Guide pratique

Board games
for agriculture and landscape
Thinking, designing, facilitating, evaluating, sharing

Sylvain Dernat, Yves Michelin,
Nolwenn Blache, editors

éditions Quæ

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General introduction: games in society

Sylvain Dernat, Yves Michelin, Nolwenn Blache

In her famous 1990 book *Governing the Commons*, Elinor Ostrom drew the following conclusion: "Since Garrett Hardin's stimulating article in *Science* (1968), the expression 'the tragedy of the commons' has come to symbolise the environmental degradation to be expected when large numbers of people share a scarce resource". However, based on her observations of cooperation arrangements in the field in Latin America, Asia and Africa, she shows that common goods and their collective management represent real opportunities for tackling the threats posed by climate change and environmental degradation. They offer genuine alternatives to state systems and individual property, promoting forms of emancipation and empowerment of individuals and groups in the face of central power or economic and political deregulation. While there are many initiatives aimed at promoting this emancipation, they come up against a multitude of personal interests and stakeholder priorities that diverge and often clash.

For example, the vast majority of citizens are in favour of preserving high-quality water resources. However, the priorities of a farmer who irrigates his crops and needs a regular quantity of water, a fisherman who is concerned about minimum low-water flow and oxygen content, and a resident who would like to drink tap water differ because they belong to socio-professional categories with different needs and expectations. These priorities also depend on the geographical, political or economic context, which defines behavioural rules and imposes non-shared standards. This state of affairs leads to deadlocks, with the common good being the big loser.

This, however, is not inevitable. Ostrom has documented the ways in which different communities have been able to create institutions that successfully manage the commons. She highlights several success factors: the management of the resource system to anticipate its renewal and guard against the risk of depletion; the creation of rules for collective choice and arbitration within the system of governance; and the integration of norms and knowledge brought into play by users. Collective action, defined as a group strategy aimed at achieving a common goal, thus appears to be a dynamic social process made possible by communication, proximity, trust and competence. Understanding these social parameters and their impact on the functioning of the environmental system in terms of how it is used and managed is essential if we are to identify effective adaptation strategies for preserving common assets and ensuring that they are managed equitably.

Individuals who wish to act collectively must therefore be able to comprehend together the complexity of the phenomena they have to deal with and be able to co-ordinate, taking into account the motivations and determinants of the other stakeholders. But this is neither obvious nor usual. The management of common goods requires the use of specific tools capable of representing the complex

dynamics of ecological and socio-technical agricultural systems in which individuals with divergent interests and heterogeneous capacities operate. These tools must also facilitate debate on shared issues and the construction of effective management methods that are acceptable to all parties. Faced with this difficult challenge, social actors, development agents and simple groups of citizens have been tinkering with tools and experimenting with solutions for decades.

Among these many initiatives, gaming has long been identified as highly relevant for at least four reasons:
– The simplifications it makes, while retaining a similarity with reality, make it easier to grasp reality, offering the possibility of understanding its complexity and making its functioning more comprehensible.
– By promoting the total commitment of players during the game, it helps each participant to step into the shoes of others and discover points of view, ways of doing things, and ways of relating that they would not necessarily have access to in 'real life'.
– By enabling players to experiment with different outcomes by acting on certain parameters over the course of successive games, they can assess the consequences in a risk-free environment.
– By virtue of its playfulness, the game can arouse players' interest in an abstract skill that can then be applied to a concrete problem. By attempting to solve the problem in a game sequence, each participant assimilates a large amount of knowledge, which is more durably implanted than in conventional learning processes involving formal knowledge and iterative trial-and-error learning.

Games can therefore be integrated into participatory approaches to make social values more tangible, understand the responses of stakeholders to various scenarios, and show the implications of decisions and proposed changes on the state of a common good, a natural environment or a region. Games have been used to transmit knowledge or reveal mechanisms but, also and above all, to facilitate communication between social groups that did not know or understand each other, and to support various types of stakeholders in providing new solutions for sustainability. This 'socioconstructivist' approach to the game is essential: it is interaction that precedes learning. Individuals need each other to evolve and to make their environment evolve. Games are therefore not seen as a means of persuasion or manipulation; rather, they facilitate shifts in ways of thinking that are sometimes deeply entrenched. This enables collective action rather than simply transferring knowledge.

