Tactical Knowledge in Team Sports From a Constructivist and Cognitivist Perspective

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Traditionally, teaching team sports has been based on a strategy that puts forward the mastery of motor skills prior to actual involvement in the game, thus emphasizing physical capacities more than an understanding of the game. Supporting a constructivist and a cognitivist perspective to the teaching–learning process, this paper focuses on tactical knowledge constructed by the students. In order to shed light on the nature of tactical knowledge envisioned for the students, the systemic and therefore dynamic view of team sports is presented. Categories of knowledge are thereafter illustrated, and three main steps that students go through to construct and stabilize their tactical knowledge are identified. Finally, some similarities and differences between the constructivist and cognitivist perspective presented in this paper and the knowledge-based literature on motor expertise are discussed.

The work presented in this paper has been patiently conducted on the basis of theoretical choices and postulates about learning and options about the function of the school; it has been and still is systematically applied and regulated by physical educators who collaborate with the team sport group of the University of Burgundy. The elements discussed were selected because they can facilitate an articulation between practical problems of the learning–teaching system and theoretical considerations. This choice for “objective empirism” (Bouthier & David, 1989; Fabre, 1972) might help put aside too formal proposals, not suited for the real world.

Why take such a position? The observation of current practices in teaching games shows a series of highly structured lessons. A first part is dedicated to a warm-up with or without a ball. A second part is based on teaching techniques, and just at the end, the games are employed if the lesson as such is considered finished. Bailey and Almond (1983) have stated that such an approach that stresses the need for developing motor skills before getting involved in the game puts more emphasis on physical capacities than on the understanding of the game. Hughes (1980) had indicated that understanding requires knowledge and
perceptions. In accordance with Bunker and Thorpe (1986), we submit that individual performance must be contextualized in the game.

Despite the importance of decision making and knowledge in effective game participation, there appears to be, at least from a constructivist perspective, little research in the area of student decision making while playing games, either in physical education lessons or in actual competition. Researchers need to find ways to grasp and describe cognitive processes as they occur during a match. As a consequence, researchers would better understand those mechanisms that influence the interplay between knowledge acquisition and skillful performances. This perspective questions the view of Lewis and Anderson (1985) that procedures result from the compilation of earlier declarative knowledge. Whatever the case, it appears that as skill is achieved, more and more of what a player knows becomes automated. Players demonstrate little awareness of what underlies performance and typically are unable to give the reasons for their performances.

Starting with this fact, which seems to apply widely in the realm of physical education, we wish to submit a few ideas on the notion of tactical knowledge in team sports in the hope that they may contribute to the evolution of the teaching of soccer, basketball, European handball, and other team sports in the schools. Before going further, there is a need to distinguish between the notions of strategy and tactics. A schema of play constitutes a preestablished program that puts forward an automatic regulation in order to economically face relatively stable situations. Such schemas make it possible to take the opponents by surprise with an initial advance or (simply by playing faster) to overcome the opponents' defense, as in volleyball or in football.

In sports where continuous play is insured by the rules of the game (primary rule of Almond, 1986), there is always a need to adjust for the active opponent trying to interfere with one's skill execution. In soccer, rugby, or similar sports, resorting to play schemas is rarely appropriate since as the game unfolds, disorder settles rapidly. In this case, strategy refers to these elements discussed in advance in order for the team to organize itself. Tactics are a punctual adaptation to new configurations of play and to the circulation of the ball; they are therefore an adaptation to opposition. As discussed by Gréhaigne (1994), strategy concerns (a) the general order, that is, the outside order form resulting from the general strategic choices of the team (e.g., background play, team composition), and (b) the positions to be covered according to particular instructions each player receives in training (assigned position). For their part, tactics relate to (a) the positions taken in reaction to an adversary in a game situation (effective position), and (b) the adaptation of the team to the conditions of play (flexibility).

The cognitivist perspective is intended for teachers who place their students in the center of the teaching–learning process and is based on constructivism (Piaget, 1967). Constructivism recognizes that awareness, although at first focused on the results of activity, must reach the inner mechanisms of such activities for true learning to occur. This transformation of learners, in team sports, takes place when they meet and solve a number of problems related to the configuration of the game and to motor performances by themselves. Players "construct" their knowledge from a strong subject–environment interaction. This game-centered perspective leads to a learner-based rather than content-based teaching style.

