HOW SERIOUS ARE SERIOUS GAMES?

SOME LESSONS FROM INFRA-GAMES

Geertje Bekebrede
Faculty of Technology, Policy and Management, Delft University of Technology
PO Box 5015, 2600 GA Delft
The Netherlands
+ 31 (0) 15 2781139 (w)
g.bekebrede@tbm.tudelft.nl

Igor Mayer
Faculty of Technology, Policy and Management, Delft University of Technology
PO Box 5015, 2600 GA Delft
The Netherlands
+ 31 (0) 15 2787185 (w)
i.s.mayer@tbm.tudelft.nl

Stijn Pieter van Houten
Faculty of Technology, Policy and Management, Delft University of Technology
PO Box 5015, 2600 GA Delft
The Netherlands
+ 31 (0) 15 2788545 (w)
s.p.a.vanhouten@tbm.tudelft.nl

Roy Chin
Faculty of Technology, Policy and Management, Delft University of Technology
PO Box 5015, 2600 GA Delft
The Netherlands
+ 31 (0) 15 2781886 (w)
r.t.h.chin@tbm.tudelft.nl

Alexander Verbraeck
Faculty of Technology, Policy and Management, Delft University of Technology
PO Box 5015, 2600 GA Delft
The Netherlands
+ 31 (0) 15 2783805 (w)
a.verbraeck@tbm.tudelft.nl

ABSTRACT

In this paper, the authors explore the possible contribution of *serious games* for advanced academic and/or professional learning in particular to support the decision-making and

Proceedings of DiGRA 2005 Conference: Changing Views – Worlds in Play.

management of complex infrastructures, such as utilities, ports and wind farms. The developments of the computer industry make it more attractive to add computer technology into simulation games to make the results of the game more realistic and so achieve more learning with the participants. In the future this will be more important to make the games still attractive for the players, because they are grown up with computers, e-learning and online communication. An example of a case study of SIM Maas, a simulation game about the development of the Port of Rotterdam (PoR), will be given. This case illustrates the use of computer-based simulation-games for professional learning.

Keywords
simulation games, policy process, infrastructure management

INTRODUCTION

Infrastructures are essential for our social and economic life. Yet the world of infrastructures is becoming more complex due to changes in technology, policy, and demand and therefore difficult to understand and manage. Business managers in infrastructure-based industries are facing strategic and operational problems with long-term decision horizon. Public policy makers and politician are confronted with unexpected effects of their policies of liberalisation of the markets and privatisation of the utility companies and students and young professionals have problems with getting *the big picture* and acquiring the necessary professional skills. Therefore managers, policy makers and young professionals need support to understand the complexity of infrastructures and to get the big picture.
In this paper an explanation will be given about the use of serious games for learning about the management of complex infrastructure projects. We will introduce some concepts of the use of serious games and explain why digital games can support managers in taking decisions. Our ideas will be illustrated with a case about the planning and land designation of the 2nd Maasvlakte in the Port of Rotterdam (PoR).

SERIOUS GAMES FOR LEARNING ABOUT MANAGEMENT OF INFRASTRUCTURES

For most people games are related to entertainment but games are for a long time used for serious purposes. The first and most of the serious games are designed for the military industry. The use of simulation games for learning about infrastructure management, planning and design is relative new. Marc Prensky (http://www.marcprensky.com/writing/nasaga/mprensky-nasaga.html) makes a distinction between simulations and games. Simulations focus on a thing or process and try to copy the reality and purpose of a simulation is practice. From his opinion games focus on user experience, includes fantasy and the purpose of games is entertainment. For the advanced learning of policy processes we think we need the best of both. This means simulation games needs to have enough entertainment, fun and engagement for the participants but also convey a sense of reality and urgency to professionals. To avoid a long discussion we simply post simulation games as a safe environment, based on reality, in which participants can experiment with decisions and negotiations. The participants can experience and analyse the consequences of the decisions over the time. These experiences are relevant for the understanding of the complex infrastructure systems.

Just as the military world infrastructures are highly complex, multi-actor systems, involving strategic decision-making competition and conflict, negotiation and diplomacy, tactics, logistics, operational planning and much more. Managers can use simulation-games to analyse decisions, draw conclusions from them and communicate strategic recommendations. And simulation-games can be used to communicate the recommendations, for personnel training and for operational exercises.

Digital games

For more than 40 years games are used for serious objectives such as education, learning, decision and policy support. But many of such serious games did not make use of any computer technology. Simple and more complex simulation-games, with less computer-support but with high social interactions have been widely used and developed for public policy making, decision-making and higher learning. The safe environment, and the possibility of participants to experiment freely contributes to a better understanding of how complex social-technological systems work and how decisions can be made about them [6]. There is growing support for the idea that the technology and concepts used by the entertainment and video-gaming industry can be used to revolutionize-learning and policy support [1, 3, 7] see also www.seriousgames.org). The use of computer technology will become more important because 1) the current students are grown up with (advanced) digital games and computer use, 2) the concept of experiential learning and 3) e-learning tools.