This book adopts this perspective by focusing on the specific themes of agriculture and landscape, which raise many questions about the common good and working together. Agriculture is currently facing a number of upheavals such as climate change, the erosion of biodiversity, the arrival of digital technologies, and the decline in the number of farmers. These upheavals are necessitating far-reaching changes and creating a strong need for adaptation. These changes cannot be addressed solely at an individual level (one farmer, one farm) but rather must be seen as collective actions within regions and sectors that take into account their specific social, economic and environmental characteristics. They impact land use, the composition of flora and fauna, the layout of plots of land, the density of networks of hedges, low walls or embankments and the shape of watercourses, large or small. In other words, these changes influence all aspects that are directly linked to the landscape.

Across the world, many professionals (farmers, technical advisers, experts), citizens and researchers are designing and using board games to facilitate

consultation, change practices or representations or simply to pass on knowledge. Games have been used for this purpose for several decades. Although some initiatives are supported by game design specialists, and there are flagship titles for the general public, such as *Farming Simulator* or *Agricola*, most games are created by novices. This breathes new life into the field of games by giving people plenty of room to create. However, these initiatives often fail due to a lack of audience, time or structure, or simply because the games are poorly designed or misused. Many games remain in drawers and do not benefit the greatest number of people, even though these tools could really help to 'create a sense of community'. The main aim of this book is to provide newcomers with the tools to progress step by step through their project, from building and running a game to evaluating and disseminating it, until they produce a useful result for the community.

This book has been written by researchers and teachers with almost 20 years' experience of developing, using and teaching games on agricultural and landscape issues. They have collaborated with specialists recognised nationally and internationally for their expertise in games and these themes. Like a practical guide, this book looks at the main pitfalls and offers the most operational solutions possible. However, readers should be warned that this book is not a 'turnkey' solution. The authors want readers to take charge of creating, facilitating, evaluating and disseminating their own games. This book is a support tool in the strict sense of the term, providing support for the reader's projects without laying out a ready-made path.

This process is subdivided into three main parts:
– The first part provides knowledge resources to help readers better understand serious board games dealing with agricultural and landscape issues. It also provides a framework for understanding the social dimension of the game, as perceived by the authors, and as will be explored throughout the chapters. Finally, it offers a typological approach to situating the game within a range of practices.
– The second part focuses on the actual design of the game. It takes you from idea to prototype in a few simple, precise stages. In particular, it looks at the specific issues involved in transposing agricultural or landscape models into games.
– The final part deals with post-design. It explains how to run a game session from preparation to delivery, and how to evaluate it to measure its impact during and after the session to ensure that the games are used effectively. Finally, it looks at how to maximise the potential of the game by raising questions about dissemination, intellectual property and communication.

Throughout the text, examples are used to illustrate the message. These examples deal with games developed by the various authors. Detailed descriptions of these games are freely available in the games library on the GAMAE platform.[1]

Furthermore, the book is illustrated throughout the chapters by an example of the design of a serious game that serves as a case study thread or 'throughline'. The one we chose focuses on the return of the wolf to the Massif Central in central France. This predator, now a protected species, had been absent from the area since the mid-20th century. Its return is causing a great deal of controversy in this pastoral region as it calls into question the agro-pastoral systems that have evolved since its disappearance. The discourse surrounding this

1. https://ludotheque.gamae.fr/

charismatic animal is charged with emotion, with conflicts between actors exacerbated by the reality in the field and the fantasies (both positive and negative) surrounding the wolf. A serious game based on this complex issue was therefore created in 2020 by a group of final-year engineering students at VetAgro Sup in Clermont-Ferrand. This is where the editors of this book teach and study. This game was chosen to illustrate the book as it is a typical example of a serious game designed using a trial-and-error approach by a group of 'naive' students. It is thus possible to trace its creation from start to finish: from when the instructions were given to when the game was tested under real conditions. This is exactly what the readers of this book expect. This throughline example therefore provides a reflective analysis of an experience that predates the creation of the manual. It highlights the aspects of which the students were unaware, which sometimes led them to make design errors or encounter technical impasses. This retrospective analysis has enabled us to enrich the content of the various sections based on what we believe readers would like to find there.

