Serious and Simulation Games – A Definition Approach

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Abstract. Information systems used in modern business become more complex because the holistic approach of process implementation turns increasingly into the focus of corporate's demands. To handle such Very Large Business Applications (VLBA), the recruiting of tomorrow's new experts is an important educational task. Business simulation games are an effective teaching method: On the one hand, the participants learn the theoretical concepts. On the other hand, they can adapt their new knowledge. But there are lots of different serious games, even in literature multiple expressions exist. In this paper, a literature review is performed to mark out different types of games with an educational character. It is found out, that the most common expressions are serious gaming and (business) simulation games.

Keywords: Serious Games, Simulation Games, definition.

1 Introduction

In relation to market globalisation, business applications grow because information technology enables competitive advantages. Topics like holistic process implementation or workflow support services are one reason why the complexity of industrial information systems raises. Besides the importance of theoretical background, a substantial demand on experts with practical skills who can handle such complex systems exists.

In addition, life includes – but is not limited to – making decisions, whether in private or business matter. Much of them are made intuitively; but critical situations, where the impact of decisions is elusive, are hardly to manage. Otherwise when a choice is made it is difficult to roll it back.

Educational games are a helpful instrument to train the handling of such situations while they simulate a special environment where the decisions could be analysed and evaluated. Once developed for military to train strategic and tactical thinking, they have broken into almost every field of life, e. g. as flight/driving simulators, for security education, for defence purposes, in corporate management or for handling information systems; either with more intensity on entertainment or with regarding to reality.

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According to their application, target group and focus, different terms have been developed in literature to define or describe such educational games. In order to presend an overview about the meanings of such terms, the paper presents the definition and shows how the meanings of the words differ from each other.

2 Definition Approaches

"Serious games" or "serious gaming" and "simulation games" are very common terms for games with a focus on education. But before being able to deal with different types of educational games, the term "game" itself has to be explained. This is to be done in this section.

2.1 Game

In 1939, Johan Huizinga delivered an extensive and approved definition of the term game (Ger.: Spiel) within his work "Homo Ludens". There, he compares it as a voluntary action or engagement within a specified dimension of time and space. This engagement follows voluntarily accepted but stringent rules. The participants undergo a feeling of excitement, pleasure and an awareness which differs from "normal life".[1]

Consequently, forced or appropriated activities are not captured by the term *game*, they would be covered by *seriousness* [2].

In English literature, there are three different comprehensions between the words *play, game* and *gambling*:

- *Play* could be put on a level with the above definition of Huizinga, respectively his description of *game* (Spiel).
- *Game* emphasises the rule-based concept. So, developing a rule-following strategy or tactic will be supported or is possible to dominate or win the game. Huizinga's broad definition fits here, too.
- *Gambling* consists of games of pure chance. In such games luck plays an enormous role. Although these sort of games obey a set of rules. But due to the extensive part of luck, a strategy could hardly influence the result.[2] Known games of chance are roulette and blackjack.

Words like video game or computer game are attempts to create a definition of the word game – detached by the word play – to underline its special rule-based character [3].

Salen and Zimmerman propose the following definition:

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[1] Huizinga, J.: *"Spiel ist eine freiwillige Handlung oder Beschäftigung, die innerhalb gewisser festgesetzter Grenzen von Zeit und Raum nach freiwillig angenommenen, aber unbedingt bindenden Regeln verrichtet wird, ihr Ziel in sich selber hat und begleitet wird von einem Gefühl der Spannung und Freude und einem Bewusstsein des 'Andersseins' als das 'gewöhnliche Leben'"* [1].

[2] If the percentage of luck consists of almost 100 percent in a game, a strategy performs any effect on the result and is therefore ineffective.

"A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome" [4].

But many computer games give their players the opportunity to let them decide in with way they might perform, so this sort of video games does not target on a concrete aim, they offer a sand box environment, wherein the player could act freely as he or she might to. Therefore, they could not be summarized under the narrowly defined term game. They belong to free games. Examples of such free (video) games are SimCity[3], The Sims[4] or the Myst and Uru Universe[5]. Free games have been performed by children, even by adolescents and adults for centuries [3].

