Simulation games and a management approach: Thinking in systems

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Abstract

In this article we are in search of the active substance of simulation gaming from a practical and conceptual management perspective (system perspective). From the practical point of view, we provide a list of reasons why simulation games are a powerful tool for management applications. For instance, games are a safe environment for experimenting. In addition, we use a system perspective to examine the analysis, design and debriefing phase of simulation games. We conclude that system thinking provides the active substance of simulation games because it offers a methodical and systematic way to: (1) design powerful simulation games that correspond well to the situation that has to be simulated; (2) explore the game model and perform it from the perspective of the game participant; and (3) draw conclusions about the processes in the simulated model as well the real-life situation.

1 Introduction

No book on what makes simulation games work can leave out a contribution from the perspective of management. In this chapter we explore the relationship between simulation games and management from two perspectives. The first is a more practical one and focuses on the question why simulation games are a powerful tool for management applications. We use the second, more conceptual, perspective to explore how systems thinking may be helpful in designing and using simulation games. Systems thinking is a perspective used by many management scientists and forms the basis of a variety of management theories. We ourselves use this approach in

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designing, playing and debriefing simulation games, which is why we have chosen it to answer the question about the active substance of gaming.

Simulation games and the field of management are undeniably linked to each other. Many people unfamiliar with the term 'simulation games' nevertheless know exactly what you mean if you talk about management games or business games. A Google search gives you a profusion of simulations designed to improve management and business, for students as well as for managers. 'Management games' is a generic term for all kinds of simulation games that focus on aspects of managing a business, ranging from games that focus on single aspects such as business administration, logistics, marketing, strategy development, and staff policy to ones that address all or some of these aspects in an integrated way.

The observation that simulation games seem to do very well in the field of management makes us curious to answer the question as to why this is the case. What is it that makes simulation games such a successful tool in the field of management and business? Although this is a different question to the main question in this book (which theories help us to understand why simulation games work?), we cannot resist the temptation to briefly address it. We shall do so in the next section.

We will then focus on the reverse question: can we explain the strength of simulations games from the perspective of management sciences? In exploring this question, we restrict ourselves to one specific type of theory, namely systems thinking. We briefly discuss what systems thinking is about, and in the subsequent section we describe how we apply elements from systems thinking to the way we design simulation games and how they support playing the simulation game and the debriefing. In the concluding section, we reflect on the benefits of systems thinking for simulation games.

2 What makes simulation games a powerful tool for management applications?

If you want to train people to become managers or if you want managers to acquire and use new knowledge and skills, there are key features of management games that make them very suitable for this purpose. From the literature and our own experience, we arrive at the following overview:

- Insight by experience
  Playing a simulation game provides managers with new insights into complex issues re-

lated to managing businesses or organizations. And rather than having to read books or listen to lectures, managers prefer learning situations that enable them to gather the main issues rather quickly and give them an opportunity to directly apply the newly acquired knowledge, information and skills. Simulation games offer such a learning environment. Managers are often doers and the feature of insight by experience matches the wishes and needs of this kind of learner.

- Focusing
  Managing a business or an organization involves dealing with many interrelated aspects, such as strategic decisions, marketing, personnel, flows of materials and products, demands of the clients, actions and decisions of competitors, and financial foundation. All these aspects have to be in sync and managers have to address them all simultaneously and in an integrated way in order to make correct decisions. In a simulation game the manager can concentrate on a single aspect, while the effects of other aspects are simulated in the background. Such simulation games are often referred to as marketing games, logistic games, financial games, and so on.
- Dealing with complexity
  This feature is related to the previous one, but it stresses an extra means by which the designer and facilitator can enhance the learning process: the simulated environment and the assignments in the game can be made increasingly more complex in the course of the game, e.g. the market becoming more differentiated, an increasing number of suppliers with different offers, fluctuations in the prices of raw materials, shortage of personnel. Managers can gradually learn to deal with increasing complexity.
- Overview
  This feature is also related to the 'focusing' feature. It is hard to distinguish all interrelated aspects of a business or an organization, and to understand how these different aspects influence each other. In the day-to-day situation too many details hinder managers in seeing how aspects are interrelated and how to deal with them (integrally). A simulation game can provide the manager with a bird's eye view of the organization and its aspects: the big picture.
- Accelerated feedback cycles
  One of the characteristics of many managerial decisions is that it takes some time before the results of these decisions become clear. In practice this means that it is difficult to establish causal relationships between decisions and outcomes, which makes it very hard to learn from our own decisions. In simulation games, time may be accelerated, making the effects instantaneously visible. The effect of this is that managers can under-

go several cycles of decision – feedback – improvement which in turn enhances the learning process.