These introductory lines give the reader a sense of what this book is about. It is not just another guide to game design focusing on agriculture and landscape. It also offers a fresh perspective on games, exploring how they can be mobilised to facilitate the transitions that we urgently need to address. Ultimately, the authors aim to make the reader active and breathe life into the book. Indeed, it is possible that this book will propose inadequate or incomplete solutions to certain situations or that readers will come up with new and innovative ideas. Readers are invited to submit their ideas to the editors so that the guide can be enriched with new content in future editions.[2]

2. These proposals can be sent to Sylvain Dernat at sylvain.dernat@inrae.fr.

Part 1
Understanding board games to improve their design

Playing is often perceived as a childish activity that is obvious and requires no effort. From there, it's an easy mistake to think that designing a game is child's play, but that's a line we'll be careful not to cross. Designing a game, especially one that serves a purpose—in other words, a serious game that is also enjoyable to play—is not something one can improvise. There are plenty of games that are either too serious to be enjoyable or too simplistic to be useful. Fortunately, games have been the subject of abundant literature and academic study for over a century. In this section, we propose to review the origins of the study of games, as well as the main theoretical approaches and meanings. This will provide anyone tempted to design or use a serious game with a basic understanding of the subject.

The first chapter aims to better characterise what a game is and specifies the characteristics of a serious game. It also proposes a broader definition of the board game, emphasising what makes it so rich. Playing is not a trivial act. We therefore thought it would be useful to devote a specific paragraph to examining the act of playing a game from a deontological point of view and then to consider its impact in the social arena. This perspective lies at the heart of this book. It is therefore important to describe it in order to understand the meaning that the authors give to the creation and mobilisation of play.

Chapter 2 looks at the specific nature of games that deal with agriculture and landscapes, exploring the origins of this playful practice and addressing the many complexities that arise from agricultural and landscape issues in games.

Finally, Chapter 3 proposes a typological approach to the use of games based on the above-mentioned approach. This typology aims to help readers position their game design or mobilisation project within a multitude of possible practices and characterise the issues and opportunities involved.

1. Key concepts before designing a game

Sylvain Dernat, Yves Michelin, Nils Ferrand, Nolwenn Blache, Sylvie Paradis, Sylvie Lardon

While it is easy to recognise a game when we see one, it is much harder to give a simple explanation of what a game actually is (Wittgenstein, 1953). In French, the verb '*jouer*' (to play) and the common noun '*jeu*' (game) use the same root, like in German (*spielen* and *Spiel*), Spanish (*jugar* and *juego*) and Italian (*gioca* and *gioco*) to designate two quite different aspects that English distinguishes as game and play. Game refers to the framework within which the ludic activity takes place, i.e. a system of rules. Play refers more to the play activity itself, the experience and what constitutes that experience.

This distinction reflects the existence of two opposing poles that fundamentally structure games (Caillois, 1958). On the one hand, Caillois refers to the disciplined game, regulated by conventions and similar to the English term game, as *ludus*. Chess is a very good example of this type of game. On the other hand, he refers to *paidia* as spontaneous and turbulent play devoid of rules, reminiscent of play. Caillois refers to the spontaneous games played by children who spin on a swing faster and faster until they get dizzy. All games fall somewhere on a gradient between these two poles. A highly codified game does not exclude the pleasure of playing, and vice versa. This is why the term 'gameplay', widely used today, was coined in the English language to encapsulate this duality in the design of games.

This tension between *ludus* and *paidia* (or between game and play) is common to all games and serves as a reminder that games have two dimensions: objective and subjective. These dimensions are explored by various theories and provide an essential foundation for any game designer.

What can we learn from the sciences of games (ludology) and play?

