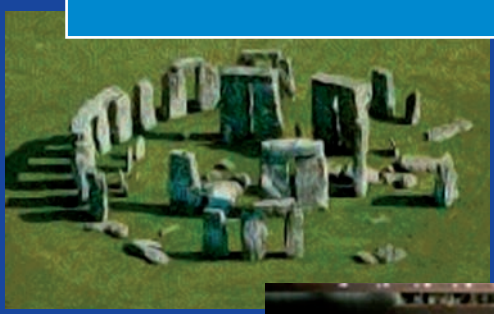
MODELING AND SIMULATIONS FOR LEARNING AND INSTRUCTION

# The Magic Circle: Principles of Gaming & Simulation

## Third and Revised Edition

Jan H. G. Klabbers



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The Magic Circle: Principles of Gaming & Simulation

# MODELING AND SIMULATIONS FOR LEARNING AND INSTRUCTION

Volume 1


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***Audience***

The primary audience for this book series will be educators, developers and researchers involved in the design, implementation, use and evaluation of models and simulations to support learning and instruction. Instructors and students in educational technology, instructional research and technology-based learning will benefit from this series.

# THE MAGIC CIRCLE:
# PRINCIPLES OF GAMING & SIMULATION

Third and Revised Edition, 2009

By

Jan H. G. Klabbers

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*Printed on acid-free paper*

For my parents, my wife Catharine, and daughters Catja and Lara

Dr. Jan H.G. Klabbers (1938) has held professor and research positions in the U.S. (MIT, Case Western Reserve University), in the Netherlands (Radboud University, Leiden University, Utrecht University, University of Amsterdam, and Erasmus University), and in Norway (University of Bergen). He is honorary member, former President, and former Secretary General of the International Simulation and Gaming Association (ISAGA). His publications cover social systems theory, design science and analytical science methodology, and the design and application of gaming and simulation in a wide variety of areas of application such as, health care systems, educational systems, human resources, general management, and global climate change policy development. Dr. Klabbers is involved in social systems development and action learning.

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# PREVIEW

The field of gaming and simulation resembles a flowering orchard. It is very diversified in two respects. Firstly, scholars and practitioners in gaming and simulation represent a great variety of expertise, knowledge, and disciplinary background. Moreover, they apply games and simulations in numerous contexts of use. Secondly, games and simulations come in many different varieties, covering the whole spectrum from role-play to digital games. Grasping the big picture is not simple. Key terms are “play”, “game”, and “simulation”. “Play” refers to a certain kind of human activity, and “game” to a certain setting, or form of play, which allows for, or triggers playful behavior. The term “simulation” refers both to a dynamic model, an image that represents a reference system, and the running of that model. A simulation is a functional model that imitates the behavior of a reference system. That reference system can relate to an existing system - in real life - or to a purely abstract system with no direct connotation to empirical reality. In other words, with respect to such an abstract system - expressed in a formal mathematical language - the rules of correspondence with some reference system may not be defined, or they may not yet be relevant.

To grasp the meaning and potential of gaming is an important goal for a variety of disciplines, each of which use different theoretical backgrounds and methodologies. This diversity of approaches results in a many-sided image of gaming and it makes building bridges between particular perspectives both necessary and difficult. One possible solution is to explore specific domains, where different fields of study converge. Such an approach can provide a more detailed characterization of the common problems, as well as highlight the interpretative limitations of the specialized areas of research and practice. That is, defining and investigating the existing points of convergence promotes establishment of foundations for a more coherent understanding of the field. In this book, I will present such a common and converging perspective. It goes beyond the specific knowledge domains of (mono-) disciplines and enlightens gaming from the viewpoint of social systems, more particularly social systems as complex self-adaptive systems. It offers a meta-disciplinary view, connecting various levels of organization, and understanding.

The terms “play” and “game” have been used interchangeably as if the two are the same. In this book, I will focus attention on games - forms of play - and gaming, which is a basic form of both human activity and human expression. While entering a game, and assuming the role of player, people temporarily enact a world, which is a class of its own. Interactively they shape a narrative and write local history. The enacted worlds can be purely virtual, imaginary, even disobeying laws of nature. Games can be designed as images of existing social systems with certain rules of correspondence in mind. As Huizinga pointed out in his book “Homo Ludens”:

> All play moves and has its being within a play-ground marked off beforehand, either materially, or ideally, deliberately or as a matter of course. Just as there is no formal difference between play and ritual, so the "consecrated spot" cannot be formally distinguished from the playground. The arena, the card-table**, the magic circle** [emphasis added by author], the temple, the stage, the screen, the tribunal (court of justice), etc, are all in form and function playgrounds: forbidden spots, isolated, hedged around, hallowed, within which special rules obtain. All are temporary worlds within the ordinary world, dedicated to the performance of an act apart. (Huizinga, 1985, p. 10)

Learning to understand and to read what happens in the magic circles of games is not straightforward. Playing games is a total experience. Are we able to produce a coherent image, a leitmotiv, to capture it in scientifically sound terminology? The structure of scientific research forces knowledge to be extracted from a fully integrated world into disciplinary knowledge domains and inference schemes. The gamed experience becomes des-integrated by disciplinary units that is, faculties and departments. Thus, the way scientific research is organized aggravates the lack of coherence in game studies. Proper approaches to game science require at the least a trans-disciplinary, more preferably an interdisciplinary, or even a meta-disciplinary frame-of-reference.

Playing a game is a total event of being involved in a temporary, provisional, and integrated world. In current scientific research, play- and game-studies are scattered over various disciplines. Providing a comprehensive frame-of-reference for addressing the great variety of approaches to gaming and simulation is not a simple task. Such a synthetic perspective on inquiry and practice should allow the gaming and simulation communities to accumulate a common understanding of principles. Making coherent distinctions between the different types of games and simulations - to learn to see the forest for the trees - requires a commonly accepted conceptual framework. That does not yet exist. Gaming is a science, an art, as well as a craft. Especially as a specific craft within various professional communities, it is stubborn to change and adjust to outside incentives. This hampers cross-fertilization.

Games and simulations as a particular field of scientific enquiry and professional practice have been developed since the beginning of the twentieth century. Simulation and game design and their use, on the basis of varying tools, such as paper, pencil, boards, computers, simulation software, multi-media hard- and software, and the Internet, have been addressed widely in the literature. Simulation and gaming methods are being used in the natural sciences such as physics, chemistry, biology, computer science, in engineering, especially by those who are active in advancing cybernetics, control theory, and (general) systems theory, as well as by behavioral and social sciences such as psychology, sociology, anthropology. More recently, the humanities have become increasingly engaged in the study of video- or computer games as expressions of new media cultures. They approach those games - mainly used in the entertainment business - as interactive narratives. Mathematical game theory, and the more recent offspring "multi-agent-based modeling" have gained a solid position in economics. Business simulations

and general management games are embedded in the curricula of many business administration schools.

To bring needed order to this rapidly diverging field of viewpoints, approaches, distinct disciplinary lines of inquiry, research and design methods and techniques, and the widely spread professional game cultures, I present an outline for the game science that I will elaborate on the following chapters.

## OUTLINE OF GAME SCIENCE

The fragmentation of game science has accelerated since the rapid growth of digital games for entertainment. In this book, I will be looking for the core of game science through combining key qualities of the natural and social sciences, and humanities.

Few scientists have witnessed such a radical change in their area of research and practice as those who engaged in play and gaming since the 1950s. For thousands of years playing games was considered a nice way to pass the time, to relax and unwind, to drive away boredom, and offer solace. Mainly since the 1950s gaming started drawing attention as a viable approach for studying and handling the complex social issues of that time. While searching for the roots of game science, I draw attention to one of the important traces in history of professional practice in gaming that goes back to the early 19$^{th}$ century. About 1810 the Prussian army started to use war games for training officers through re-enacting - simulating - historic battles: learning to fight the last war. War gaming gradually became a standard teaching and training method in the army.

After WWII, former senior US army officers - after becoming company managers - started transferring their knowledge about and experience with war games to company management. The business games that were developed were not meant for entertainment. They aimed at training managers to run their companies in a competitive market: the battlefield becoming the metaphor of the market. In terms of their instrumentality, those early games were elaborate paper and pencil games, often complemented with game boards. The first computer-supported business games, developed during the late 1950s, were simple and cumbersome to develop and risky to run, because of computer breakdown. Only simple calculations on business data were possible.

On a more theoretical level in 1944 von Neumann and Morgenstern had published their classic book “The Theory of Games and Economic Behavior”. They elaborated on a formal, mathematical theory of sequential decision making among rational economic actors. This branch of game science has gained wide attention and academic recognition, bringing forward several Nobel prizewinners in economics.

During the 1960s game science broadened its scope. Scholars from various disciplines such as, sociology, social psychology, international relations, urban management, geography, ecology, health sciences, demographics, started adopting gaming and simulation methods in their research. The resulting applications had many similarities with regard to their form. Basically, they were board games. They differed in their content and disciplinary inference schemes. Also here, calculations were simple and cumbersome.

Nowadays we play on-line multi-media, massively multi-player on-line games from our home computers through the Internet. Rapid advances in information technology and computer science have produced a tool rich environment for the design and use of games. They are driving the wide spread use of digital games for entertainment. The emerging game industry has accelerated since the 1980s, producing numerous games that are attracting globally millions of mainly young players. The game market for entertainment has become big business with an annual turnover of the same order of magnitude as the film industry.

Game science is advancing through these waves of change, driven by the digital computer game industry, computer and information science, as well as through advances in professional gaming practice such as in education, training, public and business management, policy development, health care, and so on. When asking game scientists about the core of their science, one should expect to hear diverging answers. Some scholars and professionals would for example say: "The design and implementation of games for learning, for business management, urban management, or health care". Others would say: "The design of interactive learning environments and action learning". Some would remark: "Game development to enhancing change and innovation", or "game design for the entertainment industry".

So far, game science has a poor record with respect to its theoretical foundation. Classifications or classification systems of games are weakly based on comprehensive game theories. Moreover, they generally tend to disregard the duality of views: the outsider/spectator and insider/participant perspective, and the related multiple reality when it comes to commenting on games and play. The variety of games is being labeled on the basis of their empirical and practical familiarity. I will argue why a theoretical underpinning of games, in their capacity of mini-theories of social systems, is difficult to achieve, and how it can be achieved.

In the analytical science tradition, games are mainly used as if they were "natural objects". They are considered research methods for developing and testing theories. Validating games is a notoriously difficult endeavor. In the design science tradition, focus is on design specifications vis-à-vis operational requirements, on building and assessing artifacts in their operational contexts. Criteria of their success are usability and utility. Emphasis is mainly on instrumental reasoning, and on demonstrating scientific tricks with games. In a tool rich society, technology, and particularly information technology, increasingly is dominating the world of playthings: games and toys.

*Viewpoints*

The core idea of game science requires that we start paying attention to three questions:

- What is a game?
- What knowledge is involved in game design?
- What knowledge is involved in playing games?

The first question refers to the nature of their being, the existence of games, as well as of the basic categories of their being and their relations. The related ontological questions deal with issues concerning the sorts of games that exist, and how such

games can be grouped and related within a hierarchy, and subdivided according to similarities and differences.

The second question concerns the design of those artifacts. For their design and use I will, among others, distinguish between declarative and procedural knowledge: between *knowing that* and *knowing how.*

The third question addresses the nature and scope of the theory of knowledge (epistemology) related to games. Each discipline involved enlightens a particular and partial perspective on game, play, and simulation. For example, considering games as languages, interactive narratives, semiotic systems, or group dynamics implies making an epistemological choice.

Key questions for game designers and facilitators are:

- What knowledge goes into the design?
- While playing, how will participants construct knowledge?
- How do we know what they have learned?
- How do we justify the designer and facilitator's knowledge claims?
- How do we justify the players' knowledge claims?

Key questions for game designers and players are:

- What is real?
- What is the nature of the relationship between what game players know and what is known?
- How do the players engage in discovering or constructing knowledge?
- What knowledge does the game player employ to interpret and act during the game, and subsequently interpret and act on the world?
- How do game players justify their knowledge claims?

Addressing these ontological and epistemological questions sets the stage for game science and offers a frame-of-reference for understanding the great variety of approaches.

The basic thesis is that from ontological viewpoint, games are social systems: groupings of people operating both in a natural, and social environment. They consist of interconnected *actors, rules*, and *resources*. The numerous ways they can be read and understood presuppose conceptual schemes for interpreting their great variety of appearances and ways of use.

Philosophers of science emphasize the deeper meaning of play, and its evolutionary role in human development. Huizinga (1955) paid attention to the play element of culture, play as catalyst of culture. Others focus on the art and craftsmanship of game design, and the idea of playful gaming, which implies that some games might not be playful. Still others limit their scope to games for learning. I am mainly interested in the synthesis of these viewpoints. In this book I offer a meta-disciplinary perspective that interconnects and transcends the contributions of the various mono-disciplines in the behavioral and social sciences, humanities, the natural and technology sciences.

Advances since the 1950s have shaped game methodology. Particularly the rapid development of digital games since the 1980s has caused a proliferation of sub-disciplines, each sub-discipline donning its particular lens to study the artifact. This divergence of views stimulates the scientific and professional acceptance of game and play, and broadens its scope. It adds to building cultural capital.

However, it intensifies as well fragmentation and hampers a joint search for coherence and cohesion.

Those who focus on the idea of play tend to view each imaginable social situation as an enactment of play. The world, the nation, the company, the institute, and the family, all are examples for actors going on stage, and playing their roles. Those who favor the idea of gaming tend to view interpersonal activities that relate to social, political, cultural, business, economic, and technological processes mainly from the game perspective, emphasizing both the competitive, and cooperative element of human action. Also physical, biological and ecological processes can be modeled as games.

Taking into account the viewpoint of complexity science, three forms of complexity are available: algorithmic complexity, organizational complexity, and organized complexity. Computer science has a keen interest in further exploring algorithmic complexity of games. Game science and eco-systems science share interests in complex adaptive systems and related organizational complexity. Game and social systems science favor the notion of complex self-adaptive systems.

Computer science recently has discovered that digital games offer valuable platforms for research and education in software development and computing. Digital games are considered ubiquitous multimedia services and applications. Computer scientists focus on issues such as, calculability and problem solving, mechanisms for handling interactive and on-line software systems. Related ideas are digital games - interactive virtual worlds - for learning and entertainment: edutainment. To enhance the status of digital gaming for professional practice, the odd term “serious games” was introduced, implying that non-sense games are the reverse of serious games. In the literature I did not yet find traces of a class called “non-sense games”. I will argue why the term “serious game” does not make sense.

By combining art and technology, and computer science and linguistics, computer science and language departments have joined forces. They study computer games and entertainment computing in similar vain, as studying film, and multi-media products. They view digital games as cultural objects that are classified as genres: various forms of interactive narratives. Topics of interest are for example, games as art forms, novel approaches to digital game design, mobile games and games as social networking tools, converging and cross-platform media, cultural and media studies on games, and policy and legislative responses to digital games.

Cognitive neuroscience aims at better understanding feeling, thinking and acting from the perspective of the individual human brain. Research in embodied cognition and simulation of action for understanding others shed light on empathy, sympathy, compassion, and emotional contagion. All are human qualities that surface during game play. Game laboratories offer adequate facilities for conducting basic research in cognitive neuroscience. Advancing understanding how the brain works will help the design and use of games for learning.

Prior to the advent of video games, since the 1960s computers have increasingly been used to support and assist games. *Computer-supported games* have built-in game mechanisms that are inherent to their dynamics. Without these mechanisms the game cannot run. Examples are business games, in which the

computer represents the market dynamics vis-à-vis the microeconomics of the participating companies. The players stay in control of the game dynamics. In *computer-assisted games*, the computer keeps track of the data flow and information exchange between the players. The computer only monitors the processes. The players define the locus of control. The class of digital games - video games - fits into what Thavikulwat called *computer-directed games*: high computer control with high computer-player interaction.

From these examples it is understandable that game scientists choose a particular perspective that suits their interests. That diversity of views should not be denied, nor should we try to change it. Nevertheless, it regretfully hampers the development of the profession if all those who are involved only look at gaming through their separate windows. Compare this situation with physics. Although physics consists of various sub-disciplines it enjoys a common notion about the profession through comprehensive theories and shared research methods. Moreover, it applies, disseminates, and utilizes its knowledge through advancing technology. Such a shared image of game science is lacking.

The common question about the core of game and play is not new. Philosophers have raised that question and have reflected on it since the Greek philosophers thousands of years ago. Starting with the 1950s, professionals have been busy with designing a whole variety of games, most recently based on Internet applications, at the cost of finding answers to a series of fundamental questions. What is the meaning of game and play? What is real and what is virtual reality? What knowledge does a person employ to interpret and act on the world? When playing, how do we understand the intentions of other people? How does embodied cognition during game play connect to the world? How do explicit and tacit rules of the game intertwine? How could we build simple and effective games from complex systems? To which extend are games valid models (theories) of reference systems? Are we able to bring forward a general theory of games? Are we able to help players (social actors) to find smart solutions and approaches to complex issues? How do games enhance learning and how do they improve our thinking capacity and action repertoire?

Current answers to these questions are scattered and inadequate. A philosophy of science uses paradigms - theoretical think and action frames - to characterize a scientific domain. Which paradigms relate to game science, and which paradigm has the best chance to emerge and prosper? Suppose we would agree on the paradigm of game science as the science of human action in social systems, which include actors, rules, and resources. The nice thing about this paradigm is its independence of the instrumentality of games. Game activities can be understood indeed in terms of human action. A reasonably well-developed methodology is in place. However, this does not explain most of the key questions in the field. For example, which forms of play are most adequate in the market economy, or in a pluralistic society? Which games as forms of play - if any - are feasible in autocratic societies? How much knowledge is needed for their design, and how to tap that knowledge? How do we recognize and define the best options? What is the most appropriate form for the players?

*Architecture*

The architecture of games resembles the architecture of social systems. Game scientists view the world through the windows of play and game. Moreover, they device games for intervening in that enacted world. Societies, companies, institutions, and families - in general, social systems - can be understood from the perspective of game and play. Game scientists focus on a better understanding and re-framing of social systems. That capacity does not imply that they claim to know and understand everything about politics, governance, culture, economics, and technology. Through their meta-disciplinary viewpoint they enlighten and enrich qualities of social systems that are hidden from traditional political sciences, sociology, psychology, public and business administration, and so on. The work of the game scientist does not start when someone says: “We have gathered lots of data and information, would you be willing and able to handle this issue?” The work of the game scientist surpasses such a question, because they will need in advance a framework for understanding, modeling and designing social, socio-economic, and technological processes, moreover, imagining options for intervening in them.

An alternative paradigm relates to algorithmic thinking. It brings forward games to simulate social systems, recipes for calculating future scenarios for example through hierarchical, multi-level, multi-actor simulations. This paradigm stresses games as tools for solving social questions. Whereas a physicist tries to capture a phenomenon in a formula, the game scientist will try to grasp a process in a workable design, not being satisfied with a certain pattern or scientific law. It could very well be that such a law does not work in unique practical circumstances, or that it is not ethical to apply it. As a matter of fact, regularities expressed in (scientific) laws are extremely rare in the social domain. Laws that are embedded in legislation are equivocal, allowing multiple interpretations that need to be negotiated. Game scientists are interested in simulating these processes by putting people (social actors) in the “driver’s seat”.

