99 - GAME - A COMPLEX ADAPTIVE SYSTEM

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INTRODUCTION

In the last decades, the Theory of Complexity has awakened the interest of the scientific community due to its studies about the dynamics of non-linear interaction in systems. The characteristics of dynamic and non-linear systems have brought about new possibilities of observation and interpretation to the sports practice which also has allowed a more specific approach over games as live systems. Systems are understood here as distinct and original elements with already established communications and relations, forming a collective whole and maintaining each agent's own expression.

The work of Robert Axelrod and Michael Cohen called “Harnessing Complexity: organizational implications of a scientific frontier”[1], seeks to offer concepts and mechanisms which enable the reader to comprehend organizations as complex systems. It is from this referential that we defend the game of high efficiency as a complex system in which structured teams try to achieve success through the interaction of its agents or strategies.

We comprehend the distinct role that the game can assume in our society since the search for a systematic overcoming of stress in daily life to the practice of leisure activities until the demand for professional attitudes of those involved in it and who also search for better and greater performances. This last way of a game organization, ruled by institutional means, is what interests us at this moment because the agents involved in it come from different orders - expertises - and contribute to only one purpose. They search for triumph and success in an overcoming contact that can be called adaptation.

In a game of high efficiency, the audience - present or distant - keeps its focus of attention in some of the agents who make the show goes on such as athletes, the umpire, technicians and fans as well. From a systemic language perspective, we could say they are observing only the top of an iceberg, in which these agents are located. Most of the times, the majority of the audience cannot visualize the other half-submerged part in which other agents are inserted, that means, those who, along with others already mentioned, also build it.

Trying to advance in our comprehension, make better choices and minimize unwanted consequences, this project characterizes itself as a bibliographical exploratory research aiming to point out the game of high efficiency as a Complex Adaptive System from the point of view of the organization of the teams that are part of it, according to the reference structures provided by Axelrod & Cohen (2000).

DISCUSSION

Research within the science of complexity does not make detailed predictions. It is, on the other hand, a structure that suggests new kinds of issues and possible actions. It corresponds to multiplicity, interlacement and a continuous interaction of several systems and phenomena that constitute the environment. Therefore, it is necessary to fully comprehend them in order to be able to interact with them.

The complexity can only be understood by an open-thought-system, in depth and flexible, called the complex thought. It configures a new view of the real world that accepts and seeks to comprehend its constant changes and that does not intend to neglect the multiplicity, uncertainty and randomness of its reality.

Firstly, there is a revelation that some phenomena are not possible to be explained in their totality like complex ones, such as the human being, the universe, life and death, love and hate and the rapprochement of science and philosophy (MOLES, 1971). Then, there is a discovery that the world can be a system (BERTALANFFY,1977), an ecosystem, in which fragments are not and cannot be seen or studied without the comprehension and acceptance of the whole from which they are comprised of. They are unaccountable from the point of view of logic though, that means relations and inter-relations of this whole with their parts and vice-versa, which are just apparently distinct. This is what Morin (1999), used to call "order within disorder" or "certainty of uncertainty”. Therefore, it is called complexity.

According to Morin (2000,2002a) the revolution in the conceptions of the world, earth and man which took part in the 15th century was not but a ministerial crisis compared to the transformations brought out by the achievements of the 20th century. That created the need to abandon the idea of an organized, perfect and eternal universe to the idea of a still-coming and dispersive one, which was born through irradiation. Within it order, disorder and organization act in a dialogic, complementary, competitive and antagonistic way at the same time. We are in the beginning of a paradigmatic revolution guided towards complexity.

Complex systems are constituted by parts which are connected to a whole. From this interaction, some unpredictable behaviors emerge which turns impossible to a part to represent the whole, whose result is bigger than the result that the units could have if they worked independently. Complex systems have the interconnection and interlacement as their main peculiarities. They do not exist as independent parts.

To Axelrod & Cohen,

“'Complexity' does not simply denote “many moving parts”. Instead, complexity indicates that heavily influence the probabilities of later events. Complexity often results in features, called emergent properties of the system that the separate parts do not have”. (2000, p.15)

The General Theory of Systems was approximately created in 1920 by the German biologist Ludwig Von Bertalanffy (1977). Its sustainable basis is the interaction among several elements (or subsystems) in order to enable a bigger one to happen. The authors Zadeh and Polak (apud ALVES, p.20) “consider a system as a collection of objects joined by some form of interaction or interdependency”. To Morin “a system is an organized global unit of interrelations between elements, actions and individuals” (1977, p.132).