However, the meaning of a game varies from the age of human life: During infancy, gaming helps to promote cognitive skills and to develop social identity, e. g. by imitation of other people or by training/repetition of motion sequences. Gaming is predominantly a single activity until school readiness. Later, with the group activities, the competition character of games rises under an agreement of rules. Adults consider games on the one hand as a possibility to relax and to escape from pressure in reality. On the other hand, competitive aspects still play an important role [2].

In general, a game describes the activities in a specified dimension of space and time, which should be executed in a way to fulfil given aims without injuring predefined rules. The gaming process itself surrounds the participant in an atmosphere of tension, joy and challenge [2]. However, this atmosphere can also turn into frustration and sadness when the result of the game does not match expectations.

2.2 Serious Games

In the American-speaking world, Serious Games form the interface between entertainment technologies and applications in the institutional and educational sector.

Serious Games are used in many branches, e. g. in the medical sector, in military and in business sector to recruit or train employees. Nevertheless, they also take part in public sector in order to sensitize people for a special or relevant topic. Learning within a secure and realistic environment is a crucial advantage of serious gaming (e. g. flight simulators) [5]. Enriched with funny activities in a particular context, they are often used for education, planning and advertising purposes. Their playful and/or challenging design focusses on user motivation. In order to ensure good results, their development needs a "careful strategy" [19].

This genre of games was established in conjunction with the release of *America's Army* and the foundation of the Serious Games Initiative by Ben Sawyer and David Rejeski in 2002 (at least in the English-speaking world) [2]. But this expression has already been used before era of Information Technology: In 1968, Clark C. Abt used the expression for board and card games and defined it as follows:

"Reduced to its formal essence, a game is an activity among two or more independent decision-makers seeking to achieve their objectives in some limiting context. A more conventional definition would say that a game is a context with rules among

[3] http://www.simcity.com
[4] http://thesims.com
[5] http://www.cyanworlds.com

adversaries trying to win objectives. We are concerned with serious games in the sense that these games have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement" [6].

But a general definition has not been established until now. It is only evident, that serious games describe games or similar applications which are developed by instruments or technology of the entertainment software sector but do not serve only for playful belongings [5].

The parts of game-aspects (entertainment value) and informative or educational aspects should be balanced. So, the user could adapt his or her experiences for life. Serious Games are not limited on one genre[6] and can use every game technology or be conceived for every platform. The main effect of these games lies in learning experience [2].

An expanded definition is formulated by Ben Sawyer, co-founder of Serious Games Initiative:

"Any meaningful use of computerized game/game industry resources whose chief mission is not entertainment" [7].

Sawyer points out that a clear division between entertainment games and serious games could not be performed and is either not necessary. In accordance to the game America's Army, this game simulates a training situation for one person whether another person plays the game only for entertainment purposes. So, in general, every game, which is not intended only for entertainment, could be seen as a serious game [2].

Table 1 categorises serious games into the following subdivisions [5]:

Table 1. Classification of Serious Games [5]

Classification	Description	Examples
Corporate Games	Industrial applications for corporate training of education	Innov8, Sharkworld, KoCUA, Ultimate Team Play
Educational Games	Serious Games for use in scholar/university qualification with concrete learning objectives. Even games especially developed for children belong to that category.	DiaboloVR, Genius Politik, Luka und das geheimnisvolle Silberpferd
Health Games	Health games simulate concrete medicinal scenarios and encourage general health care	Glucoboy, Human Sim, Mind Habits, Pulse!!, Re-Mission
Persuasive Games	Political or social motivated games for the broad public which transport arguments and persuasion through edutainment	Darfur is Dying, Fatworld, Food Force, Global Conflicts – Palestine, PowerUp, September 12th, Serious Policy

[6] Simulation, adventure, strategy or shooter games are examples for game genres.

Furthermore, it is not clear if serious games could be put on a level with learning games or e-learning. For example, Hawlitschek subsumes all video games of the category "playing with educational content" or "learning with playful content" as learning games, whilst in serious games, both aspects are combined in a way that the user learns playfully [8].

