CHOOSING COLLABORATION AS A FORM OF MECHANISM IN THE APPLICATION OF GAME THEORY

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Abstract

The current paper presents a combination between causality as a form of methodological instrument and its practical application to four pure types of games according to the classification of Roger Caillois. A contribution of the paper is the comparison with the four types of Bartle's players as well as the representation of games as serious games with rules whose main purpose is to teach and train. Another contribution is the focus on the feedback mechanism in games as a form of an evaluation mechanism, stimulating students' motivation, especially in rational games, typical of the business environment.

Keywords: serious games, causality, feedback

JEL: D71, D74

Introduction

Collaboration as a form of causality is an example of a positive feedback mechanism that encourages development, decreases the stress and anxiety level and stimulates multiplication of a similar behavior in other players. This is valid only when rationality prevails as a leading motivation factor in a system, adapting to the next equilibrium state, which is also a self-maintaining and self-development state. The desire for a positive outcome is the motivating factor.

The Main Concepts and Their Relation to Feedback

The objective of the paper is to focus on the most optimistic version of feedback under the form of collaboration, defined as communication and more specifically the choice of correct words for the purpose of successful negotiation. The latter is an example of serious game. This can further be applied to teaching evaluations as output in the educational system.

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The paper poses a couple of research questions: Is adaptation possible through the proper choice of feedback and does holistic adaptation in the form of communication and rational games lead to collaboration in different areas.

Methodologically the paper uses systems theory in its classical form with focus on causality and feedback. Feedback is a form of causality that leads to stability. Feedback results in positive adaptation under the form of self-correction mechanisms and multi-stability. The concepts that will be discussed here include a distinction between game theory and systems theory as well as definitions of the concepts of serious games and gamification.

Game theory assumes the existence of rational or consistent players, consequently rational decision-makers both in the two opposite cases of conflict and cooperation (Myerson, 1997, p. 1). It is based on mathematical models and quantitative models. The other assumption is that of intelligent players (Myerson, 1997, p. 2). Utility functions of players are compared and if utility payoff structures are similar, players reach an agreement. Payoff structures differ in various situations and in the case of uncertainty the player or decision-maker makes a choice resembling a lottery model (Myerson, 1997, p. 6). Rationality based on the lottery principle does not sound promising for the purpose of consistency of logical actions. That is why serious games are needed to provide stability of feedback.

Game theory is also named „interpersonal decision theory" (Rosenmüller and Trockel, 2001, p. 3) with three different versions of the game: conflict, cooperation and competition. Thus the focus is on the first level of analysis, individuals. Solutions to games imply rationality and rationality implies a certain benefit that can be formulated in mathematical terms.

Systems theory studies the interaction between individuals and their environment without specifying a particular theoretical framework (Friedman and Allen, 2021, ch. 1). It has been described as „conceptual framework or metatheory" (Friedman and Allen, 2021, p. 3). The initial conception is found in the work of Talcott Parsons on social systems as well as in the work of Bertalanffy on biology. The systems theory framework is composed of theories of different disciplines. The role of Bertalanffy is in the introduction of wholeness in the framework. This allows for the advent of the terms feedback, input, output and homeostasis. This approach includes all levels of analysis as well as synergy. Feedback as a linear chain of events is linked to causality in the explanation of growth and change. Talcott Parsons on his part has introduced the „structural functionalism" (Friedman and Allen, 2021, p. 6) framework with four functional states of social systems: adaptation, growth or goal attainment, integration and homeostasis or latency. These four states are integrated. Feedback is thus described as the exchange of information between the system and its environment. Bertalanffy introduced the

notion of dynamic equilibrium called steady state or negative entropy under the form of a balanced state (Friedman and Allen, 2021, p. 8). In other words, the adaptability of the system leads to homeostasis or equilibrium through balance. Homeostasis is a flexible or variable balance. Adaptation is a form of interaction, a causal relationship between the person and the environment, equilibrium as a result of a limited choice of options.

Feedback is a process of „self-regulation" (Leighninger, 1978, p. 459) and a form of homeostasis. Feedback is a form of circular relationship, corrective action, a virtuous cycle with control mechanism. Positive feedback is described as „pseudo-feedback", leading to instability in the system or a vicious cycle.

The term **„serious games"** was created by Clark Abt in 1970 and popularized by Ben Sawyer in 2002 (Wilkinson, 2016). It has an interdisciplinary background and has been influenced by video games, digitalization, simulation-based learning. The paper uses Roger Caillois' categorization of serious games, balancing fun and purpose and having the tendency to move from free-play to rule-based games. Unlike the classical notion of games, serious games move beyond entertainment, encourage motivation.