This paper has four major sections. The first section examines how team games are characterized. The second section presents the content of the notion
of knowledge in a cognitivist perspective. In the third section, suggestions are presented about the construction of tactical knowledge. The final section discusses some similarities and differences between a constructivist and cognitivist perspective and the knowledge-based literature on motor expertise.

A Conception of Team Games

Before discussing various categories of knowledge involved in learning team sports, one must specify the context in which the learner is expected to experience transformation. Consequently, we will briefly present a conception of team games (mainly for invasion games; Almond, 1986) that prevails in many European countries. This conception bears a strong influence on the categorization of knowledge proposed in the paper.

Definition

Although unique in their own peculiar way, team sports offer certain indissociable characteristics, within a given set of rules, in a whole oriented towards a particular goal of productivity: winning the match. These characteristics are as follows:

- A rapport of strength: A group of players confronts another group of players, fighting for or exchanging an object (most of the time a ball). (Throughout this paper, ball will be used to represent any object used in a team sport.)
- A choice of motor skills: The players must master a certain range of motor responses, either those of daily life or others much more specific and elaborate.
- Individual and collective strategies: Implicit or explicit decisions, taken by the group, on the basis of a common frame of reference, in order to beat the opponents.

The emphasis put on this indissociable character of the relationship between these three elements bears consequences on the way one approaches and formalizes or patterns team sports (Gréhaigne, 1994). The essence of team sports could be stated as follows: In an opposition relationship (Deleplace, 1979), each of two teams must coordinate its actions in order to recover, conserve, and move the ball so as to bring it in the scoring zone and effectively score. In a similar way, Metzler (1987) describes this essence of sport as being a matter of resolving in action, many together and simultaneously, series of problems not foreseen a priori as to the order in which they will appear, their frequency and their complexity. And all this in order to resolve in a contradictory way, in the same action, the attack on the adverse camp and the defense of his own camp. (p. 144)

The practice of team sports—self-organization of a group confronted by another group with antagonistic interests or in view of reaching a goal (usually
a target) using a common strategy (Gréhaigne & Roche, 1990)—can bring a player who is expected to regain possession of, pass on, or eventually propel a ball (a) to resolve anticipation-coincidence motor problems (set of his movement before the arrival of the ball and regulate it as the ball arrives), (b) to make choices among information, among potential answers depending upon likely costs and benefits, and (c) to manage varying courses and trajectories of the players or of the ball in conditions of decisional urgency. The player, or the learner, is therefore confronted with a complex system. In what ways can one analyze this system? From a cognitivist standpoint, the inner mechanisms of this dynamic system can only be examined from a systemic perspective.

**Systemic View of Team Sports**

A complex system is made up of several simpler elements interacting in a definite manner. Mistakes indicate failures in the interrelationships of various parts of the proposed system. Adaptive action will depend not on the sheer strength of the contenders, but on the continued variation and adaptation of the players in the face of the opponents and under the pressure of time. The actions of a given player thus become contingent upon those of others.

However, more than individuals playing one with another and one against the other, the notion of opposition also leads us to consider the two teams as interacting organized complex systems (Gréhaigne, 1989). The structural characteristics of these systems consist of a program that can be modified (transformed) according to acquired experience. The main functional property of these systems is being able to learn; that is, each team can learn as a team. Operational conditions of such systems in team sports require that one manage disorder, before anything else, while preserving a certain order and thus allowing decisions in a not completely a priori foreseeable environment.

Given that we are focusing on two teams in opposition, a systemic approach of team sports brings us to consider, among others, two main organizational levels, “match” (a set made up of the confrontation of two teams) and “team,” looking at their structural and functional characteristics. By structural, we mean the spatial organization of the constituent elements of the system (synchronous property). By the functional aspect, we refer to the various time-related processes such as exchanges, regulations, and reorganization of the elements (diachronic property).