Derived from information theory and inspired by structuralism, the mostly Anglo-Saxon game sciences view the game as a set of rules, a series of instructions designed to set limits and specify the procedures to be followed. The rules define a perimeter, a spatial and temporal limit within which particular principles apply. These rules depart from the usual principles that apply in the real world. The game is therefore an artifice for simplifying reality to make it more comprehensible. However, the game is not defined solely by its rules. It is also a way of organising them. The rules must be arranged in such a way that they can interact with each other to form an organised whole. As these rules can be implemented with different players without being changed, ludology defines the game without referring to what a player is. In fact, players are not at the heart

of its concerns, as they are only there to use the rules. In this type of approach, we are more interested in the operations that players can perform than in their thoughts or feelings as individuals.

Conversely, studies of play provide a psychological, sociological or even cultural perspective on the practice of play. In his famous book *Homo ludens*, Johan Huizinga (1988) shows that play is an integral part of human culture. It is impossible not to play. We think of play as an experience or an attitude. According to these theories, which are influenced by the French school of thought, play is distinguished first and foremost by its meaning and the player's inner experience. The player therefore occupies a central position. The aim of this research is to understand how players use the game to create experiences in which they know they are in a hypothetical world with its own reality. This second degree is a defining feature of games. Describing how this process operates in the player(s) allows us to describe the game. In this case, the media used to play the game merely serve to support its use: the rules, equipment and practices are not playful in themselves. These studies therefore attach less importance to the media used to play a game and focus instead on the reasons why people play. The game is defined more by the attitude of players towards it than by its complex technical medium.

The five dimensions of playing a game

To avoid falling into the pitfalls of analysis, Brougère (1995; 2005) suggested that playing a game should not be defined in a single, compartmentalised way, but should be approached through five dimensions:

– The game operates on a second level of meaning. To play is to pretend. Any activity could become a game, provided that this framework of second-level engagement is maintained. Conversely, a game taken at face value would cease to be one.

– The game involves a series of decisions. For the players, playing the game means making decisions, and the decisions they take directly influence the course of the game.

– The game is organised around decision-making mechanisms. To make these decisions, players must adhere to a coherent set of rules that form a system. This concept differs from that of a single rule, as players can comply with the decision-making mechanism while circumventing the rule itself. This is what makes the game flexible and adaptable.

– The game is always in a state of tension between predetermination and uncertainty. We never know exactly how a game will unfold or end. While it is regulated and therefore not totally uncertain, it is not totally certain either, as it leaves room for the players' own investment and behaviour.

– Games are frivolous because they minimise the consequences of the decisions made during the game. In a game, you carry out actions in a risk-free environment because the game resembles the real world without being real. It allows you to confront failure without suffering the consequences.

So, is the notion of a serious game an oxymoron? After all, the frivolity and second-degree nature of games are quite contradictory to the serious nature claimed by this type of game. This paradox leads us to define what a serious game is.

What is a serious game?

The term 'serious game' refers to any game whose main purpose is not entertainment. In this case, the game has a purpose other than 'pure entertainment', a concept that was formalised and made explicit when this type of game was first conceived. However, this distinction appears to be unfounded, as many games are used for learning purposes, particularly with children. They are therefore useful in their own right. Moreover, according to Abt (1970), the originator of the term 'serious game', even if the main purpose of this type of game is not entertainment, it can nevertheless be entertaining. It is the serious intention of the game designer or the game session that makes the game 'serious'. Serious games are therefore a particular type of game in which frivolity is not a primary design consideration, although it may be. It is nonetheless a game that meets all the other characteristics.

Moreover, the term 'serious' is now used almost exclusively in reference to digital games. A serious game necessarily makes use of digital technologies for playful learning purposes. While this is due to the massive use of digital technology in the creation of computer games for training and education purposes over the last 20 years, we feel this definition is too simplistic. In practice, the term 'serious game' should be used very broadly, to encompass applications that do not use computer technology. These are known as 'analogue games'. This is what this book is all about.

