System approach to games and competitive playing

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ORIGINAL ARTICLE

System approach to games and competitive playing

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Abstract
A deep understanding of sport competition is essential for games because the success of coaches and players in such events is dependent on many qualitative and latent factors, which are explainable by means of highly problematic and complicated procedures. The difficulty of setting out the "winning-factors" in games in orderly fashion has forced researchers to study a game as complex entitites, and in particular as dynamical systems (Bar-Yam, Y. (2000). *Applications of complex systems: Sport and complexity*. NECSI. Website publication: http:/necsi.org/guide/examples/basketballcomplexity; Bar-Yam, Y. (2003). *Dynamics of complex systems*. New England Complex Systems Institute: Perseus Books Group; Mayer-Kress, G.J. (2001). Complex system as fundamental theory of sports coaching? Keynote presentation. *International sports coaching symposium*. Taichung, Taiwan, 01/11/16-18, arXiv:nlin.AO/0111009 v1 2 Nov 2001; McGarry, T., Anderson, D. I., Wallace, S. A., Hughes, M., & Francs, I. M. (2002). Sport competition as a dynamical self-organizing system. *Journal of Sport Sciences, 20*, 771–781). This article is a further attempt to explicate games in this fashion. The article examines games by analyzing three main and interrelated categories: "game" itself, "system", and "conflict". I will try to prove that the match (the process of game playing itself) is a conflict of at least two complex dynamical systems. Such a vision stands in debatable contrast to the published, well-known approach of Tim McGarry and colleagues (McGarry, T., Anderson, D.I., Wallace, S.A., Hughes, M., Francs, I.M. (2002) Sport competition as a dynamical self-organizing system. *Journal of Sport Sciences, 20*, 771–781), which contends that competitive playing itself constitutes a dynamical self-organizing system.

Keywords: *Game, sport competition, conflict, complexity, dynamical systems theory*

Introduction

In order to characterize a game sport and the participants involved in it as systems one must first examine the concept of "game" in its various relations to other concepts. These relations construct different categories of the analyzed systems. Grehaigne and Godbout note two kinds of these categories:

> "*. . . the notion of opposition . . . leads us to consider the two teams as interacting organized complex systems (Grehaigne, 1989). . . . a systematic approach of team sports brings us to consider, among others, two main organizational levels: "match" (a set making up the confrontation of two teams) and "team" . . . "*
> *(Grehaigne and Godbout, 1995, p. 493)*

Some authors (McGarry et al., 1999; McGarry et al., 2002; Mayer-Kress, 2001; Pavicic, 2003) maintain that a sport competition (what Grehaigne and Godbout call a "match") is a dynamic self-organizing system (a system with all the attributes of complex systems).

A broader view of competitive sport, in my opinion, offers at least four possible analytical categories:

1. "Game" as a system of ordered information, a code of rules restricting and defining participants' behaviors in specially constructed conditions of space, time, and means.
2. "Match" (game playing) as a process of participating sides (systems) competing between them.
3. "Game player" as a system, which directly functions in sport competition conditions. A single player or a team of players can represent such a system.
4. "Game (sport) institution" is the organizational system encompassing all subsystems and en-

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suring the successful participation of a "game player" in competition.

Each of these systems can be considered and described according to its structure and functions.

Formal structure of game and its features as a system

As I shall demonstrate below, game is, above all, an abstract or analytical system. Unlike real systems (such as "game player" and "game institution"), which can only exchange information, abstract systems are composed only of information (Kuch, 1974). Before beginning any analysis it is necessary to draw up a set of special features of game noted by others, without connection to the concept of "system" (Coakley, 1980; Harris & Park, 1983), such as competition, rules, roles, and special complicated skills.

