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THE VIEWS OF SELECTED AUTHORS ON THE CONCEPT OF THE GAME

Summary: As many people around the world, as many games does it exist. Asking few people what the term 'game' does mean, what kind of games do they know, we would become the same amount of answers. This suggests, that the term "game" is either well known, either good defined. However the field of science in games is evolving, new types of games come into existence, there is a lack of one game definition. To investigate this issue, I researched the evolution of primary game definition in math, through manager simulating games, strategy games up to the interactive games. This paper presents the overview of many games types that were created during the time.

Keywords: math, games, simulation.

Introduction

Games exist since always. Seeking through history, people always played. As an example we could bring gambling, which is the probably oldest form of playing of human kind – no matter what culture, it existed. The word "probably" was used not coincidentally, because we have no knowledge, what was the first type of games. It could also be Greece Olympic games, but also each war could be seen as a game. But let us concentrate on the game definition and properties in its different kinds.

Mathematical approach

In math, when we talk about games, we are entering a math section called "the game theory". It's a science that's dealing with researching conflict situation by using mathematical terms and appliance. The list below presents the kind of those situations.

- G1 = *Γ(n)(heads or tails)*

The first player chooses head or tail and then, without knowing what was the first player's choice, the second player is doing. If the choice match, the coin of the first player is taken by the second player – in other case the second player loses his coin. The game continues *n*-times.

- G2 = *Γ(n)(Tic Tac Toe)*

  We have a square field containing *n* rows and columns, where both players, one after another, are placing *x* and *o* symbols. The one wins, who manage to build a complete row, column or diagonal of the square with his symbol.

- G3 = *Γ(n,k)(NIM)*

  On the table lies *n* matches. Each player alternately, can take one, two, or … *k* matches. The goal is to force the opponent to take the last match on table.

- G4 = *Γ(n)(Morra)*

  Both player in the same moment shows one, two, … *n* finger and calls a number that means the finger he guesses the opponent shows. If only one of the player guessed correctly, he wins that many tokens, as the added number of fingers they showed. In other situation no one wins.

- G5 = *(Prisoner Dilemma)*

  Two criminals was caught and placed in separated cells. Each became a deal: if you agree, you are guilty, and the other say he's not guilty, you go to prison for a month, and the other for 10 month; if you both say that you are guilty, you both become 5 month of prison; if you both say you are not guilty, you both become 2 month of prison.

No matter how are the rules, the games have some characteristic qualities:

- It is assumed that all players have the full knowledge about the rules.
- The number of players is finite, but player not always means one person. Sometimes a player means two persons (like in card game "bridge").
- The game ends with win, or payoff, which is a real number. The goal is the maximization of his win with any known methods. The payoff depends of the decision made by a player and his/her opponent, so we have here payoff functions. In some games the payoff might not be a real number – it can also be satisfaction, happiness, prestige etc.

- Each player has some number of decisions he can make, what is called a strategy. With this term we mean also the whole description of player behavior during the whole game in each situation that can happen. Not in all games they are easy to describe.
- A game can contain a random factor. He might come spontaneously, but it appears sometimes in artificial way.
- Some games are one decision game, and some need many decisions to make – sometimes we need to remember the history of our decision, or of our opponent.
- Each game has an information – one of the most important terms in game theory. There are few kinds of information. The knowledge of your own payoff function is the "minimal" information. Knowing own strategy and of all players, knowing own payoff functions, knowing own place in game during its running is called a "complete" information. When additionally all players know all players payoffs, and they previous moves, the information is called easily "full".

  We distinguish the following types of game in game theory:
- Games in normal form

  That game we define as pair $\Gamma = (\sum , \pi)$ where:
  1. Set $\sum_i$ we call the strategy set of player i, where $1 \leq i \leq N$;
  2. $\sum = \sum_1 \text{ x } \sum_2 x \ \ldots \ x \sum_N$ is the set of states in game Γ;
  3. Function $\pi_i : \sum_1 \text{ x } \sum_2 x \ \ldots \ x \sum_N \rightarrow \boldsymbol{R}$ is a payoff function of player i, where $1 \leq i \leq N$ and $\pi = (\pi_1, \pi_2 , \ \ldots \ , \pi_N)$;
  4. Vector $(\pi_1(s), \ \pi_2(s) \ , \ \ldots \ , \ \pi_N(s)) \leftarrow \boldsymbol{R}^N$ is called a payoff vector of state $s = (s_1, \ s_2, \ \ldots \ , \ s_N)$.

  The goal of player i is the maximization of his payoff function π_i through choose a strategy from set $\sum_i$, where $1 \leq i \leq N$.

