actions in earlier

matches or sets, and they vary these strokes to avoid counterattacks. This involvement mode is apparent in the following interview excerpt.

I have to start off right, that's clear. I know that at any time, if I can get off to a good start, he might get scared, because he was leading two sets to zero, because he had three match points and now we're tied. [0 to 0, Set 5, Match A]

3.2 Progression of players' mode of involvement throughout the match

The series begin and end at different times in matches. We have constructed graphs in order to present the temporal organization of the exploration and execution series during the four matches (Figure 1). These graphs point out that exploration series and execution series are distributed differently at the beginning and at the end of matches.

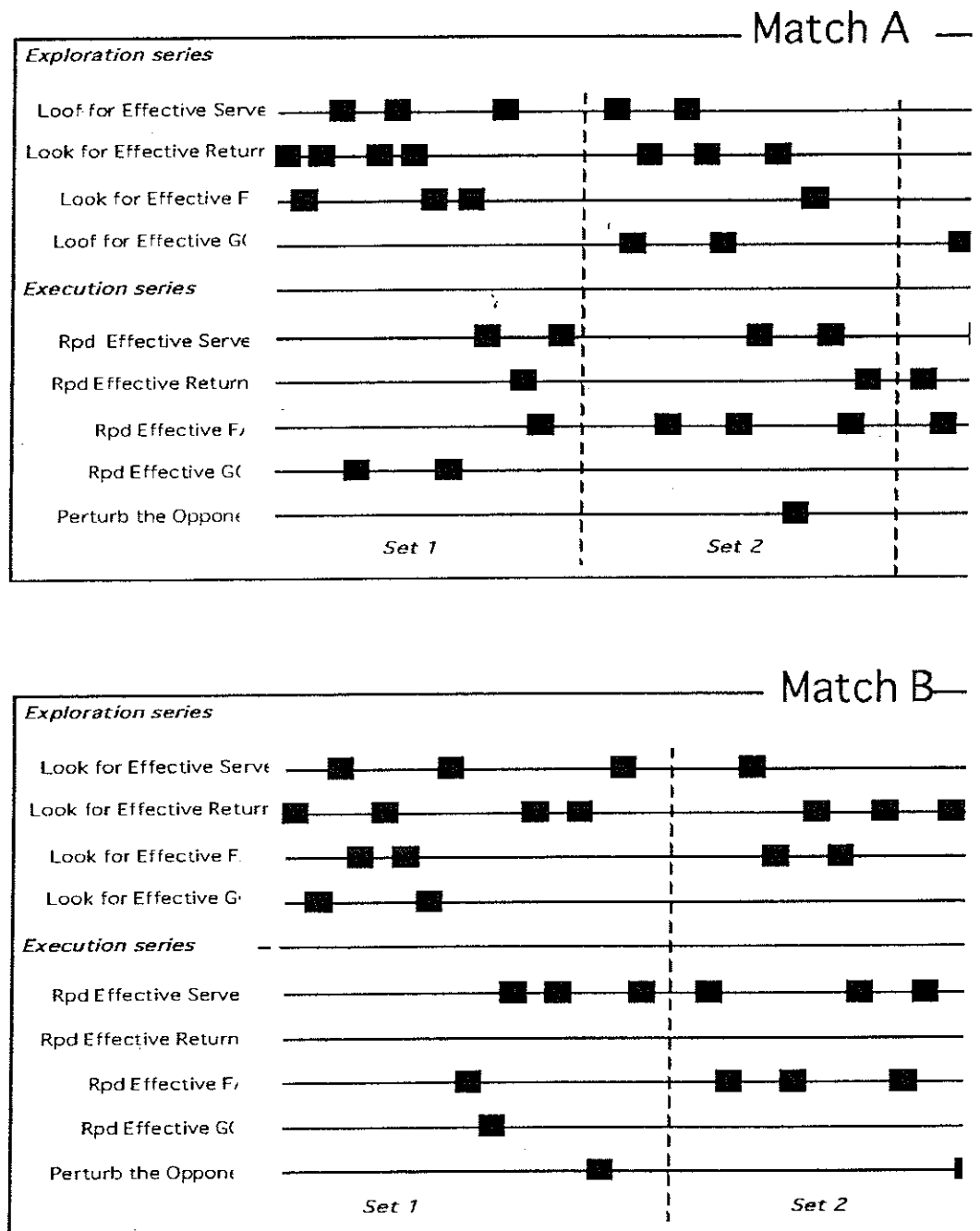
The temporal organization of these different exploration and execution series reflects the progression of players' involvement mode and players' preoccupations during matches: while at the beginning of the match, they focus mainly on interpreting their opponent's play, on the last two sets, they concentrate solely on repeating effective strokes in order to win points. Matches start with a discovery period during which players look for what strokes bother their opponent. In general, this takes them two sets. The length of this period is linked to the rules and scoring system of table tennis matches. The fact of having to win three sets to win a match frees players of having to worry about scoring at the beginning of the match, so they can look for strokes where their opponent is weak. During this phase, players discover the various characteristics of their opponent's play: his serves, his serve returns, his preferred strokes after serving, his preferred first attacks, his favorite successions of strokes or his preferred game configurations. During this phase, what counts for players is not only points won or lost, but also the knowledge they acquire about their opponent, his weaknesses and strengths, his strategies, etc.