Rules are the most essintial factor characterizing a game and distingishing it from the "*primitive play*" (the term used by Suits, 1988). Rules ensure that a game is recorded (or fixed in folklore) as a pattern of at least four blocks of important information:

"Game":

1. *Goal directed activity.*
2. *Rules limit the permissible means of goal attainment.*
3. *Rules prohibit more efficient in favor of less efficient means.*
4. *Rules are accepted to make the activity possible.*

(Meier, 1988, p. 26)

It is my contention that the second and third blocks contain information that form the underlying support ("the root") for the creation of an artificial system. Esposito (1974/1995) calls this basis "possibility"; Kretchmar (1975/1995) considers it as a "test" construction. Both refer to the special playing situation that a person creates for testing his abilities in dichomotic conditions. Kretchmar (1975/1995, p. 38) explains this situation in the next breath: *"... test involves an alternation of vulnerability and impregnability rather than a simultaneity of these factors"*. In other words: emotional animation created by uncertainty, intrigue, and by the unique situation in which the question of "Can I do it? – I know, I can fail" creates playing itself. In this light one can understand Suits's (1988, p. 5) note: *"Boredom is the mother of play"*. Certainly boredom is an antonim for such kind of emotions. And Caillois has supported this by the next:

"Every game of skill, by definition, involves the risk for the player of missing his stroke, and the threat of defeat, without which the game would no longer be pleasing. In fact, the game is no longer pleasing to one who,because he is too well trained or skillfull, wins effortlessly and infallibly."

(Caillois, 1961, p. 7)

The search of additional conditions for shaping a test situation of "possibility" involves competition. In competition "primitive play" is always changed into the "game", i.e. competition turns a test into a state of "contest" between competing opponents (Kretchmar, 1975/1995). It is expressed by a change of "Can I do it? ... " to "Let's see if you can beat me". Competition makes rules of playing absolutely essential and causes them to become a central point of game creation as an artificial system of information.

Game, however, has not only a formal structure, i.e. *"rules, which delimit and order the boundaries of the gaming experience"* but also a social, cultural, and aesthetic one as well (Mackay, 2001, p. 4). One can also add to this list the "progress rhetoric of play" (Sutton-Smith, 1997, p. 35–51), i.e. the psychological-developmental structure of play and games (Vygotsky,1933/1966; Piaget, 1951). The cultural structure of the game is more important for the subject under discussion here because the process of game creation and rule development always involves the cultural context of its being practiced and insitutionalized by society. As Lebed (2004a) notes, such institutionalization can be realized in one of three ways: (a) "crystalization" (as football rules crystalized over a period of hundreds of years), (b) "natural selection" (e.g., modern handball, which "survived" in the competition against three similar officially recognized European games), and (c) "invention" [e.g., basketball rules invented by Dr. Naismith to fit the special objectives set down for him by state authorities (Nisenson, 1949)]. This "troika" clearly illustrates the close connection to the cultural subtext: "crystalization" (the old way) connects us to ancient religion rituals as an origin of games; invention (the new way) calls attention to modern man's creative abilities for using games to meet cultural (and in a majority of cases-educational) purposes.

Finally, as has been accepted since the times of Groos (1901), and Huizinga (1938), whether game arose from religious rituals (Simri, 1966) or from marriage rites, or is an artifical construct of modern times, the competitive game itself is a product of human cultural activity, the main features of which

are stimulating obstacles (test[1]) and creating conditional conflict.

Suits (1988, p. 3) constructs a dichotomy for these conditional conflicts: "*performances* in contrast to *games*", and later (Suits, 1988, p. 4) he adds: "games generate *new* skills by erecting *artificial* constraints just so those constraints can be overcome, whereas performances eliminate natural constraints in order to refine old skills". This leads to two great discussions of the second half of the 20th century: the first one about the "tricky triad" – play, game and sport, and their inter-definition (Suits, 1988, 2004; Meier, 1988; Schneider, 2001) and the second one about correct games typology and classification (Caillois, 1961; Ellis, 1985; Hopper, 1998; Lebed, 2004b).

To avoid making the discussion even more involved, I propose to center the analysis on "*agon*" (Caillois, 1961) competitive games with play article (ball, disc, shuttle-cock), in which the match, according to Lebed's (2004b) classification, is carried out in direct simultaneous competition between opponents (football, volleyball, tennis, etc.). This is especially necessary because the conditions of conflict between playing and competing opponents are sharpest in these kinds of games. Therefore this type of playing is most problematic for systematic comprehension, psychological diagnostics, and pedagogical control.