- Organizational change processes
  Many organizational change processes are set up in a participative way, i.e. organization members from all levels are actively involved in one or several of the phases of the change process. Simulation games are very suitable tools in this kind of situation (see for example Van de Westelaken, 2002; Geurts et al., 2000), helping to create commitment among employees.
- Organization simulator
  In addition, simulation games are a powerful way to present management and the organization members with the changed organizational structure or with a future situation; this gives them the opportunity to learn and practice new skills or coordinate activities in order to cooperate.
- Safe environment for experimenting
  Management decisions may have far-reaching consequences in a variety of fields. A simulation game provides a situation where managers can experiment with new ideas, and if an idea turns out to be poor, the negative consequences only affect the simulated situation without endangering the real-life situation.
  This feature of management games is frequently mentioned as one of the unique selling points of simulation games in an organizational context. Obviously it is a very strong characteristic, but we should be aware that this safety does not necessarily hold for personal reputations or interpersonal relations. These may be threatened even in the context of a simulation game (Hijmans et al., 2008).
- Developing strategic thinking
  Many educational programs train managers-to-be for jobs at the strategic level of organizations. However, during the educational program it is very hard to place students in real-life situations where they can become acquainted with and practice strategic issues and strategic decision making. A simulation game is a very good alternative to present them with the complex world of the strategic manager, where they have to combine information from several sources, take decisions and see the effects of their decisions.
- Competition
  Most managers enjoy a challenge and want to perform better than others. A management game (almost) always contains a competitive element: one business has to perform better than the other to win the game. So managers not only test themselves on knowledge and skills, but are also challenged to perform better than others.

- Fun and relaxation
  Playing a simulation game is fun; meeting colleagues in a different context and having to work together on a completely different task than usual may help participants to reflect on their daily activities from another perspective in a more relaxed situation, away from daily routines and pressure.

These are arguments that explain why simulation games are considered a powerful tool in management education and support. Most characteristics we have mentioned here are generic for all simulation games, and are not exclusively related to the field of management. But the complex character of management problems and the training of managers require tools that make this complexity manageable on the one hand, and provide an opportunity to gain an overview of the whole situation on the other. Simulation games have the potential to combine these requirements.

After this little excursion about the fit between the field of management and simulation games, we now focus on the second question: how does systems thinking help us in designing and using simulation games?

3 Systems thinking

In this section we give a short description of the core of systems thinking. We focus on the main characteristics that are important for the following section. For further details, readers are referred to the sources mentioned.

Contrary to traditional thinking, which focuses on parts isolated from the whole and on simplifying, systems thinking concentrates on parts and the relationships between those parts within the whole, and on complexity. Hatch (1997, p.35) says: 'the idea of interrelated parts emphasizes that, while all systems can be analytically broken down for the purpose of scientific study, their essence can only be identified when the system is confronted as a whole. This is because subsystem interdependence produces features and characteristics that are unique to the system as a whole.' Thus, the core idea of systems thinking is that a complex whole can have properties which only refer to the whole and are useless in terms of the parts that together form that whole (Checkland & Scholes, 1990).

Systems thinking goes back to the 1950s when bio physiologist Ludwig von Bertalanffy presented his General Systems Theory. His focus here was on the similarities underlying and uniting all sci-

entific phenomena across both natural and social sciences. He referred to these phenomena as systems. Although they are not systems, they can be seen as such (a 'system' in itself does not exist). Von Bertalanffy recognized that all these phenomena are related: societies contain groups, groups contain individuals, individuals are comprised of organs, organs of cells, cells of molecules, and molecules of atoms (Hatch, 1997). This is called recursiveness of a system: subsystems are embedded in systems, like the Russian doll effect. What is considered part of a system and what is not (its environment) depends on the focus of study and is a decision of the person beholding the system. In terms of simulation games for management, if a simulation game focuses on (processes within) a specific department, the management and other departments of that business are left out (or are given a position in the environment of the system, i.e. outside the system).