3.3 Knowledge construction during the matches

The results show that during the matches, players not only use knowledge acquired during previous matches and practice, but also construct new knowledge about their opponent, by testing hypotheses which are necessarily limited in number, due to the risk of losing points and the match.

Four modes of knowledge construction were found: (a) validating old knowledge, (b) invalidating old knowledge, (c) finding co-occurrences, (d) identifying patterns in opponent's strokes.

Figure 1. Temporal organization of the exploration and execution series during the matches (a part).



3.4 Validating or invalidating old knowledge

Players know that an opponent's way of playing can differ across matches and that it is crucial, in each individual match, to assess these particularities in order to determine what strokes would be effective. Assessing opponent's particular way of playing validate or invalidate certain old knowledge constructed during

past matches. This mode of knowledge construction is apparent in the following interview excerpt.

Here I'm returning his serve. It's the first serve in the match. I can tell what spin it has, but I'm returning the ball too far to his backhand side and he's attacking backhand. So now I already know I have to return the ball closer to the middle of the table, but, well, I knew that before. But I'm going to see what he does anyway with his backhand. But here he's attacking so now I know I shouldn't return the serve to his backhand side. [0 to 0, Set 1, Match A].

3.5 Finding co-occurrences

Players notice that their opponent reacts in a certain way and connect this to their own strokes. This mode of knowledge construction is apparent in the following interview excerpt.

Here I can see that when I manage to do a pivot after the serve, he's uncomfortable. He doesn't really know where the ball will go. It's true that when I play with a pivot, it's harder to tell where I'm placing the ball; I sort of disguise where I'm placing the ball. And there he's surprised: he doesn't even touch the ball. [5 to 12, Set 1, Match A].

3.6 Identifying patterns in opponent's strokes

Players discern patterns in the opponent's way of playing and establish cause and effect relationships between several strokes. This mode of knowledge construction is apparent in the following interview excerpt.

Here I'm topspinning to the middle of the table. He's not smashing backhand, I pivot and smash. The fact that he didn't smash is what let me pivot. Then with the forehand I can smash. So here, perfect, I found an answer on this point. I'm topspinning to the middle of the table. I can see that it bothers him, that he can't smash, that I've got time to pivot then and get out of cross-court backhand. I know I'm capable of redoing it and I know I have to redo it. So here, it's really a point where I feeling like I've found something. [7 to 6, Set 3, Match A].

4 Discussion

The results are discussed according to three aspects of players' activity during matches: (a) learning during the match, (b) its disguising component, and (c) its indeterminate nature.