For example, physical laws, which describe and explain hydrodynamics, are well known. That sort of knowledge is widely applied for example in the chemical industry and water infrastructure. This does not necessarily imply that authorities know how to handle flooding. Understanding hydrodynamics is not sufficient to deal with disasters. Needed are methods to simulate flooding in a certain populated area and to offer the actors involved workable response repertoires to prevent or mitigate the damage to people, infrastructure, and ecosystems, taking into account the multiple agencies involved. Such a design is by no means trivial. Moreover, we need to be aware that social systems are reflexive, self-organizing systems with emerging properties. So, what information and knowledge about various aspects of the social system involved are required to effectively design games?

Choosing (social) problem solving through simulation with formal models is a too narrowly instrumental view on gaming. To come back to flooding, designing a game on flooding will certainly take into account knowledge about hydrodynamics. However, it would be simplistic to think that flooding results from these natural laws. Human settlements, their community practice and infrastructure, and level of industrialization in relation to their surrounding ecosystems impact on the risk of

flooding. Games depend on smart designs that link human action with the available (natural) resources, legislation (rules), and infrastructure.

In addition to the utility of games we need to be aware that they are valued for themselves. They are temporary worlds apart. Play and games are expressions of our existence.

*Cross-fertilization*

Eigen and Winkler have pointed out that games deal with natural phenomena. Chance and principles are the basic elements of those games. They asserted that play is a natural phenomenon that has guided the course of the world from its beginnings. Chances and rules underlie games and play in the shaping of matter, in the organization of matter into living structure, and in the social behavior of human beings. Huizinga has argued that play is older than culture as the idea of culture presumes a human society. Animals - who also play - have not waited for mankind. Play exceeds purely biological activity of immediate survival. It is the meaning of actions that is basic to play and games.

Physics studies the inanimate nature, biology animate nature, psychology the living human, and sociology society. Basically, nature is given. Our knowledge about nature is an evolving construction. Society is not given. It is an ongoing process of self-reproduction. The realm of game science extends continuously through its self-made progress, and through the multiplicity of complex systems that mankind creates among others driven by technology. The Internet has opened a new dimension of game science that the game scientist prior to the 1980s was not able to envision, let alone study. Game science is a unique interplay of advances in science, practical applications, instrumentality, craft, and art. This interplay shows in the design and use of games. We are witnessing the early signs of that interplay. It offers a promising road for the comprehensive study of and steering in social systems. Governmental policies and measures utilize only a small part of what is possible from game theoretical and methodological viewpoint. That also applies to managing companies and economies. One of the reasons is the limited access of game scientists to boardrooms in government and industry.

*Connecting cultures*

An integrated game philosophy shall need to address the question of interconnecting the cultures of the natural, social and behavioral sciences, and humanities. That is a great challenge. Game science increasingly has shown during the last decades that these cultures need each other. This is partly due to key questions that have been raised, and it follows apparently from the abundance of applications. The coupling of these cultures is also driven by the methods and techniques that the game scientists need. Successful applications of game science integrate knowledge from the natural, social, behavioral sciences and humanities with technology. While searching for a game epistemology and ontology, I will connect to the frameworks of the analytical and design sciences.

The purpose of the book is to outline game science by presenting principles underlying the design and use of gaming and simulation. That frame-of-reference will enlighten the characteristics of particular games and simulations from a common perspective. I will pay less attention to instrumental reasoning than on theoretical and methodological questions. The main reason for choosing this road is the lack of a robust methodology that underpins gaming and simulation methods. Game science is firstly a way of thinking, and secondly, a method and a technique. In addition, the framework presented will help to grasp the interplay between forms of knowledge and knowledge content in connection with gaming, interplay that evolves through the action of the players. These notions I consider preconditions for raising epistemological questions in relation to game science and the educational value of games and simulations. They will provide a suitable context for addressing design science and analytical science approaches to artifact design and assessment and theory development and testing.

Due to the high diversity of approaches, the field has to accommodate the great variety of views on gaming, games, simulations, models, and modeling. Therefore, as mentioned above, I will choose an interdisciplinary and where appropriate a meta-disciplinary approach.

*Itinerary for reading the book:*

Those readers who are mainly interested in getting familiar with games and simulations are invited in reading Chapters 1, and 2 of Part I, and Part III: Cases. Teachers and trainers in addition, should read Chapters 3, and 7. Those who are mainly involved in game design should focus on Part II, particularly to Chapters 4, 5, and 7. Finally, those readers who are involved in research in game science should pay special attention to chapter 3, and Part II. All readers are invited to select relevant cases from Part III, to see how gaming and simulation work in practice. In every chapter, due to the focus on methodology, some parts are abstract and theoretical, other parts are practical.

Jan H.G. Klabbers
September 2009

# CHAPTER 1

# KALEIDOSCOPIC PERSPECTIVE ON GAME, PLAY, AND SIMULATION

## HISTORIC TRACES

Suppose you would have the opportunity to visit the Museum Het Valkhof ("Falcon House") at Nijmegen, the Netherlands. It houses among others, a large and important collection of Roman antiques. The museum is situated at the edge of the historic Valkhof Park with a nice panorama of the river Rhine, with at its other side, up North, the open and flat area where two thousands years ago the Batavians used to live. Het Valkhof was also two thousands years ago the site of a Roman encampment on which about 800 A.D. the Emperor Charlemagne built a castle. Today it is an exciting modern location for art and culture.

The large and varied archeological collections of the museum reveal the prehistoric, Roman and medieval past of the city of Nijmegen, with a wealth of information on various themes – the Roman army, Roman religion and burial traditions, trade and crafts, and games to pass the time – all of which conjure a picture of everyday life in Noviomagus (Nijmegen), once the most important Roman city in the Netherlands.

At the exhibition floor with its light, airy space, you will find a stone bench with three game boards printed on it. For each game, pieces are provided and the rules are printed on the bench. The games are LUDUS LATRUNCULORUM (the SOLDIERS GAME); the MILL GAME, and the CIRCULAR MILL. Youngsters play those games while their parents visit the museum. The MILL GAME is also part of the decorations put on the floor of the Antonio Fortress in Jerusalem by Roman soldiers (Grunfeld et al., 1994). The game board of the MILL GAME looks as follows (see Figure 1.1).

In 1283 the book "Libro de Jeugos" (Book of Games) was published. It was the first book in European literature devoted to games (Grunfeld et al., 1994). It was part of a series of books, covering the most important issues of that time: history, law, religion, astronomy, and magic. The compendium was established through the personal leadership of Alfonso X, king of Castile and León, who brought together a group of experts. The king – known as Alfonso the Sage – was an eminent scholar himself. The fact that games – in all their known appearances – received considerable attention, gives evidence of their importance in medieval Spain. In his introduction the king points out that it is God's disposition that human beings unwind and relax through a variety of games, and that this pleasure will offer solace, and drives away boredom. Alfonso's editors limited themselves to the Spanish and Moorish medieval culture. Libro de Juegos describes for example 'NINE MEN'S MORRIS' ('MILL GAME'), which was played by the ancient Egyptians.

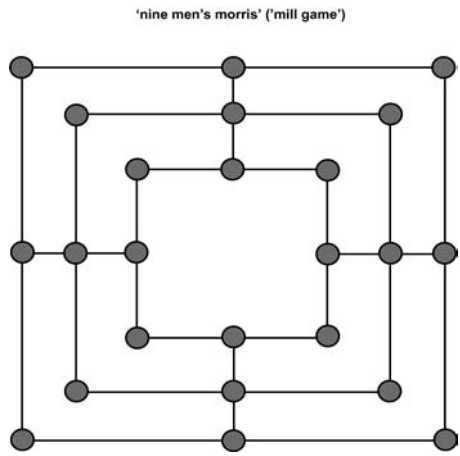


*Figure 1.1. Game board of the MILL GAME*

It is probably one of the oldest board games in the world. The English name 'Morris' could be linked to the earliest Medieval French version with the name 'merrils' or 'morell' (Grundfeld et al., 1994). It could however also refer to old English folk-dance for men, with in this case the nine pieces of the game representing nine dancing men. Another ancient game called "WARI" or "AWARI" is a variation of the so-called Mancala games, played in ancient Egypt. Game boards, carved in stone, have been found in the pyramid of Cheops and in the temples of Luxor and Karnak. Games are spread too over Asia and Africa. In Surinam playing games is part of funeral rituals to entertain the soul of the deceased person (Grunfeld et al., 1994). It is interesting to note that Backgammon, one of the great pleasures of 13$^{th}$ century nobility, originated from the Roman game 'Tabula', by Arabs called 'Nard.' A global perspective on games shows that they are embedded in human culture. For example, African tribes, Eskimos, Japanese intellectuals, and Mexican Indians play games. Games have crossed borders and cultures without asking for permission from rulers.

## PLAY ELEMENT OF CULTURE

The shifting meanings on the terms *play*, and *game*, presented above, lack a more fundamental view on the play element of culture. Without a basic understanding of the play concept, it will be difficult, if not impossible to address related scientific questions and puzzles. It will moreover hamper grasping its significance in human society.

Play in the blood. The many manifestations of play and their widespread use show that it is connected through an indissoluble tie to human culture. Huizinga (1985) was explicit about the nature and meaning of play. He argued that play

precedes culture, because the idea of culture, however vaguely described, always presupposes human society, while animals have not waited for the human being to teach them to play. One can safely assert that human society has not added significantly to the general notion of play. Animals play just like humans. All the essential features of human play are present in playing animals. Watching young dogs playing with each other, one can notice these features. They invite one another by posture and gestures to join in. They obey the rules not to eat through each other's ears. They pretend to be angry. Particularly, they apparently seem to enjoy it. Such playing of young dogs is only a simple form of animal play. There are examples of more highly developed forms of play: real contests and fine performances before an audience. Play is more than a physiological phenomenon. It goes beyond boundaries of purely biological or physical activity. In play, there is something at stake that goes beyond the immediate desire of survival. Each play is a meaningful activity, and foremost a free act. Because of its quality of freedom, it exceeds the confines of nature. Play is not ordinary or 'real' life. It is departing from ordinary life in a temporary atmosphere of activity with its own purpose. Based on these notions, Huizinga defined play as follows:

> Play is a voluntary activity or occupation, executed within fixed limits of time and place, according to rules freely accepted but absolutely binding, having its aim in itself and accompanied by a feeling of tension, joy, and the awareness that it is different from ordinary life. (Huizinga, 1985, p. 28)

Through these limits of time and space, players (actors) enter a magic circle and enact a world, which is both real and imagined. The scope of this definition is both very broad, and very limiting. It is broad as it covers animal, child, and adult play, as well as the whole variety of games, exhibitions and performances. It is limiting because it requires a "stop rule", and a well-specified location, while it seems to exclude the linkages of play with law, war, knowing and wisdom, and art, topics that Huizinga addressed in the chapters of the book. The purpose of law, knowing and wisdom, and, art is to keep the game going which implies that there is no stop rule. If one considers war as form of diplomacy and international relations with particular means, than underlying play and war is a game without stop rule. The connotation of play and law, war, knowing, and art presumes an ongoing game without clearly defined stop rules. Huizinga called the category *play* one of the most fundamental in life. While reflecting on the expressions of the play concept, he observed that languages have varied in getting the numerous aspects of play into one word. There are highly developed languages, which have retained totally different words for the various play forms. This multiplicity of terms has hampered the aggregation of all play forms under one term. Huizinga illustrated this by discussing expressions for play activity in languages such as, Greek, Chinese, Sanskrit, English, Japanese, the Germanic group of languages, etc. From this review of play related terms, he gathered that cultures generally refer to play as contest, as battle: "Play is battle, and battle is play" (Huizinga, 1985, p. 40).

Compared to the English-American language, which has two words "play" and "game", the Dutch and German language for example have only available one generic term: "spel" and "Spiel", for expressing playful kinds of activities. The more subtle differentiations that the terms "play" and "game" offer are more difficult to

express in Dutch. This becomes clear when comparing the original Dutch text of Huizinga's Homo Ludens with the English translation.

Huizinga (1985) – in his foreword of "Homo Ludens" – mentioned that he was convinced that civilization arises and unfolds in and as play. The Dutch subtitle of his book is: "The play element *of* culture". When giving lectures in Zürich, Vienna, and London, his hosts wanted to correct it to "The play element *in* culture". Each time Huizinga protested and clung to the genitive "of". It was not his object to define the place of play among all the other manifestations of culture, "but rather to ascertain how far culture itself bears the character of play". He approached play historically, not scientifically. In the English translation (Huizinga, 1955), the translator, who prepared the English version from the German edition, noted that as English prepositions are not governed by logic, it was decided to retain the more euphonious ablative "in" in the sub-title. I think that it is not the whole story for the following reason. In the Dutch version, at p. 74, Huizinga stated: "Culture does not begin *as* play, and it does not begin *from* play. It begins *in* play". That particular sentence is missing in the English translation. Nonetheless, the English text (p. 75) continues, similar to the Dutch text with: "In play, therefore, the antithetical and agonistic basis of civilization is given from the start, for play is older and more original than civilization". Comparing the original Dutch and the English text, I notice some important differences. The English translation is less consistent with Huizinga's basic thesis: underpinning the play element *of* culture. Huizinga pointed out that as "culture artifacts" grow more composed and elaborate, their production becomes more high-wrought. The basis of civilization becomes increasingly overgrown with ideas, systems, concepts, norms, skills, and traditions (customs), which seem to have lost their connections with play. Culture grows increasingly serious, and while it evolves, it seems to give only incidental prominence to play. So it seems. In the following chapters on play and law, play and war, playing and knowing, etc, he argued that such a view is not correct. In the chapter "Play and War" Huizinga (1955) reflected on the "Law of Nations", and observed that

> Its principle of reciprocal rights, its diplomatic forms, its mutual obligations in the matter of honoring treaties, … all bear a formal resemblance to play-rules inasmuch as they are only binding while the game itself is recognized. (p. 100)

Then he drew the interesting conclusion: "We might, in a purely formal sense, call all society a game, if we bear in mind that this game is the living principle of all civilization" (pp. 100-101). This observation upsets the idea of play executed within fixed limits of time and place. Viewing all society a game implies that games can and should go on without a stop rule. It forms a marked and interesting contrast with the definition of play, mentioned above, which states that "play is a voluntary activity or occupation, executed within fixed limits of time and place." Moreover, the notion that society is a game is consistent with the subtitle of the book: the play element *of* culture.

Huizinga checked the conceptual value of the word "play" by the word, which expresses the opposite. For this he chose the word "earnest", used in the sense of "work". The opposite of work can either be play, jesting, or joking. He chose the complementary pair *play-earnest* as the most interesting one. Leaving aside here linguistic questions, Huizinga argued that the two terms are not of equal value. The

significance of the term “earnest” is defined by and exhausted in the negation of “play”, earnest is equivalent to “not-playing”, and nothing more. The significance of “play”, on the other hand, is not defined or exhausted by calling it “non-earnest”. Players can be both playful and serious, while playing. Therefore, the play concept is much broader and of higher order than is seriousness. Seriousness seeks to exclude play, whereas play can very well include seriousness. Strictly speaking, the term “serious game” excludes play, and “serious games” are not playful. They are work. To prevent terminological confusion, I recommend abandoning the terms “serious games” and “serious gaming” from professional practice.

It is out of the scope of this chapter to discuss in detail Huizinga’s views on play. In line with the kaleidoscopic perspective of this introduction, a few critical comments should however be made. Huizinga emphasized that the great variety of cultural manifestations, whether they are rituals, contests, or ceremonies, are all forms of play. His definition of play sheds light on the human activity as embedded in institutional settings, he left however in the dark the qualities of games, their peculiar forms, that enhance or trigger typical playful behavior. That is a serious omission, for it hampers the more precise descriptions of human actions that are triggered through forms of play. The examples provided remain anecdotic. In the next chapter I will address explicitly the diversity of forms of play, their classifications and typologies. The richness of those forms of play provides clues about the multiple options game designers have available to mold game content.

Toys symbolize the play element of culture in very specific ways. For children they are first and foremost entries into fantasy worlds.

*Toys*

Closely connected to the idea of play and culture is the presence of toys, simple objects that populate children’s worlds. Toys are objects that children play with. Examples are model cars, dolls, building sets from wood, stone, or plastic that enable the interlocking of pieces such as for example available with MECANNO and LEGO. Toys used to be small and purely meant for amusement. A toy is also an object that adults use for amusement, for more or less innocent pastime, or to overcome boredom. Although generally toys are valued for themselves, they may have an explicit instrumental, and implicit educational value. Lauwaert (2009), while referring to construction toys, mentioned that building something, for example with MECCANO or LEGO, is considered a purposeful activity, with children being actively involved in decision-making and the shaping of form and structure. Those toys involve eye-hand and fine motor coordination, and require planning, imagination, thinking ahead, cooperation, negotiating, sharing, self-control, delay of reward, and last but not least, patience. Playing with these toys expresses a world apart.

Lauwaert (2009) argued that the structure of a toy, its technology, its materiality, rules and manuals, guidelines, its reputation and connotations, and I would add its genre, create a network of facilitated play practices. They constitute the culture surrounding a class of toys. The first-generation building toys of the 19$^{th}$ century of wooden or stone building blocks with no interlocking mechanisms facilitated the construction of architectural objects. The second-generation building sets of the 20$^{th}$

century offered additional qualities through designing objects as a form of play. Those construction toys mimic the design of artifacts in the public domain such as, bridges, skyscrapers, cars, and planes. They added another layer of play: there was first the play object – the toy, and the play practice – the construction process became added to it. MECANNO and LEGO are two well-known examples of those building sets. Lauwaert noted that the construction of those toys conveyed fundamental beliefs of the Western culture in construction, design and malleability of technology, and, I would add, through technology the malleability of society. Lauwaert, while quoting Manzini & Cau, offered an interesting design horizon:

> Design in this context and specific use should be understood as actions taking place at the intersection between the 'thinkable' and the technologically 'possible', between models, cultures, forms of knowledge, 'availability of materials' and 'technological development'. (Manzini & Cau, 1989, p. 17, in Lauwaert, 2009, p. 47)

Thus, during the last two centuries we have witnessed a gradual shift from building sets to construction and design toys. Since the 1980s toys were enriched with another quality. Seymour Papert launched computational LEGO bricks that would allow youngsters to construct robots (Papert, 1993). Those and similar digital construction toys are coded and programmed computer applications. Lauwaert (2009) observed that digital construction toys not only are designed objects that facilitate designing as play practice, with as its major purpose the activity of designing as such, in addition they give shape to rule-based games that evolve over time and in space. The rules of those games prescribe the behavior interactions with the building blocks. They are inscribed within the programmed code, and define on the system the causal relations between the variables and events, the elapsing of time, and the spreading out of the artifact in space. SIMCITY and the SIMS (Maxis, 2003, 2004) exemplify these developments. They provide digital construction toys for engaging in a game of design and planning. Lauwaert (2009) argued that designed artifacts have the potential to be actualized through use. The composition of the building blocks is being actualized through assembling and constructing them in a certain manner. The digital, coded objects provide the designer with a string of options to give shape to the artifact. They offer procedural options for the design activity. Lauwaert, referring to Wright – the designer of SIMCITY (2003) and the SIMS (2004), observed that these design games lack a 'you win or you lose' quality. They offer a never-ending sequence of actualizations of design potentials. As I will argue in chapter 2, these design games actually are called cooperative rather than competitive games, more particularly common access goal seeking, or non-goal seeking cooperative games (see Table 2.6). Lauwaert, while using the terms 'toys' and games interchangeably, wrapped up that digital and procedural construction toys (games) center on the journey in the play practices that they facilitate. The process of building and constructing the game, the procedural activity, is the core of that play, less the destination or the playing towards a finished artifact.