Gamification as a term emerges in 2008 and has the same connotation as serious games. The definition of gamification reads that it is „the use of game elements in non-game contexts" (Krath, Schürmann and Korflesch, 2021, p. 2). The purpose is to solve problems mostly in the educational and health contexts as well as in industry, training and simulation. The component of seriousness has the purpose of change in behaviour. The most positive aspect of gamification is the immediate feedback of the actions of the players (Krath, Schürmann and Korflesch, 2021, p. 12), serving the purpose of educational experience, learning and motivation, especially with the help of incentives. Gamification is defined as „the use of game mechanics, dynamics, and frameworks to promote desired behaviours" (MacMillan, 2011, p. 1). Gamification is related to resilience in presenting failure as part of the learning cycle, an opportunity rather than shortcoming. Gamification is an interactive system, engaging and motivating players. It is typical of „computer-mediated environments" (Seaborn and Fels, 2014, p. 29).

Adaptation through Causality and Feedback

The adaptation that is considered is human adaptation, mental rather than physical, aimed at achieving equilibrium or homeostasis as well as the achievement of „resiliency" as the capacity of „recovery from unfavorble circumstances" (Карева, 2021, pp. 21-40). This concept is related to positive adaptation in case of risk and difficult conditions, performed in cooperation with the environment. It is typical of the complex adaptive systems that are flexible and capable of self-education. They are also open to innovations. This form of resiliency is similar

to the immune system where the change of the whole system is determined by the speed of the change of the slowest part of the system, which suggests slow continuity between separate states of the system. The idea for change is mostly linked with the necessity for psychological change as transformation in response to threats (Реймо, 2013).

The definition of a system, according to Bertalanffy, founder of system's theory, reads that the system is „a complex of interrelated elements" (von Bertalanffy, 1950, pp. 134-165). The state of wholeness of the system is related to the concept of parts-whole linkage. This linkage is connected to the concept of synergy where the whole is more than the sum of its parts. Communication (Skyttner, 2005) is a must for the existence of linkage, i.e. exchange of information both among the parts of the system as well as between the system and its environment. The purpose of communication is the achievement of a state of equilibrium or homeostasis. This is mostly valid for the open, complex systems, dependent on the environment and characterized by equilibrium and dynamic homeostasis, including adaptation.

Collaboration as a transformation model presents the most optimistic scenario in the relations of players. This of course does not preclude the existence and necessity for developing mixed variants that cover the bigger section of the range of possibilities of a given scenario. The suggestion is that most welcome for adaptation and the realization of the most optimistic scenario is the application of a holistic system's analysis.

In this case we speak of the existence of utilitarian system, i.e. that of the positivist framework that maintains a rational position. Following the definition of Pareto logical action, the logical criteria is the coincidence of an objective and subjective purpose. The concept of logic of action includes the suggestion of a scale of adaptation in the case of change of the established, adopted standard. The adaptation mechanism belongs to the psychological problem of rationality.

Causality

The causal relations in a certain event speak of a scientific approach (Hamati-Ataya, 2014, pp. 1-40). A synoptic view to knowledge is most welcome, i.e. maintaining or restoring a pragmatic relation among thought, evaluation and action; subject and object; science, history and ethics. Homeostasis builds the basis of multi-stability as it uses feedback for the initiation of change or self-correction.

Adaptive behavior is equivalent of the behavior of a stable system as the region of stability is the region where all basic variables are within their normal boundaries (Ashby, 1954a). Each adaptation to change in the environment must aim towards its neutralization and the survival of the organism. This is true for open systems where internal powers balance external ones to produce Pavlov's

equilibrium. According to Holmes' classification adaptation as a form of animal behavior could be two types: self-maintaining and race-maintaining. The first type has three sub-types: life-maintaining, protective and life-improving.

The center of the interest shifts on the state of equilibrium, i.e. the basic variables of the adapted organism change less than that of the non-adapted. In order for the organism to adapt, led by the information from the environment, the organism must control basic variables by maintaining them within certain borders and manipulating the environment so that the environment reacts accordingly. This usually happens through a trial and error process where the environment is like a „black box" mechanism (does not change). This mechanism has two feedbacks-1) inside each reaction (as a result of sensory perceptions) and 2) external, determining which reaction will happen.

The main rule of trial and error adaptation is that behavior changes if trial is unsuccessful; behavior is maintained if trial is successful. When basic variables are within normal boundaries, each state of the parameters is a state of equilibrium that is a neutral equilibrium. When they are not within the normal boundaries, it is not in equilibrium and changes to a different state. Thus different behaviors are tested where equilibrium is always adapted /a result of adaptation/.