This contraction of the object of this study makes it possible to underline what in my point of view is the next important characteristic of the game as an artificially constructed contest. I am referring to the concept of "perturbation" elaborated by Hughes and colleagues (Hughes et al., 1998, 2001). Perturbation is "*. . . an incident that changes the rhythmic flow of attacking and defending, leading to a shooting opportunity*" (McGarry et al., 2002, p. 775). This aspect of my analysis leads to the most "dramatic" stage of the "test-contest" artificial development in any game, the upsetting of the balance between contesting sides. In one game the balance between contesting opponents is so clearly "crystallized" that a perturbation is occasioned only a few times (a goal in football). In such a case Kretchmar's "vulnerability-impregnability" connection is tight and the test itself (scoring the goal with an accurate foot-shot) is very hard. Another game is determined by a one's sharp mind, and the above balance is highly fragile. Dozens of perturbations (scoring in basketball) stand witness to the essential advantage of the offensive side. In other words, the "vulnerability-impregnability" connection is faint, and the test itself ("scoring a basket") is more or less easy. But that is how the artificial system is built. In any case, a temporary balance of contest conditions is an essential part of creating the system in game playing.

Thus, several unique traits can be noted as causal factors that allow "game" to be characterized as a system. I suggest that being a fixed experience of human culture, competitive game is an artificial informational system initially created[2] to be temporarily balanced, only in order to be destroyed by one of the opponents after a serial of "ritual" obligatory actions and manipulations with a standard article and under some predefined conditions.

Match is a conflict of complex dynamical systems and not a system

"Match" (game playing itself) is an entirely different case. I suggest that it is neither a real nor an abstract system. My disagreement with the understanding of "match" as a kind of system is based on a special view of the idea of "complexity" in relation to sport conflict. To substantiate this idea it is necessary to re-examine the content of a number of basic terms. The main term is "system". If one takes an early definition of system by Bertalanffy as *"sets of elements standing in interaction"* (Bertalanffy, 1968, p. 38), the process of game playing is definitely a system. This approach was quite popular during the 1960s and 1970s (Zeigler, 1976). Kuch, for example, saw a system merely in the presence of relations between elements. In his view, a system is any pattern whose elements are related (Kuch, 1974). But as systems theory developed, an essential pattern of signs has become their key indication. The first one is *wholeness*. Stein (1974, p. 3) considers system as a *"whole made up of independent and interacting parts"*.

The second indication is system *persistence*, which can be achieved by boundaries and (in complex systems only) homeostasis (Bar Yam, 2003). A system is anything that, according to Fuller, has *"insideness and outsideness"* (Fuller, 1979).

Most contemporary sources in the field under study in this article would accept this next definition: *a system is an entity of interacting parts functioning as a persistent whole distinguished from the environment by recognizable boundaries*. One of the questions resulting from this definition is whether a process of confrontation (which is a case of "negative" interaction) between independent systems is and can be a

[1] In his last publication dedicated to the game issue Kretchmar (2005, p. 40) makes the term "test" more precise: "*Games have been described as human conventions that are designed to test us - for the inherent gratification . . . or for any number of other reasons related to successfully confronting such a test*".

[2] Kretchmar (2005) calls this process "gamewrighting". Such a lexicon strengths an interpretation of game as an informational "on paper" system.

"whole" which, as such, relates the "whole" to the environment.

Opponents playing the game create a certain reality and relationship bounded from the environment by restricted terms of space and time (Huizinga, 1938). Are these sufficient to call this process "a whole"? One could perceive the confronting players as acting in "symbiotic" unity, so that one cannot play a competitive game without the other. From this point of view such a unity seems like a system. Yet it is nothing but an appearance of systematic wholeness from my point of view.