However, even after defining what a serious game is, another term commonly used remains undefined: 'gamification'. This term is occasionally confused with that of games, particularly serious games. It refers to the use of game mechanics or principles in activities other than playing games. For example, its aim is to increase the acceptability and use of tools, methods and products by appealing to people's taste for and sensitivity to games. The idea is to add the motivating mechanisms of play to a pre-existing activity to achieve a goal beyond playing. Although gamification uses game mechanics to increase the extrinsic motivation of players, whether customers or students, it is not a game because its purpose is not to play, but to achieve a specific goal in a real-world situation. As described above, these game mechanics are mobilised without being considered as a coherent whole. These mechanisms involve immersion in an attractive fictional world, the use of rewards when objectives are reached, the definition of success after the completion of defined tasks, the existence of challenges to be solved, and the creation of competitive or cooperative situations. Serious games are therefore more than just games because they go beyond the mere use of game mechanics. They are not based solely on a motivational dynamic linked to a specific moment or action. They have a longer-term objective of bringing about lasting change in a situation.

We therefore believe that in order to encourage a form of learning through play, it is necessary to mobilise the various criteria presented above from the outset of the game design. There are two complementary aspects to bear in mind. On the one hand, we need to consider the balance between the rigour of the rules and decision-making mechanisms, and the role of the player's experience within the game. On the other hand, we need to ensure that the game is useful in the real world while maintaining its internal coherence as a ludic experience in its own right. We therefore use the term 'ludicisation' to describe the process of creating a serious game.

What is a board game?

As our book focuses on board games, we need to define them more precisely. The term has many different meanings depending on the language used.

The game board as an object or support

In English, the word 'board' evokes a piece of wood, a thin, flat board used for playing games, such as a chess board. The word also has a second meaning: a board or display on which you can write or draw things you want to remember or communicate. We therefore propose considering the game board as both a communication tool between players and a surface that enables several people to play and exchange ideas.

Syeleterr

This game explores how dairy farms interact with their environment. It helps players understand the technical, economic, social and environmental dimensions of a global approach to farming. The aim is to acquire the vocabulary and basic knowledge of how a livestock farm operates and to consider the impact of the production system on its environment. It was designed between 2010 and 2020 in partnership with the *Institut de l'élevage* (French livestock institute).

Authors: Yves Michelin, Sylvie Cournut, Cécile Achour, Doriana Tremeaux.

Example

In *Syeleterr*, the board is a simplified representation of a small rural area with all its characteristic features, such as topography, farm buildings and dwellings, watercourses and land plots.

Figure 1.1. The *Syeleterr* board.

Depending on the game and the stages involved, the board may be variable in size and shape, manipulable or not, and single or multiple (composite). It can take the form of a schematic or simplified (2D) map of an area, or a 3D model. It can be a faithful representation of a landscape or farm, or a simplified model inspired by reality to a greater or lesser extent.

Whatever its form or format, it may also serve as a partial representation to be completed collaboratively during play. In such cases, for example, a map or model produced becomes a result in itself, the very purpose of the game being to compose it.

Les Tréteaux du Paysage

The support scheme for *Les Tréteaux du Paysage* (*Landscape trestles*) was set up between 2008 and 2009 to implement the landscape charter of the *Parc naturel régional des Causses du Quercy* (PNRCQ), approximately 10 years after its creation. The idea is to go out into the field and engage with the people concerned by setting up trestles and a work board in the landscape to facilitate collective observation and debate, and to encourage projection into a fictitious and simulated landscape. The game also proposes a variety of iconography, which is used as a means of expression and for individual or collaborative output (e.g. landscape block diagrams with tracing paper for drawing, a 'model' to be built using a standard village plan and Lego®, photographs of agricultural landscapes, etc.).

Authors: Laurent Lelli and Philippe Sahuc.

Example

In *Les Tréteaux du Paysage*, Lego blocks® allow players to discuss and illustrate urbanisation scenarios to accommodate climate migrants in a small fictional rural village following an imaginary, scripted disaster.

The game board as a social space

In French, a *plateau* (board) can also be the stage of a theatre, show or even film set. It is a stage that can be more or less formal, with a more or less detailed set. In a sense, role-playing games offer something similar, where participants play an assigned role in a simulated situation in which they must debate decisions, with staging that can include disruptive events and unforeseen circumstances (such as hazards, brakes or levers).