First game developers and users such as teachers and corporate trainers are now starting to serve a generation of students and young professionals that have grown up with advanced digital games and simulations. Although for many purposes, board games and social simulations will continue to have didactical power, it becomes increasingly difficult to persuade and motivate students and young professionals to play and learn from them. Their expectations regarding a game – in terms of speed, fun, gains, looks and forms of discovery – let alone how and what they learn from them! – are to a large extent mediated by their experiences with video games or massively multiplayer on line role playing games.

Second, during the previous decades our perspective about learning and education has undergone radical changes. The dominant view on teaching and learning by class room lectures and literature study, has gradually been replaced, or supplemented by 'constructivist' learning concepts. These concepts imply that students take up an active role in, and are responsible for, their own learning process – inside and outside the classroom, during their formal education and after (life long). As many will know from experience, this often implies that traditional ways of teaching are supplemented with case based project work by student groups. Games and simulations have a definite advantage over traditional project work because only the first provide dynamic and experiential feedback from a simulated world. In sharp contrast to business cases and even most e-learning modules, simulation-games do *bounce back.* They provide us with the most authentic learning experiences – next to the real world of course.

Third and much related to the above, the constructivist-learning paradigm has been accompanied by the implementation of e-learning tools and technologies. However, experiences with many linear e-learning courses and applications, in particular those for corporate training, have led to some discontentment. Some disregard such e-learning systems as *'click and fall asleep'* [7]. The response may be due to the poor quality of interactivity – among students, between students and teachers but most importantly between the students' products and decisions and the world 'out there'. This is one of the underlying reasons why there is now a growing interest in the combination of e-learning systems with simulation and gaming - both for corporate training, business consultancy and higher education [4].

It is no wonder that 'the corporate sector is keeping an eye out for new techniques suitable for corporate training'. Of course, the big question is whether these visions and expectations will materialize. In other words, can we learn about the management of ports and other complex infrastructures through digital simulation-games and simulation-based e-learning?

Games for infrastructures

From a decision-making perspective, the planning and design of infrastructures can be characterized on two dimensions: 1. the degree of consensus on norms and values; and 2. the degree of consensus on facts and causal relations [5]. Most commonly, the planning and design of complex infrastructures will score low on both dimensions, i.e., a strong disagreement between stakeholders on values and norms in combination with a great many technological, economic and logistical uncertainties. These situations are usually characterized as *ill-structured*, *wicked* or *messy* problems. The decision-making process under such conditions is known to have a number of characteristics among others:

1. The planning and design process will be pluricentric in the sense that no single stakeholder can dominate or monopolize the decision-making.
2. It will be dynamic in the sense that the perceptions of problems and solutions will change over time.
3. Stakeholders will behave strategically in order to optimise their own interests and values.

Whereas stringent project management may become crucial in later (operational) stages of infrastructure planning and design, the management of relations between stakeholders and the stakeholder negotiation process itself are essential during the initial (strategic) stages of the project [2].

To understand these complex projects, managers, policy makers and young professionals can participate in a simulation game. The overall objective of the games for the design of infrastructures is to let the participants experience and understand how uncertainty, ambiguity and strategic behaviour intervene in such project and how to manage such projects in interaction with other stakeholders. In the description of the case study will be described how this objective is reached by a computer-based simulation game.

SIMULATION GAME FOR PORT MANAGEMENT

One example of a computer-based simulation game is the game SIM Maas. The design and use of this game will be described in this paper. SIM Maas is a multi player computer based simulation-game that revolves around the infrastructure planning and land designation in the second harbour area (2nd Maasvlakte) of the PoR. After a lengthy and highly controversial public decision making process, the Dutch national government has recently decided to reclaim from the sea some 1000 ha of new land in the PoR area. During the coming decades, this new land has to be suppleted in several phases. The infrastructure (energy, roads, but also docks, jetty etc.) has to be built and future clients have to be found. The planning and decision making process is therefore characterized by a high level of uncertainty, path dependency and strategic stakeholder behaviour. Technical and political aspects of the decision-making are highly interwoven and a number of pitfalls are foreseen. Commercial and infrastructure decisions for a period of several decades need to be coordinated between different departments of the PoR. Moreover, exogenous uncertainties such as the development of the global and national economy, the relative economic development of the various industrial sectors, future innovations in containerships and logistics need to be taken into account. SIM Maas was commissioned by the PoR to support its actual

decision-making process.

The objectives of the game are to get better insight of the unexpected, undesirable and unintentional effects of the land designation strategies and construction on the mid-long term of 20-30 years as a consequence of exogenous uncertainties and strategic behaviour of the actors, to encourage integrated and multi-disciplinary thinking within the company about choices and at the end to achieve a better result of the negotiating process with regard to the process of the building and land designation of the Second Maasvlakte.

The game

The goal in the game is to take decisions with different departments of the PoR about the building and land designation, which lead to a well realisation and exploitation of the second Maasvlakte in the period 2006 and 2036. In the game the players have to decide when the start building the Maasvlakte and they have to negotiate with future clients. They have to think about which clients are desired, and where the clients can be placed. The players also have to think about their policy of dealing with options of expansion and minimum amount of ship movements.