Toys are not fundamentally different from tools and equipment in terms of the mental capacities and perceptual-motor skills they require from their users. From the perspective of playing and not playing, tools and equipment relate to work, while

the same tools become toys in a playful environment. With MECCANO toys this is most obvious. In all cases we should be aware that toys, games, tools, and equipment are extensions of human abilities. If they are well designed they are tuned to the mental and physical competency of kids and adults. They all fit into the great variety of cultural, social, economic, and technological settings of artifacts. As Lauwaert (2009) has pointed out, toys and playing are central in linking ongoing societal processes with the individual. Toys and games bring a changing society into the private homes. They function as mediators through bridging the outside world and the universe of children and adults.

SIMCITY (2003) offers an interesting example of a digital toy – a construction set for a city – that over the years evolved into an educational tool for urban planning and management, with potential for training in social systems development. The virtual worlds the players can shape enhance the capacities of their mental equipment to address societal problem solving. Through SIMCITY (2003), the SIMS (2004) and similar artifacts, virtual worlds are created that blur the boundaries between toy, play, game, simulation, image and reality, between the private and public domain. They convey a utopian image of a malleable world, moldable through design. Advancing a coherent approach to the design and use of these artifacts, combined with converging game design technologies, will increasingly impact on human performance. These artifacts are increasingly becoming integrated into individual cognition and social architecture.

## GAMES OF NATURE

Advances in complexity science are shedding light on the fundamental role of the play element of nature. Eigen and Winkler (1975) stated that play is a natural phenomenon that has determined the course of nature right from its beginning. It has shaped matter, the organization of matter to become living organisms, and social behavior of man. While referring to the origin of play, they expressed its fundamental characteristic as follows.

> The history of play goes back to the beginning of time. The energy of the Big Bang set everything in motion and caused a whirl in matter that never will end. Organizing forces tried to catch everything that dissipated, and they tried to tame chance. What resulted is not the rigid order of a crystal. It is the order of life. Chance is from the beginning the undeniable opponent of the organizing forces. Chances and rules are the elements of the game. Similar to its beginning with elementary particles, atoms and molecules, it finds its continuation in our brains. It was not the human being that invented play. It is play and nothing but play that makes up the human being. (pp. 17-18)

Eigen and Winkler (1975) paid attention to elementary forces, laws of nature and chance, and demonstrated the wide variety of structure, patterns, and forms that emerge from applying simple rules of chance. They connected self-organizing forces of nature with the idea of an evolutionary game of life on earth, to organizations in transition. The related organizational complexity is explored as it

emerges through far-from-equilibrium dissipative, autopoietic, or self-organizing systems in evolutionary space. Such games increase or decrease in complexity via their co-evolving component systems. They refer to a-priori indeterminable number of microstates, and processes. Specific organization, structure and process produce order within such huge sequence spaces. The evolutionary game concerns the narrowing down of these sequence spaces to a few biologically or socially viable ones.

Caillois (2001) elaborated games of chance as an important category of as well as attitude to play. He referred to state lotteries, casinos, hippodromes, pari-mutuels of all kinds as forms of pure play following laws of chance: mathematical laws of probability. For those playing such games of chance, "it is not an abstract expression of a statistical coefficient, but a sacred sign of the favor of the gods" (Caillois, 1958, p. 126). That connotation of the term chance brings us back again to the play element of culture. It is not contradictory to Eigen and Winkler's approach. It expresses a notion of play and chance complementary to and following from laws of nature. It shows the equivocality (ambiguity) of the idea of play. I will discuss Caillois' ideas in more detail in chapter 2.

## QUESTIONS OF TERMINOLOGY

From the play element of culture, and the use of games, sketched above, one can gather the high diversity and broad scope of game science. In the following sections, I will address both gaming and simulation, referring to activities and processes related to games as products of the human minds: artifacts. I would like to stress that the perspectives offered, usually do not address the same readers. Each view offers a different scope and pays attention to distinct goals and questions. Together, they illustrate the richness and reach of this subject of study. The nouns 'play', 'game', and 'simulation' refer to both products of human invention – artifacts – and activities such as expressed through the verbs 'to play', 'to game', and 'to simulate'. The artifacts, expressed through their nouns, only obtain meaning in the activities they trigger. A game is a form of play, and it is only a game if being played. A simulation is only a simulation if set in motion. To advance the study of these artifacts, and the related playful activities, it is therefore needed to bring order in the terminology. A common understanding of the key terms paves the road for having constructive conversations and for addressing corresponding methodological questions.

Monitoring the ongoing discussions and debates on the meaning of those terms since the 1960s, I have learned that there is still little agreement among scholars and practitioners about terminology. From a scientific viewpoint that is understandable, as those who are involved in gaming and simulation represent the whole spectrum of academic disciplines. However, the confusion about terms is broader than strictly academic. It precedes academic reflection and is more fundamental than basic research. It refers to man as a playful animal, and the play element of culture – see above – (Huizinga, 1985). The kaleidoscopic view on activities such as, playing, gaming, and simulating – presented here – indicates that for developing an integrative perspective, it is worthwhile to choose an appropriate level of aggregation. Moreover, to be able to understand their diversity of

appearances and practices, we should take on board their *contextuality*, *problem orientations*, and *method diversity*. Fruitfully dealing with method diversity is only possible from a proper methodological perspective. It will provide a deeper understanding of gaming methods and techniques.

*The idea of games in philosophy*

In *Philosophical investigations*, Ludwig Wittgenstein (1968) argued that there is no fixed set of features that define a game. As a game is a form of play, with emphasis on rules, Wittgenstein's main focus seems to be on games as human constructs, or artifacts. This applies to language as well. According to Wittgenstein, games encompass a loose set of features. A simple criterion for demarcating games from non-games is difficult to offer. It is not clear whether Wittgenstein had in mind the same ambiguity that Huizinga referred to when addressing the question of play and non-play in relation to being playful and/or earnest. Wittgenstein held that language was itself a game, consisting of tokens governed by mutually agreed upon rules that influenced the usage of words. Wittgenstein proposed performing a thought experiment. First he asked the readers to propose a definition of the word "game", and he then went on to lead them through the problems with each of the possible definitions of the word "game". Any definition which focuses on amusement leaves us unsatisfied since the feelings experienced by a world class chess player are very different than those of a circle of children playing FOLLOW THE LEADER. Any definition, which focuses on competition, fails to explain the game of catch, the game of solitaire, or any cooperative game. And a definition of the word "game", which focuses solely on rules, will fall on similar difficulties, as there are games that are not rule-driven (see next chapters). Wittgenstein's main point was not that it is impossible to define "game", but that we don't have a clear cut definition, and we don't need one. The meaning of the term “game” shows itself in its use. A “game” does not exist in a cultural or social vacuum. Therefore, shifting contexts of playing games offer a variety of meanings to the word. Everybody in a certain cultural setting understands what we mean when we talk about playing a game.

We are able to identify and correct inaccurate uses of the word “game”. Wittgenstein argued that “definitions” are emergent forms from what he termed “forms of life”, which are the culture and society from which they emerged. Wittgenstein stressed very strongly the social aspects of cognition. To see how language works, we have to see how it functions in a specific social situation. It is this emphasis that may explain Wittgenstein’s comment that “if a lion could speak, we would not understand him.” When speaking of the variety of games, we refer to *family resemblances*. Family resemblances and classifications, how exactly do they work? Why is it that we are sure a particular activity such as, Olympic target shooting, is a game while a similar activity such as, military sharp shooting is not? Wittgenstein's explanation is tied up with an important analogy. How do we classify objects and ideas? If we see enough matches between their attributes, we say we have noticed a family resemblance, which helps us to classify them. This usually is not a purely conscious and rational process. We intuitively see the resemblances. Wittgenstein suggested that the same might be true with games. Perhaps we are all familiar (i.e. socially tuned) with enough things, which are called games, and

enough things, which are not games, that we can instantly categorize related artifacts and activities intuitively. According to Wittgenstein, this also applies to language games.

He paid special attention to indirect communication, and thought experiments, and argued that many philosophers are confused, because they are not able to *see* family resemblances, and have difficulties in understanding the vague intuitive rules of the language game, thereby tying themselves up in philosophical knots. He suggested that untangling these knots requires more than simple deductive arguments. He tried to divert his colleagues from their philosophical problems to indirectly retrain their intuitive ability to notice family resemblances. It applies to language games as well as to the broader class of artifacts called "games."

*Family resemblances on "play", "game", "playful gaming"*

As demonstrated above, the terms "play" and "game" have been used interchangeably as if the two are the same. Makedon (1984) reflected on the playfulness of games, and argued that playing and gaming are each a necessary but not sufficient condition for covering all aspects of gaming. "The characteristics that are commonly held to be play include voluntariness, spontaneity, and desirability for its own sake" (Makedon, 1984 p. 30). Games, as special forms of play, are linked to rules. "Its essential quality is not subjective or attitudinal, as is the quality of play, but objective or formal. Unless the game is played according to its rules, it is not the same game or even a game at all" (Makedon, 1984, p. 31). The system of play rules fixes the range of ideas and symbols to be used in a game. They both enable and constrain the players' activities and their inter-actions.

Makedon did not make a distinction between the designer of a game and as such the key person who defines the rules, and the players who play by those rules. Therefore, I guess that he implicitly focused on rule-driven games only, with the rules set by the game designer, and subsequently executed by the game facilitator. This limited scope excludes games that are driven by the rules being shaped and negotiated among the players themselves during the game session (Klabbers, 1996). His frame-of-reference seems to exclude *free-form* or *open games* in which the players have the freedom to self-organize the rules.

Play is an activity that is desired and enjoyed for its own sake. Makedon summarized the differences between play and game by pointing out that play is subjectively grounded in the player, while game is objectively grounded in the game rules (Makedon, 1984, p. 32). A game is only a game if being played. Therefore, in practice both terms are intertwined. Although pinpointing key qualities of play and game, Makedon misses a third key quality, which emerges when considering gaming from the perspective of the anthropology of knowledge. Barth (2002) distinguished *three interrelated faces of knowledge*:

- A substantive corpus of assertions;
- A range of media of representation; and
- A social organization.

*Assertions* convey how people connect objects, and actions to explain events, and processes. These explanations may have a mythical or a rational connotation. The related "causal" inferences usually are expressed in games in terms of

behavioral (descriptive) or normative (prescriptive) rules. In cultures, the *media of representation* range from signs, symbols that are being used during consecrations, holy dances, sacral contests – all part of a festival or mythical ritual – to mathematical knowledge used for computations, to images in gross anatomy atlases, technical laboratory equipment for microbiological experiments, chemical models, geography atlases and scale models, and so on. These representations shape both thought and action and thus the practices of the people involved. The players of a game enact the real, imaginary, or virtual world, and shape a *social organization*, through these assertions and interventions in the media of representation. These three faces of knowledge interrelate in particular ways in different knowledge traditions (cultures), and they generate tradition-specific criteria for validity of knowledge-about-the-world. The substantive corpus of assertions is based upon various types of rules about how to interpret and act on the world. It refers to insights, information, verbal taxonomies, concepts and their interrelationships, and prescriptive and descriptive action repertoires. The play element of a game is embedded in its social organization. The rules encompass the corpus of assertions about the gamed reality. They represent as such a *necessary* but *insufficient condition* for playing games such as CHESS, GO, MONOPOLY, etc. Makedon does not refer to media of representation as a key element of a game. I consider this a serious omission for two reasons. Firstly, with rules but without media of representation such as for example a game board, a game is an abstract entity that cannot be played. CHESS for example, cannot be played without its game board and the pieces with their peculiar qualities. Secondly, media of representation refer to resources available to players to move within the game space. They symbolize both the real and imaginary, or virtual world that is acted upon by the players. Both MONOPOLY and GRAND THEFT AUTO symbolize a city, however from very distinct viewpoints in terms of the resources – and media of representation – available to the player(s).

Makedon, and with him, many authors on gaming and play, restrict themselves to the rules as the key characteristic – the back bone – of play and game, while omitting their linkages to the resources as conveyed through the media of representation. As a consequence, they are not able to deal properly with the concept “game space”, and the way the players – through their actions – move through this space. A game is both objectively grounded in the rules and in their linkages to the resources. For example CHESS: changing the board, the pieces, or the rules, will change both the game and its play. The media of representation typify reference systems in real or imaginary worlds. They constitute basic ingredients of games.

Games are forms of play. Reflecting on the linkages between game and play, we need to understand that games – although in principle worlds apart – operate in social contexts. Moreover, we need to take into account the interplay between the form of a game, its content, and its context, see Figure 1.2.

Meaningful play emerges through the interplay between form, content, and context. In chapters 2 and 5 I will present various classifications about forms of play. To illustrate the ideas underlying Figure 1.2 and looking ahead of chapters 2 and 10, suppose we would for example focus on gaming and global warming. By using ideas about the classifications of games (see Table 2.6), we could select a cooperative – distributed access, goal-seeking game. Such game form takes into

account the notion that the major actors involved, even while pursuing a common goal, have only distributed access to information, and partial control of measures taken. That form structures the game content. In chapter 10 I will enlighten the interplay between game form and content in the context of climate change policy development.

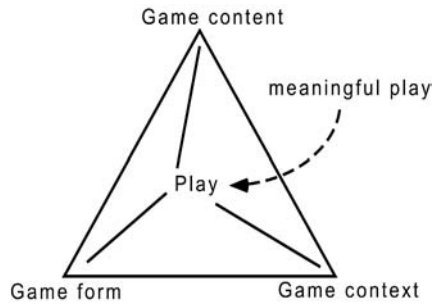


*Figure 1.2. Linkage between game and play*

Participating in a game is performing symbolic acts, which constitute our ways of understanding major aspects of the world, ways to think and feel about the world, and ways to act on it. Tracing the history of play and game is not straightforward, as the play element refers to narratives of game experiences, while the game element emphasizes their form as embedded in the rules, and media of representation. “Game archaeologists” will find traces of games in the written rules, by oral tradition, and in media of representation such as a variety of game boards engraved in stone in ancient Egypt, Rome and many other places. It will be more difficult to find narratives about what happened in a particular game, because only on rare occasions will those stories have been collected.

## AREAS OF APPLICATION

### *Outdoor gaming exercises*

Outdoor gaming is a form of experiential learning under natural conditions. Natural circumstances provide a great variety of options for learning to cope with physical, mental, and social challenges. Typical outdoor programs are: rappelling, ropes or challenge courses, assembling large wooden structures such as watch towers, kayaking, canyoning, hiking, bicycling, horse riding, rock climbing, and wilderness adventure programs. Eberle (2004) observed that one of the major goals of this type of gaming exercises is the development of new and reinforcement of desirable and existing competencies of groups and individuals. These forms of experience-based training and development aim at improving teamwork (teambuilding). Priest (1986)

mentioned the following goals of outdoor (outward bound) programs: enhancing cultural change, changing motivational climate in companies, influencing risk taking propensity, leadership, improving self-confidence and trustworthiness (acceptance, believability, confidentiality, dependability, and encouragement). The peculiar settings of these programs make them also suitable for therapeutic use, and for helping deviant juveniles or adolescents at risk (Eberle, 2004).

The social setting of outdoor training programs is primarily being used for experience-based training. It can however also be used to develop and test theories. David Berreby (2005-a) described some interesting outdoor programs to underpin his ideas about the emerging science of "tribal" psychology. He recalled an intriguing exercise by Muzafer Sherif, a social psychologist, in 1954 (see also Berreby, 2005-b). Under the auspices of the University of Oklahoma, Sherif designed the following experiment. Twenty two fifth-graders from Oklahoma City were invited in the summer of 1954 to spend three weeks in the Sans Bois mountains at a 200-acre campground – the Robbers Cave State Park – with swimming holes, streams, canoes, baseball, campfires, caves, and snakes. They were invited to explore the woods where Jesse James's gang hid out, to have cookouts, and play tug of war. Sherif's goal was to advance social psychology. That was his hidden agenda. All the boys were strangers. Sherif and his counselors observed the birth, life, and death of tribal feelings. Sherif aimed at showing that circumstances could create tribes, and tribal feeling, and subsequently that a change in circumstances could change those perceptions, and the related behavior and handling repertoire.

The boys arrived in two separate groups of 11 each, and each band had time to explore and claim some territory – a bunkhouse, a swimming hole, a ball field. Each group soon decided it needed a name and a symbol. On the sixth day of camp, one group called themselves the "Rattlers". The Rattlers learned that they were not alone. They could hear other boys in the distance, playing on the ball field. That group also had invented a name. They called themselves the "Eagles". The Rattlers and Eagles elaborated their differences. Different incidents that happened in both groups, and the way they were handled by individuals – nude swimming, clean language the Eagles way, toughing it out when hurt the Rattlers ethos, formed the identity and behavioral rules of both "tribes".

Sherif implemented some meta-rules to induce competition between both tribes. He set up a tournament of ball games, bean tosses, tug-of-war and other contests, with prizes for the team that won the most games. Within two days, feelings of mutual antagonism became manifest. The counselors had to keep a close eye on both cabins at night. Both tribes went in for raids and counter-raids. The game facilitators had to step in to prevent real bloodshed.

At the beginning of the third week Sherif had to show that changing circumstances of the boys' lives would get them to drop the Rattler-Eagle divide. He gave the two warring cultures a shared goal, which demanded that they all perceived themselves as "in the same boat." He blocked the faucet leading from the camp's one water tank. Both sides had to figure out how to unblock the spigot. During the following days he wanted them to work out several common bottlenecks. For example, he staged the mechanical breakdown of one truck, so that only one truck was available to return to the base camp. That was a moment of truth. If they stayed true to their Rattler and Eagle loyalties, they had to make two separate 60-

mile round trips, or they could decide to go as one. After a long debate, they chose to go as one group. On the way back, the boys traded stories about raids and fights. Slights and attacks that made them furious before made them now laugh and brag (Berreby, 2005-a, p. 12).