**The Organizational Level ‘Match.’** Structurally, the elements of the system are represented by the two opposing teams and the communication network between the two is defined by the rules of the sport. At this level, the idea is to characterize, from a space standpoint, the opposition rapport and to analyze essentially the relationship between the strength points of the attack system on the one hand, and those of the defensive system on the other hand. Notions at stake here are “in block,” “in pursuit,” center of gravity, circulation of the ball, and the like.

Functionally, we are dealing with the evolution in time of the opposition relationship between the two teams. In this case, each match provides a phenomenal datum (i.e., something original and unique), thus reducing the efficiency of ready-made motor or strategic solutions.
The Organizational Level "Team." From a structural standpoint, players are the elements of the system; the focus is put on their formal distribution over the playing field and their respective weight in the set-up. The communication network is defined (a) by the rules that determine possible interactions between players, (b) by the instructions received, and (c) by the interrelations effectively used by the team.

Functionally, we are dealing with the evolution in time of the players' distribution on the field (action zone of the players) and of the communication network used with regard to the conditions of the confrontation. One of the characteristics of this evolution is that regulations can take into account experiences acquired during the match and of course their relationships with previous ones. It is obvious here that strategies developed during learning sessions influence this type of evolution.

Implication for the Learner

This systemic view must be seen as fundamental to the emergence of a new understanding of the game. In a more commonly used learning approach one tries before anything else to teach students technical skills and to maintain order on the playing field (e.g., by use of formal groupings). We are tempted to say that it is as important to get the players to optimally manage disorder (Gréhaigne, 1989; Villepreux, 1987). Indeed, in a match, opposition generates the unexpected, making it necessary to constantly adapt to constraints brought about by the confrontation. A match rarely rests upon the simple application of tactical combinations learned previously during training. Thus, most of the time, during the game one can foresee only probabilities of evolution for the attack and defense configurations, which indicates the importance of heuristics for solving more rapidly the problems inherent to specific interactions between two teams. This type of approach, which puts forward "opposition" and "disorder management" as a basis for any progress, brings to light new concepts that appear fundamental for a renewal of team sport teaching. Figure 1 identifies some concepts that come into focus when one points out opposition as a fundamental element of the learning process in team sports.

Figure 1 — Concepts related to the notion of opposition.
The notion of a rapport of strength implies attempts to break the balance between two groups of players to obtain a temporary imbalance favorable to the scoring of a goal. More precisely, the configurations of the play can be considered in terms of continuity/breaking in which one or more of the following occurs:

- Movement of the ball and the players to put together a convenient configuration (continuity in a state of balance)
- Temporary break of the attack/defense system with possibility of a goal if the execution is fast enough (breaking, imbalance)
- In case of failure of the action towards the target, keeping possession of the ball and waiting for another opportunity (continuity)
- Final break of the play with loss of the ball, the defenders becoming the attackers

Therefore, decisions must be taken concerning the continuity/breaking with respect to a given configuration of play taking into account the continuity/breaking of the possession of the ball. Finally two more aspects must be managed by the players facing a double dilemma: Either (a) take risks to gain an advantage (being in advance), but at the expense of a well-organized defense, or (b) favor security by temporarily maintaining one's defensive stability (in order to avoid being late), but letting the initiative of the game to the opponents. Problems encountered in the game can only be solved by resorting to solutions based on the learner's tactical knowledge.

**Content of Tactical Knowledge in Invasion Team Sports**

In a study on formative evaluation practices of physical education teachers (Marsenach & Mérand, 1987), Gréhaigne and colleagues registered and analyzed the didactic communications of teachers during sequences of play. They noted that these communications contained orders and rules given from the border of the court during game situations. However, in the teachers' comments at the end of the sequence, nothing was said in connection with such rules or advice. It was felt by Gréhaigne and his colleagues that such rules and advice constituted declarative knowledge about team sport but that such knowledge had to be more systematically and formally identified. In order to do this, they systematically collected rules stated during game situations either by the students or by the teachers. Then, through content analysis, categories of rules were progressively identified. The categories were regularly validated in two ways: (a) The categories were submitted twice to groups of experts on team sport, and (b) physical educators tested this tactical knowledge while teaching team sports to secondary school students and submitted suggestions and corrections based upon the relevance or the lack of relevance of various rules (Gréhaigne & Laroche, 1994).