A system can be described as a collection of elements, distinguished – as said – depending on the focus of study. Elements can be both objects – bridges, computers, organizations and so on – and subjects (people). Relationships exist between these elements within the system, but also with elements outside the system. Relationships describe a certain connection between the elements, such as interaction, exchange and influence. The elements influence each other, with changes in one element causing changes in an-other.

In addition to these three characteristics:

- system borders
- elements
- relations between elements,

there are two other important concepts we wish to stress here. A system can be considered as being built up out of other systems. We can distinguish between two types of nested systems:

- subsystems
  a collection of a part of the elements in a system. All original relations between these elements stay the same. If we consider an organization as a system, the departments of that organization may be considered subsystems; together they make up the organization.
- aspect systems
  a collection of part of the relations in a system; if we consider an organization as a system, the marketing processes (including parts of subsystems that are involved in marketing) may be considered an aspect system.

There are several approaches for analyzing reality in terms of systems, such as the Soft System Methodology of Checkland & Scholes (1990) and the Viable Systems Model of Stafford Beer

(1972). It is beyond the scope of this chapter to elaborate further on systems thinking. We will confine ourselves to referring the reader to Hatch (1997), Checkland (1981) and Senge (1990).

4 Simulation games and systems thinking

Having said all this about systems thinking, we now address the questions of how applying these ideas may help us to understand what simulations games are and how the way games work can be understood from the perspective of systems thinking. We do this by describing how we use systems thinking in the design process and the use of simulation games.

Applying systems thinking to this field is not something completely new, nor a revealing discovery. After all, Geurts et al. (2000, p.22) use the systems concept when they define simulation games: 'The term gaming/simulation is used when there is a (simulated) model of a (real) system and there are actors who, in various roles, attempt to meet objectives within a set of rules'. In this definition, which does not differ in essence from most definitions, the four most important concepts are model, actors, rules and objectives. The ingredients for a systems perspective on simulation games are obviously present. In terms of systems thinking, a simulation game is a system (model) of actors (roles) and the interrelations between them (regulated by rules), pursuing a specific goal.

In the rest of this section we describe how considering the real-life and simulated situations as systems helps us when designing and using simulation games. To do this, we look in turn at the analysis and design phases of the game design process, and at playing and debriefing the simulation game. We base this description mainly on our own experience.

4.1 The analysis phase

The first step in building a simulation game is to analyze the real-life situation that has to be simulated. Many authors refer to this as systems analysis (see for example Greenblat & Duke, 1981). In terms of systems thinking, this analysis typically aims at answering three questions:

1. What are the boundaries of the field we have to transform into the simulation game?
2. What are the most important elements in this system?
3. What are the relations between these elements?

The first question comes down to delineating the system, i.e. reduction from the real-life situation, while the second and third focus on the dynamics inside the system, i.e. who are involved and how do they interact?

In the analysis phase we start with a preliminary definition of the system. As game designers, we have to define the goal or function of the system, and to delineate which elements belong to the system and which ones to its environment. We therefore have to unfold the real-life situation, and take a good look at all the parts and their interrelations. In dealing with very complex real-life systems, it is helpful to consider such a system as built up from a number of related subsystems and aspect systems.

Stakeholders

There are many starting points from which to answer the systems analysis questions. Since one of the main features of a simulation game, the product we eventually strive for, are the roles played by participants (or simulated in the model), we consider the stakeholders in the real-life system as the key elements (actors) in the systems analysis. Having decided on the key stakeholders, the most important and relevant relations between these stakeholders are inventoried and described. All other interesting aspects of the real-life system are analyzed and interpreted in terms of the stakeholders and the relations between them. The description of the real-life system is not a static description of, for example, structures but focuses on the dynamics of the interactions between the stakeholders. This different way of defining systems is illustrated in the example on the right.

If you want to describe how an organization deals with its knowledge, you may define the different parts of knowledge, see how this knowledge is acquired, who in the organization has the knowledge, how the knowledge is secured, when it is used and when it is withheld, and so on. The focus in the analysis is on the knowledge and how it is transformed and transferred in action.

But if we want to describe this organization as a system of actors and their interrelations, we first have to distinguish which actors are relevant in relation to the knowledge, who has (parts of) this knowledge, why the knowledge is important for their work, what reasons an actor may have for sharing or withholding the knowledge, with whom the knowledge is shared under what conditions, and so on. The knowledge transferring and transformation process is considered an aspect system of the system 'organization'. The various actors may be considered the subsystems of the system 'organization'.