In the reference structure proposed by Axelrod & Cohen (2000) some concepts and mechanism that can, significantly, influence an organization as a complex system, are mentioned, such as: agents and populations who, from strategies and artifacts through variation mechanisms, interaction and selection can (or cannot) obtain success from the organization itself.

An “agent” can be a person, a business or even a country with the following abilities: to interact with other agents; to react to what is happening around him and to adapt himself to the environment in which he is inserted in. So, an agent has two capacities: that of localization, in which he operates and is able to alter his context, and that of memory acquired through previous experiences

Regarding the term “population”, it refers to a group of agents who, on their turn, can be classified by their individual characteristics; thus, forming a variety of kinds. We can have countless types of agents covering their needs by means of strategies in an organization. This form of intervention, according to Axelrod & Cohen is, “a way by which an agent reacts to his environment and seeks his objectives”, (2000, p.04)

But what would the game be? The game is the result of man's own culture, specially, the culture of movement, covering both objective and subjective needs. It contagiously irradiates among their participants and assistants as well while its repercussions transcend the individual sphere and influence the behavior of social groups. Therefore, it is a real situation a SYSTEM, in which agents with several characteristics interact having strategies within several limits, besides the influence of environmental and artifact factors.

An institutionally constituted game occurs, at least, through the confrontation between two teams. When there are two or more teams participating, these games become a championship or tournament which, in the end of a certain period and dispute formula, will reveal the winner teams. As a result, this institutionalized structure - Sportive System (Federations / Confederations) - manages the game and determine its goals and objectives that will lead the organizations to prepare themselves to seek for a social recognition.

Within this context, the agents with their individual and collective technical abilities try to reach, through a selection processes, the best performance of their teams. In order to accomplish that, they select the best strategies that can interfere positively or negatively in this process. In a sportive match, it is difficult to establish levels of predictability due to the multiple actions and interactions of the participants. So, we understand the game as a Complex Adaptive System (SAC)

Having located the SAC - GAME - it is important to define which aspects will be the focus of our analysis. There are several populations of agents interacting in teams. Some can be more easily detected by the audience, such as: athletes, coaches, umpires and fans. However, there are agents who are not usually noticed such as: sport managers, people responsible for clothes, physical coach, nutritionists, psychologists and physiotherapists among others. In the analysis of this article, it will be evidenced only the first ones who receive more evidence in the spectacle.

A game involves teams in competition, puts people (agents) with diversified qualities and specialties in confront by means of artifacts and strategies that seek for success within a dynamics whose predictability is hardly prognosticated. In the game, the capacity to decide which procedure is more appropriate in a given situation and how to put into practice with higher efficiency is an example of a basic premise of SAC - game - called variation. Therefore, according to the reference structure proposed by Axelrod & Cohen[1] it corresponds to the diversity of types within a population or system and involves the reading mechanisms the agents are able to make in their environment. In this way, they interfere in the creation or destruction of agents or strategies in order to search for a better adaptation of innovation.

A player/agent can answer by what happens around him and can also try to interfere in it with a well-defined aim. This intended interference in the system result from his qualities and characteristics. The qualities of a player/agent associated to pattern of actions and in search of better results are called strategies. They are the result of moments of exhaustive experiences and the sum of previous experiences which have been accumulated and associated to the personal qualities of the agent.

The game strategies result from the work of several agents - those directly involved in the game, like the players, as well as those who are outside the court who, with their specific intervention characteristics, also contribute to the search for success. Through the work of such a diversified group one can notice the influence of different types of agents´ enriching variations in the accomplishments and enabling a better analysis of the situation to the players with whom we work and also about the team who they play against.

The variety of existent actions in a game is the result of a dedicated work from different agents who interact with each other. During their preparation, they copy what has been correct and come up to a conceptual recombination, in which the qualities of an agent are used in association to the strategies of success already tested. During this time, the training of the players/agents threaten the relation exploration versus usage of strategies, through which they try to reproduce the efficiency of their actions by simulating tensions within a context close to the real world.

This encouragement to exploration tends to be the differential and the attempt in strategies few or not yet tested in real situations. Its application in games depends on the situation in which the team finds itself in the championship and also on the needs and risks that the team must face in relation to its desired aims and position in the championship.

If the team is on an imminent risk of, for instance, not continuing in the competitions by means of previous failures, the exploration of new alternatives is an essential condition in the attempt to avoid a final disaster. Its elimination from the event, in which the SAC characterization is concerned, is called extinction. This team/system would not intervene in the dispute and everything that it represents would lack consideration and reference.

The interaction corresponds to how, when and where the agents interact and it involves the mechanisms that may come to alter it. The interactions are affected by the location of the agents, the available technologies and the internal or external interactions activations.