Each system that abides to the cause and effect law, uses the ultrastability method. In the case of a linear system, there is only one state of equilibrium that may be stable or unstable. In the case of a system within the system, occasional transformations of states occur so that every state may equally likely convert into a different state.

In the case of an environment with increasing complexity, the subsystems have many states of equilibrium (Ashby, 1954b, ch. 15). The total environment or universe contains many partial functions and the group of variables, active in a certain time will differ from the group of variables in a different time. Consequently, within the environment, the activity will fluctuate and will be conditional rather than invariant. In a given system, there is temporary and conditional differentiation of subsystems that are partial functions. Environments with four levels of interrelations exist (3 and 4 are two cases of one variant):

1) whole, where the interrelation among the parts is zero;

2) whole where the subsystems are linked in a chain, without feedback among the subsystems;

3) more realistic whole, where the subsystems are linked with feedback but the relations are not rich, rather one-directional;

4) the most interesting case where links are in all directions, with feedback, rich internal connection among the subsystem but poor connection among the subsystems.

The first case is one of adaptation of „iterated systems", i.e. an organism exchanging with the environment through several independent reactions/ subsystems. As each subsystem reaches equilibrium and stays there, the whole changes cumulatively towards total equilibrium. The second case is one where the parts of the environment are linked in a chain, i.e. the adaptation is serial and must happen in sequence-first subsystem A, then B, then C. Reactions are learned in this sequence as well, by stages if mastering of the process is aimed. This learning process is due to ultrastability by step-mechanism.

The third case is one with an environment of linked subsystems with feedback. This type of environment differs according to the communication stages among the subsystems. One is with week communication and the other is a richly connected environment, close to the maximum and corresponding to the form of iterated adaptation, where each subsystem is treated independently of the others (Ashby, 1954c, ch. 16). In this case, the environment is very complex for adaptation and is called „poorly joined environment", with many states of equilibrium, i.e. a poly-stable environment; poor interaction among the subsystems; adaptation through ultrastability or feedback of second order. This means that each basic variable is within its proper boundaries in the states of equilibrium; the reactive part of the organism is also divided into subsystems with no direct link. The two subsystems that form unity which is ultrastable and subsystem adapts to subsystem in the way an animal adapts to the environment in a step mechanism till the achievement of a stable field.

Feedback and Evaluation

Feedback is also a form of causality. Feedback creates a feedback loop, providing players with information about their behavior which could serve as a basis for changing and consequently improving their behavior and motivation. Feedback could be immediate and delayed and a delayed one usually induces anxiety (Kapp, Blair, Mesch, 2014).

Timing is the most important factor in giving feedback as proper timing could really make a difference. Immediate feedback is closely tied to the facilitation of the rapid response of players and is also a signal once for a stimulus of a job well done and second is a signal for a necessity of changing/adapting/ improving the given behavior. Immediate feedback is crucial especially for inexperienced players versus the more experienced one. The latter could benefit more by a slightly delayed feedback as this would stimulate their own critical thinking, self-evaluation and creativity. If more experienced players are given the chance to improve their behavior based on self-evaluation this could positively reflect on their confidence, decrease insecurity and create a self-balancing/ managing mechanism. There is no better result of the teaching process than the

transformation of a dependent student into a self-managing initiator of positive change.

Of course, the best form of feedback is combined feedback, juxtaposing positive and negative ones. The worst case is the one with the lack of feedback, especially when it comes to inexperienced players. Feedback could be applied to forms of teaching evaluations that could improve teaching methods. Teaching methods in this case are the input in the system and evaluation is the output of the system. Both input and output create the full cycle of development of the system.

When it comes to serious games, as is the example of negotiation in today's „fast-paced and interconnected business world" (Austin, 2014, p. 348), skills are required as the one for developing „collaborative, mutually beneficial relationships" (Austin, 2014, p. 348). This is crucial not only in business organizations but also in international relations and everyday-life situations where conflict should be suppressed. Maintaining proper behavior becomes the most important skill in the hectic times of lack of stability and blurring/fuzziness of the foundations of society. This should be accepted as a challenge rather than a problem as every challenge gives a chance for positive development and the perception as a problem more likely feeds negative feedback. Negotiation skills are closely tied with communication skills. Feedback as communication is also a form of lessons learned.

Comparison of Bartle's Players with Caillois' Game Types: Choosing Collaboration

Collaboration is very important in teamwork, especially when developing a new product as software for example. Trust and motivation are vital in the development process and they could lead to „high-quality learning and creativity" (Steffens, Marczak, Filho, 2015, p. 10). Collaboration is described as „the combination of communication, coordination and cooperation" (ibid) or the so-called „3C Collaboration Model". That model is enriched by adding awareness and group formation as additional dimensions in the overall picture.