Thus although the object of study is the same, the specific angle from which we look at it is different. And since we eventually have to design a simulation game, the approach with which we describe the system in terms of actors and the relations between them may be very successful and effective.

When analyzing the real-life system, we can use the basic characteristics of a system (boundaries, elements and relations). If we want to describe this system more systematically and profoundly,

we can use more elaborate and sophisticated models, e.g. the CATWOE elements of Smyth and Checkland (1976), or elements of Stafford Beer's viable systems theory.

A systematic analysis of the reference system is not uniquely reserved for the systems analysis in the game-building process; all techniques that work with models of (part of) reality are based on a thorough analysis of the reference system, but the focus on actors as the point of departure for the analysis and description of the system is unique for the game-building process.

4.2 The design phase

During the design phase, the real-life system (or reference system) is gradually transformed into the simulated model that is represented in the simulation game. Important steps in this phase are designing and creating the gaming elements (scenario, roles, rules, events, indicators, etc.), but also ensuring the correspondence of the simulated system to the real-life system. Especially if the simulation game is based on a metaphor, it can be difficult to establish this correspondence or the validity of the game. If the analysis of the reference system is based on an elaborate systems analysis, it is easier to establish correspondence in terms of the structural validity (who are the actors and what are their characteristics?) and process validity (what are the relations between them?) (Raser, 1969; Peters et al., 1998).

Since we consider a simulation game to be a model of a system of actors and their relationships, we usually start with the elaboration of the roles in the game. After defining the roles, the relationships between the roles are elaborated, resulting in rules, resources and means, an accounting system, symbols, and so on.
To develop each role, we have to ask and answer questions such as:

- what is the objective or goal of this role?
- what are the tasks and activities of this role?
- what resources and means does the actor have at his or her disposal?
- what motivates this actor to obtain his or her goals?
- what kind of relations and interactions does this actor have with other actors in the system?

The first four questions help us to elaborate the element in the system as clearly as possible. By treating each of the actors/roles as a distinguished subsystem, separate from the other subsystem, the game design efforts will become more manageable and controllable.

The fifth question helps us to obtain insight into and shape the dynamics in the game. The relations between the actors as represented by roles in a simulation game may be manifold. Here are just some examples of what the relationship may involve:

- flows of information (inquiring, answering, sharing information)
- assignments (asking/giving/receiving instructions)
- authority (asking/giving/receiving approval)
- flows of resources (asking for/handing over resources)
- supervision
- assessing or criticizing
- emotional expressions
- non-verbal exchanges.

In systems terms these can be considered aspect systems. Dealing with them one by one (i.e. including them in the game model or discarding them) and connecting the subsystems (the roles) through these aspect systems will help us to construct a simulation game that properly deals with all important aspects.

4.3 Playing the game

Simulation games as we design them differ in a very significant way from other model-based techniques. In most techniques (e.g. system dynamic modeling), participants are positioned outside the system under study. They observe how the system functions and are able to manipulate the system (by pushing or pressing 'buttons'). The system will behave differently after this action, but the system has no effect on participants; this is obvious since they are located outside the system.

In simulation games we have a different situation. The most important roles in the system are played by the participants. Participants are not outside observers but part of the system. And what is more, the system is built up around them: they play the leading part. Because all actions directly and indirectly affect their own position, participants will immediately notice the effects of their own actions or those of other participants. They are in the middle of all action that takes place and it is from that position that they observe, experience and learn about the important elements and dynamics. Being part of the system and not just the initiator of actions, as well as being at the receiving end of actions makes the participants' experience very intensive.

Let's go one step further: the system in a simulation game can be seen as a social system. It is a situation in which people interact, with their values, knowledge, expectations, moods, and whatever personality characteristics they may have. This is a part that the designer cannot manipulate. Participants, as the core of the system in the simulated situation, bring along their own social system, something you cannot determine beforehand. Although this may seem an undesirable situation (the designer loses control over part of the situation), we believe that it is this char-

acteristic of simulation games that makes them so powerful: participants are not just playing a role, but are playing themselves in a specific setting. This may reinforce the way that participants experience the situation and learn in and from it.