This thesis is based on the following explanations:

1. The "game player" is a system that can cooperate or confront with other systems. In case of conflict confrontation he/she can never form the symbiotic "new whole" with an opponent system. Playing opponents can not be "a whole persisted from the environment" because each of them is "the tip of a spear". He/she is a dependant element of his own super-system, which is already a "persisted whole" named "a sport institution".
2. A live complex dynamical system (as every one of the players is) cannot behave in exact accordance with the written rules of a formal "simple" system (as any informational system is), even if this simple system is a restricting framework for the complex system's activity. D'Agustino (1981/1995) notes that a certain "ethos" of games practicing creates a code of non-written rules factorizing a player's behavior in contest. Playing sides widen the circle of their degrees of freedom and include them among the consensual "we may". This principle of matching, I suggest, encompasses not only prohibitions and constraints but main tactical and technical characteristics of playing as well. The simple informational system "game" determines what is considered success and what ways are forbidden to achieve it. Such an informational system describes "*a whole group of games . . ., like a combat in which equality of chances is artificially created*" (Caillois, 1961, p. 14). Nevertheless, the system cannot resolve the majority of conflicting "inter-counteractions" of the two complex systems, which seek opportunities to win by using unexpected behavioral strategies, ingenious tactics, and masterly skills. Thus, a complex system's behavior is always more complicated than the behavioral matrix created by the informational system. In other words, life is always richer than a schema. Formally thinking, both competing systems are larger than the framework they are given. This conclusion makes it possible to ignore the framework itself, because the informational system restricts both sides in the same way and mode. Only by ignoring this is it possible, as I suggest, to note that the *antagonistic conflict can be restricted by rules but cannot be systematized (i.e. closed and ordered) by them.*
3. The confrontation of live complex systems is, above all, a conflict of purposes conducted on the background of specific motives. Sometimes motives are also at conflict. To illustrate this, consider a hooligan attacking a simple person on the street. Noone would call such a conflict "a system". The match, on the other hand, is a voluntary conflict interrelation provoked by one motive shared by both opponents. But each opponent's aim or purpose is directed against the other. In any segment of a match, the success of one opponent does not lead to – and does not cause – but rather *is* the defeat of the other. Therefore, such a unity can never be a "whole" having any content and common dynamics. The one case in which the game process becomes a system is a cooperative game. But this example only strengthens my main contention because it shows the systematic "whole" character of the cooperative relationship between a number of complex dynamic systems (players) connected by and revolving around common motives and purposes.
4. It is possible to strengthen my "counter" arguments using the terms and main principles of "complex systems theory" (Rozen, 1985, 1996; Mayer-Kress, 2001; Bar-Yam, 2003). In the (somewhat extravagant) terminology of complex theory, the material parts or the subsystems are called "*levels*". A level is a characteristic of a dynamic system that remains constant until it is changed by a "*flow*". A flow is a movement of matter or information exchange between the levels.

According to Rozen (1985) a flow is a certain function (f), which in the case of live systems can be given the special term "*emergent behavior of dynamical systems*":

$$f: A \rightarrow B \qquad (1)$$

where

A - initial state of a system;
B - final state of a system
$\rightarrow$ - emergent behavior (Rozen, 1985).

My arguments are based on the next step in this reasoning. In the case of a conflict relation between two levels S1 and S2 (assuming the premise that a just match *is* a complex system, and it is the super-

system for subsystems S1 and S2), we get:

$$\begin{aligned} &f1: \quad S1 \rightarrow S\Pi \\ &f2: \quad S1 \rightarrow S\Pi \end{aligned} \tag{2}$$

where S1-initial state of the first subsystem;
S2-initial state of the second subsystem
SΠ-a final state desired by S1 and S2.

In case of conflict between the levels, three conclusions follow from (2):

$$\text{If } f1 = f2, \text{ neither S1 nor S2 can come to the} \tag{3}$$

wanted state SΠ;

$$\text{If } f1 > f2, \text{ S1 become } S\Pi \tag{4}$$

$$\text{If } f1 < f2, \text{ S2 becomes } S\Pi \tag{5}$$

But the complex system can change its state *as a whole* only if both f1 and f2 have completely reached their destination, and all levels have attained the desired state. (In this case state SΠ is the "*attractor*"[3] of the dynamical system and the desired result of the system's self-organization). But this order of things is impossible, because SΠ can be an achievable attractor for only one level: S1 or S2. If S1 becomes SΠ and S2 does not, the whole system does not achieve the attractor, and furthermore, it will never achieve the attractor.