The game, in its more consumable way which is the spectacle, resembles an Iceberg. What emerges is just a part of it because we do not have the real dimension of what it hides within. In its visible part, the interaction/opposition is highlighted among the multiple agents in the search of success or victory.

These agents who are in direct exposition such as athletes in their confrontation, project behavioral regularities, as a result of a collective work. It is by means of their performance that other non-apparent participants interact and become visible somehow. They contribute to the system dynamics by their self-tested knowledge.

During a game, different contributions of agents are carried out and evaluated. In the internal interaction, we emphasize strategies that are chosen by the technician; the mental attitude intended to be incorporated to the players facing stress/pressure situations; the physical work performed and which makes the maintenance of high levels of technical performance easier and even the person responsible for clothes who contributes to the maintenance of uniforms within the characteristics required by the players.

Regarding the external environment, we emphasize the actions of sport managers which design the disputes; the media whose contacts usually impose date and place for the competitions and even if the fans who, by their stimulating or failing attitudes, also interfere in the game dynamics by requiring new athletes to be hired and choosing the location of trainings when they take part in it.

It is in the team's training unit that interactions take another special space of coexistence in which the agents mentioned above, as well as others, act. It is the place of the game and training surrounded by other necessary places (dining hall, rooms for physical preparation, recovery, media, games and others) which temporarily determine themselves in the interventions. Once again, it is possible to distinguish an external activation interfering from the definition of the period of competition, the available budget for maintenance and hiring of players, of a sportive politics to guide people and so on. The internal activation concerns the strategies to be used in future games, injured athletes and time predicted for their recovery and also studies about the opponents in video. All these activation situations influence each other and rely on time as a limitation to their achievements.

In the training unit, routines are also more presented. The tacit ones, which are pre-organized movements, are those that the athletes repeat exhaustively under the command of the coach. These actions are defined and based upon their technical qualities,

usually, copies of other successful actions. In order to carry them out efficiently, each player must know their diverse variations and how they can intervene in them.

There is a hierarchy of actions that will be better carried out through the exercise of new technical routines in which each athlete improves their strong points and minimize their weak ones, having in their colleagues, during the training steps, a simultaneous situation of opposition and model to be copied.

Thus, the team is able to be motivated during its preparation in order to search for and overcome possible challenges. It comes to be so stimulated that it does not loose its focus and keep an emotional phase that enables propositive actions based upon cooperation. Without it success tends to become hardly achievable.

Before the game begins, during it and at its end, some barriers are idealized in order to minimize interferences and provide tranquility and support to the athletes, preserving the interests of the team. Situations such as stipulating moments for the media, a special place to the organized fans, a distance from the opponent fans, collective interviews at the end of the game favoring the local media and the partner's visibility, usually become more evident. These stipulated and developed actions go through a constant evaluation and, as a result, they promote alterations among the agents and, if it is necessary, in the location where the system in inserted.

It is important to highlight the interventions make the system alive and in which the opinions mentioned above are concerned, it is possible to notice an imbricated network that must interact with *what* and *when.* The idea of proximity in these different locations determines one of the probabilities of interaction among the agents. It is also associated to the concept of activation that can be external and internal determining sequences of the activities. Thus, the space-time location affects significantly the interactions by their proximity or distance, besides organizing them under different ways, pointing conceptually the role of the agents mentioned above.

This encompasses a selection comprehending a set of processes leading to an increasing or reduction in the frequency of several kinds of agents, artifacts and /or strategies within the system.

In which the dynamics of a game is concerned, some agents come to be highlighted due to the time they remain exposed in association to the roles they have to play. The more evident and obvious ones are the athletes and the Technical Commission. The first ones are responsible for the performance itself, in which personal qualities and correct choice of strategies are decisive to achieve success/victory. The second ones have to select and organize the strategies, within time and space and also choose the athletes who, in a given moment, have the responsibility to carry them out.

The interaction between the qualities of the agents and the options of actions come to be evident and essential. Strategic actions idealized to activate success may be generated inside the system or even copied and adapted to the player's performance characteristics and practiced through long periods of trainings. In other words, they must have enabled learning.

For instance, the coach of a basketball game determines that his team uses offensive actions in a more incisive way in order to stimulate the opponent to commit failures, specially those considered to be technically better. Concerning the definitions of success criteria, one can observe a strategy that does not care about an immediate victory which, independently from the score, can be less favorable. However, it tries to interfere and enlarge the winning chances at the end. Through the information obtained during the match from a scout (largely used), the coach may change his way of playing and/or use players who have had a better required performance.