Many of these serious games also feature real farms, such as the game *L'exploitation dont vous êtes presque l'agriculteur (The farm where you're almost the farmer*), which was developed based on a PhD thesis that aimed to identify the resilience factors of dairy farms (Perrin, 2021). In this game, descriptive sheets present techno-economic data that bring the case examples to life.

This contextualisation, in which a story is played out to support the game, can also be likened to 'forum theatre', a creative workshop that offers support through exchange and interaction to raise awareness of different views, discourses, stances, etc. This approach is inspired by one of the tools of the Theatre of the Oppressed, invented in Brazil in the 1960s (Boal, 1974).

However, these 'life-size' games fall outside the temporal, spatial and social framework of board games. Therefore, we consider games that use a portion of space or landscape as a stage to be outside the scope of this book because the associated game design is very different.

The game board as a group of actors

In English, the word 'board' can also refer to a team, a group of people making decisions together. This idea underlies a number of board games, which several authors in this volume draw on in their work on agriculture.

Vitigame

The game was designed following the work of the Eco3Vic project (funded by Ademe), in which a methodology and tools were developed for participatory eco-design workshops with winegrowers, based on environmental assessment results using life cycle analysis (LCA).

Authors: Anthony Rouault, Christel Renaud-Gentié, Séverine Julien, Aurélie Perrin, Frédérique Jourjon.

Dynamix

This co-design tool was developed with a group of farmers, extension officers from the Ariège Chamber of Agriculture and researchers from INRAE as part of the GO PEI 'Rotations 4/1000' project. It helps cereal growers and livestock farmers to redesign their systems and to encourage the relocation of inputs by diversifying rotations and including grassland for cereal growers and local food for livestock farmers.

Authors: Julie Ryschawy and Aude Pelletier, with the support of Anaïs Charmeau, Txomin Elosegi, Myriam Grillot, Guillaume Martin and Marc Moraine.

PayZZage

This board game invites participants to think collectively about the relationship between livestock, landscape and biodiversity. Created in 2016, the game provides a fun and active way to learn about agro-ecology and functional biodiversity. It helps players to put into practice skills such as reasoning about plot allocation based on production objectives and constraints, decision-making and soft skills such as communication, negotiation and cooperation.

Authors: Gilles Martel, Audrey Alignier, Estelle Meslin.

Example

In the *Vitigame* game, players have to work together to design a more environmentally friendly winegrowing technique. Other games focus on collective decision-making within a single farm to promote greater sustainability (e.g. agro-ecological practices) and resilience or cooperation between different farms in the same area (*Dynamix*). There is also the *PayZZage* game which focuses on the links between farming practices and the landscape.

The game board as a shared experience

We also think it is interesting to mention a few English expressions, such as 'to take on board', which means to take full account of opinions. Another example is 'to get on board', which means to set off for a destination by boat, plane, etc. These expressions evoke movement towards something else, towards an elsewhere. The also refer to the adoption of a different perspective through an experience 'to be lived', by moving, taking a step aside or following an itinerary towards a place that will become clearer by the end of the session.

The simulation of a situation that is more or less in line with reality plays an important role in encouraging participants to embark on this journey. In fact, a shift or a more or less caricatured or simplified interpretation of reality are strategies that make it easier to comprehend a complex problem, offering an invitation to think more systemically.

The game as a means of revealing or transforming social space

Because players invest themselves fully during a game session, the act of engaging in serious play with 'real people' is not a trivial matter. Therefore, we believe it is essential to draw the attention of designers of serious game to several principles pertaining to deontology—defined as the rules governing a professional or codified practice, which allow all stakeholders involved in a gaming process to conclude that they have performed high-quality work. It is a deontological necessity to understand why we wish to create or employ a game. (To assist in defining the purposes of the game, we refer you to Chapter 4, section "What are the game's objectives"?). However, these purposes may not necessarily align for the designer, the facilitator and the participants, which complicates the situation.

Having fun while staying grounded in reality

As researchers, entertainment is rarely our primary focus. The fun aspect is only an instrumental factor because the game will be used if it is fun. However, when the serious purpose of the game session is revealed to the players, there is a risk that the system will no longer work because this information is likely to alter their behaviour. This mechanism is often observed in social psychology experiments. Therefore, there is an internal contradiction in combining two *a priori* antinomic objectives in the same device: the real intention, which is serious, and the act of playing, which is usually not serious. Therefore, the first question to ask yourself when creating a serious game is to clarify its primary purpose beyond the fun aspect.