In this social psychological experiment, the experimenter takes first the role of game designer, subsequently of game operator, and finally of outside game evaluator, explaining what happened. By setting and changing the conditions for the participants to act, he shaped conditions for the game (social system) to shape itself. The boys were not aware that they were involved in a game. Within the physical settings, which he created, the "players" enacted (accidentally) a system of rules, and symbols that conveyed their identity as group ("tribe"). The outdoor game became a real and temporary social system for them. Through their insider stories they gave the social system *meaning*. For Sherif it was a model of a social system. Through his outside observer's position, he provided an explanation at a level of abstraction, which was distinct from the "players" level of understanding. He provided a social psychological, and Berreby gave it tribal psychological explanation. Other inference schemes may offer still other explanations. Conclusion: One dynamic system of interactions produces many stories of insiders, and many explanations by qualified outsiders.

This story is one example of an outdoor game to test a theory about social psychology, and tribalism. Berreby argued that "tribal" perceptions and feelings about race, religion, and nation, arise from a built-in mental faculty. I would argue that the interplay between that mental faculty and the enacted social and physical environment are triggers for constructing and continuously reconstructing a particular social system. "Tribal" psychology, so framed, connects anthropology, social and cognitive psychology.

### *Game theory*

Operational gaming has a long history. Sun Tsu, the great Chinese general of the 5th century B.C. used concepts of operational gaming and some elements of the theory of games, in its two-person zero-sum form (Shubik, 1983). Twenty-three centuries later the Prussian war staff used war games to experiment with strategies and tactics, and another two centuries later, Von Neumann and Morgenstern elaborated on mathematical game theory.

Modern game theory became prominent with the classic work *The Theory of Games and Economic Behavior* by John von Neumann and Oskar Morgenstern (1944). It contained a mathematical theory of economic and social organization. They elaborated the method for finding optimal solutions for two-person zero-sum games. Initially work on game theory was primarily focused on *cooperative games*. Such games refer to social systems that have the capacity to enforce coordinated behavior on agents (social or institutional actors), which become members of coalitions. The related game theoretical mechanisms – from law to legal contracts – are abundant in societies. Cooperative game theory analyses optimal strategies for institutional actors, presuming that they can enforce formal agreements between them about proper strategies for handling their varying interests. For example, two players are involved, one positioned over the rows and the other over the columns

of the payoff matrix in Table 1.1. In game theory, the players are actors that represent institutions or agencies with opposite interests. Therefore, I will use the term *actor* to indicate the distinction with individual persons and their assumed positions in the game. For example, BRIDGE is a two-actor game, because it deals with two opposite interest groups or stakeholders' positions.

Even in case of changing partners, the game still deals with two opposite interest groups. In the case of Table 1.1, each actor has two options, each option leading to a specific payoff. In game theory, the term *strategy* refers to a rational and exhaustive plan that cannot be disturbed by the actions of the opposite actors, or by "nature". When a game is presented in this form it is presumed that both actors act simultaneously or, are not informed in advance about the actions of the other. The state of the world is represented via the payoffs in the matrix. The classic form of a two-person game is depicted in Table 1.1.

*Table 1.1 State space of two-person game*

| Payoff matrix | *Actor 2 chooses* ***Option1*** | *Actor 2 chooses* ***Option2*** | *Row Maximum* |
|---|---|---|---|
| Actor 1 chooses **Option1** | Payoff 6 | Payoff 5 | 5* |
| Actor 1 chooses **Option2** | Payoff 5 | Payoff 4 | 4 |
| Column minimum | 6 | 5* | |

A simple example will illustrate the style of reasoning of game theory. The numbers in the matrix refer to the payoffs, pending the options the actors choose. In case of Table 1.1, by definition, the numbers represent the payoffs that actor 2 will have to pay actor 1. Both actors try to maximize their profits or minimize their losses. Whatever strategy actor 1 will choose, actor 2 will always make the most profitable counteroffer. Taking into account the options of actor 2, for actor 1, strategy 1 is most profitable choice. Similarly, taking into account the options of actor 1, for actor 2, strategy 2 is most profitable. After a number of iterations, both actors will find out that this strategy is most beneficial for both of them. It is the optimum strategy. Changing the state space of payoffs and extending the matrix to n players, very elaborate strategies may evolve that – expressed in formal, mathematical, language – predict optimal solutions. John Nash (1950-a, 1950-b, 1951, 1953) developed an optimum strategy for non-cooperative multi-player games: the Nash equilibrium, for which he received the Nobel Prize in 1994. Thomas C. Schelling and Robert J. Aumann shared the 2005 Nobel Prize in Economic Science. The two scientists have been awarded the prize for their fundamental works on game theory. Aumann (1959) dealt with cooperative N-Person games, while Schelling (1960) elaborated the strategy of conflict.

Paul Walker (1995) traced game theory back to the Talmud. He noted that the Babylonian Talmud is the compilation of ancient law and tradition set down during the first five centuries A.D. which serves as the basis of Jewish religious, criminal and civil law. One problem discussed in the Talmud is the marriage contract. A man has three wives whose marriage contracts specify that in the case of this death they receive 100, 200 and 300 respectively. The Talmud gives apparently contradictory recommendations. When the man dies leaving an estate of only 100, the Talmud recommends equal division. However, if the estate is worth 300 it recommends proportional division (50,100,150), while for an estate of 200, its recommendation is (50,75,75). This peculiar ruling has baffled Talmudic scholars for two millennia. From the perspective of modern game theory with its state space represented through the payoff matrix such as depicted in Table 1.1, it was recognized that the Talmud anticipated with these alternative solutions the theory of cooperative games.

Game theory distinguishes two approaches: the theoretical, which is formal and mathematical, and the experimental approach. Game theory progresses by the continual interplay of theory and experiment. Game theorists hypothesize ideas and principles, which are subsequently explored by stating them in precise mathematical language. This allows predictions to be made, which experimentalists can test. With the theoretical approach, a mathematical model, based upon axioms of rational decision-making, predicts optimal solutions to N-persons games. It is a normative theory that prescribes which strategy is most optimal for rational decision makers. The experimental approach puts subjects in a setting such as for example depicted in Table 1.1 (see above), and studies how the strategies of both players evolve over time. By developing and testing hypotheses, experiments falsify theories of human sequential decision-making, which are framed according to the layout of payoff matrices. When there are surprising new experimental findings, theorists attempt to model them in order to test the adequacy of current theories: testing whether the theory correlates with the data sets. If a gap emerges between theory and experiment, which lasts for a long time, then the theorists will have to reexamine the assumptions behind such unsuccessful theories. Although being focused on the mathematical analysis of economic behavior, game theory provided strong conditions in the 1950s for a favorable reception by sociologists and psychologists, especially from the viewpoint of interactive decision theory. However, as Luce and Raiffa stated:

> Initially there was a naïve bandwagon-feeling that game theory solved innumerable problems of sociology and economics, or at least, that it made their solution a practical matter of a few years' work. That has not turned out to be the case. (Luce & Raiffa, 1957, p. 10)

It is still problematic. One of the major obstacles for embedding game theory in mainstream sociological and psychological research was the question about the correctness and fruitfulness of the economist's paradigm of rational action. The concept of *rationality* is defined in a way that it suits the formal theory and its underlying axioms. Through its axiomatic approach, game theory offered a context free, universal approach to interactive decision making. However, as Jessie Bernard (1954) had pointed out, sociological phenomena are context dependent. Institutions affect the way a game is played, and culture affects what is happening in a society,

which impacts on the rules of the game (Bernard, 1954). Moreover, human behavior does not fit into the strict definition of rationality of game theory. Bernard mentioned another difficulty with game theory. It refers to determining exactly what the rules and payoffs are. Both need elaborate empirical research before the game exercise can start. She mentioned that in many cases it might be impossible to determine what the payoff for a specific strategy is or to compare the payoff of one strategy to that one of another. The comparison of *utilities* in the payoff matrix is another obstacle. If a millionaire and a beggar would jointly play a zero-sum game, the winning or losing of for example 25 Euro would have a significant higher utility for the beggar than for the millionaire. "Utility" in rational economic terms is not similar to its meaning in psychological terms. In addition, I argue that human decision-making is a self-referential process, meaning that the interpretation of the rules and the payoffs fluctuate over time, and vary over contexts. These obstacles have turned out to be major impediments to mathematical game theory in the social and behavioral sciences. Empirical verification of game-theoretical analysis was and still is a major problem.

William Gamson carried game theory a step further by investigating what it had to say about building coalitions (Gamson, 1961). Some years later Gamson published the game SIMSOC – simulated society (Gamson, 1968). SIMSOC resembles conceptually an extended prisoner's dilemma game. Many business simulations can be described as extended prisoner's dilemma games. They do not apply the rigor of the axiomatic game theory, and give the players more freedom to interpret the rules and appreciate the multiple meanings of the payoffs. Current developments in game theory relate to multi-agent modeling (agent-based simulation), which are used for designing so-called artificial societies. Game theory is primarily academic of nature.

*Functionally integrated business games and simulations*

War games and game theory stimulated the development of a new class of games and simulations. A short history of the field of business games and simulations reflects the predominant management paradigms of 20th century. The first of these types of games is THE MONEY GAME, developed in 1912 in the UK. In the Leningrad Textile Factory (USSR) M. Bierstein developed the ORGANISATION OF PRODUCTION GAME in 1932. After World War II, large companies increasingly were seeking the same optimal market position, each one responding to actions taken by competitors. As many former army officers entered business, they brought with them knowledge about and experience with war games. Business was and still is viewed as war among competitors. It is obvious that in such an atmosphere corporate managers became interested in adopting war games as prototypes for running a business.

In 1957 the American Management Association introduced the first functionally integrated business game. It was the start of a whole series of general management games, developed in the 1950s and 1960s in the USA, such as the UCLA Game, the Harvard Business School Game, the Carnegie Tech Management Game, The New York University Game, INTOP (International Operations Simulation), and The Executive Game. In Japan the Top-Management-Decision-

Game, model 625-B, was developed. These first generation games ran on main-frame computers. Nowadays they run on PC's. Usually, decisions of the participating management teams deal with selling price; production volume; R&D budget; marketing budget; materials purchase budget; plant and equipment investment budget; and dividend. These decisions are made quarterly or annually, and the results from the simulation model are fed back to the teams for assessment and adjustment for the next time increment. Profitability is the major goal of these games.

Thorelli (2001) expressed the spirit of 1950s well by telling the story about the development of the business simulation International Operations Simulation (INTOP) in an ignorant and hostile academic environment. He was a GE executive when he first became excited about management games. This was the Sales Management game developed by G.R. Andlinger, published in the Harvard Business Review in 1958 (Andlinger, 1958). It was a hand-scored board game. Andlinger's game was certainly a pioneer effort. Joining the University of Chicago in the following year, Thorelli brought the game into his marketing and business policy classes, pending the development of a new, computer-based game. He continued:

> An underlying educational premise was a strong belief that different people learn in different ways – calling for a varied set of pedagogical instruments. A related idea was that business schools – like other professional schools – should have the mission to strike bridges between classical (as well as applied) disciplines on one hand and practical applications on the other. Aside from class discussions of cases, relatively little was really being done in this area at the time. Perhaps the single most important objective was to develop an exercise to demonstrate the interaction between *structure* (of the organization as well as the task environment), *strategy*, and *performance* (SSP) in the business world. By making the game international, participants would naturally expect different business environments and presumably they would begin to see the interactions of SSP variables. It was easy to foresee the imminent rapid growth of international business and its importance to management. Both to reach a broader audience and to focus on cross-functional interaction, the aim was to create a general management game useful in both functional (production, marketing, finance, and so on) and integrative capstone courses. The notion of a 'business management laboratory' was prominent in our minds. With colleague Robert L. Graves and then graduate assistant L.T. Howells we spent the next three years developing the first IB strategy simulation on the UNIVAC 1. (Thorelli, 2001, pp. 492-493)

The structure of INTOP and its more recent version INTOPIA reflect the generic structure of well-known business simulations. Several companies operate in the same national and/or international market. They manufacture goods with the available facilities. The core mechanism for representing the dynamics of such games is micro-economic theory. That theory is formalized in the computer program, which calculates the consequences of the decisions of each of the companies, in terms of turn over, costs, market share, profits, etc. Emphasis is on

business strategy vis-à-vis the market. The internal organization of the companies is modeled via functional subsystems such as production, finance, marketing, personnel, etc.

*Behavioral simulations*

Closely linked to business simulations of the type sketched above, and emerging in the US in the 1960s, are behavioral simulations. Contrary to business simulations with their focus on economic theory, this type of games pays special attention to learning about organizational behavior, organizational design, change, development, and management. They simulate the many aspects of organizational life such as, the development of work teams, informal groups, organizational differentiation and integration, leadership, organizational conflict, information processing systems, politics, etc. Emphasis is mainly on the wheeling and dealing of the internal organization of a manufacturing or service company. A classic example is THE ORGANIZATION GAME (Miles & Randolph, 1985).

Video games

Traditional board and card games still enjoy high interest, and annually many new games of such type are being designed for commercial reasons. Since the advent of the PC in the 1980s a new variety of games has rapidly proliferated: video- or computer games that run on PCs, mobile phones, or on specifically designed consoles such as Xbox, PlayStation, or the Gamecube. Publishers such as, Electronic Arts, Atari, Activision, etc. distribute the games, and pay for using, and for the privilege of producing games for their consoles. The publishers cooperate with numerous design studios from all over the world, which envision and develop the digital games. On average, it takes three years to design and market a game. At November 30, 2005, Sony announced that it had supplied one hundred million game computers – Playstation 2 – to retailers. Playstation 2 entered the market in March 2000. Similar figures apply for Xbox. They offer an indication of the global market of digital games. The games PRINCE OF PERSIA, GRAND THEFT AUTO, F.E.A.R, CIVILIZATION, CALL OF DUTY, AGE OF EMPIRES, WORLD OF WARCRAFT, the SIMS etc. represent a multi-billion market for the game industry. Especially the younger generation – thirty years of age and younger – is very much involved in playing these and similar entertainment games. They enter a virtual space through their *avatars*, which have to *conquer a whole variety of odds*, defending themselves from being attacked by odd characters popping up in endless repetition, even after they have been destroyed. The odds in physical space may take shape in the form of walls, barred doors or corridors, ditches, canals, sweeping obstacles, etc. By conquering the odds, the avatars – as the extension of the players in virtual space – find their trails though the maze, and by doing so, they frame interactively their narratives.

These highly competitive games require a high level of cognitive and psychomotor skills. The Cyberathlete Professional League (CPL) organizes annually a World Tour Grand Finals, awarding $500,000 in cash prizes in 2005 to the top 16 competitors over the course of the three days. The 2005 winner received

$150,000, the largest cash prize ever for a computer game tournament (see http://www.thecpl.com/league/). Although purely developed for commercial reasons, these video games impact on youth culture, the way youngsters spend their time at home and at school, communicate with their friends, and the way they learn. Gradually universities are becoming aware of the social and cultural impact of video games, of their reach, which is extending beyond the traditional boundaries of play and entertainment in family homes and arcades, into the classroom. That emerging youth culture is influencing social and group dynamics at playgrounds and other local youth facilities.

Many traditional board and card games such as, CHESS, GO, etc. have been digitalized and included in standard software for PCs. That adaptation implies both a shift in media of representation of those games – the interaction between the game board and the pieces on it – and the roles of the player(s). With CHESS, the computer assumes the role of the opponent. It becomes a rule-driven agent, who makes choices and moves pieces, based on a built in algorithm. Through the Human Computer Interface (HCI) the player interacts both with that agent (the artificial competitor) and the digital game board.

The commercial sector is still the major source of video game development. The initial costs of developing and marketing video games are very high. Also the financial risks are high. Property rights of game console manufacturers place high financial constraints on the development and use of digital games. They form bottlenecks in the flow of new and innovative game design.

Through so-called game engines – software packages that generate a variety of images – commercial, digital game design tends to a repetitive process in terms of form and content. Commercial success with one genre of play tends to repeat its prior success. Successful games tend to become pioneers of a certain genre, leading to a series of games of similar form and content. Informatics, Computer science and Information Science departments at universities are becoming a major source of innovations for game design. Humanities, and the social and behavioral sciences are gradually showing a keen interest in game studies, from various perspectives such as, multi-media studies, game cultures, social interaction, and cognition. Computer science and language faculties are increasingly joining efforts in video game design, the computer science taking care of software development, and linguistics and humanities of the narrative aspects. Video games – viewed as interactive narratives – offer a rapidly developing new area of research. Contrary to the other varieties of gaming – sketched in this chapter, which are driven by scientific curiosity, video games are mainly commercial products, and only recently – through their technological and social impact, and vast financial resources – they are becoming object of scientific study.

## THE ADVENT OF GAMING ASSOCIATIONS

Via games and simulations, developed since the 1950s, we are witnessing their rapid proliferation to areas such as, social studies, urban and land use management, ecology, education (classroom instruction), international relations, health care, natural resources, etc. In addition, the field offered a broadening scope of forms: role-playing games, board games, computer-assisted, computer-

supported, and computer-directed games, frame games, (policy) exercises, behavior simulations, and a variety of computer simulations.

In the early 1960s, James Coleman, William Gamson, Garry Shirts, Clark Abt, and a few others were pioneering the development of games for use in classroom instruction (Stadsklev, 1974). Richard Duke and Allan Feldt were pioneers of urban and land use gaming. Duke designed METROPOLIS (1964), METRO-APEX (1964), METRO (1965) and Allan Feldt the COMMUNITY LAND USE GAME (CLUG) (1966). Harold Guetzkow developed INTER-NATION SIMULATION (1966), and Gary Shirts STARPOWER (1969), opening gaming to International Relations studies. Many others followed their footsteps in the 1970s and 1980s, diversifying the field of simulation gaming to many new areas.

In line with the spirit of the 1960s, associations such as ISAGA (International Simulation and Gaming Association), NASAGA (North-American Simulation and Gaming Association), SAGSET (Society for the Advancement of Games and Simulations in Education and Training), and ABSEL (Association for Business Simulation and Experiential Learning) have been established in the early 1970s. They have carried out pioneering work to establish gaming and simulation in academia and professional practice. More recently, associations such as, JASAG (Japan Association of Simulation And Gaming), SAGSAGA (Swiss Austrian German Simulation And Gaming Association), a Dutch special interest group called SAGANET, and DiGRA (Digital Game Research Association), have been established. All these fellow associations propagate gaming and simulation, both as a way of thinking, a methodology (study of methods), and a technique.

## TENSIONS

The kaleidoscopic perspective, presented above, shows the richness and reach of human activities vis-à-vis the play character of human society. I have touched on several approaches to play, game, and simulation. Their core idea refers to activities, embodied experiences, drama, and to the playground of the mind, bound by ties of logic, causality, imagination, myths, poetry, and to social play as a form of social reproduction. Game sessions may very well develop beyond the reach of reason. Although also animals play, it should be noted that they do not develop and posses games. Games have additional quality to play. Forms of play can be traced as artifacts over thousands of years of history, and at very different locations such as in China, India, Arabic world, Africa, Europe, and America, by people very far apart in time and space. Games result from the artificial, artful (craftsmanship), and since the 1940s, from scientific conceptions (phrases, formal languages, and utterances) about the world. They are artifacts that derive their meaning from the activity called “play”. Human activities become play in situations of strife, challenge, contest, ritual, and competition for whatever cause or goal. In due process, they become social games.