E-learning refers to computational and online-aided learning. The knowledge transfer happens with the help of software. Otherwise, trainer and participants meet in virtual class rooms.

Marc Prensky defines the (digital) game-based learning as "[…] any learning game on a computer or online" [9]. So, the educational content has to be integrated in a way that the user should feel like a gamer and not like a learner. As described above, entertainment and education have to be balanced. Otherwise it is a learning program or a usual entertainment game [10].

2.3 Simulation Games

Originally used for tactical simulation and planning of war operations in military, simulation games have been adopted to civil training since 1950s because their application area has been extended as a result of the combination of war games, operations management and computer science [20].[7] In present times, simulation games now hold a special part of serious games. But not all serious games are simulation games. Serious gaming is a more general term for games, whilst simulation games have a special relation to reality because they concentrate on simplification (simulation) of existent problems in reality.

Geilhardt/Mühlbradt compare a simulation game (Ger.: Planspiel) with a constructed situation, in which one or more person(s) act(s) in a model of predefined rules. The behaviour will then be systematically observed and analysed [11].[8]

Kriz disassembles the term into three components [12]:

- **Simulation** of a closed (sub-)system. Simulation means the technical transformation of a given model. Separate elements could only influence or interact each other within simulation environment.
- **Game** refers to a bundle (set) of rules for structuring relevant and predefined processes
- **Role** is defined as function which the participants take over in dynamic systems.

From this decomposition, the characteristics of simulation games could be derived: Planning (description) and Game [13]. In addition to that, Adelsberger et al.

[7] Business simulation games supporting corporate management and leadership in enterprises (decision making) were the first civil games. As a first approach, the famous "BEER Game", developed in 1985, enriched those games with manufacturing content and engineering related topics [20].

[8] Geilhardt, T./Mühlbradt, T.: "konstruierte Situation, in der sich eine oder mehrere Person(en) in oder an einem […] Modell nach vorgegebenen Regeln verhalten, wobei das gezeigte Verhalten systematisch festgehalten und nach einem explizierbaren Kalkül bewertet werden kann" [11].

emphasise the importance of evaluation apart from description of scenario and simulation [14].

Even Léger adds the evaluation process as the final component of simulation games because the behaviour and decisions of participants/teams has to be reflected in order to be able to learn from the feed-back of the game leader [15].

By using simulation games, important processes and hierarchical structures existing in real life could be simulated and simplified for comprehension [11].

Comparison of Simulation Games and Simulations

In literature, there are partially contrary approaches of diversification between simulation games and simulations themselves. One possibility to divide is delivered by Kern. He cuts the dynamic role process into two sections [16]:

1. In the *action section* (Ger.: Aktionsbereich) the person acts in the sense of its represented role and makes decisions.
2. In the *reaction section* (Ger.: Reaktionsbereich) a simulation processes the decisions of the activities done in the action section. Results are presented as output.

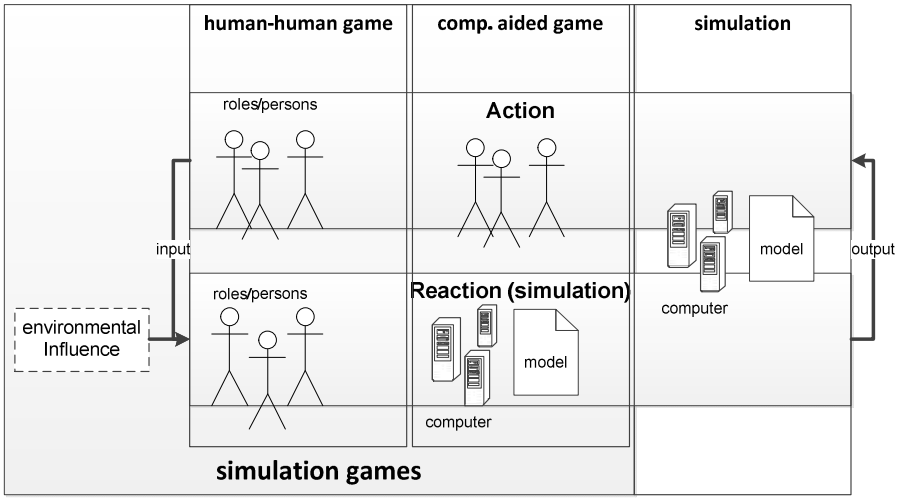

Fig. 1. Action and reaction section of simulation games [ref. to 13]