SIM Maas is based on the real situation and choices that the participants have to make in the game are the same kind of choices they have to make in the real process. To make the game real the area, which is used for the simulation is equal to the area of the second Maasvlakte, also the existing area of the harbour is unchanged. The used map is a possible design which fulfils the requirements of the size of the lots and the length of the quays. The simulation makes use of realistic data to give realistic outcomes, although this does not mean these values are true. In the game three different types of clients are simulated, namely container terminals, chemical industry and distribution clients. Also these clients are based on reality, but the names and business information is changed in such way that there is no relation with real clients anymore.

SIM Maas uses advanced simulation and gaming techniques to: 1. Reach better short and long-term commercial results for the 2nd Maasvlakte; 2. Increase the insights and knowledge about exogenous and endogenous uncertainties related to infrastructure planning and land designation strategies 3. Improve the communication and co-ordination of different departments of the PoR. The decisions will be inserted in a simulation tool. This Java-based tool will show the building of the area in a 3D visualisation tool and the financial output will be exported to MS Excel so the results can be reused easily.

Game play

The participants of the game are the directors of the different departments of the PoR. The directors are the Commercial Director, which is responsible for new clients, the Operational Director, which is responsible for the building of the area and the General and Financial Director, which is responsible for the financial performance and the communication and these persons have to take decisions together. The participants have to take two different kinds of decisions namely decisions about the building of the harbour and decisions about the acceptance of the clients. But these decisions are related to each other for example clients can only establish when the lot is finished, on the other hand from financial perspective it is better to wait as long as possible with the building of the lots. So the situation can exist that the lot is not finished when the client has a contract. The decisions the directors take are the input for the computer simulation. This simulation shows the building of the harbour, the rented lots and the clients and also some financial output to show the financial performance of the Second Maasvlakte.

Expected results

At this moment there are no experience of the results of the game play, yet the game is at the end of the design phase. But there are some expectations of the results of the game sessions. In the first place the participants will learn about the kind of decisions they have to make. In the game participants can design creative solutions in the negotiation with clients. The participants have to decide to wait for the superior client or accept also smaller less reliable clients to assure some income. Second the relation between the building of the area and the negotiation with the clients will be illustrated in the game. The PoR have to agree with the client of the start date of the contract, but they have to be sure the lot is ready to use.

Also the game can show the consequences of choices, for example when a lot is allocated to a client this will influence the possibility to allocate other clients or the differences between building the Maasvlakte as fast as possible or build when the demand of clients is sufficient. With these insights the participants are more consciousness of the decisions they have to make in the future. The game is not meant to give the solution of the best design or the best way to deal with this situation but the support the understanding of the different consequences.

CONCLUSION

Simulation games can be used for serious purpose, for example for managers to practice decision making in complex infrastructures. Infrastructures are complex socio-technical system and (future) managers have to learn how to deal with this complexity. Infrastructures are the early adopters of the use of advanced computer technology because modelling, simulation and virtual worlds are already an integrated part of world of infrastructures. With the introduction of the computer technology the outcome of the games can be made more realistic. The data can be compared better with the reality, but also the picture and graphs are prettier and so communicate the message of the game better. Thus, digital games will be increasingly designed for higher learning and professional training.

There is however one point we would like to stress. Simulation-games will never be able to meet the aforementioned challenge if they are used separately and/or in isolation from other approaches and methods. They work best when they are embedded into a broader research, learning or intervention process in which a number of complementary methods and activities are used. One of the definite pitfalls of simulation-games is the fact that we often falsely assume that the game in itself will be powerful enough to cause change or learning, which the outcomes will be used ‘automatically’ for decision-making. This is seldom the case. In our experience, *the game often ends where it ends*. Getting the best out of simulation-games implies that careful attention should be paid to the preamble, the debriefing and follow-up stages.

REFERENCES

1. Aldrich, C. *Simulation and the Future of Learning: an Innovative (and perhaps revolutionary) Approach to E-learning*. Pfeiffer, San Francisco, 2004.
2. Bruijn, J.A.d., Heuvelhof, E.F.t. and Veld, R.J.i.t. *Procesmanagement over procesontwerp en besluitvorming*. Academic Service, Schoonhoven, 2002.
3. Crawford, C. Serious games: Improving Public Policy through Game-Based Learning and Simulation, no date.
4. Dziabenko, O., Pivec, M., Bouras, C., Igglesis, V., Kapoulas, V. and Misedakis, I., A web-based game for supporting game-based learning. in *GAME-ON Conference*, (London, United Kingdom, 2003), 111-118.

5. Hisschemoller, M. and Hoppe, R. Coping with untractable controversies. The case for problem structuring in policy design and analysis. *Knowledge and policy. The international journal of knowledge transfer and utilization*, *4* (8). 40-60.
6. Mayer, I. and Veeneman, W. *Games in a world of infrastructures simulation-games for research, learning and intervention*. Eburon, Delft, 2002.
7. Prensky, M. *Digital game-based learning*. McGraw-Hill, 2001.