The existence of a complex system depends on wholeness and on the support of the emergent behavior for all levels in a state of cooperative progression towards the attractor (Rocha, 1998). This notion principally contradicts the state of two levels in conflict flowing in opposing directions. A normal dynamic system cannot develop its process of seeking the attractor before its self-organization is completed and internal conflicts are eliminated. This is a very important part of a system's persistence. Only a simple artificial informatic system, as a "game" is, can be created "on paper" for self-destruction.

> *"Qualitatively, to understand the behavior of a complex system we must understand not only the behavior of the parts but how they act together to form the behavior of the whole."*
>
> *(Bar-Yam, 2003, p. 1)*

Thus, in the case of a match we have a principly impossible example of the "system" that changes as a whole through self-destruction and has counter-directed internal flows[4] deconstructing it. Finally I suggest that the artificial self- destructive system (written rules of a game) can be only the framework, the "test", and the cause for relations of "normal" complex dynamic systems. But they act independently in these conditions and according to their separate interests. If one comprehends the process of game playing both as a "conflict" and as a "system", he considers the function (the flow) as the equivalent of some matter (the level). And this is, certainly, a logical mistake.

Criticism of the "homeostatic model" of the game playing process

The understanding of a game process as a system leads one of the groups of sports specialists (Anderson et al.) to propose a view of sport competition as a dynamic self-organizing system (McGarry et al., 2002).

The main concept presented by those authors is, as I see it, disputable because their "homeostatic" vision of competition is founded on an old "S-R" behavioristic scheme[5], which is not correct. Moreover, it might entail methodologically unfavorable results in training players for defense and in performance analysis of play (Lebed, 2003).

> *"One feature that characterizes a dynamic system is the transition in some order parameter . . . as a result of scaling in some control parameter. . . . Thus, a horse will change . . . from a walk to a trot or from a trot to a gallop as a result of increasing its locomoting speed".*
>
> *(McGarry et al., 2002, p. 772).*

> *"With this constraint of mind, McGarry et al. (1999) suggested a physiological attractor for sport competition that serves to draw the system towards a state of homeostasis or stability".*
>
> *(McGarry et al., 2002, p. 778)*

The authors usually interpret the results of an offensive act as a destabilizing factor in the system's rhythmical dynamics. Therefore they see the defensive act of the opponent as a restabilizing act or even a reaction "towards the state of homeostasis" (McGarry et al., 2002, p. 778) of the system. For example, two or three volleyball defenders try *to save* the ball on court by blocking an opposing shot-maker from landing a ball. Opponents exchange

[3] "Attractor" is a term accepted in the theory of complex systems. The term means a wanted state of a life complex system in its strivings after stabilization of homeostasis or behavioral adaptation to environmental influences (Rocha, 1998; Dimitrov, 2003).

[4] These antagonistic flows are not the same as those modeled in the PerPot metamodel of a complex system (Perl, 2001). Perl's antagonistic flows balance and delay one another, and this balance creates a performance potential of the whole system. In the case of game playing a match takes place only if the opposing forces are equivalent. Since one of them becomes bigger its level becomes the state of "winning" and the "system" is thus destroyed.

[5] "S-R" is the classical schema founded by the behaviorist psychology. The STIMULUS (S) of the object causes a RESPONSE (R) (a thought, a sense or a movement) in the subject.

roles during game playing. Therefore the authors draw the entire process, which they call a dynamic self-organizing system, as "thrust-and-parry" in individual contests and "ebb-and-flow" in team sports systems.

In addition to my above mentioned views – "The match is a process. Thus, it is "a flow", which cannot become "a level" (see part 2) – I would like to make several critical comments about this approach. The first is more general and touches upon the theoretical foundations of the proposed model. To begin with, it is rather problematic to accept the mechanistic transfer of regularities suited to motor-adaptive activities of living systems (such as a horse pace) to the regularities of human group activity (which is what these authors actually do). This transfer is only possible where the main conditions of both systems are similar. In our case in particular they would both have to have an equal issue of decision-making and system controlling. Secondly, relations between the side that "thrusts" and the side that "parries" are presented in a far too reductionist form. The simplified "S-R" scheme does not take the active anticipative behavior of both the sides into account.