Collaboration could be achieved by causality and feedback loops. Following the assumptions of the so called game mechanics or „the essential play activity performed again and again in a game" (Zimmerman and Salen, 2003, p. 316), the elements that have to do with feedback are: points, badges, leaderboards.

System thinking views the world as a series of interlocking connections. The smallest interconnection is a feedback loop. Games as functional systems have a causal effect. Different causality mechanisms work based on the motivation of the so called **Bartle's players**. Players may have multiple roles. However, there are four types of interactions: 1) achievers, where success/ reward is the motivating

factor, 2) explorers, where information is the motivating factor 3) socializers, where communication/empathy is the motivating factor, 4) competitors or killers, where desire to beat the other is the motivating factor (Bartle, 2014).

Similar to a pack of cards, achievers are diamonds that like acting on the world; explorers are spades that like interacting with the world; socializers are hearts that like interacting with other players (empathy) and killers are clubs that like acting on other players.

These are four approaches or four player types, based on two dimensions of the playing style: action versus interaction, and world-oriented versus player-oriented. The purpose is to promote balance or equilibrium. The choice among the four types depends on the mood and on the players' style.

Balance could be achieved through game dynamics by achieving equilibriums of interactions. One way of doing it is by placing emphasis on players rather than the game and thus increasing communication among players. Another way is by the mechanism of tilting the game towards the world and the forms of interaction rather than action. This introduces a more social rather than game-like debate and focuses on the achievement of collective goals.

Balance by communication could be achieved simply by choosing different words. In this line the Amy Jo Kim's Social Action Matrix (2012) is suitable as modification of Bartle's model.

Table 1: Modification of Bartle's Model

Create – purchase, express, design, build, decorate, choose, customize
Explore – view, collect, rate, vote, curate, review
Collaborate – comment, like, greet, help, share, contribute
Compete – win, challenge, compare, taunt, showoff

Source: Farber (2015, p. 136).

Moodle could be used for motivating learners (Denmeade, 2015, p. 3). Based on the Bartle's Player Types, multiple roles could be played and you could change the roles you play over time but will have dominant methods of interacting. Specifically, we are talking about four types: 1) achievers who like playing games, 2) explorers that interact with the environment, 3) socializers that like communication and 4) competitors that like to dominate

Bartle's classification is similar to some of the types of games, defined by the French anthropologist **Roger Caillois**. The first type represents pure competition (Bartle's competitors or killers), the second – random result or luck, the third-role-playing, the fourth-the thrill from being in motion (exploration). The chance factor and mimicry or simulation do not have a match in Bartle's types.

This classification of games that could be regarded as theory of play of course could be modified with additional boxes and implies combinations between and among types. It acknowledges the social function of games but does not take into account the fact that games give best results if they are nation-specific. Also, rules are not equally controlled by rules and rules do change during the operation of adaptable games (Caillois, 1958).

Table 2: Caillois' Classification of Games

Agon – competition with set rules	**Alea** – Games of chance
Mimicry – Games of make-believe	**Ilinx** – Games of disorientation

Source: based on Table 1, Caillois (1958, p. 49).

Table 3: Paidia versus Ludus: main characteristics

Paidia	**Ludus**
/Spontaneous,	Structured,
Improvised,	/Rule-driven,
Impulsive/	Disciplined/

Source: based on practical exercise and collaboration with students during Information Security classes at the Rakovski National Defence College, Sofia, Bulgaria

Achieving balance is the motion from paidia to ludus as described in p. 49 of Caillois' book. The movement from turbulence to rules could definitely be achieved through the introduction of a market or business /profit/ element in the game.

Game theory can influence serious games. Games are viewed as systems. Serious games are used to teach or train. They may involve a simulation of a problem in a scenario. Serious games are played both in the military and in the business environment. Zero-sum games are like competitive games, non-zero sum games are cooperative, involving learning.

Conclusion

Causality and feedback have been described using the philosophical foundation of systems theory and the concept of holistic adaptation of the system to the environment. The starting point is the rationality of players and feedback could be either communication in the complex systems or evaluation in the teaching process. Communication is interaction, negotiation, balance, proper choice of

words. Collaboration is a function of the motivation of the players and is more likely to be achieved upon the introduction of a market element in the game.

There are several recommendations as a result of the analysis in the paper. First, serious games with their potential for immediate feedback and collaboration could lead to self-regulation and development. Second, the assumption of rationality in a game would lead to easier adaptation. Third, the feedback in serious games is a precondition for control and virtuous cycle in the system in the case of rule-based games as opposed to games of chance. This facilitates learning and motivation. Fourth, the system is stable in case of an increased role of communication among players.

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