Games are forms of play. The linkages between the rules and the resources define the variety of play forms. It is worthwhile to note the important distinction between *rule-based*, *principle-based*, and *free-form* games. In rule-based games, the rules are not questioned. They are just followed. The actors play by the rules. Those, who do not obey the rules, are out. In principle-based games, the actors

have freedom to interpret the rules, based on the underlying norms, before acting. The actors have some freedom to play with the meaning of those rules. This distinction applies as well to the North-American society, which is more rule-based then European societies, which tend to be more principle-based. In free-form games, only a few ground rules or "rules of nature" exist, such as the time of the beginning, the stop rule, the role of the facilitator, and the location in which the game takes place. All other rules that seem to be suitable evolve during the game session, and are being negotiated and shaped by the actors themselves. Therefore, free-form games are self-organizing, or self-reproductive systems (autopoietic systems).[i] These distinctions have so far received only minor attention in the literature.

Playing games implies that the players engage in an evolving process. Playing a game is a total event of being involved in a temporary, provisional, and integrated world. A key question is: How can knowledge about a reference system be gained, assimilated among the actors, re-integrated and disseminated to enhance the social system's performance? Answers to this question may be considered simple and straightforward. However, providing the way academia is structured, I argue that we are dealing with a self-made problem. The structure of scientific research forces knowledge to be extracted from a fully integrated world into disciplinary knowledge domains and inference schemes. Such knowledge becomes des-integrated by disciplinary units called departments in universities. As a consequence, the integrated experience of playing games becomes des-integrated in scientific research. An integrative body of knowledge – to deal coherently with the many faces of a gaming experience – needs special attention.

To illustrate the scattered world of gaming and game studies in academia, I present a random list of disciplines and departments of fellow scholars globally involved in gaming: *architecture (& building); biology; business administration; cognitive economics; cognitive engineering; communication; computer science; computing arts and design sciences; design & environment; economics; education; environmental information; information science; information systems; integration of technology in education; interactive arts; international relations; language; linguistics; management; marketing; mathematical economics; media studies; natural resource management; policy studies; organizational behavior; political science; project management; psychology (leadership/work & organization); public administration; research methodology and methods; social psychology; social sciences; sociology; systems agronomics; systems management; teacher studies; technology education; telecommunication; urban planning; etc.*

To underpin my argument about the diversity of disciplines involved, and to indicate which key concepts they use, I wrap up results of a study by colleagues from JASAG (Japan Association of Simulation And Gaming) (Klabbers, 2004). At the 34th ISAGA annual, international conference, held at Kazusa Akademia Park in Chiba, Japan from August 24-29, 2003, the first day was dedicated to ISAGA/JASAG Symposia with as special topics, "The past, present, and future of JASAG," and "The contribution of JASAG to S&G."

Yusuke Arai (2003) and Fumitoshi Kato (2003) reported on a study about concept mining in JASAG related publications since 1991. The purpose of the study was:

- To (re-) identify the domains of research;

- To understand the characteristics of interdisciplinary approaches.

The research projects carried out covered a wide variety of domains of research such as, management, System Dynamics, artificial society, systems science, information and decision-making, multi-agent approaches, education, play therapy, agricultural policy, environmental issues, conflict resolution, international relations, intercultural communication, consensus formation, policy studies, game theory, group dynamics, business gaming, organizational behavior, and others.
Major contributors were:

- Information engineering, information science, knowledge science (22%);
- Social engineering (19%);
- Management, organization theory, decision-making (19%);
- Business game practitioners, business consulting (10%);
- Social psychology;
- Economics;
- Political science;
- Others.

The list of 33 key concepts from 129 publications in the journal "Simulation and Gaming" run from "simulation" (50 references), "game" (47 references), to "earth" (6 references) and "Internet" (3 references).

Concept mining in the proceedings of the JASAG annual conferences produced a list of 80 key concepts. They run from simulation (132 references), game (98 references), through society (40), decision-making (13), theory (8), multimedia (8), to cognition (5), and eco (4). It is an impressive list of contributors and concepts, illustrating the great diversity of the Japanese gaming and simulation community.

Considering these listings, I notice that many of my dedicated colleagues work in distinct university departments. On the instrumental level, noticed during numerous international meetings over many years, I have seen a growing understanding about gaming and simulation methods and techniques. Nevertheless, as game science is more importantly, a way of thinking, on a theoretical and methodological level, game scholars have difficulty in speaking with the same tongue. The high diversity of the field is both strength, and a weakness. Game professionals should pay more attention to a proper rhetoric for cross-fertilization about theoretical and methodological questions. Professionals and scholars, by lack of a common theoretical framework, tend to fall back on the inference schemes of their particular disciplines.

In the following chapters I will address this problematical issue in more detail, and pay attention to the scope of activities covered by the terms *play, game, and simulation*. For that matter, I will use "gaming" as the common term, encompassing the terms "play", "game", "simulation", and the interesting connection "playful gaming". I do not intend to discuss in detail the various disciplinary approaches to gaming with their emphasis on methods and techniques per se. Such an approach would be lacking coherence due to the many distinct and often disjoint conceptions underlying gaming methods and tools. Moreover, it would not due justice to key questions about this trans-discipline. More particularly, I will focus on methodological issues on an appropriate level of aggregation, to offer an integrated view on this currently diverse and scattered field of study and professional practice. My purpose is to enlighten common principles underlying game science. These and

similar views will eventually improve common understanding, and professional practice.

It is a commonly held opinion among professionals that games and simulations offer a shared "language" to enhance stakeholders' competency in handling multifaceted issues. I have indicated above that game science needs such a common language, if it will further evolve as a meta-discipline in its own right. To summarize: game science contains many methods. Moreover, it is a way of thinking. In the following chapters, I will address practical, theoretical and methodological questions to improve the way we conceptualize these artifacts. Therefore, in chapters 4 – 7, I will emphasize first the position of the designer, and design science as the frame-of-reference for addressing key questions. Subsequently, I will pay attention to the analytical science domain of gaming and simulation.

*Working definitions*

A **game** is a *form of play*. It is an activity involving one or more players who assume roles while trying to achieve a goal. Rules determine what the players are permitted to do, or define constraints on allowable actions, which impact on the available resources, and therefore influence the state of the game space. Games deal with well-defined subject matter (content and context).

**Play** is a voluntary activity or occupation, executed according to rules freely accepted but absolutely binding, having its aim in itself and accompanied by a feeling of tension, joy, and the awareness that it is different from ordinary life.

In these working definitions, I have not yet addressed questions about forms of knowledge and knowledge content; competition and cooperation; extrinsic and intrinsic rules; entertainment, education, and training.

## NOTES

[i] *Poïesis* means in ancient Greek: "to make, "to produce". This word, the root of our modern poetry, was first a verb, an action that (re-) produces and transforms the world. Autopoiesis means self-reproduction. See also Maturana & Varela (1980) *Autopoiesis and Cognition*.

# CHAPTER 2

# THE GAMING LANDSCAPE IN THE 20TH CENTURY

## INTRODUCTION

In chapter 1, I have sketched general ideas about and approaches to play and game. In this chapter I will pay major attention to classifications, typologies, and taxonomies. Therefore, focus will be on games as products – *artifacts* – of human creativity, ingenuity and craftsmanship. Purpose is to bring order to the variety of appearances of those artifacts. While discussing classifications and typologies, I am mostly interested in the viewpoints of the authors that underlie those schemes, asking myself whether the perspectives offered may bear fruit in developing a common perspective, an integrated framework to the gaming and simulation landscape. In addition, I am interested in the question: What makes a game unique? The idea of singularity, of being distinctive and unique applies particularly to games with their wide variety of appearances. Studying the classifications – referring to the question what these artifacts have in common – as well as reflecting on what makes games unique, points to the need for a deeper understanding of their architecture. To be able to unravel it, I will present a generic framework.

## THE GAME ELEMENT OF WESTERN CIVILIZATION SINCE THE 20TH CENTURY

When Huizinga (1985) wrote the book “Homo Ludens” in the 1930s, he paid major attention to the play element of archaic societies, and early civilizations with special emphasis on the linkages between play and law, war, knowing and wisdom, philosophy, and art. Subsequently, he sketched the ludic qualities of western civilization since the Roman Empire. To illustrate his viewpoint, he discussed more in depth the rituals, festivities, contests, and play qualities of the ancient Greek culture. In the last chapter of the book, he addressed the play-element of contemporary civilization that is, the late 19th century until the 1930s. He observed the increasing influence of sports, and especially ball games in the late 19th century in England to the extent that the term *sport* gradually replaced the term *game*. This was the current history of the early 20th century. Sport in current society that is, in the early 21the century, has become big and serious business. Its commercial racket has great impact on the true play spirit: spontaneity and carelessness that were so characteristic of the play qualities of ancient civilization. Huizinga claimed that the professional [*of the 1930s: note author*] lacks spontaneity and carelessness.

In modern social life sport occupies a place alongside and apart from the cultural process. The great competitions in archaic cultures had always formed part of the sacred festivals and were indispensable as health and happiness bringing activities. “This ritual tie has now been completely severed: sport has become

profane, “unholy” in every way and has no organic connection whatever with the structure of society, least of all when prescribed by the government” (Huizinga, 1955, pp. 197-198). Considering the position of sport in contemporary cultures, and the linkages of the Olympic Games, soccer world championships, and other national and regional tournaments with government policies, one could question their play element of culture in Huizinga’s sense. Observing the rituals of soccer fans in Latin-America and Europe in behavior and outfit, I would argue that the strong agonistic habit that is so peculiar of modern sports, both at the playing fields and at the stadiums, are very closely connected to modern high-tech cultures vis-à-vis networks of hooligans. Commercial sports competition may not belong to sacred play-forms of an ancient past, I still view it a basic play element of culture, however dismantled its magic may be. Business has become a game, and gaming has become business.

In the same vain, Huizinga dismissed already in the 1930s “modern” science as play.

> The logical development of civilization which we call science is more inextricably bound up with dialectics than is the aesthetic … By way of tentative conclusion we might say that modern science, so long as it adheres to strict demands of accuracy and veracity, is far less liable to fall into play as we have defined it, than was the case in earlier times and right up to the Renaissance, when scientific thought and method showed unmistakable play-characteristics. (Huizinga, 1955, p. 204)

Since science increasingly is feeling the political pressure to produce knowledge usable to society, a pressure that materializes through budget allocations, latitude for play is becoming tight.

Regarding the play-element in contemporary social and political life, I note that Huizinga’s observations of the 1930s still apply in even more naked form. Certain play forms may be used consciously to cover up a social or political agenda. Spin-doctors in government make it their trade, using mass media to disguise questionable political designs. This is a form of false play. Watching TV in many countries, and especially the high proportion of games and ‘run-arounds”, one notices that post-modern life is being dominated to an ever increasing extent by a quality that has something in common with play and yields the illusion of a strongly developed play-factor. Huizinga (1955) called this quality of play *puerile (childish, foolish)*. It is the most appropriate appellation for that blend of adolescence and barbarity, which is increasingly rampant over the Western world. That world, mediated through the mass-communication infrastructure demonstrates an insatiable thirst for trivial recreation and crude sensationalism, the delight of mass-meetings, mass-demonstrations, parades, and so on. Whole nations turn into clubs, flattering self-love and narrow group-consciousness, with politicians dancing on the waves of such popular entertainment. These forms of play, demonstrating the infantile play elements in culture, should not distract us from the more sincere characteristics of (fair) play that I am addressing here. I do not suggest that children’s play as such is puerile, as it usually is sincere with much magic involved.

Since the first Industrial Revolution there is decreasingly little room for the play element of culture. Utilitarianism, rationalism, and efficiency propagated through

technological progress, and scientific management with its machine bureaucracy of work and production, have forced an over-estimation of the economic factor in life. Huizinga noted (1955) that they have killed the mysteries and acquitted man of guilt and sin. Weber (1947) speaks of a disenchanted world.

Contemporary civilization cannot exist in the absence of a certain play-element. It presupposes limitation and mastery of the self, the ability not to confuse its own tendencies – expressed in the private space of life – with the ultimate and highest goals of a community, conveyed in the public domain. Mastery of the self implies the understanding that it is enclosed within certain bounds freely accepted. Huizinga (1955) stated that civilization will, in a sense, always be played according to certain rules, and true civilization will always demand fair play: good faith expressed in play terms. He recollected the endless rotation of the tension between play and earnest. Looking for a pivot to resolve that question, we will not find it in logic, and we have to look for it in the sphere of ethics, and esthetics. Play in itself is neither good nor bad. It lies beyond morals. However, if we have to decide whether an action to which our will impels us is a serious duty, or is permitted through play, then our moral conscience will at once provide the touchstone. The play-seriousness duality loses all meaning as soon as truth and justice, compassion and forgiveness become embedded in the way we act. “One drop of pity is enough to lift our actions beyond intellectual distinctions and classifications” (Huizinga, 1985, p. 209). Therefore play surpasses rational and logic analysis.

Since the beginning of the 20$^{th}$ century a more profane interpretation of play and game has gained prominence, especially through scientific endeavors linked to the growing awareness of social questions raised during the First Industrial Revolution: business has become a form of play, and play has become business. The related issues became more manifest during the Second Industrial Revolution. Characteristic of the First Industrial Revolution was the transformation of energy from one form to another. Through artificially constructed engines such as, the heat engine, a whole new complex technology emerged, replacing natural (physiological) engines (animals and human beings) as sources of mechanical work. Heat engines became the slaves of the industrial societies. Human beings were responsible for their maintenance, for tending them and steering their work through routine control operations. The increasing complexity of the industrial enterprises through mass production, and the resulting auxiliary social and political organizations, required a new way of thinking about the efficient organization and management of work. The counterpart of the complex technology became scientific management, advocated by Henri Fayol, F.W. Mooney, Lyndall Urwick and Frederick Taylor. They saw management as a process of planning, organization, command, coordination, and control, while drawing on a combination of military and engineering principles. The classical management theory with its emphasis on designing bureaucratic organizations, combined the way the machine routed production with the way the bureaucracy routed the process of administration (for more details about scientific management, see for example, Morgan, 1986).

In such a setting the idea of play as an activity valued for itself (autotelic) lost much of its appeal. The term *game,* with its connotation of rule-driven contest and competition, moved to the foreground. It fitted better with utilitarianism, rationalism,

and efficiency of industrial practice. The autotelic character of play shifted to the allotelic quality of game. It became functional to a goal outside the immediate sphere of play. The functionally integrated business games and simulations, discussed in chapter 1, illustrate my point. Their main purpose was and is to train general management skills, and business administration. The expertise gained through these business games proliferated during the 1960s to areas such as, social studies, urban and land use management, ecology, education (classroom instruction), international relations, health care, natural resources, etc. In addition, the field offered a broadening scope of play forms: role-playing games, board games, computer-assisted, computer-supported, and computer-directed games, frame games, (policy) exercises, games for simulating social processes, behavior simulations, and more recently, digital, or video games. Computer-directed games – Thavikulwat (2009) uses the term "computer-directed simulations" – refer to digital, or video games, driven by computer software: the computer in control of the game. So, how is current practice shaping the gaming landscape?

## THE CURRENT LANDSCAPE

Since the beginning in 1970, the International Simulation and Gaming Association (ISAGA) has mapped its activities in a common scheme, taking into account *foci of interest* and *areas of application*. Areas of application represent the reference systems that are being used for gaming and simulation. They provide the content for the great variety of forms of play. ISAGA has distinguished the following foci of interest:

- Theory and methodology
- Design
- Research methods
- System development
- Assessment & evaluation

More particularly, under those general headings, attention is focused on themes such as for example:

- Learning & education (individual and professional development)
- Individual & collective competency in cooperation or competition
- (Intra- and cross-cultural) communication
- Management development & conflict resolution
- Organizational (institutional) change
- Policy-development in multi-actor, multi-level arrangements

These themes are not mutually exclusive. They refer to purposes, contexts of use, and target audiences.

The following areas of application – reference systems – are distinguished:

- Administration (business and public management)
- Environment (eco-systems)
- Entertainment
- Services such as, health care, education, banking
- Resources such as, human/cultural resources and natural resources
- Human settlements/geography

- International relations
- Military
- Religion
- Technology, information technology included.

Since the 1990s increasingly the area of research of digital games has gained prominence, among others promoting Multi-User Virtual Environments (MUVEs) to support game-based learning. The main goal of these games originally was and still is entertainment. Increasingly advances in 3-D virtual worlds platforms proliferate to areas of professional practice such as, military training, leadership training, training firefighters, business development, health care, and so on. In all those practical cases, games are being designed to simulate particular social systems. Although these virtual worlds enrich considerably the realm and reach of gaming, we should not overestimate their impact on players. The instrumentality of digital games, and the virtual worlds they convey, may disguise the concepts, ideas, and embodied experiences that are basic to human play in face-to-face game settings. As I will argue in chapter 3, we can interact with virtual worlds. We are not able to physically enter them. That restriction limits the meaning and scope of digital games in relation to human experience through direct face-to-face interactions.

Game design has received wide attention. However, it has been limited so far to instrumental design, the design of the artifact as such. More recently, due to the growing awareness of the broader potentials of gaming, attention is shifting towards the use of games to enhance change, to improve the capacities of participants to support change, and to their growing impact on (youth) culture. That understanding requires a distinction between two levels of design: the instrumental design of the game as such, and related organizational design on the basis of that game. Those dedicated games trigger interventions that become embedded in organizational change processes. I have coined the terms “design-in-the-small” (DIS), and “design-in-the-large” (DIL) to take both levels of design on board (Klabbers, 2003, 2006). Design-in-the-large is linked to social system’s development. In all cases, what matters is the interplay between both design levels. I will not elaborate here the underlying ideas. For more details, see chapters 4-6.

When digital gaming gradually becomes embedded in the broader area of gaming, as developed, and practiced by ISAGA, NASAGA, SAGSET, ABSEL, JASAG, SAGSAGA, etc. (see chapter 1) then it will gradually immerse into the more general framework, presented in Table 2.1. As the field is advancing rapidly, Table 2.1 should be considered work-in-progress. Its form and especially, its content will change over time.

In each cell of the matrix of Table 2.1, a variety of games may be used. They range from role-play, frame games, board games, behavioral simulations, computer-assisted and computer-supported games, to computer-directed games. Many classifications on play and games have been developed to capture the variety of *forms, functions, activities, and processes*. Each of them highlights certain characteristics, while ignoring others. Before discussing several classifications in more detail, I first will further elaborate on the term *play*, which, as learned from Huizinga’s exposé, incites so much confusion.