According to the "thrust-and-parry" principle and the "S-R" formula, the defenders' role comes down to an attempt to salvage the homeostasis of the "system". In principle, this position precludes any chance for any "embryonic" offensive activity on the defenders' part. But there is no such situation in an actual match where the defender's only business is to protect his side (goal, basket etc.). In actual sport performance, this theoretical principle is expressed by hundreds of practical coaches and the example of Holland's "total football" in 1970s. Usually two or even three defenders of Netherlands' national team would attack the offensive side that controlled the ball, on its half of the playing field, thus creating perturbation among the opponent's forces. As a result, the opponent often lost the ball. Finally, it is easy to assume that the reactive "S-R" schema leads to a reactive and passive strategic philosophy of defense in game sport competition. Such a principle could be "mistranslated": (a) by coaches, who might build passive defense strategies and (b) by researchers in the process of developing performance analysis computer programs. A significant flow of very important information could disappear from a program of match observation if it were built on a homeostatic model of game playing, such as the one discussed above.

The subordination of real systems in game sports

We may certainly claim that two kinds of real systems can take part in game competition: "game player" and "sport institution".

The "game player" itself can be imaged as a rather complicated object for analysis, not an ordered system or a chaotic system, but rather both of them simultaneously. On the one hand, the player's mind, which controls his/her behavior through decision-making and neural-motor regulation, undoubtedly has features of a chaotic system. On the other hand, a properly regulated emergent behavior expressed by appropriate acts and operations is certainly a sign of a well-ordered system. Such a description would be accurate in the case of a person's behavior in mundane life situations. But game playing is characterized by conflict, aggression and anxiety and their resultant stress, by time limits for evaluating a situation, and by decision-making clouded by uncertainty regarding the intentions of teammates and opponents. These are really the essential factors for acting on the "*edge of chaos*"[6], i.e. for the emergent behavior.

The designation of the system as "on the edge of chaos" becomes unequivocal if the "game player" is a team. Such a system is more chaotic initially than a playing person. The equifinality[7] of a collective "game player" is always a harder problem because the instability and degrees of freedom of these systems are directly dependent on a number of players (levels of the system), their possible interactions in game (flows), and on each one's level of craving to achieve victory in cooperation (motivation).

The real systems of the second kind ("sport institution") are those that exist in the formalized framework of game sport. These are simple organizational super-systems, which function according to certain rules of business management. The point here is that the "game player" is the main subsystem of "sport institution". Their conglomerate (Figure 1) forms a very special structure of complex and non-complex levels and builds complicated relations between them through the personality and mediation of a coach. But "sport institution" is not only a complex system; it is also a three-loop cybernetic system.

In such a system one of the levels is a controlling "subject", and others are "objects" ordered according to a certain subordination. But the main feature of a cybernetic system is its "feedback," that is, a

[6] One of the terms accepted in the theory of complex systems. It means all live dynamical systems constantly existing on the edge between successful adapting to environmental changes and destruction.

[7] Equifinality is the movement of a system from chaos to stability, which achieves its outcome (Bertalanffy, 1968).

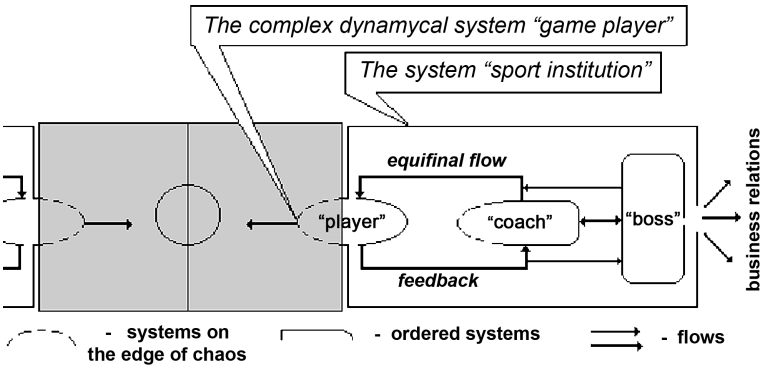

Figure 1. Systems taking part in the process of game playing in the framework of formalized game sport (explanations in the text).

specially organized flow extending from the controlled object and directed to the controlling subject. Since the 1960s cyberneticans have claimed that only a closed loop of connections – "subject→object" and (obligatory) "object→subject" makes the successful control of each system possible.