The second point of attention regarding deontology is the relationship to reality. When creating the game, designers must decide on and clarify the relationship with reality that they want to establish. In other words, they need to define the extent to which the underlying model is faithful to reality. A game may lack fidelity to reality because of poor design (see Chapter 5), or it may deliberately detach itself from reality to accentuate a phenomenon and make it more intelligible. Some games, for example, take players to extreme places to encourage them to think, as they are more likely to engage with a caricatured situation than a more nuanced real-life situation.

Le Genêt Belliqueux

Initially designed between 2003 and 2016 to raise awareness of agricultural and landscape issues among first-year agronomy engineering students as an introduction to the three-year curriculum at VetAgro Sup, the game's target audience and objectives were subsequently broadened. In a simplified yet systemic way, it illustrates the effects on vegetation and the landscape of the interactions between grazing practices, the dynamics of the conquest of pioneer species, and public policies.

Authors: Yves Michelin and Sylvain Dépigny.

Example

In *Le Genêt Belliqueux*, the transition from seed to adult plants capable of reproduction takes place in the equivalent of one year, with a much greater reproductive capacity than in reality. The result is a vegetation colonisation dynamic that is much faster (in reality, it normally takes more than 10 years for the landscape to close in) and much more responsive to farming practices (pastoral improvement is almost immediate in the game, whereas it takes several years in reality). Thanks to this distancing from reality, the process of competition between plants and farmers through grazing and management practices is much easier to perceive and understand.

The impact of games on reality

The relationship with reality can also be seen through the impact that the game process can have on it. Indeed, as with any process that enters the social field, the use of a serious game will have an effect on the real world (Daré, 2005). From the outset, it is essential for the designer and facilitator to consider that the game is not just a game. This is where their responsibility lies. The question is how to guard against the undesirable effects that a game could have in the real social arena, such as violence between players during a game, personal attacks and accusing certain actors in the real social arena of behaviour observed during the game.

This may involve, first and foremost, the forecasting and anticipation of the impacts that a gaming session may have. If we cannot foresee everything (as is often the case), putting safeguards in place can help to mitigate risks. For example, we could establish procedures to halt the play if a conflict arises between two individuals, involve a mediator, or include a moderation process in the game rules to calm players down (see Chapter 7, section "How to define the rules of the game" for more information on game rules).

Another element to consider is the alignment between the designer's intention when creating the game and the intention of the facilitator who is going to use it. Beyond the designer's prescriptions, games can be used for other purposes. For example, the facilitator may target a different audience to that intended by the designer or adapt the game to address specific issues. If facilitators take this liberty in relation to the context in which the game was intended to be used as announced by the designer, they must be aware of the breach of contract risk this entails, and the potential consequences for the game's functionality and integrity. However, facilitators accustomed to using games in their own practice may enrich the game and broaden its scope.

Participatory or expert design

In certain contexts, the designers of a serious game may be in close contact with the actors in the target system. The question then becomes how to engage with them in order to design a scientifically sound game that meets their expectations. Actors' status may differ from one situation to another. For example, they may be sponsors of the game with high expectations in terms of concrete results. They may also be partners in a research-action process, yielding results for the local area as well as methodological or theoretical advances for the designers. Finally, they may simply provide practical support for work that is independent of the actions envisaged by these actors. We therefore feel that it is important for any designer of a serious game based on real-life situations to consider how to collaborate with the relevant structures when designing and using the game.

Regardless of their involvement in the design of the game, actors will inevitably have a specific perception of the problem and the objectives assigned to the game. The challenge for game designers is to align these perceptions with their work. There are two possible scenarios. They can either document the instructions and project outline at the outset and then work independently of the actors in the field. Or they can involve the stakeholders directly using a participatory modelling process. The effectiveness of the latter approach is relative, as it requires the participation of a large number of people. This type of design also requires specific technical skills and methods to ensure the quality and accuracy of the data collected. However, involving stakeholders in the construction process is a sign in itself that knowledge is being shared and structured, and it is a precursor to change. This type of design often results in tools that better align with the expectations of the actors, which ensures that the game is more widely accepted by a local audience. In contrast, if the game is solely the product of specialists, there is a risk that it will never be used or only very rarely.