Tactical knowledge is fundamentally for us "knowledge in action" because, for a player, tactical awareness and performance are strongly linked. We submit that knowledge in team sport (Gréhaigne, 1992; Malglaive, 1990) rests upon three general categories of knowledge: action rules (in the sense of "efficient
Towards principles of action

Getting collectively and individually organized (decision making)

Motor capacities
Perceptual skills and Sensori-motor skills

Action rules
Towards principles of action

Rules for managing play organization

Figure 2 — System of knowledge in team sports.

Action rules (Goirand, 1993; Gréhaigne, 1989; Gréhaigne & Guillon, 1991; Marin, 1993; Vergnaud, Halbvacks, & Rouchier, 1978) define conditions to be enforced and elements to be taken into account if one wants to insure efficient action. Such rules are basic to tactical knowledge about the game, and their use—whether isolated or in connection with other rules—provides an answer to a given problem. They represent a punctual truth, and some rules, momentarily true, can become obstacles to progress in other occasions; for instance, to create open space, one must fasten the defense in one zone and swiftly pass the ball in another one.

Based on a number of related action rules, efficient principles of action (each defined as a theoretical structure and an operative instrument) in turn orient various actions, making it possible to act on reality (Gréhaigne, Billard, Guillon, & Roche, 1988). Principles of action constitute a kind of macroscopic frame of reference that makes it possible for the teacher and, eventually, for the student to isolate and classify noted facts; for instance, to play in movement in order to bring the ball in the scoring area and score. The following lists provide action rules and related principles of actions for the attack and the defense in invasion team sports. It should be noted that these lists are not exhaustive. The following action rules are related to keeping the ball:

- Having at one’s disposal a maximum number of potential receivers, or increasing the possibilities of exchange.
- Protecting the ball (using one’s body as obstacle).
- Keeping the ball away from the opponent and close to oneself.
- Making passes directed into space behind the defender and in front of the attacker.
- Moving to be at passing distance, seen by the ball-owner, away from the defender.
The following action rules are related to playing in movement:

- Reducing the number of exchanges required to reach the scoring zone.
- Reducing the time used to bring the ball in the scoring zone and shoot.
- Varying the rhythm and the intensity of the moves.
- Moving when the space is free. Creating passing angles.
- Passing the ball ahead of the receiver.
- Favoring the instantaneous passes. Keeping moving after having released the ball.
- Receiving the ball while moving.

The following action rules are related to exploiting and creating available space:

- Using the depth and the width of the field or court.
- Locking the defense in a zone, playing on another.
- Alternating direct play and indirect play, short passes and long passes.
- Locking the opponents to free some partners. Changing the direction of play.
- Using spaces not occupied by opponents.
- Moving away from the opponents, in the intervals, or behind the opponents.
- Creating screens or blocks and exploiting them.
- Using speed and temporal advantages.

The following action rules relate to creating uncertainty:

- Keeping the alternative direct play/indirect play. Changing one’s rhythm (slow/quick).
- Luring the opponents into a zone to conclude in another.
- Increasing the number of players involved in the action.
- Feinting, that is, combining the change of rhythm, space, and orientation (body and leans). Moving in one direction, releasing the ball in another.
- Adopting a posture, an orientation that allows various actions (disguising one’s intentions).

The following action rules are related to defending the target:

- Initiating pressure in the area of the ball in the few seconds following loss of possession.
- Putting as many players as possible between the ball and the target.
- Reinforcing and covering constantly the axis of the goal.
- Organizing the team in lines of strength and planning the supply.
- Putting the attack off-center towards the outskirts. Moving the ball away.
- Covering one’s partners. Preventing shots.
- Withdrawing quickly while looking at the ball to re-create the defense lines.