  We have here a number $I(s_i)$ that's the end lower of payoffs prayer i using strategy s_i. Then $sup\{ I(s_i) : s_i \leftarrow \sum_i \} = \alpha_i$ we call the minimal or the guaranteed payoff of player i. Each strategy s^0_i that realized the minimum payoff we call the careful strategy, and the strategy that gives the player the win, we call the winning strategy.

  On example of game G1, we have sets of strategy $\sum_1 = \sum_2 = \{H, T\}$. The payoff function $\pi_1, \ \pi_2$ are as follow:

  $$\pi_1(H,H) = \pi_1(T,T) = 1, \ \pi_1(H,T) = \pi_1(T,H) = -1, \ \pi_1 = -\pi_2$$

  The payoffs for both players are 1 and -1. Their guaranteed payoff is -1, and maximal payoff is 1. All strategies are careful, and none of the players has a winning strategy.

If state $s = (s_1, s_2, \ldots, s_N)$ is not dominated by any other state, we call it the optimum state by Pareto. The same state name is used in economics. Also common used term in game theory is the equilibrium state by Nash, and the perfect equilibrium state.

By the other types of game I will use the definitions, skipping the writing of mathematical equations, because there are not the main topic of this article.

- Games in evaluated form

By those types of games, we can single out two situations. In one of them the players can decide how will they go on in each situation they face, and on the second one, they will make their decisions while facing the situation, and using the game history. To present the history of game, the easiest way is to show it as a tree. We have the first decision (the root of the tree) and the decisions that can be made are branches of the tree. The decision of the other player makes new branches from the peaks of the early branches. This goes on, until the players find their self in peak that is no more decision to choose, and the game ends. The mathematical research in this case is the graph theory and its properties. The following illustration shows an example of a game tree.

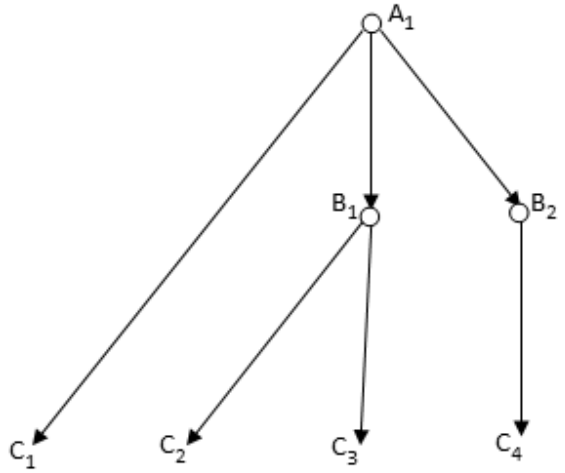

Fig. 1. A game tree model

Source: Płonka [2001].

We have two players A and B, and the end peaks are signed C. The first player has four strategies, the second three. The payoff function is the probability going to the indicated endpoint.

A good example of that kind of game is G2 and G3.

- Two-person game (matrix game)

  Under a two-person matrix game $\Gamma(A,B)$, where $A,B \leftarrow M_{nm}(R)$ are real value matrixes, we understand a game, in which the payoff of the first and second player are the values respectively of matrix A and B at i row first player choose, and j column the second player choose. Both players give their choice at the same time, and both players know the A, B matrix values. The example of how it works is the G5 game.

$$A = \begin{bmatrix} 5 & 1 \\ 10 & 2 \end{bmatrix} \quad B = \begin{bmatrix} 5 & 10 \\ 1 & 2 \end{bmatrix}$$

Fig. 2. The matrix A and B from player one and two in game G5

Source: Płonka [2001].

Computer/video gamers opinion

If a computer gamer were talking about what is a game, he would start with naming kinds of games – mental, sport etc. Types… – but what about a definition of game itself?

According to James Rolfe [www1] – a gamer featuring his own show about games – a game is a game, when we can play it. The possibility of playing seems to be the main idea – but there are other conditions right after that. If we have a game, it should have a defined goal, we want to know, what should we do in this game. We should also be able (after a period of time) to win the game – games making it impossible to win, i.e. being stuck in one moment (and being not the only one who has that problem) – is for a gamer no game. All seems right, but there's one more condition – in a game, we should be able to lose. If a gamer can't lose in a game, then it's no point playing it.

What about a strategy and payoff in a game?

As strategy for a gamer is only one – win the game. By gathering experience during a play, knowing what will happen next (we know what will happen, because we played it earlier), we know what decision we will make. We could say, that we are using the history of our gaming, as a strategy for winning, and

also, that the player is making a simulation in his head how will his next step be. The payoff in a game is differenced by game programmer. The payoff can be winning the game, winning with high score/best time (when multiplayer game) and combined of it.