The example enables one to notice that when desired performance are altered within the match, others which are more adequate can be implemented. In this case, only the team that has trained can use these performances with a higher probability of success, ovecoming a casual determinism.

One can also notice a hibrid selection of agents and strategies that highlights the usage of characteristics of the agents recombined with the ones required by the strategies. At each game, due to inferred qualities from the oponents, this interaction is reorganized such as the time available for new combinations or the cost of strategies that comprises a differential to achieve success. This procedure is valid througth the credits of group-work enabling the interpretation and projection of better strategies facing a new challenge and, thus, minimizing the probability of erros.

In this way and through the simultaneous interaction of each and every agent actions and effects can be better predicted, pointing to a more probable success generating leaderships and patterns of berhaviour, besides a great contribution to the community. These substantial experienced procedures in SAC - hard predicitable games, are the emulators to the copy of leaders who, in the presented commentary, are the athletes and/or the tecnhicians with their supporting teams.

FINAL REMARKS

Complex Systems are formed by parts which are connected to a whole. From the interaction of the parts, some unpredictable behaviors emerge. This is why it is called complex thought as it seems that there are no logic for these apparent systemic relations. This is what Morin (1999, 2000) calls "order within the disorder" or "certainty of uncertainty" and, therefore, it is called complexity.

At first sigh, is a fabric of (complexus: what is weaved in a group) heterogeneous inseparably associated constituents: it points out to the paradox of the one and the multiple. In a second approach, complexity is clearly a fabric of happenings, actions, interactions, retroactions, determinations, accidents that constitute our phenomenal/extraordinary world. But then, complexity presents itself with the anxious traits of confusion, inextricable, disorder, ambiguity, uncertainty. (MORIN,1999, p.17)

To move these concepts to the organizations´ viewed as systems, it requires the comprehension of the whole, adding to it the thought, the influence, the participation and the singular qualities of each agent who are, on their turn, in constant interconnection and interlacement. It overcomes the analytical method which, in face of its scope, dynamics and contextuality of the systemic thought, can be classified as a reductionist process.

The game, understood a sports activity, can be introduced to society as a “great social encompassing phenomenon from the point of view of a spectacle as well as a professional and commercial activity” (RUBIO, 2006). This manifestation for an intense variability can lead all its participants to experience great emotions, interactions and selections. Thus, it explains itself as a complex adaptive system due to its implicit characteristics of reciprocity and unpredictability.

Even though indetermination is essential to a nice sports show, it is not dependent on that. So, the comprehension of the structure is important though not sufficient to understand, for instance, why some games are more impressive than others, having them all have the same structural basis. (DAMO,2001)

The game as a complex adaptive system can be compared to an Iceberg. The spectacle is what emerges to us as a whole. As the Iceberg's base is not visible to the spectator, we lack to know all the systemic structure of this sportive phenomenon. In this way, the referential proposed by Axelrod & Cohen (2000) lead us to think deeply about and comprehend organizations as complex systems.

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GAME - A COMPLEX ADAPTIVE SYSTEM

ABSTRACT:

Complexity is the systemic approach to phenomena. It strengthens the interaction between each part and the whole, leaving behind the reductionism that has been permeating most science investigation fields, giving place to creativeness, turning self-organizing processes and impossible ("UNPREDICTABLE") behaviors viable. This study aims to present high profile sports games as a complex adaptative system based upon the high profile teams that integrate this system, following the reference mainframe proposed by Axelrod & Cohen. It is important to notice that three essential processes feed sports games as complex adaptative systems: variability, interaction and selection. These processes offer an intertwined concepts set that generate productive actions in the system. This system cannot be fully understood and controlled by its complexity, but it offers opportunities and resources to notice its structural bases and allow its development through pondered intervention. Complex adaptative systems are considered in terms of agents populations that, through strategies and artifacts, interact among themselves and with the environment in a purposeful way or not. These agents (athletes, referees, coaches, supporters) may be in evidence during a sport game, while others (roupeiro, physical therapist, physical trainer, nutritionist…) may not be seen by the general public, but, by their interaction capability and in their specific strategies fulfillment, are responsible for a team achievement degree in a specific game or competition.

KEYWORDS: complexity, System Theory, high profile game.

LE JEU - UN SYSTEME ADAPTIF COMPLEXE.