The problem here is controlling complex dynamical systems, which in principle are not controllable. Therefore a coach's influence on a player (team) cannot be called "control" in a clear sense of the word, but rather a process of organizing and ordering toward equifinality. The coach himself is also an "ordered/chaotic" system like the "game player". But he/she is the factor that has to realize the desired process of equifinality (see Figure 1) of the game player's activity in competition. The coach-game player connection (the first cybernetic loop) is the main and most important flow in the super-system "sport institution". Coaching in general and especially coaching in game competition entails processes of control at the "edge of chaos". Direct coach influence on the game player is always a difficult process that slides along the "chaos-order" scale. At the same time the process of equifinality cannot be maximal. A certain degree of freedom has to be retained for the game player's own emergent behavior, as in the final analysis, it is the game player who makes decisions and performs them independently.

The strong cybernetic subject-object relationship exists only between the 'boss" and the "coach". On the one hand, all rules and regulations of business management apply to this relationship. On the other hand, a coach, as much as the player, acts "on the edge of chaos" during competition. All the features of an emergent behavior in a complex dynamic system seeking an attractor characterize the coach's managing decisions and behavior at this time. The problem is in the contradiction between the content of the "coach-boss" simple business-relationship system and the content of the "coach-player" complex system relationship. The coach's achievement (winning by the player) is assessed by the criteria of simple management systems. But winning itself is a result of a cybernetic loop connecting two complex systems that cannot be principally assessed by these "simple" criteria. This is the "great" contradiction of coaching as a profession.

The third cybernetic loop of the system "sport institution" is a subject-object relationship between a "game player" and a "boss". Here the emphasis is mainly on "manager-worker" relations only, because an effective sport manager never participates in the direct control of the training and competing processes of "his/her" athletes. He/She has to ensure achievement of the whole system's goal and the "workers'" satisfaction (coach and player).

Game playing as a conflict between systems

Having defined the basic terms of the article, we can now continue and explain my main position for understanding a sport competition if it is not a system. For best understanding, the description of a competition must be broader than for game sports alone. If a competition entails a conflict, it must be possible to categorize different competitions with a certain amount of regularity according to the intensity of conflict between opponents (Figure 2).

The grouping of sport competitions according to conflict intensity level was a result of a logical union of the four different conflict classifications prevalent in games theory. This union facilitates the use of four different criteria (and thus four linear classifications) for a multi-faceted classification and description of the object under study (sport conflict). According to the six columns formed by these four linear classifications, at least six different kinds of sport competitions can be identified (Figure 2).

A particular group of sports is representative of each type of competition. We can recognize boxing and other combat sports in the first group. Any kind of cross-country activity represents the fourth group where opponents can possibly influence one another. The fifth group is illustrative of sprints in track-and-field athletics or swimming competitions where lines or boundaries separate athletes from one another.

<table>
<tr><th>Criterion of classification</th><th colspan="6">Kinds and features of sport conflict</th></tr>
<tr><td>Timing</td><td colspan="5">conflict with simultaneous competing of sides</td><td>competing in sequence</td></tr>
<tr><td>Goals of sides in a conflict</td><td colspan="3">conflict of two sides with two opposite goals</td><td colspan="3">conflict with a common goal for all sides</td></tr>
<tr><td rowspan="2">Method of confrontation</td><td colspan="4">conflict with direct counteraction</td><td colspan="2" rowspan="2">conflict with undirect counteraction</td></tr>
<tr><td colspan="2">aggressive</td><td colspan="2">non-aggressive</td></tr>
<tr><td>Form of confrontation</td><td>"subject - subjective" conflict</td><td colspan="3">"subject - subject - objective" conflict</td><td colspan="2">" objective" conflict</td></tr>
<tr><td>Level of conflict</td><td>1 very high</td><td>2 high</td><td>3 middle</td><td>4 less than middle</td><td>5 low</td><td>6 very low</td></tr>
<tr><td>Samples</td><td>fencing, boxing</td><td>soccer, hockey</td><td>squash, tennis</td><td>cross-country</td><td>sprint, swimming</td><td>gymnas-tics</td></tr>
</table>

Figure 2. Unified classification of sport competitions according to conflict intensity level.