*Table 2.1. Realm of Game Science*

| | **Foci of Interest** | | | | | |
|---|---|---|---|---|---|---|
| | I. Theory & Methodology | | | | | |
| | II. Artifact design (DIS) | | | | | |
| | III. Research methods, including assessment & evaluation | | | | | |
| | IV. Systems development (DIL) | | | | | |
| | V. Education & Training: topics for example: | | | | | |
| | Skills & abilities | Communi-cation | Cog-nition | Policy Formation | Decision-making | Entertainment |
| **Areas of application (content):** | | | | | | |
| 1. Business administration | Operational management | | | | Strategic management | |
| 2. Public administration | | | | Policy develop-ment | | |
| 3. Eco-systems | | | | | | |
| 4. Settlements | | | | | | |
| 5. Services | | | | | | |
| 6. Intern. Relations | | | | | | |
| 7. Military | | | | | | |
| 8. Religion | | | | | | |
| 9. Technology | | | | | | Virtual worlds |
| 10. … | | | | | | |

## AMBIGUITY OF THE TERM PLAY

It is difficult – and I would say fruitless – to provide a purely functional explanation of play. Above, I have indicated a diversity of forms of play in the gaming landscape, expressed by Table 2.1. I have not yet addressed the wide variety of experiences of playing games. Brian Sutton-Smith (2001), in his book "The ambiguity of play", in search for definitional clarity, aimed to develop a coherent theory of play. He found himself in the position of having to deal simultaneously with seven types of ambiguity, presented by William Empson (1955). Referring to play, he denoted the following ambiguities:

1. The ambiguity of reference (is that a pretend gun sound, or are you choking?);
2. The ambiguity of the referent (is that an object or a toy?);
3. The ambiguity of intent (do you mean it, or is it pretend?);
4. The ambiguity of sense (is this serious, or is it nonsense?);
5. The ambiguity of transition (you said you were only playing);
6. The ambiguity of contradiction (a man playing at being a woman);
7. The ambiguity of meaning (is it play or play fighting?) (Sutton-Smith, 2001, p. 2).

Sutton-Smith presented a list of activities that relate to play form and play experiences. It is arranged from the more private to the more public forms of play:

- *Mind and subjective play*: dreams, daydreams, fantasy, etc.;
- *Solitary play*: hobbies, collections, writing to pen pals, etc.;
- *Playful behavior*: playing tricks, playing around, playing for time, etc.;
- *Informal social play*: joking, parties, cruising, etc.;
- *Vicarious audience play*: television, films, cartoons, etc;
- *Performance play*: playing the piano, playing music, being a play actor, etc.;
- *Celebrations and festivals*: birthdays, Christmas, Easter, etc.;
- *Contests (games and sports)*: athletics, gambling, casinos, etc;
- *Risky or deep play*: caving, hang gliding, kayaking, etc. (Sutton-Smith, 2001, pp. 4-5).

To bring more coherence to the idea and experience of play, he has chosen *rhetoric* as his main approach. Rhetoric in his view is "a persuasive discourse, or an implicit narrative, wittingly or unwittingly adopted by members of a particular affiliation to persuade others of the veracity and worthwhileness of their beliefs" (Sutton-Smith, 2001, p. 8). He did not have in mind a discussion of the substance of play, or its science, or its theories, rather the way, in which the underlying values – attributed to play – are conveyed. He noted that play rhetorics are part of multiple broad symbolic systems – political, religious, social, and educational – through which we construct the meaning of the cultures in which we live.

Sutton-Smith (2001) discussed the following seven rhetorics of play as:

- *Progress*: usually applied to children's play;
- *Fate*: usually applied to gambling;
- *Power*: usually applied to sports, contests;
- *Identity*: usually applied to traditional and community celebrations;

- *Imaginary*: usually applied to playful improvisation of all kinds (imagination);
- *Self*: usually applied to solitary activities (hobbies, bungee jumping);
- *Frivolity*: usually applied to the activities of the idle or the foolish.

Sutton-Smith hoped that via the seven rhetorics he presented, he would be able to build a bridge based on some *unifying discourse*, a more genuinely *interdisciplinary organization of play*. To catch the multiplicity of concepts he has applied to play, he finally offered "play as a model of adaptive variability" as an integrative eighth rhetoric with the following basic features:

- *Evolution of the brain*: play to increase the brain's variability;
- *Redundancy*: reproduction of useful structures to enhance adaptation;
- *Flexibility*: play to improve adaptability – the capacity to adapt.

In attempting to present a coherent discourse on play, Sutton-Smith put himself in the observer's position. Considering the seven ambiguities of play – presented above – through that outsider's position, he was not able to cope adequately with the intentions and perspective of the players themselves. Nevertheless, he was aware of the duality of play both from the perspective of the outside observer, and the inside participant of a game. Sutton-Smith's puzzle was:

> … it is clear that verbalizations about a ludic experience are not the same as that experience. When the adult says play is a developmental experience, for the child it may be nothing but hide-and-seek. What the Puritan says is character destroying gambling may be, for the player, the one satisfying experience in the week. Because forms of play, like all other cultural forms, cannot be neutrally interpreted, it is impossible to keep ambiguity from creeping into the relationship between how they are perceived and how they are experienced. … scholars also seem to have in common, wittingly or not, the way they manipulate these rhetorics to justify their own preoccupations with the different play forms. (Sutton-Smith, 2001, p. 216)

I would rephrase it as follows:
*It is clear that theorizing about a ludic experience is not the same as that experience. When the scholar says play is a developmental experience, for the player it may be a satisfying and joyful experience. Because forms of play, like all other cultural forms, cannot be neutrally interpreted, it is impossible to keep ambiguity and discrepancy from creeping into the relationship between how they are observed by scholars, and experienced by the players.*

The notion of rhetorics (*theory or discourse*) is a notion that pertains to the domain of descriptions, and as such it is relevant only in the meta-domain in which the observer makes his commentaries (theories, rhetorics), which cannot be deemed to be operative in the experiential domain of the players of a game, the object of the description. As long as such rhetorics (theories) are not connected to the experiential domain, they are fictions. In the ludic experiential domain of playful gaming, the conceptual is intertwined with the embodied experience, which links explicit with tacit knowing. The seven ambiguities of play, referred to above, result from the choice to theorize about play from the position of the meta-domain. From the position of the player – the experiential domain – those ambiguities will evaporate easily, being replaced by ambiguities related to making sense of the

situation that is, produce meaning while playing. Sutton-Smith was aware of it, yet he did not switch perspective, to take on board the rhetorics of the players as well. He chose to stay an outside observer, while ignoring the knowledge domain of the players, and as a consequence he was not able to deal adequately with the ambiguity of play. He was only able to tell one part of the story.

Through this understanding of the ambiguities of play we are aware of the intricacies of game science, which needs to include both the perspective of the observer, verbalizing patterns of play through disciplinary lenses, and the experience of the players, expressing meaning and sense making. If both domains of knowing are disconnected, then the total experience of play will get lost. This dual perspective is a basic feature of game science, which does not fit easily in common academic affairs.

## SYNONYMS

Providing the lessons learned from Huizinga's and Sutton-Smith's exposés, it will be tricky to offer a list of terms that relate to the terms *play*, and *game*, in the hope that they shed better light on this ambiguous phenomenon. Presenting a list of synonyms implicitly offers an analogical line of reasoning: objects are different even though they look similar. Nevertheless, I will take that risk, as in common use these terms are often linked with play and game. I will start with a comprehensive work definition of a game. It is an adjustment of Abt's (1968), and Ellington's et al. (1982) definitions.

### *Working definition of a game*

*A game is any contest or effort (play) among adversaries or teammates (players) operating under constraints (rules and resources) for an objective (winning, victory, prestige, status, or pay-off). The exercise, or activity, should involve overt competition, or cooperation between the individuals or teams, who are competing against each other, or together (while jointly conquering circumstances) fighting the odds.*

Next, I will list terms that are related to the terms *play* and *game*, referring to their common use.

### *Play*

- Spending time, doing enjoyable things;
- Taking part in games;
- Including a person as a member of a team;
- Performing an activity guided by the rules of a game.

### *Game*

- An activity or sport involving skill, knowledge, or chance, in which you follow fixed rules and try to win against an opponent or to solve a puzzle;

- A particular occasion, usually, arranged in advance, on which a game is played;
- A part of a match, for example in tennis or bridge, consisting of a fixed number of points;
- The degree of skill or the style that someone uses when playing a particular game;
- The equipment that you need to play a particular indoor game, for example a board, dice, cards;
- An activity that children do, for example pretending to be someone or using toys;
- A situation that you do not treat seriously;
- A way of behaving in which a person uses a particular plan, especially to gain an advantage;
- Games: an organized event in which competition in several sports takes place.

*Model*

- A physical representation that shows what an object looks like or how it works;
- A theoretical description of a system or process that can help you understand how the system or process works, or how it might work;
- An example that has been especially built and organized to demonstrate how it can function;
- An example of a person's behavior you copy, because you admire it, and want to be like that person.

*Simulation*

- The process of simulating something that is, reproducing a set of conditions, or the result of simulating it;
- An attempt to solve a problem or to work out the consequences of doing something by representing the problem or possible course of events mathematically, often using a computer.

*Simulator*

- A device designed to reproduce actual conditions to train people.

*Gamble*

- A risky action or decision in the hope of gaining money, success, or an advantage.

*Exercise*

- A series of energetic movements which you do in order to get fit or remain healthy;
- A short piece of work that you do, which is designed to help you learn a particular mental skill;
- An activity planned to achieve a particular purpose.

*Sports*

- Amusement, fun, not seriously;
- Activity for amusement and exercise;
- Meeting for athletic contests;
- Sports are games such as football, soccer, and cricket, and other activities which need physical effort and skill;
- Any kind of enjoyable activity for which you need physical or mental skill.

These terms have in common the following attributes: players, activities, concepts, forms, contests, places, and purposes. Subsequently, let us see in which form these attributes are embedded in several classifications and typologies of games.

## CLASSIFICATIONS OF GAMES

Games are forms of play. Referring to Sutton-Smith (2001), I already have presented various views on play. The following classifications are based on those broad ideas, and focus more on special forms of play. They take their broad scope of play for granted. I will not discuss these classifications in great detail. They serve to illustrate the variety of views on, and approaches to gaming.

*Caillois*

Caillois (2001) has presented a classification that is close to Huizinga and Sutton-Smith's notions of play (Table 2.2). The classification makes an important distinction between two kinds of rules, and four forms of activities in culture. The *paida* element concerns the free play of a game, based on its intrinsic values for the players. The *ludus* element pays more attention to institutionalized rules and conventions imposed on the players. The paida-ludus dimension refers to ways of playing. Caillois considered both game qualities to be the extremes of a continuum.

Many games are a mixture of the paida and ludus elements. The four cultural activities – categories of play: *agôn, alea, mimicry,* and *ilinx* vary with respect to locus of control of the players. With agôn and mimicry, the players can control events. With alea and ilinx, when entering the game, they leave control to the circumstances. Caillois speaks of four categories of play – *competition, chance, simulation*, and *vertigo* – and in addition calls them basic attitudes governing play. He mentioned that they are not always encountered in isolation. In many games the various attitudes of play become associated. He presented six possible pairs:

- Competition & chance (agôn – alea)
- Competition & simulation (agôn – mimicry)
- Competition & vertigo (agôn – ilinx)
- Chance & simulation (alea – mimicry)
- Chance & vertigo (alea – ilinx)
- Simulation & vertigo (mimicry – ilinx).

Based on this scheme, Caillois (op. cit.) distinguished forbidden, contingent, and fundamental relationships between these four attitudes of play. Vertigo and agôn are incompatible. The conditions for ilinx destroy the conditions for agôn: respect for rules, self-control, efforts to win, testing oneself under conditions of equality. In a similar vain, simulation and chance are mutually exclusive.

*Table 2.2. Classification of games adapted from Caillois (2001)*

| | AGON<br>*Competition*<br><br>Equal probability of success | MIMICRY<br>*Imitation*<br><br>Players pretending to be someone else | ALEA<br>*Chance*<br><br>Players cannot exert control over outcomes | ILINX<br>*Vertigo*<br><br>Attempts to disrupt regular perception patterns |
|---|---|---|---|---|
| PAIDA<br>(Free-form, improvisation)<br>⇓<br><br>⇑ | Racing, athletics<br>Playing jazz | Children's imitations, masking & pretending to be someone else | Counting out rhymes, heads and tails | Acrobatics, horseback riding, merry go round |
| LUDUS<br>(Rule-driven, conventions) | Soccer, chess, sports tournament | Theater | Lottery, roulette | Mountain climbing, tightrope walking |

Regarding contingent relationships, chance and vertigo, as well as, competition and imitation can be associated without harm. A fundamental relationship exists between *agôn* and *alea*. They are symmetrical to each other, and complement one another. A multitude of games exist that combine the two attitudes in varying degrees. Card games, golf, poker, soccer, etc., are not purely games of chance. They also require skills, self-control, testing oneself under conditions of equality, and prior submission to the decision of a referee. Many board games are a combination of skill and chance. *Agôn* and *alea* are regulated through the rules of the game. Without rules there would be no competition. *Mimicry* and *ilinx* form another kind of fundamental relationship. Both presume a world without rules and regulations. Caillois said:

> The combination of *alea* and *agôn* is a free act of will, stemming from the satisfaction felt in overcoming an arbitrarily conceived and voluntarily accepted obstacle. The alliance of *mimicry* and *ilinx* leads to an inexorable, total frenzy, which in its most obvious forms appears to be the opposite of play, an indescribable metamorphosis in the conditions of existence. The fit so provoked, being uninhibited, seems to remove the player as far from the authority, values, and influence of the real world, as the real world seems to influence the formal, protected, regulated, and protected activities that characterize the wholly inhibited games subsumed under the rules of *agôn* and *alea*. The association of simulation and vertigo is so powerful and so inseparable that it is naturally part of the sphere of the sacred, perhaps providing one of the principal bases for the terror and fascination of the sacred. (pp. 75-76)

Although tripartite combinations occur, Caillois considered them rare juxtapositions that do not influence the character of the games involved. For example, a horse race is typical *agôn* for the jockeys, at the same time a spectacle that stimulates *mimicry* among the spectators, and a pretext for betting on the winner – a game of chance: *alea*. Caillois' interpretation of term simulation (mimicry), although related, is not equal to the meaning of simulation presented in chapter 4.

*Ellington, Addinall, and Percival*

Ellington, Addinall, and Percival (1982) developed a classification, using different game formats (Table 2.3).

*Table 2.3. Classification of games according to format (adapted from Ellington et al., 1982)*

| Non-electronic games | | Electronic games |
|---|---|---|
| Psychomotor skill games | Intellectual skill games | Games of chance |
| Field games (outdoor athletics)<br>Table games (snooker, pool) | Simple manual games<br>Card games<br>Board games<br>Device-based games | Video games<br>Computer games |

They distinguished pure games, pure simulations, pure case studies, and their overlaps: simulation games, games used as case studies, simulated case studies, and simulation games used as case studies. Pure games, according to their point of view, contain all exercises that include competition and rules. Pure simulations contain all exercises that represent a dynamic representation of real situations. Pure case studies are non-interactive, in-depth studies and illustrations of special or

general features, concerning the history of cases that happened in health care, legal procedures, companies, etc. Their definition of pure games emphasizes the agôn/ludus combination from Caillois' classification.

*Shubik*

Shubik (1983) focused on the use of games, contrasting rigid-rule and free-form games. He distinguished for practical reasons five kinds of use (Table 2.4). He made a distinction between *gaming, simulation*, and *game theory*. He referred to gaming as being people oriented, and having close connections with the behavioral sciences. For him simulation was more linked to computers, and becoming increasingly intertwined with econometric modeling. He connected game theory to mathematical methods in the study of decision systems – sequential, and iterative decision-making – related to a study of conflict and cooperation. Apparently, for him the paida/ludus continuum was important in connection with the various kinds of use. In his review, he paid no attention to the broader cultural context of play, and considering the context of his publication, emphasized the academic and professional use of games. Interestingly, he recognized the research potential of games, *research gaming* as he called it, as a growing and important field of use. He referred to managerial issues, and experimenting in social, experimental psychology, and experimental economics. Nowadays, experimental economics is strongly related to agent-based modeling. It combines both theory generation and validation.

*Table 2.4. Taxonomy of games (adapted from Shubik, 1983)*

| | From ➔ Rigid-rule games: | | To Free-form games |
|---|---|---|---|
| Use | Manual games | Computer-based games | |
| Training | | | |
| Teaching | | | |
| Operational:<br>• Policy formation<br>• Dress rehearsals<br>• Sensitivity analysis | | | |
| Research<br>• Theory generation<br>• Theory validation | | | |
| Futures Studies<br>• Structured brain storming<br>• Policy exercises | | | |

Since the 1960s games and simulations have been used as future studies to develop and experiment with future scenarios on large-scale social issues such as global and regional economic development, global climate change, regional, national, and local environmental pollution, health care, etc. During several of these studies, the gaming approach, embedding behavioral aspects, became integrated with simulation, including technological-economic-ecosystems aspects, in one integrated framework. I will discuss such studies in more detail in Part III.

These three examples, in combination with Huizinga and Sutton-Smith's classes of play, illustrate a common academic understanding of play and game during the 20th century. Since the rapid advent of digital games for entertainment since the 1980s, that picture needs some adjustments for at least two reasons. The development of digital games for entertainment until recently was not driven by scientific curiosity, but by conquering a highly profitable market. Moreover, those who developed a keen academic interest in those games came from disciplines that previously had not shown much interest in gaming. These newcomers from the humanities, linguistics, media studies, and computer science, were, and to a large extent still are, not aware of the gaming tradition that had emerged since the 1950s. They not only have started to re-invent the wheel, increasingly they have started to develop their own branch of academic gaming, introducing new concepts and terminology. I will pay attention to this new gaming culture by discussing the following two characteristic approaches to classifying computer games.

*Rollings & Adams*

Rollings & Adams (2003) have distinguished genres in interactive entertainment (Table 2.5).

*Table 2.5. Genres in Interactive entertainment*
*(adapted from Rollings and Adams, 2003)*

| **Genres in Interactive entertainment** | |
|---|---|
| Action games | Physical challenges, puzzles, races; |
| Strategy games | Strategic, tactical, & logistical challenges; |
| Role playing games | Tactical, logistical and exploration challenges; |
| Real world simulations | Physical and tactical challenges (sports games & vehicle simulations) |
| Constrctn&Mngmnt games | Economic and conceptual challenges; |
| Adventure games | Exploration, puzzle solving, conceptual challenges; |
| Puzzle games | Logical challenges; |

A *genre* is a figure of speech, in this case, about a play form, which people consider to have the same style or subject. It refers to key elements that games have in common: rules, roles, challenges, etc. The types of games, and the related challenges are not mutually exclusive. They overlap. As common elements, and styles of play make the distinctions, a genre is more related to the practice of play, and to a certain play culture, and less to a conceptual class such as applied in

Tables 2.2, 2.3, and 2.4. They allow games to cross genres, by combining elements of play. Their approach to classifying digital games is more fluid than the classifications mentioned above.

*Aarseth*

Aarseth (1997) has taken a more rigorous approach to classifying computer games. Relating games to text, his focus is on textuality, on story telling, or interactive narrative. Games are viewed as communication devices, generating text. His style of reasoning is related to concepts from ergodic theory.