In Table 1 we have a game classification by J. Klabbers [Klabbers, 2003], that, in authors opinion, we can make a description of each game. In table are mentioned also board games, that someone might say it's not a computer game, but now almost all games (board, card) have it's computer game analog.

Table 1. A game classification schema

	Actors	Rules	Supplies
Syntax	Players – their kind (persons, teams) and number	Communication rules, allowed moves, begin and end of game	Game environment (physical and its infrastructure)
Semantics	Roles	Relation between roles (communication structure and coordination), rules, procedures.	Allocation in game environment.
Pragmatics	Context and aim of learning	Arbitrage rules, game procedures, evaluation of results.	Computer, paper, boards.

Source: Klabbers [2003].

Klabbers was also making this classification duo to manager games, so now we come to next chapter.

Manager opinion

Manager games simulate managing a company, organizations, what has a directly specified goal. Not all authors agree, that in such kind of games, we have to do with simulation. One of them is Barczak, who wrote "Computer war games", is the meaning, that a simulated character of a game is depending on simulated character of a model, and then the managing of the experiment of a game. So this mean, that a game can have a simulated character, but it don't have to depend on a simulated model, which make a assumption, that there are different kind of quality in category manager games. When there comes to define what component posses a typical manager games, it would be as follow:

1. Role definition – description of situation we have on start, defined actions and decision that the players can or can't make.
2. Scenario in which the roles are set.

3. Calculating system – tool to proceed the decisions and generates it consequences.
4. Roles and procedures are structuring the activity of exercise members.

In Table 2 below, we have the characteristic of manager games where we see, that a typical manager game is quite common either with activated exercise and algorithmically model.

Table 2. Characteristic of manager games and related

	Activated exercises with role playing	"Typical" manager game	Work at simulated algorithmically model
Actors	Few people or few people teams	One person	Agents/none
Rules for actors	Not unequivocal	Rigid	Unequivocal/none
Goals	Appearing	Enforced	Unequivocal
Success criteria	None	Customized	Good defined
Learning	Interactive	Interactive and canvassing	Acquisition
Learning goals	Affective	Affective and cognitive	Cognitive
Interactions with other players	Unpredictable	Set with bans and warranties	None
Models common areas and contest	Common goal/cooperation	Common goals (users competition)/no common goals (rivalry)	No common goals no rivalry
Material resources	None	Boards, cards, checkers	Computers
Imitate objective system	Abstract	Universal	Specific
Algorithmically model	None	Black box	Clear

Source: Balcerak [2007].

In conclusion, the strategy of players is to achieve the goal the way, the game is constructed. The payoff is win – on one side we could call it satisfaction, on other side, the knowledge.

Simulated games

The expression "simulation game" was mentioned in chapter about computer games, as in that about manager games.

Klabbers sees a game as a type of social system. During it, the actors are interacting according to rules, and they are using specified by rules supplies. Despite of that, there exist games, that are using no supplies, and they are called "behavioral". A other type of simulated game is replacing the actors with some algorithmically rules. The schemas of those games are as below:

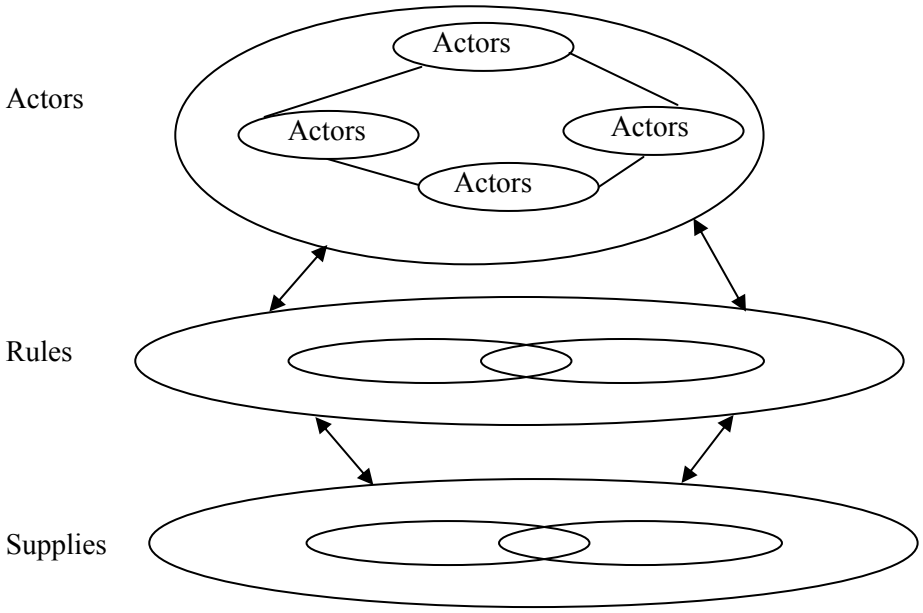

Fig. 3. The basic architecture of a simulated game

Source: Balcerak [2007].