Future's language

There is another aspect we would like to stress. Duke (1974) has mentioned simulation games as an example of the communication pattern he calls the 'future's language'. Here, all relevant information is simultaneously present and it is up to users how they deal with and process it. A road map is an example. All relevant information is there, it is up to you as the driver how you use it: begin at your point of departure and find your way to the destination, begin at the destination and reason backward what the best route would be, first look at the type of roads and decide on the basis of that information, decide to drive through the mountains or just along the sea, and so on. In a simulation game, too, a large amount of information is present. And it is up to participants in their roles to decide where to look, what information to use, in what order, and so on. There is a risk that participants will drown in all this information. Adopting a systems view on the simulated world and presenting the game in such a way to the participants may help them to organize and select the relevant information in an orderly way.

4.4 Debriefing the game

Finally we look at the debriefing process from a systems perspective. During the debriefing the experiences of the participants are discussed, related to the real-life situation and transferred into learning about the real-life situation. The experiences of participants are manifold and relate to various parts of the game. The idea that a simulation game is a system of actors and their relationships provides us with a systematic approach for conducting the debriefing. We can distinguish several levels in the system: the actor/role, the other actors and the relationships between them, the system with its system borders, the subsystems and the aspect systems, the environment, and finally the way these levels are linked and influence each other. These distinctions provide the opportunity to systematically switch between these aggregation levels: starting at the level of the individual, moving to the level of the other actors and the relations between them, to the system as a whole, the subsystem and the aspect systems, to the environment, or vice versa. By carefully switching between the levels, participants can discuss their experiences in a well-organized manner and the implications of these experiences for other levels in the system is made manifest. In addition to the possibility of switching 'vertically' between levels, another strategy is to switch 'horizontally', and thus successively cover the perspectives from various roles. In doing so, we also help participants to (learn to) see the big picture.

5 Conclusions

The process of designing, playing and debriefing a simulation game is often represented as all or part of an inverted cone, the so-called cone of abstraction. This cone reflects that the game model is a reduced and abstracted representation of the real-life situation, obtained via a systems analysis as an intermediate step (see figure 1).

In table 1 below we sum up how the most important features of these three levels of the cone can be characterized from a systems thinking perspective.

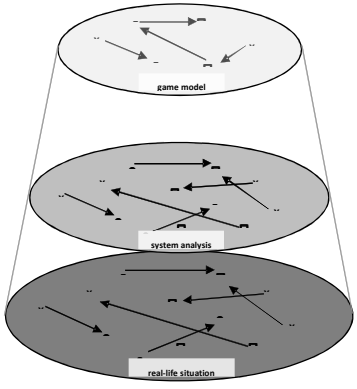

Figure 1: The cone of abstraction

real-life situation	→	systems analysis	→	game model
the complex real-life situation that has to be learned about	→	system, system borders, subsystems and aspect systems	→	described in scenario and rules
stakeholders in this situation	→	actors = elements	→	roles
interactions between these stakeholders	→	relationships between the elements (actors)	→	rules, scenario, events, supported by resources, data, etc.
the social system: values, knowledge, expectations, moods, etc. of the stakeholders	→	*(not present in the systems analysis)*	→	the social system: values, knowledge, expectations, moods, etc. of the players

Table 1: The most important features of the three levels of the cone of abstraction characterized from a systems thinking perspective.

This table shows that, seen from the perspective of systems thinking, the crucial characteristics of the three levels of the cone (the three phases of the gaming process) can be transformed into

each other. Reading from left to right, this table shows the basic principles of the analysis and design phases.

Other important aspects of working with simulation games can be represented in a similar way. An example is shown below in table 2.

real-life situation	→	systems analysis	→	game model
non-key characteristics of the complex real-life situation that has to be learned about	→	the introduction of new sub-systems and new aspect systems	→	events

Table 2: An example of how to represent important aspects of working with simulation games.

The table also indicates how the game model can be translated to the real-life situation during debriefing, and as we have stressed, opportunities for relating distinct parts of the game system (role, other roles, relations, system, subsystem, aspect system and environment) also make it possible to systematically translate from the game model to the real-life situation.

To come back to the question where this all started: can management sciences, in this case systems thinking, provide us with the active substance of simulation games? We think the answer should be yes. Systems thinking offers us a very methodical and systematic way to:

- design powerful simulation games that correspond well to the situation to be simulated
- explore and perform in the game model from the perspective of the participant
- draw conclusions about the processes in the simulated model as well about the real-life situation.

Perhaps systems are not the active substance for the participants while playing, but thinking in systems certainly is for the designer and for the participants' learning process.

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