The following action rules are related to regaining possession of the ball:

- Recovering the ball as close as possible to the opponent’s goal.
- Increasing the numerical density in the middle of the field and in the attack area.
• Impairing the progression of the ball, challenging every opponent.
• Looking for the interception.
• Putting immediate pressure on the player with the ball—harassment.
• Positioning oneself on likely trajectories of the ball to isolate the ball carrier from his or her partners.

The following action rules related to *challenging the opponent’s progression*:

• Reducing the number of potential receivers.
• Foreseeing the opponents’ actions.
• Quickly understanding the opponents’ system of play.
• Having explicit communication with the defense. A player must coordinate the defense.
• Evaluating the capacity and the skills of one’s direct opponent.
• Keeping both the attackers and the ball in view.
• Sticking to agreed-upon rules and to one’s task.
• Impairing the opponent through one’s placement and movements.
• Feinting to trick one’s opponent.
• Rapidly modifying one’s defensive system to adapt it to the game.
• Adopting an optimal position on the field. Reducing the available space.
• Keeping the attackers away from the target.
• Defining everybody’s rules on set play.
• Spotting the favorite sector of action of one’s direct opponent.
• Reducing the effective space of one’s opponent.
• Delaying the attack whenever the defenders are outnumbered.

Play organization rules cover a certain number of themes related to (a) the logic of the activity, (b) the dimensions of the play area, (c) the distribution of players on the field, and (d) a differentiation of roles. These rules also cover a few simple organization principles that may facilitate the elaboration of a strategy; for instance, in soccer, like in hockey, *due to the shape of the target, defenders must constantly hold the central axis in order to throw the attackers off center*. The following list provides examples of such organization rules for the time prior to the game:

• Adopting a given plan of defence.
• Adopting a given system of play, a general framework.
• Assigning an optimal position on the field (or on the court) for each player.
• Identifying one’s strengths and weaknesses and those of the team.
• Constructing a game plan.
• Assigning roles and tasks within the team.

The following are organizational rules to be used during the game:

• Creating imbalance in one’s favor.
• Coordinating and connecting the various actions of the team.
• Playing into a weak axis of the opponent’s defense.
• Maintaining movement in the game.
• Gaining and keeping an advance on defensive replacement.
• Optimally positioning everyone along the axis and at the outskirts of the field or the court.
• Letting opponents gain the ball and choosing the right moment to regain possession.
• Rapidly adapting to the specific of the opponent’s attack and defense.

Motor capacities refer to two large categories of problems related to (a) the perceptual and decisional activity of the player, and (b) the motor skills which the player possesses or must develop. Indeed, if they are to be applied, rules require the development of motor capacities. Thus, rules and motor capacities can hardly be dissociated; for instance, *in order for the player controlling the ball to effectively deal with a ball request from a partner, the latter must be in the field of vision of the former and at passing distance.*

To improve tactical knowledge players must establish guidelines on which to base their decisions. The action and organizational rules presented earlier (a) conceptualize the goals and objectives for attacking and defending and (b) nurture cognitive processes. In a cognitivist perspective in light of “teaching for understanding,” students are constantly required to engage in cognitive processes, including analyzing a problem or a situation, planning solutions, evaluating the effectiveness of their actions, making judgment about the consequences of their action, noting the appearance of constants, and validating these constants by a return to the game (Gréhaigne et al., 1988; Kirk, 1983; Schwager & Labate, 1993). But how do players elaborate and memorize this knowledge?

**The Construction of Tactical Knowledge**

Anderson (1976) proposes two distinct classifications of knowledge: declarative and procedural. *Declarative knowledge* is the knowledge of factual information. It is conceptualized as a prepositional network consisting of nodes and links (Chi & Rees, 1983). Each node indicates a concept, and the links represent associations between concepts. Procedural knowledge is usually conceptualized in terms of production systems. Procedures are if-then statements for completing sequences of action that are activated through associations with declarative concepts.