Ornstein (1989) pointed out that ergodic theory resulted from an attempt to understand the long-term statistical behavior of dynamical systems such as the motions of a billiard ball, or the motions of the earth's atmosphere. The theory aims at abstracting out the statistical properties of dynamical systems. Two systems are considered the same (isomorphic) when viewed as an abstract system or object, if, after ignoring sets or event with probability zero, there is a one-to-one correspondence between the points in their phase spaces. Corresponding sets have the same probability and evolve in the same way. Abstract dynamical systems arise in many different contexts. Brown and Nilsson (1962) stated that in an ergodic random process, time wise sampling leads to the same statistical results as ensemble sampling. Ensembles are time series data collected from experiments. Suppose, we would sample any one member of the ensemble at a large number of points in time, then the data obtained should have the same statistical distribution as would be obtained if each member of the ensemble were sampled once at any particular time, for example t=1. Aarseth (1997) applied these notions to games, viewing them as abstract objects that generate text: strings of signs. He pointed out that text is an object with as a primary function to send out verbal information. Therefore, a text does not operate independently from a material medium, and is not equal to information – a string of signs transmitted to an observer. Aarseth viewed information as a string of signs, which may make sense to an observer. To make that distinction clear, he introduced the following terms: *scriptons*, *textons*, and the *traversal function*. Scriptons are strings of signs as they appear to the reader. Textons are strings of signs, as they exist in the text. The traversal function is the mechanism by which scriptons are revealed or generated from textons and presented to the user of the text. Based on this terminology, he introduced a typology enabling the description of any text (read: game) according to their model of traversal. Seven variables constitute that typology (Aarseth, 1997, pp. 62-64):

- *Dynamics*: changing contents of scriptons, or the number (and content) of textons.
    - Scripton: strings of signs as they appear to the reader;
    - Texton: strings of signs as they exist in the text;
    - Traversal function: the mechanism by which scriptons are revealed or generated from textons and presented to the user of the text.

  If scriptons are constant, then the text is static.

- *Determinability*: A text is determinate if the adjacent scriptons of every scripton are always the same. If not, then the text is indeterminate.
- *Transiency*: Text is transient if it passes (scrolls over the screen) and the user does not need to do anything to the passing of scriptons. If the user scrolls text – self-pacing – then the text is intransient.
- *Perspective*: If the text requires the user to play a strategic role, as a character in the world described by the text, then the perspective of the text is personal (see interactive narratives in MUDs); if not, then it is impersonal.
- *Access*: If all scriptons of the text are readily available to the user at all times, then the text is random accessible. If not, then access is controlled.
- *Linking*: A text may be organized by explicit links for the user to follow. Links may be conditional, or no links may exist.
- *User functions*: The user may perform the following functions:
    - Explorative function – choice of path to take;
    - Configurative function – scriptons are chosen or created by the user;
    - Interpretive function;
    - Textonic function; the user can add textons and traversal.

These seven variables with their various possible values create a multidimensional space of 576 unique media positions. For example, the game MULTI-USER DUNGEONS (MUD1) will produce the following profile: static, indeterminable, transient, permanent, controlled, conditional, and explorative (Aarseth, 1997). Based on this typology, digital games – as text objects – can be classified with unique profiles.

A precondition for this approach is that all text, and its *scriptons*, *textons*, and the *traversal function* are predefined otherwise the game-artifact cannot be identified. Therefore, this typology will only be of use for digital games. I consider it too limited to characterize for example MMORPGs (massively multi-player online role-playing games)

Aarseth's approach demonstrates the elegance and strength of a theoretically underpinning of a classification. It focuses on computer games as narratives, and deals with computer semiotics. The resulting demarcation line excludes many games from the classification.

Next, I will present a classification that includes key characteristics of games from the perspective of the setting that players step into: competition or cooperation.

*Klabbers*

Game theory has provided the following key concepts on gaming: competitive and cooperative games, and zero-sum and non-zero-sum games. Systems theory, and computer science have introduced concepts such as, goal-, and non-goal-seeking, common- and distributed access. Combining these terms in a coherent scheme brings forward the following functional classification (Table 2.6). The classification does not make distinctions along the paida/ludus dimension (Table 2.2). The contest may be between teams of players, competing against each other, or among

teams of players, engaging in common activity, while fighting the odds. They may or may not have common access to rules and resources, the loss of one player may be the gain of the other one. They may seek to achieve a common goal, or they just like to meet each other in cyberspace, just for the fun of it. Although one may question whether with respect to MMORPGs (massively multi-player online role-playing games) a stop rule applies, finite games obey the "rule of nature": there is a beginning and an end. Goal seeking, cooperative games require an attitude of play, which is distinct from zero-sum competitive games. These differences impact on the way the players will communicate and interact with one another.

*Table 2.6. Functional classification of games*

| **Finite Games –** stop rule | | | |
|---|---|---|---|
| **Competitive Games** | | **Cooperative Games** | |
| Common access Games | Distributed access Games | Common access Games | Distributed access Games |
| **Zero-sum games**; *Chess Tennis, Monopoly*<br><br>**Non-zero-sum games**; *Poker Hide-and-seek* | **Zero-sum games**; *Bridge Simsoc**<br><br>**Non-zero-sum games**; *Business simulations Clug* Funo** | **Goal seeking**; *Rock-climbing charades*<br><br>**Non-goal seeking**; *frame narratives* | **Goal seeking**; *Bafa-bafa* Beer game* Dentist* Hexagon* Funo* Perform**<br><br>**Non-goal seeking**; Mmorpg** |

Note *: BAFA-BAFA (1973); BEER GAME (1966); CLUG (1966); DENTIST (chapter 8); FUNO (chapter 11); HEXAGON (1976); PERFORM (chapter 9); SIMSOC (1978). Note ** Mmorpg (massively multi-player online role-playing games)

## ARCHITECTURE OF GAMES AND SIMULATIONS

All classifications presented above convey a perspective on games and simulations, which denotes their internal structure, their *architecture* so to say, without describing it in detail. An additional and more serious objection against these classifications is the concept of game as external to the actors, the players. This is strange, as they are *artifacts*: human constructions, developed with clear intentions in mind that only receive their meaning while being played. Their architecture preconditions the dynamics of play, and include forms of knowledge that can make knowledge content meaningful while playing. Therefore, classifications of the kinds discussed above, are flawed. They miss the core idea that brings forward such a variety of appearances and functions: their *morphology*

with *actors included*. Aarseth (1997) referred implicitly to the internal structure of games-as-text. I consider this too limited a view on games for the following reason. Huizinga (1985) has discussed the play element of culture, arguing that play is a culture shaping human activity. Acknowledging that basic role implies that the morphology of games should receive more attention. The study of form and structure of these artifacts should be at the basis of their classifications, generating classes and specimen with distinct qualities. The morphology of games and simulations should provide the foundations for developing a coherent taxonomy.
Studying the architecture of games covers three aspects:

- Art and science of design of the artifacts;
- Style and layout of particular artifacts;
- Structure, design, and assessment of an artifact.

In this chapter, I will focus on the second aspect: style and layout of particular artifacts. In Part II, I will address the other two aspects in more detail.

Strongly related to the play element of culture is the notion that games – as forms of play – are expressions of human and social systems that generate culture. If play is valued for itself, it can only intrinsically be valued, if it creates a human and social system that temporarily is a world of its own. What will happen within the magic circle is both real and imagined. To be able to interconnect both worlds, we need a suitable core concept. My thesis for the study of the architecture of games is the following: *games are social systems, as well as models of social systems*. This notion implies that for the study of games and simulations, we need to be aware of, and accept a *dual position*. We should study games both from the position of the insiders, who play the game, and of the outsiders, who observe the game being played, and comment on it. As a consequence, we will have to acknowledge two linked but separate knowledge domains. In chapter 3, and Part II, I will elaborate further the implications of this thesis.

## GAMES ARE SOCIAL SYSTEMS

For a proper approach to game science, it is worthwhile to understand games as human organizations. Therefore, I will start with wrapping up key notions of social systems. Subsequently, I will use that frame-of-reference for elaborating the architecture of games.

### *Social systems*

While playing games, adults and children give shape to human organizations. When considering the variety of games, an equal variety of organizational forms can be observed. For that reason organization theory offers a fruitful frame-of-reference for reflecting on gaming. The way people organize themselves in various social settings tells much about their culture, and their codes of conduct. Because of the variety of forms of organization, the generic term *social system* captures their common features. Nations, companies, institutions, collective networks, and groups are examples of social systems. All show particular structural characteristics. In organization theory, structure is viewed as the arrangement of parts, components or subsystems of the entire organization. Weick (1979) has pointed out that the

structure that determines how an organization acts and how it appears, is the same structure established by regular patterns of interlocked behavior. Reproduction of such a structure is the outcome of collective behavior: the system of interaction. Giddens (1993) speaks of duality of structure.

> Interaction is constituted by and in the conduct of subjects; structuration, as the reproduction of practices, refers abstractly to the dynamic process whereby structures come into being. Social structure is both constituted *by* human agency and is at the same time the *medium* of this constitution. (Giddens, 1993, p. 128)

The study of social systems deals with the various kinds of human organization, from the societal level down to small groups, and individuals in social settings. Organization science, organizational psychology and sociology, management science, political science, and systems science contribute to this vast area of research. I will highlight two features of social systems, drawn from the above-mentioned disciplines that are of relevance for linking social systems with games. Social systems:

- Are boundary maintaining entities;
- Consist of three interlocked strata (levels of description) (Figure 2.1):
    - *Culture* that is, norms, values, beliefs, attitudes, etc. of the actors involved;
    - *Structure* that is, vertical and horizontal communication and coordination;
    - *Technology* that is, the whole complex of routine and non-routine procedures to handle material processes (Klabbers, 1986).

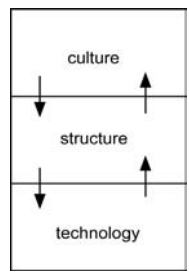


*Figure 2.1. Representation of strata of social systems*

Members of a social system draw hypothetical lines to enable them to distinguish between ‘us’ and ‘them’. That hypothetical line frames the interface with its environment. Every social system – through converting and harnessing matter and energy – has a material basis. The resulting physical infrastructure – the arrangement of material objects in the space that the social system occupies – generates products, artifacts, and services. All the related processes are part of the technology stratum in the broad meaning of the word. Steering, or governing that stratum requires appropriate communication and coordination procedures. The

resulting structure drives the flow of data and information between the actors. In current industrial societies, Information technology (the Internet, mobile phones, etc.) enables that flow in time and space. Structural conditions enhance or limit the interactions between actors. The system of interactions between the actors produces a social organization with its values, norms, beliefs, symbols and rituals: its particular culture. Motivational conditions – being part of a culture – stimulate or inhibit the actor's interests in communication, and in exercising or accepting control over their actions. That control structure, which is embedded in the communication rules, also impacts on the control over the processes of the technology stratum: the material resources. The communication and coordination structure interlock with the material processes. Through the structure of a social system, special activities and tasks are integrated and coordinated. The dialogic forces of *differentiation* and *integration* of tasks produce a hierarchy of regulation and control in the social system. Contrary to the general notion in organization science, the concept of structure in social systems should not be seen as fixed or external to social action. Giddens (1993) made an interesting point, which implicitly links the morphology of social systems with games. He introduced the notion of *duality of structure*: structure being a constraint upon action, as well as enabling action. He pointed out that actors routinely draw upon rules and resources, and thereby reproduce them in the course of their daily activities. He quoted Mouzelis for saying:

> Actors often distance themselves from rules and resources, in order to question them, or in order to build theories about them, or – even more importantly – in order to devise strategies, for either their maintenance or their transformation. (Mouzelis, 1991, pp. 27-28)

By speaking of actors, rules, and resources, and linking them with the duality of structure, Giddens presented not only a particular meaning to the culture, structure, and technology strata, introduced above, in addition, he offered a framework for isomorphic mapping human organization on gaming. By doing so, he opened the realm of social theory to gaming theory. I will illustrate the meaning of these abstract concepts by the following example.

A family is a social system. The parents and kids shape a certain familiy culture with its particular beliefs, attitudes, norms and values. Those norms, values, etc. do not need to be exactly the same for both parents and the children. Usually, family members disagree about norms and attitudes, especially when the children are teenagers. So, the family exercises a mixed set of individual and collective qualities. The parents and kids communicate: they co-construct and sustain a system of interactions, based on the way they relate to one another, the specific context in which they interact, and the content of their conversations. That system of interactions and the related communication rules define the structure of the family: the vertical and horizontal communication. Parents tune tasks among each other, coordinate the tasks of the children and follow through whether they are carried out as agreed. These tasks may relate to homework from school, cleaning the rooms, cleaning the dishes, doing groceries, and so on. A family earns income for living in a house, uses water, electricity, and gas, and appliancies such as the refrigerator, the TV, etc. These are the basic resources for maintaining the family's household. Teenagers usually start distancing themselves from the parental

authority, and the rules of conduct, in order to question them, or in order to build "theories" about them, or – even more importantly – in order to devise strategies, for either their maintenance or their transformation. Parents usually disagree with their teenagers, and together they engage in an ongoing conversation about norms and values, and ways of communicating/interacting with each other. They continuously produce and reproduce their family, living in this city, in this country or state, and in this part of the globe: an extending horizon of social and physical environments.

*Steering social systems & games*

Connected to the concept of control is the notion of steering, and the position from which it happens. Steering is *allopoietic* if it happens by an outside actor, or agency. It is *autopoietic* if the internal actors are in control. As regards allopoietic steering, the behavior of the system is controlled by the function it fulfills in the larger social system and by the input it receives from its environment. The system involved is viewed as an instrument, produced and used by another external system to reach its goals (Maturana & Varela, 1980). This distinction also applies to games. They may be used as instruments to achieve a goal defined on a game and its actors. In such case, the game is functional to an outside purpose. Its use is allopoietic. If games are used solely for training skills, and the outcomes are graded accordingly, then they are allopoietic. In general, those games are rule-driven. If playing a game is valued for itself, and the actors are free to shape their own rules of play (a free-form game), then these actors also shape the goals of play. Such games are autopoietic. They are not structured by external information they receive, but by their internal system of interactions. Therefore, the (meta-) cognitive structures used by the system (game) are constructed (produced) by the system (game) itself. Maturana and Varela (op. cit.) rejected the concept of knowledge as a representation or image of some external reality. Cognitive interaction between the system and its environment is restricted to triggering internal processes by external perturbations (Heylighen, 1990). Thus, a social system is not reactive to its environment. It first enacts (constructs) that environment, and subsequently acts on that image. Evidently in social systems – as in games – the actors enact these internal processes, while producing a system of interactions: their social organization. They form the autopoietic (self-reproducing, self-organizing) forces within the system.

These core ideas about social systems apply to all kinds of human organization, and by definition, they also apply to games. It is out of the scope of this chapter to discuss social systems theory in more detail. In chapter 4 I will discuss this gaming theory.

## BUILDING BLOCKS OF GAMES

*Social systems approach*

Social systems as well as games consist of three interconnected building blocks: actors, rules, and resources (Figure 2.2), which are similar to the strata described in Figure 2.1.

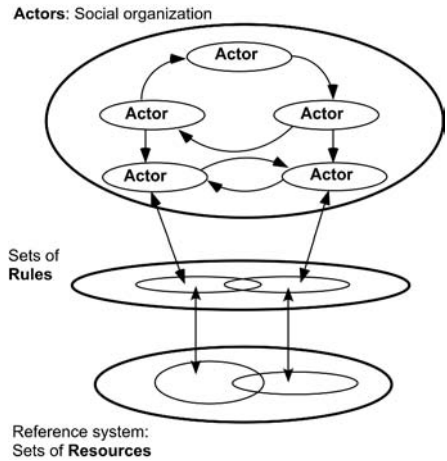


*Figure 2.2. A generic model of games and simulations*

Actors constitute systems of interactions: a social organization. They draw upon rules and resources while functioning in organizations. In a soccer game for example, the players, the coaches and the referees are the main actors. They interact according to the rules. Their resources are the ball, the soccer field, the stadium, the annual budget, and so on. While confirming their roles, and making use of the rules and resources, they produce and reproduce the social system concerned (that is, a particular match, and the annual competition in the league). By changing the rules and/or the resources, they either transform the system or produce a completely new one. They may attract new players, or switch from soccer to rugby. Because of the duality of structure, they can also change position, from inside participant (actor) to outside observer. In that case, they can question the motives and effectiveness of the actors, the rules as applied by the referee, and the quality of the resources: the right of wrong ball, proper lighting in the stadium, the right player for the right position, and so on. That could help to develop strategies for the maintenance or transformation of the social system that is, the soccer game, the team, and the competition.

From a morphological viewpoint, Figure 2.2 represents the basic architecture of games and simulations. It is the starting point of any game, running from one actor to multiple actor configurations. In each game, the players (actors) interact with

one another, while applying rules, and utilizing resources. In a one actor setting, such as in many digital games, the player – through the avatar – enters a virtual world, which represents a particular social system with its rules and resources. The rules and resources may be the same for every actor, they may overlap, or they may be even distinct from one another. Actors may also violate those rules.

*Classification of games & simulations*

The generic model of Figure 2.2 enables us to make a clear distinction between games and simulations with respect to the form of the artifact. In the literature the terms *games*, *simulations*, *gaming simulations*, and *simulation games* are often used interchangeably, not taking the precaution to be accurate about their meaning. In the areas of gaming, addressed in Table 2.1 this mixture of terms is used for pragmatic reasons, blurring the distinction between form and function. Games, as artifacts of a certain form, can be used to simulate certain social systems. This way of phrasing implies that the function of simulating refers to rules of correspondence between the artifact and a real life reference system. However, as pointed out earlier, simulation can also refer to a model of some particular form. In this case, form and function overlap. In this book, when using the terms *game* and *simulation*, it will mean artifacts of a certain form. Connected to this, when I describe games to simulate a certain social system, I will be explicit about that role, and about the function of the game that is, to simulate a system and a process. When I further use the term *game*, I will refer to its form. Therefore, I will not use terms such as *simulation game*, and *gaming simulation* as they mix up the terminology. They mix form and function.

Figure 2.2 represents a fully-fledged representation of a game, with all the ingredients of a game: actors, rules, and resources. Many forms of play exist that do not define explicitly the resources. They represent a subset of the building blocks of Figure 2.2. Examples are role-playing games, frame games, and certain types of scenario games. Such forms of play are depicted in Figure 2.3.

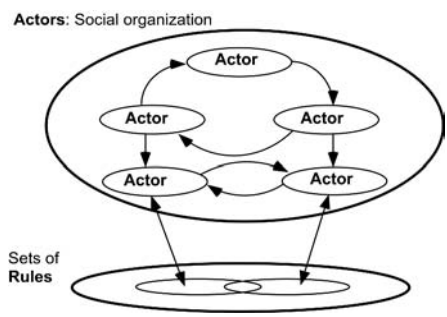


*Figure 2.3. Representation of role-playing games*

If the actors are excluded from the game model, leaving two interconnected ingredients for modeling the social system: rules and resources, then the artifact will represent a dynamic feedback model, see Figure 2.4. Decision rules, embedded in feedback loops, such as applied in System Dynamics, define the processing of resources. These decision rules can also be defined as formal algorithms, which then become conceptualized as *agents*: rule-driven sequences of events. The generic scheme of Figure 2.4 represents the field of *computer simulation*, *agent-based simulation* included. (For more details, see chapter 5.)