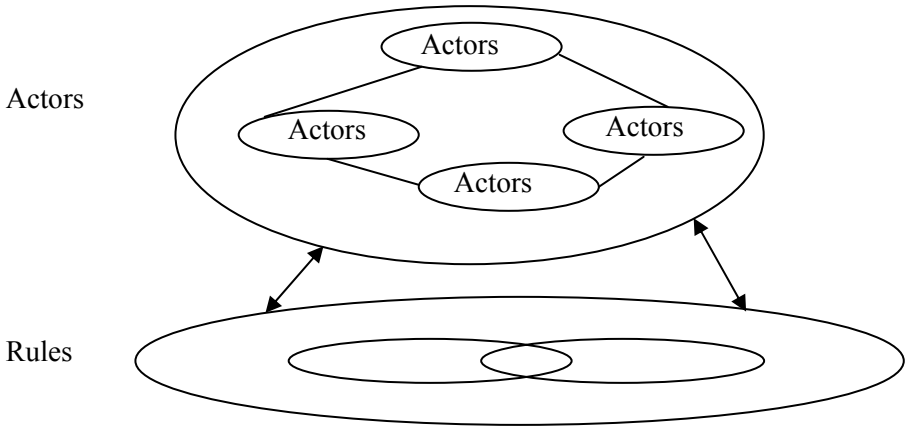

Fig 4. The behavioral game architecture

Source: Balcerak [2007].

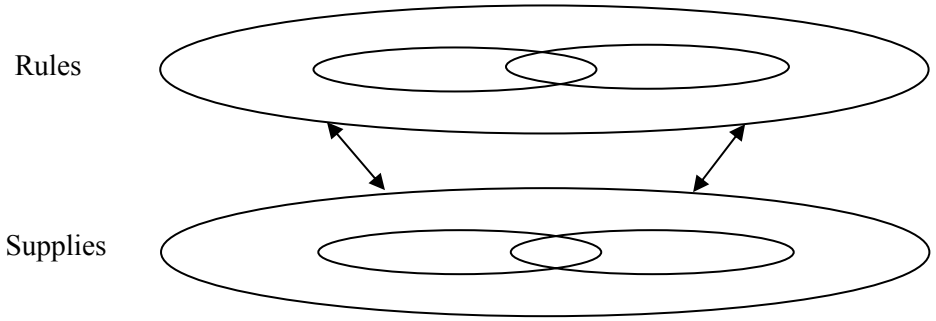

Fig 5. Algorithmically simulation architecture

Source: Balcerak [2007].

Some authors, like L. von Mises, are looking at a simulation game as a mental model, which are using categories, characteristic, and other data supplies, that are not simply measured by numbers. According to that, system dynamics is a "try" to materialize a mental model.

Conclusion

In this paper a view on the concept of a game was shown. Many times, although a game seems to be simple in categorizing, it isn't that simple. Games are very different, can be very different presented and qualified. We probably all heard (or said at least once) this sentence: "life is not a game". Seeing the views of some authors, making our decision, and even our thoughts as a game (like in G5 prison dilemma) – we can't be so sure we are not all a part of a "life game", where players are we all, where we posses (or not) supplies, and everything is ruled by "reality" (or maybe there is a person that rules all of it?).

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POGLĄDY WYBRANYCH AUTORÓW ODNOŚNIE DO KONCEPCJI GRY

Streszczenie: Tyle ile ludzi jest na świecie, tyle istnieje gier. Gdyby zapytać, co oznacza sam termin „gra", jakie są jej rodzaje, otrzymałoby się taką samą liczbę odpowiedzi jak liczba pytanych. To sugeruje, że samo sformułowanie „gry" nie jest ani dobrze znane, ani dobrze zdefiniowane. Pomimo tego iż na polu naukowym gry są rozwijane, powstają nowe ich typy, brakuje jednej konkretnej definicji gry. Aby zbadać tę kwestię, prześledziłem ewolucję terminu „gra" od podstawowej definicji matematycznej aż po gry menedżerskie, strategiczne i symulacyjne. W artykule zaprezentowano przegląd wielu typów gier, które powstały w ciągu lat.

Słowa kluczowe: matematyka, gry, symulacja.