RÉSUME:

La complexité est l'approche systémique aux phénomènes. Il fortifie l'interaction entre chaque partie et la totalité, en partant derrière le reductionism qui a filtré la plupart de l'enquête de la science présente, place donnante à créativité, devenir des processus auto - organisant et des comportements impossibles viable. Cette étude a l'intention de présenter de hauts jeux des sports du profil comme un système de l'adaptative complexe a basé sur les hautes équipes du profil qui intègrent ce système, en suivant le gros ordinateur de la référence proposé par Axelrod & Cohen. C'est important à avis que trois processus essentiels nourrissent des jeux des sports comme systèmes de l'adaptative complexes: variabilité, interaction et sélection. Ces processus offrent un ensemble des concepts entrelacé qui produit des actions productives dans le système. Ce système ne peut pas complètement être compris et contrôlé par sa complexité, mais il offre à occasions et ressources d'observer ses bases structurelles et autoriser son développement à travers intervention considérée. Les systèmes de l'adaptative complexes sont considérés quant à populations des agents qui, à travers stratégies et objets, réagissez réciproquement parmi eux-mêmes et avec l'environnement dans un chemin prémédité ou pas. Ces agents (athlètes, juges, entraîneurs, soutiens) peut être dans les évidences pendant un jeu du sport, pendant qu'autres (roupeiro, kinésithérapeute, entraîneur physique, nutritionniste…) ne peut pas être vu par le public général, mais, par leur capacité de l'interaction et dans leur accomplissement des stratégies spécifique, est responsable pour l'un degré de l'exploit de l'équipe dans un jeu spécifique ou compétition. MOTS-CLE: complexité, Théorie du Système, haut jeu du profil.

EL JUEGO - UN SISTEMA ADAPTABLE COMPLEJO

RESUMEN:

La complejidad es la aproximación sistémica de los fenómenos, que refuerza la interacción entre las partes y el todo, deja de lado el reducionismo que tiene pautada la investigación científica en gran parte de sus campos, dando el lugar a la creatividad posibilitando la emergencia de comportamientos imprevisibles y procesos de auto organización. El objetivo de este articulo es apuntar al juego de alto rendimiento como un sistema adaptable complejo a partir de la organización de los equipos que lo integran, según la estructura de referencia propuesta por Axelrod & Cohen. Destacamos que los juegos como los sistemas adaptativos complejos son alimentados por tres procesos esenciales: variación, interacción y selección. Estos brindan un conjunto de conceptos entrelazados que no pode ser plenamente comprendido y controlado por su complejidad, pero ofrecen recursos y oportunidades para percibir sus bases estructurales y permitir su desarrollo a través de la intervención ponderada. Los sistemas del adaptables complejos son considerados en términos de poblaciones de agentes que al usar en estrategias y artefactos, interactuan entre si y con el medio de forma intencional o no. Estos agentes (atletas, árbitros, técnicos, afición) pueden ser los mas evidentes en un partido mientras (utilero, fisioterapeuta, preparador físico, nutricionistas, etc…) pueden no ser visualizados por el público general, pero que por la capacidad de interacción entre si y en la realización de sus estrategias específicas determinan el grado de obtención de éxito del equipo en un juego o campeonato. PALABRAS CLAVES: la complejidad, la Teoría del Sistema, el juego del perfil alto,

JOGO - UM SISTEMA ADAPTATIVO COMPLEXO

RESUMO:

A complexidade é a abordagem sistêmica dos fenômenos, que reforça a interação entre as partes e o todo, abandona o reducionismo que tem pautado a investigação científica em grande parte de seus campos, dando lugar à criatividade possibilitando a emergência de comportamentos imprevisíveis e processos de auto-organização. O objetivo deste artigo é apontar o jogo de alto rendimento como um Sistema Adaptativo Complexo a partir da organização das equipes que o integram, segundo a estrutura de referência proposta por de Axelrod & Cohen. Destacamos que os jogos como os sistemas adaptativos complexos são alimentados por três processos essenciais: Variação, Interação e Seleção. Estes fornecem um conjunto de conceitos entrelaçados que geram ações produtivas no sistema que não pode ser plenamente compreendido e controlado por sua complexidade, mas oferecem recursos e oportunidades para perceber suas bases estruturais e permitir o seu desenvolvimento através da intervenção ponderada. Os sistemas adaptativos complexos são considerados em termos de populações de agentes que ao usarem estratégias e artefatos interagem entre si e com o meio de forma proposital ou não. Estes agentes (atletas, árbitros, técnicos, torcidas) podem ser os mais evidentes em uma partida enquanto, (roupeiro, fisioterapeuta, preparador físico, nutricionistas...), podem não ser visualizados pelo grande público, mas que pela capacidade de interação entre si e na efetivação de suas estratégias específicas determinam o grau de obtenção do sucesso da equipe em um jogo ou campeonato.