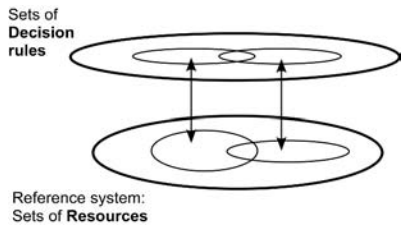


*Figure 2.4. Representation of feedback systems, and agent-based models*

A third option for modeling social systems, is to only address the resources of social systems that is the input-throughput, and output of matter, energy, and information as for example in supply-chains: energy supply and demand, and information systems. Such input-output models may be driven by a transfer function, which links time series of inputs to time series of outputs, ignoring the internal structure or throughput of the system (black box), or they may depict the internal structure, see Figure 2.5.

Dynamic models, illustrated by Figure 2.5, represent the domain of simulations, both in form and function. Therefore, I consider simulation models to be a subset of the more encompassing game model of Figure 2.2. It is out of the scope of this chapter to discuss simulation modeling. For more details, see chapter 5.

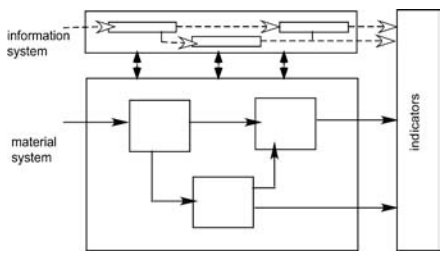


*Figure 2.5. Representation of resources modeling*

CHAPTER 2

# ABOUT RULES

Rules are associated with regularity, the common order of things, instructions, prescriptions, orders, directions, measures (of length), customs, influences, procedures, codes of conduct, government, and law.

The following distinctions between rules are relevant for gaming.

- *Regulative rules* – instructions often written down.
- *Functional* and *substantive* (fundamental) rules. Functional rules serve a pragmatic purpose, while substantive rules have an existence, independent of circumstances such as, a Constitution.

Rules are:

- Official instructions, which tell people what they are allowed to do and what they are not allowed to do in game, or in a particular place or situation, or during pomp & circumstances.
- Courses of action to do something properly or to achieve a particular goal;
- Statements, or assertions that describe the way things happen in a system. Such rules are often considered behavior rules, or laws of nature in terms of correlations, if-then, or deterministic, stochastic, or fuzzy causal inference schemes;
- Ways of behaving or taking part in something that is right and acceptable (rules of conduct);

To rule is equivalent with:

- To have the power to control affairs, and to use that power (autocratic, democratic rule);
- To govern a country; to regulate conditions of a state by rule of law;
- To have the power of control or the system of control over a group of people, even if they are not required by any rules or laws;
- The most powerful and influential feature of a particular situation;
- To have an idea or feeling that controls or strongly influences thinking or doing;
- To make official decisions;
- To control an activity or process, usually by means of rules of law.

Rules are synonym to *codes* that is,

- A set of ideas by a group of people about the proper way to behave;
- A set of written rules which state how people should behave in a particular country, society, or business;
- Any system of signs or symbols that has a meaning for example, language, gestures, or social behavior.

Rules are linked to, or embedded in steering and control.

Wrapping up these interpretations, it is important to distinguish between rules as *prescriptions* – normative rules – and rules as *descriptions* of processes, which result from the execution of normative rules. The idea is that normative rules bring

forward regularities, or order. The rule “No Trespassing” could mean: trespassing not allowed, or trespassing does not occur. So, to understand the meaning of a rule, it should be put into context. Rules may differ in their measure of detail, and in their reach (Klabbers & van der Waals, 1989). The more detailed they are, the more they exclude. As regards the domain of a rule, it is important to know which activities are allowed or prohibited by a particular rule. The smaller the domain and the more detailed a rule, the more rigidity it causes in the social system. This combination of detail and domain may cause a dilemma. It may be that detailed rules may be only applicable to a very limited domain. In such a situation, detailed rules call for many rules to control the system. The game designer will have to decide how important it is to write down detailed rules. Compare for example the following instructions:

*“Bake an apple pie for George”; and*
*“Cook a dinner for fifteen people.”*

The first instruction is more detailed than the second one. It leaves at best some freedom for choosing among various recipes for apple pie. There are far more alternatives open for cooking a dinner. One should be aware that the sheer existence of a rule-base does not necessarily imply that the anticipated activities and processes actually will take place. A rule taking effect, presupposes both acceptance by the people involved, and the capacity to execute and uphold it. Acceptance can have various grounds such as, coercion, morals, self-interest, etc. The capacity to apply a rule depends on its phrasing. If it is equivocal, then people tend to partly play *by*, and partly play *with* the rules. This ambivalence becomes even trickier when multiple rules apply that are inconsistent or in conflict with each other that is, they are mutually exclusive. Those considerations are important for the game designer and facilitator to be aware of. It influences the transparency and playfulness of a game. Inconsistent and conflicting rules may be designed into a game in order to question for example ethical issues among actors.

This diversity of terms associated with the rules of the game, provides a continuum running from *rigid-rule* to *free-form games*. In rigid-rule games, the rules are detailed, and refer to a well-defined domain of application. Free-form games include a few basic rules, such as the start and stop rules, the use of space and equipment, the authority of the game facilitator to intervene for example to insert time-outs, intermediate debriefings, and so on. Rigid-rule games are usually operational games. They are triggered at the beginning with the instruction (Christopher & Smith, 1987): This is the problem. How will you solve it? Free-form games start with: This is the situation, how will you deal with it? The dynamics of a rigid-rule game aim at convergence of ideas and actions. A free-form game may lead to convergence, or divergence of ideas, and accepting a multiple reality about the issue at stake. Facilitating and debriefing a rigid-rule game is easier than facilitating and debriefing a free-form game. The last one requires the higher competency to deal with a more fuzzy and volatile process that tends to duck out of the facilitator’s control. The players are in control of the process, and they self-organize their social system to meet their needs and interests. The choice between using rigid-rule or free-form games depends on purpose, context of use, and the target audience.

It is important to know that a certain class of rules will directly impact on the system's resources. They are the rules that is, statements, or assertions that describe the way things happen in a system. Such rules are often considered behavior rules, or laws of nature in terms of correlations, if-then, or deterministic, stochastic, or fuzzy causal inference schemes. They express our understanding of the world: the reference system, and the way we have arranged the order of things. Descriptive rules either result from the execution of normative rules, or are expressed in terms of cause-effects between variables, or events, or in terms of if-then rules applied to activities. As a rule of thumb, normative (prescriptive) rules are included in the rule-base of the game, and descriptive rules are embedded in the processes that model the resources, see Figure 2.2. Understood in this way, normative rules belong to the manipulation set of the game designer and facilitator.

## MORPHOLOGY OF GAMES

The social systems approach to gaming offers a complete and coherent model by combining institutional and behavioral aspects about the game situation in relation to reference system. The institutional aspects include the physical, environmental, and the socio-economic infrastructure that structurally condition the activities of individuals and groups of individuals. The behavioral aspects concern the capabilities and related actions and efforts of the players. In Part II, I will discuss these qualities in more detail.

From the designer and facilitator's viewpoint, it is worthwhile to note that games convey a message that is to be learned and understood while playing. In chapter 3 I will elaborate how to conduct gaming sessions to make that message clear to the participants, and to guarantee that the lessons learned make a lasting impression. When entering the magic circle, the players enter a symbolic world, with its peculiar signs, references, conventions, and media of representation, rituals, and practices. Each game represents a local language to convey the embedded message. For that reason, I will combine the frames-of-reference of social systems and a semiotic theory of gaming.

### *Social systems & linguistic approach*

Marshev and Popov's semiotic theory of gaming (Marshev & Popov, 1983) is fruitful for two reasons. It offers a general outline for understanding the basic elements of gaming, and it presents games as languages that is, vehicles for communication.

Each game is a language with its particular *syntax*, *semantics*, and *pragmatics*. Combined with the generic structure of games: actors, rules, and resources, the linguistic approach provides the following gaming framework (Tables 2.7, 2.8, 2.9, and 2.10). As a language it conveys and produces meaning and context dependent situated knowledge. From a pragmatic viewpoint, the purpose of a game can be autotelic or allotelic. It is autotelic if the players have the freedom to act according to own goals and sources of motivation. They are free from dependence on authority and be allowed to reason for themselves (Moore & Anderson, 1975). A game is allotelic if the players act according to pre-determined goals and sources of motivation, often embedded in the rules. A game is allotelic if it serves an outside

purpose. The game itself and the efforts of the players represent means to some end. The players are recipients of information that they will handle according to the rules of play. They depend on the authority of the game facilitator and are forced to reason according to the knowledge provided by the game. Most operational games that are used for skill training are allopoietic. They are training tools.

Combining the social systems and linguistic approaches to gaming brings forward a generic framework for defining the morphology of games and simulations in great detail. It includes the actors, and allows for making fingerprints of any game.

*Table 2.7. Syntax of a game*

| **Syntax**<br>The syntax defines the grammatical arrangement of a game: the formal system. | |
|---|---|
| **Actors**<br>Number of actors: individual and aggregate actors (teams). The number of game places of actors. In case of digital games, the *avatars* that connect the actors to the virtual world. | Participants of the social system. The number of persons participating in the game. Actors are capable of carrying out activities. They can be individuals or groups (teams): aggregate actors<br><br>The dynamic coupling of actors and avatars in digital games. |
| **Rules**<br>Game manipulation set<br><br><br><br>Evaluation function | This subset of rules defines the manipulations allowed, communication rules, and the possible moves with the pieces, as transitions of the positions over time, and possibly – in case of digital games – an algorithm for the right moves.<br><br>Rules describe the initial game positions. Dependent on the type of game, they may also define the intermediate and final positions, including the rules for finishing the game. |
| **Resources**<br><br>*Game space*<br>Set of game positions<br>Set of pieces to play with | The set of places for resource allocation. The arrangement of the set of pieces (positions in the frame) at a certain moment in time defines their position in the scheme or *state space* of the game. The set of all theoretically available state spaces define the game space.<br>The game space symbolizes a real or imaginary reference system: the physical environment & the infrastructure.<br>*The way the pieces interrelate is defined by the rules. The pieces are arranged in the game space via the initial setting, and change during the process of playing.* The set of places defines the game space: the evolving states with the state space. |

Taking into account the game resources, and to give an idea of the meaning of the game space, consider for example the board game AWARI. It consists of two rows of six boxes, and at the opposite ends two boxes for collecting the chips won. Providing the initial condition: four beans in each box, these beans are divided over the boxes, following the rules. The AWARI game space is in the order of magnitude of 900 billion positions (NRC, 2002). For games such as CHESS and GO the game space is still incalculable. These positions are discrete. If a dynamic, non-linear mathematical model is used to represent the resources, such as in a System Dynamics model, then the state space of that model defines the game space.

*Table 2.8. Semantics of a game*

| **Semantics**<br>The way a game corresponds with our understanding, with our conceptual frames that is, their general interpretation is called the semantics. | |
|---|---|
| **Actors**<br>Roles of participants;<br>The symbolic representation of the system of interactions: the meaning of the social organization. | The *role* is a key term in the semantics of a game. It provides a context for interpreting the position of the actor in the game. It offers a lens and a perspective for interpreting and acting. The role structure gives shape to the theoretical (formal) structure of the system of interactions. Actors assume those roles and express them according to formal and informal rules. Actors may take multiple roles. They have available pieces (resources) in the game space. They can make a sequence of moves with these pieces while trying to achieve their goals. They have access to various sorts of information during the game. |
| **Rules**<br><br>Valuation set | Relationships between roles.<br>The relationships between the roles shows the communication and coordination structure.<br>Conventions, regulations, procedures, and codes of conduct, rituals: evaluation of social situations.<br>Who is allowed to interact with whom, and when?<br>Assertions about cause-effect relationships. |
| **Resources** | The placement of pieces at one moment in time is understood as a particular state of the social system, expressing the socio-economic and cultural situation.<br>The symbolic meaning of the pieces in the game space, referring to their real life meaning.<br>Places for resource allocation. During the game pieces are allocated in the game space. This allocation, from its initial position onwards, defined by the rules, is for the actors to decide. Initial and intermediate positions are evaluated to make subsequent moves.<br>Meaning of the initial, intermediate and final positions for each actor. |

*Table 2.9. Pragmatics of a game*

| **Pragmatics**<br>Designing, preparing, conducting and assessing a game session comprise the pragmatics of a game. It includes the macro-, and micro-cycle of a game (see chapter 3). During the preparations, the game facilitators allocate the actors to their roles. The materials for the game, the facilities and equipment are prepared. Conducting a game starts with the instructions to the players (briefing) and proceeds by facilitating, debriefing and assessing the game. | |
|---|---|
| **Actors**<br><br>Learning context<br><br><br><br>Learning goals | Allopoietic vs. autopoietic steering:<br>If the goals of the game are external, as usually happens in professional training, its steering is allopoietic, emphasizing the training of skills. If the game is valued for itself (autotelic), then steering is autopoietic.<br><br>Knowledge as acquisition, knowing through interaction.<br>If transfer of explicit knowledge is the primary goal, in terms of concepts, cognitive maps etc., players' minds are viewed as mental containers. That knowledge is acquired. If knowledge is the result of meaning processing between the players, knowledge is the consequence of the system of interactions in the learning community (for further details, see chapter 3). |
| **Rules** | The team of facilitators applies the rules.<br><br>Format & instructions:<br>The format defines the procedures for conducting the game, the steps of play, and methods for presenting information. Games can be rule-driven of free-form, requiring a different format and phrasing of the instructions.<br><br>Assessment functions:<br>Assessing a game, after its final position has been reached, starts with the debriefing, including a thorough evaluation of the subsequent positions of actors and resources in the game space, the moves the actors have made and the motives for making those moves. Also intermediate assessments (time-outs) are possible. |
| **Resources** | Materials of the game: equipment, paraphernalia, and facilities. The participants may use equipment such as computers, paper and pencil, scissors, etc. For conducting games appropriate facilities are needed: rooms, tables, chairs, projectors, and so on. |

Marshev and Popov (1983) said that the interpretation of a game is *correct* if each correct position in the game corresponds with a similar time dependent description of the social system. The interpretation is *adequate* if every position in the game corresponds with a true position in the social system and can be reached from the initial position.

*Table 2.10. Basic ingredients of game architecture*

| **Architecture of games** | | | |
|---|---|---|---|
| **Social System** | **Syntax**<br>*Form* | **Semantics**<br>*Content* | **Pragmatics**<br>*Usage* |
| **Actors** | Number of players<br>Number of game places of actors | Roles<br><br>Composition of roles in social organization | Learning context: types of steering;<br>Learning goals: kinds of knowing; |
| **Rules** | Game manipulation set:<br>Preparatory rules;<br>Start & stop rules;<br><br>Rigid-rules;<br>Principle-based rules;<br>Free-form.<br><br>Initial game positions;<br>Allowable moves;<br>Final game positions | Relationships between roles, communication rules, procedures<br><br><br><br>Evaluation of places for resource allocation, and relative position within team of players | Team of game facilitators<br><br>Format & instructions for rigid-rule vs. free-form<br><br><br><br>Assessment functions |
| **Resources** | Game space;<br>Set of game positions;<br>Set of pieces | Positioning of pieces: meaning of cultural, socio-economic situation<br><br>Set of occupied & available positions | Materials:<br>Equipment<br>Paraphernalia<br>Facilities |

Both conditions ensure that the game and the social system match, that they do not contradict each other. The game – as formal system – is complete. Table 2.10 summarizes the key characteristics of the morphology of games, embedding the social systems with the linguistic approach in one framework. Basically, referring to the pragmatics of gaming, playing games implies learning, unlearning or even breaking habits.

## DECONSTRUCTION OF GAMES

Marshev & Popov (op. cit.) distinguished three areas of application: education, research, and operational/practical. Taking their views on board, I have adjusted and updated these three areas.

The educational functions of games are:

- Demonstration function – enlightenment of concepts, principles, methods, processes, and procedures of the socials system involved;
- Training function – developing skills, problem solving, decision making etc.;
- Motivation function – involving learners in the educational process, and to stimulate intrinsic motivation;
- Arousal function – increasing the level of activation of learners.

The research function of games includes:

- Formalization function – artifact design;
- Heuristic and creative function – developing search strategies and envisioning new opportunities;
- Verification function – artifact assessment & theory testing (see chapter 7);
- Organizational function – project management & organization (see chapter 5).

The operational function of games includes:

- Games as interventions (change agent) – culture reshape, improving the internal organization of the social system, competency of staff, decision making procedures etc.;
- Planning function – organization design, scenario design;
- Experimental function – using games to experiment with various strategies to explore viable options – designing and applying scenarios (see also chapter 7).

The operational function broadens the scope of gaming to organization design, and social systems development. From that perspective, I have linked gaming in its capacity of change agent to *design-in-the-large*, while for the design of the artifact as such I have denoted the term *design-in-the-small* (Klabbers, 2003, 2006) (For more details, see chapter 5.)

Whenever gaming is used for these areas of application, it is recommended to apply the framework of Table 2.10 when selecting an existing game to see whether it suits the requirements. In my teaching, I have extensively used Table 2.10, and the underlying concepts, summarized in Tables 2,7, 2.8, and 2.9. Through its application the students learned to read and understand the architecture of a whole variety of games, from traditional board games to currently available computer games. For them often it came as a surprise to see that the scope of computer

games is less complex on the conceptual level, and more complicated on the purely instrumental level than many conventional games. The architecture of many existing professional games, developed since the 1950s, turned out to be more complex in terms of their conceptualization – their theoretical framework. One reason may be that they address real social issues.

A few years ago, I applied the scheme of Table 2.10 in a legal case. A Dutch consultancy had charged a Scottish consultancy to have copied their game without paying a proper fee for buying or licensing it. The Scottish consultancy approached me to support their case on short notice. They were very explicit in stating that their game was not only distinct from the Dutch game in form and content, moreover, it had been designed on the basis of a unique design specification provided by a major client. The Scottish consultancy claimed that they had not committed piracy. However they had to prove it for the Netherlands Institute of Arbitration. I accepted their request under the clear precondition that, if on the basis of my deconstruction of both games, I should come to the conclusion that the games were basically similar, I would be explicit about it in my report to the board of arbitrage. That precondition was accepted.

On the basis of the frame-of-reference of Table 2.10, I deconstructed the architecture of both games in great detail. The results, written down in a lengthy report, underpinned the conclusion that the Scottish game was distinct from the Dutch game in terms of its design specifications, in particular with respect to its rule-base, the resources and their form of presentation. What looked similar on the surface was very distinct in its architecture. The complaining party, the Dutch consultancy, was not able to substantiate their charge on the same level of detail, and lost the arbitration. In my teaching and in the legal case, deconstructing games according to the schemes of Tables 2.7, 2.8, 2.9, and 2.10, presented above, has turned out to be productive and worthwhile.

Using the generic framework presented above for deconstructing games, the next challenge is to use the classifications discussed in this chapter for arranging interesting existing games. Once they have been classified (grouped), each class should be deconstructed applying Table 2.10 to figure out key qualities of those classes, and to look for a more fundamental taxonomy on games.