Fig. 1 illustrates action and reaction section of simulation games referred to Kern's work. Simulation games could be computer-aided designed or a human-human game where e. g. the game leader performs the output by processing the teams' decisions with the use of formulas or other given instruments. While serious games span both areas, simulations only fill out the reaction section [9]. Therefore, a simulation could be part of a simulation game but not the other way round. An additional system component representing extraneous environmental disturbance could influence the results of simulation games.

Rigid-Rule and Free-Form Games

Simulation games consists of two different gaming concepts: either the rigid-rule game (Ger.: geschlossenes Planspiel) or the free-form game (Ger.: offenes Planspiel).

The most common types of simulation games are the rigid-rule games. These games follow strict rules [17]. The participants will be set into a preconfigured situation. A set of rules and a game instruction exist. The task is to play the game in a most successful way.

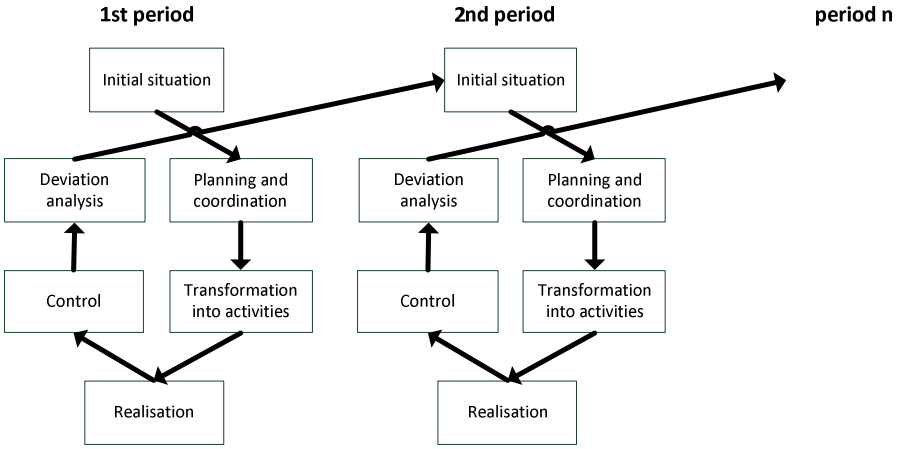

Fig. 2. Typical management cycle of ridge-based games [ref. to 17]

Due to the strict set of rules, the gaming process consists of the same phases during each round. Fig. 2 shows a typical management process cycle of rigid-rule games. Every step repeats in every new business period.

In comparison to that, free-form games deliver an organisation to produce or evaluate a simulation. Instructions are widely avoided [17]. Although free-form games have rules how they are created, they do not offer a predefined system of rules which restricts the action opportunities of the participants. They will be defined during the gaming process or during the development process of the simulation. Nevertheless, such games also follow a process structure but the problems are not predetermined by the game leader [17].

3 Summary and Future Work

It is found out that among the prevalent terms serious games and simulation games, a general approved definition still does not exists. In some cases, it is also difficult to delimit the terms.

While serious games are a sort of combination of entertainment and education ("edutainment"), simulation games mostly build on reality scenarios and strict processes to transfer knowledge.

Further research work could be concentrate of the construction of a methodological box in order to structure the high amount of serious and simulation games on the market. An interesting point of view would be – by modelling the box – to find out criteria, in which serious and simulation games have the same characteristics and in which points they differ from each other. Also a new approach in simulation games are system-integrated games, such as ERPsim[9] from HEC Montéal where the participants directly enter their decisions into the information system (here: SAP ECC 6.0) or have to get their results directly from the system. How far have teaching scenarios of classic simulation games[10] to be adapted for system-integrated simulation games?

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[9] http://www.erpsim.ca/

[10] E. g. X enterprises can produce x products and deliver x markets.

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