4.1 Learning during the match

As the match progresses, players construct new knowledge in relation to their past experiences and to the judgments they make about the current situation. Their activity is innovative, for they construct new knowledge. The acquired knowledge is utilized in the immediate present, and would also be carried over into the future and to upcoming matches. Players' activity during matches doesn't consist of executing preexisting plans. Such plans exist, but they are constantly being refashioned in accordance with the utilization and construction of knowledge that offers new possibilities (Sève, Saury, Theureau and Durand, in

press).

As a whole, players' involvement in the match can be regarded as a twofold process: (1) the search for practical, immediate effectiveness (win or lose points), and (2) the construction of new knowledge that is currently useful. This construction of new knowledge during matches can be considered as one of the counter-intuitive results of this study. Indeed, it is generally accepted that because so much is at stake in a top-level sports meet, it is not a place for learning but a place for applying already acquired knowledge. The best conditions for learning are thought to be ones where the implications of one's actions are inconsequential and where mistakes are allowed or even required for progress.

4.2 The disguising component of the activity

In addition to the exploration-execution dichotomy, these results demonstrate the importance of disguise in table tennis players' activity. Players discern their opponent's weaknesses all the while attempting to disguise their own. They had to hide two things: the fact that they are having trouble, and the next action they are going to produce. This is necessary to the dynamics of the interaction, for a simple reason: their opponent is probably carrying out the same exploratory and interpretive activity as they are.

4.3 The indeterminate nature of the activity

Players adjust their strokes to the paths of the balls their opponent send them; in turn, their strokes modify the situation, resulting in an ever-changing, dynamic, and highly unpredictable series of game configurations. The activity and the situation thus determine each other in a circular way. This reciprocal determination makes competitive interaction an open-ended process that does not fit into any predefined structure: the expected outcomes of strokes are not necessarily the ones actually produced, and the opponent's strokes continuously make room for new possibilities in the current situation (Sève, 2001).

During one and the same action, a player has to play the offense and the defense (Sève, 1993). The alternation between acting as the server and acting as the serve receiver that occurs every five points generates two characteristic situations. When players are server, they have the initiative on the first ball, so they can direct the course of events in a favorable way. When they are serve receivers, they are forced to respond to the opponent's serve by trying to limit the advantage the first ball give his opponent. The server's advantage is temporary here, and as the play progresses on each point, the advantage can be reversed. When players dominate, they try to score points by reproducing effective strokes and setting up winning game configurations; when they are dominated, they try not to lose the point by avoiding the repetition of strokes proven ineffective and game configurations that made them lose.

5 Conclusions

These results question the general conception of a table tennis player's activity and the distinction traditionally made in sports research and sports

training theories between practice and competition. Theories of sports training see the activity of athletes during competitive interaction as the reproduction of what was learned during training, and as the execution of a pre-designed plan for the match (Salmela, 1996; Weineck, 1983; Werchoschanski, 1992). While training does indeed support the development of motor and decision-making skills that become true resources during a match, a player's activity is not limited to the mere replication of what was acquired during training, nor to the application of a predetermined strategy. A player's activity in a competitive interaction has several other components, including exploration, learning, disguise, and indetermination. These findings suggest we reconsider the role of training in competitions. Some human activities rely on what Ericsson, Krampe, and Tesch-Römer (1993) call deliberate practice, whose function is to ensure an extremely high level of expertise and performance in its actors. Sports are one such activity, as are artistic activities like music, and intellectual activities like playing chess. Deliberate practice is supervised by teachers and coaches and is generally quite diversified. It is aimed at developing the knowledge, strategies, and skills actors need to produce expert performance. Ericsson et al. distinguished expert performance from "eminent performance" (p. 392). Expert performance reflects mastery of the kind of knowledge and skills teachers and coaches know how to impart. Eminent performance, on the other hand, requires actors to go beyond the knowledge available in that domain, in order to make original contributions which, by definition, are not directly teachable. Our results lead us to conceive of a table tennis match as a form of practice which gives rise to new acquisitions, ones that are not taught in today's training programs for French top-level athletes, which include few exploration or disguise (Sève, 2000).

6 References

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