Turner and Martinek (1992) suggest that knowledge and skill are related. Procedural knowledge and the time variable appear to have the greatest influence on this relationship. This is in accordance with the findings reported by French and Thomas (1987) and by McPherson and Thomas (1989) that show a significant relationship between sport-specific knowledge and the decision component of performance. Anderson (1982) and Chi and Rees (1983) suggest that the acquisition of declarative knowledge provides the foundation for the development of procedural knowledge such as what to do in a specific game situation. There are also specific relationships between motor skill and action rules. But, at this stage, we suggest that students can, whenever necessary, systematically question themselves on the basis of the learning situations, putting forward hypotheses about the problem to be solved and about the way to do it. Students are therefore able to analyze the constraints of the task and identify its various specific objec-
tives while formulating action rules and even associating them with principles of action.

This self-questioning can lead to a more complex or a simpler planning. It is a way of learning which consists of understanding in order to succeed and succeeding in order to understand further. When necessary, such learning allows self-questioning on the part of the student before and after the action (e.g., Piaget, 1974). We think that this way of learning develops at the same time as opportunities for the students to construct personal and significant motor-skills.

From all this, one can define the intelligent behavior of players according to their capacity to assume three related sets of processes (Andreewsky, 1991):

- **Solving processes**: Elaborating and selecting relevant solutions in order to achieve one’s goals and, more generally, to solve formulated problems.
- **Understanding processes**: Answering in a coherent and appropriate manner questions directed to oneself and, more generally, conceiving and elaborating significant and understandable rules.
- **Effector processes**: They are organically related to decision making. (This is particularly apt for a team sport player.)

Indeed, what would be the use of choosing a given solution to solve a particular task of the game if the corresponding required motor skills are not in the player’s repertoire of available motor answers?

In a wider sense, if one considers that any intelligent cognitive activity may always be articulated with problem solving, with understanding of behaviors, situations or briefings, and with performing motor activities, then these functions must be seen as mingled in terms of a system at the disposal of production. For the student, *solving* means starting from an initial state and an objective (final state hoped for) to look for possible paths allowing to progress from one to the other, to build up a system of landmarks. *Understanding* means starting from a path to analyze it and grasp the functional articulations of its various stages. Understanding means building a meaning. *Acting*, finally, means to execute the decisions taken, making it as fast and economic as possible.

Knowledge about the organization of the game, sport-specific knowledge, and knowledge about configurations of play provide the basis for understanding the game. Some of this knowledge may be true at a given time and false at another; it may also depend upon the specific sport used at the moment. All this has to do with the quantitative and qualitative aspects of all the information available in relation to the time at one’s disposal to process them, a greater state of urgency calling for less time, and a lesser state of urgency allowing more. From this standpoint, the action rules used by the players consist of declarative knowledge at first, particularly in the first phase of the construction process. Then, according to the urgency of the task, the rules become either procedural knowledge or routines (automatic procedures) with their known characteristics of economy and speed.

**Similarities and Differences Across Oceans and Cultures**

So far, much has been written in this paper in terms of different concepts, different ways of looking at tactical knowledge in team sports and learning. At the same time, we recognize that much has been left implicit. In many cases,
opening windows and expanding the discussion on various themes would have, as we see it, introduced considerable distortions in the flow of the presentation we wished to put forward. Nevertheless, it seems appropriate to summarize three postulates that underlie the view presented here concerning the learning (construction) of tactical knowledge.

Learning Implies an Interactive Process

The development and the maturation of any individual takes place through an adaptation to an environment perceived as a system of constraints and resources. At the outset, there is no formal object of learning defined as a given set of solutions to be reproduced as is. The analysis of this adaptation necessarily includes the reciprocal action of a subject over the environment and the environment over the subject. Children construct their intelligence by interacting with their internal physical environment (action over one’s nervous system), with their external physical environment (action over objects), and with their social environment (language, the others, etc.)

Learning Implies a Constructive Process

Faced with whatever situation, learners know how to do certain things, and their development rests upon former learning. This development occurs through a new coordination of blocks of knowledge under the influence of internal or external constraints forcing an adjustment of the learner’s activity. In this sense, there is no novice at Level 0.

Constructivism therefore admits the existence of a reality that puts in our way obstacles running counter to internal unfolding of mental activity. There are also assertions that the reality allows the expression of regularities. As Piaget (1970) states, “Consciousness is first centered on the results of activities before reaching their mechanisms; consciousness therefore starts from the periphery, not from central mechanisms” (p. 128). This resorting to consciousness appears at the time of misadaptations; otherwise, when mechanisms operate normally by themselves, they do not provide such occasions for adaptation.