The sixth group encompasses all competitions where athletes do not confront one another directly, but perform in sequence.

Similarly, we can characterize game sports (which are the main subject of this article) as reflecting the features of the second and third kinds of competitions. Football, basketball, handball, hockey and other games with direct contact between opponents are all included in the group marked by high intensity of conflict expression. Using this classification, we can introduce the next multi-characteristic of such competitions: conflicts between two sides simultaneously competing to achieve two opposite goals. Additionally, they are "subject against subject for object[8] capture" conflicts with direct aggressive counteraction. This kind of game sport differs in one main detail from games where opponents play and compete without direct contact (volleyball, tennis, squash and so on). It entails non-aggressive player counteraction, which lowers conflict to a middle level intensity (see the third group, Figure 2).

In the types of game sports mentioned above, two opponents in the process of playing are subjects whose decision making is both interdependent and independent at the same time. The symbiotic similarity of their main motive (to win) and their inherent clash of interests ("my win is your loss") reflects this connection. In such cases each side necessarily sees the other as an obstacle to achieving its aim and gratifying its motives. The obligatory presence of conflict in a sport competition turns it into a special kind of activity. This is the conflict activity of human systems.

In this way one can interpret game playing as a "low-governed" conflict between confronting sides. Such a process is always an initially active conditional conflict between independent yet mutually influenced opponents (systems), engaged in opposing tasks connected with scoring and manipulating a play article in symbiotic "inter-counteraction". As I suggest, there is a strong relationship between the intensity of the conflict and the level of randomness and entropy in the behavior of "game players". It would seem that a higher level of conflict intensity of certain game sports corresponds to higher complexity. Thus a dynamic system is more randomized, its self-organization is more problematic and its emergent behavior is more chaotic. Stabilization and ordering of such a system is a very hard mission, which demands specially groomed personalities from players, coaches, and managers who can construct effective cybernetic systems.

Conclusions

1. The system approach as an overview of the field of competitive game playing discussed above makes possible to distingish two main categories directly connected to the concept "game". The first is "game" as an artificially constucted system of ordered information in accordance to certain rules and a certain cultural context. These rules create a fragile balance: (a) between player and conditions of the constructed test (optimally high hurdle) challenging him to play; (b) between counteracting and/or contesting players in the case of

[8] In such a way we understand that a "subject-subject " fight in a game makes sense only when the sides conflict for two "objects". The first one is a play article (a ball, a puck), the holding of which alone offers the possibility to score the goal. The second object is scoring the goal itself, what Suits (1973) call a "pre-lussory goal."

competition. The second category of "game" is connected to the live process of game playing, which, as I suggest, has to be given a separate special term: "match".

2. According to the view developed in the article, game sports have to be comprehended by a systems approach in at least four main aspects:
   A. The examination of "match" as a system is not worthy of criticism. The "homeostatic" model of McGarry and colleagues, which presents competition as a dynamic self-organizing system, cannot be accepted.
   B. Three sorts of systems actually exist in game sports:
      – the abstract informational system "game", which builds the framework for game playing;
      – the complex dynamic system "game player";
      – the managed (cybernetic) system "sport institution", which consists of at least three subsystems: a "game player" level, a coaching level, and a managing level.
   C. Such an evaluation of game sports has to take into account both the complexity (i.e. the emergent behavior of the whole, the persistence of that whole, and the self-organizing of each sub-system) and the cybernetic character (i.e. subject-object controlling equifinality) of the analyzed systems.
   D. Competitive game playing (that takes place on the background of mental pressure, extreme physical effort, and different limitations on decision-making) can be considered conflict activity of complex dynamic systems.

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