Learning Implies a Cognitive Process

Action regulation, particularly in the learning phase, occurs through mental activity whose consciousness is but one aspect. Resorting to conscious or nonconscious cognitive processes is essential for constructing knowledge as we have defined it. It is not sufficient for the teacher to state rules; the student must make the rules his or hers. In a learning activity, the learners (actors of their own formation), develop a self-regulation activity that consists of (a) comparing the goal aimed for with the obtained result, and (b) analyzing the reasons of failure or success. This comparison allows an evolution of the planification, of the selection of action and of the motor resources solicited. The passage from succeeding to understanding is done through a sudden awareness of the properties of the action and the objects in relation to the properties of the action on the objects.
At first, the learner draws up a temporary mental representation that is an interpretation of the reality (functional representation or operative image). This operative mode makes it possible to stock information. When this model is no longer sufficient to solve problems, the learner experiences a conflict between a former explanatory system and the need to construct a new representation holding more explanatory power. Learning then operates from a restructuration of representations which works on a continuity/rupture mode (Chatillon, 1985).

As evidenced by the excellent review of Abernethy, Thomas, and Thomas (1993), over the last two decades there has been a considerable increase in motor expertise research, and part of this research has been conducted within a knowledge-based paradigm (e.g., French & Thomas, 1987; McPherson, 1993, 1994; McPherson & Thomas, 1989; Starkes, 1987; Thomas, 1994; Thomas, French, & Humphries, 1986; Thomas & Thomas, 1994). Researchers in the sport pedagogy and the motor learning domains have also examined the question of "communicating information to enhance skill learning" (e.g., Landin, 1994; Lee, Swinnen, & Serrien, 1994; Magill, 1994; Rink, 1994; Silverman, 1994). It was not our intention to compare our constructivist cognitivist perspective with the considerable literature produced in relation to knowledge and performance in sport. It seems appropriate, however, (a) to acknowledge the research conducted in this area, as rightly suggested by one referee, and (b) to attempt to briefly pinpoint similarities and differences between the views presented in this paper and the conclusions of research reported in the literature alluded to above.

Although the work discussed in this paper has been conducted with reference to the teaching of sport skills, the various constructs alluded to are clearly closer to those used by the researchers centered on motor expertise and knowledge than those of researchers centered on communicating information between the teacher and the students (under the form of information, verbal cues, augmented feedback, etc.). Therefore, we see the notions of declarative and procedural knowledge as central to learning, as do J. Thomas, K.T. Thomas, McPherson, Starkes, French, and others. We even share the reserve expressed by Abernethy et al. (1993, p. 325) as to the validity of these knowledge structures.

It has been shown in motor tasks, especially in high-strategy motor tasks (McPherson, 1994; Thomas, 1994) or complex tasks (Gréhaigne, 1992), that experts "possess a more complete and highly differentiated store of both declarative and procedural knowledge than novices" (Abernethy et al., 1993, p. 325). With reference to team sports, we submit that experts may be those who have constructed and integrated the various components presented in the discussion of action rules. But most often this knowledge is nonconscious.

The view presented in this paper therefore goes beyond the cognitive perspective of learning; it rests also upon a constructivist perspective that requires a distinction between acquired knowledge (not necessarily tested by the effector system) and constructed knowledge resulting from repeated hypothesis—verification cycles during practice. This explains, in part, the distinction made between strategy and tactics and why the focus of the paper is on tactical knowledge rather than on strategic knowledge.

Finally, from what we have written about the construction of knowledge, it should be clear that the tactical knowledge domain described in terms of action rules and organization rules can in no way be seen as complete and stable; according to various learners, various levels of development, and various sports,
it can, of course, be reduced or expanded, but the general frame presented in Figure 2 should apply in all cases. Further research is needed to explore tactical knowledge in all sports, and McPherson’s (1994) discussion on mapping this tactical domain should help us in the future.

References