The game as an intermediary/boundary object

Serious games may be considered boundary objects, insofar as they allow for a shared representation of a complex problem among various actors. Consequently, the analysis of a problem performed by a restricted group of experts becomes easily accessible to other groups of actors. The serious game thus acts as a mediator between heterogeneous actors. It fosters the confrontation of their viewpoints and offers different 'handles' on the problem, facilitating the emergence of solutions. A serious game can also produce its own boundary objects (an annotated map, a completed table, etc.), which subsequently constitute a record and a useful output for action, as is the case with the game *Les Tréteaux du Paysage* (Figure 1.2).

Example

Les Tréteaux du Paysage (see p. 17) proposes one or more activities to be carried out *in situ*; these represent various stages that facilitate the data collection, observations and proposals which will subsequently prove useful.

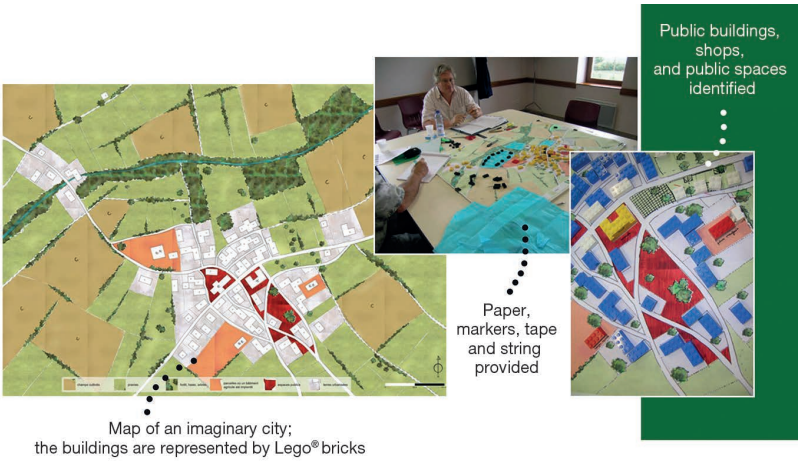

Figure 1.2. Example of a game from *Les Tréteaux du Paysage*.

This activity uses a model representing a village and its surroundings. The village incorporates characteristics from several villages in the Causse, yet it remains fictional to avoid focusing on a specific real village. It also serves as a test for this new system.

The board game is also a frontier object insofar as it has structural elements (e.g. tokens, board) that offer players from different social backgrounds different ways to engage with the game, thus situating itself at the frontier of these social worlds.

SSol&co

The game *SSol&co* (*Soil & co*) was initially developed in 2021 to share the results of an analysis of the systemic obstacles (sociotechnical diagnosis) to changing practices towards agroecological management of soil health in sheltered market gardening in the Provençal context with Provençal market gardeners. It was first tested with a group of agricultural extension officers and then used during two parallel sessions at a workshop attended by 17 Provençal market gardeners (including organic and conventional market gardeners, technical advisers, input suppliers, marketers, public policy actors, association, September 2019). It was then used again in the training programmes proposed to L3 vocational students and M2 agro-ecology students in 2020 and 2021.

Authors: Yann Boulestreau, with the help of Mireille Navarrete and Marion Casagrande.

Example

The plot contamination scale associated with a level of yield loss on the *SSol&co* game board enables the various participants (farmers, marketers, advisers, etc.) to visualise and manipulate the level of contamination in the plot. The researchers who designed the game see it as a tool for demonstrating the influence of non-farmers on farmers and their choice of practices, and its impact on soil health and yield. Participants simply see it as an indicator showing them whether they are making the right or wrong choices for the health of their soil and the impact these choices will have on their farm's yields.

The game facilitates dialogue between parties, even when they are in conflict, by enabling representations to be shared, and can thus contribute to the emergence of solutions. Agriculture and the landscape are areas in which conflict involving a wide variety of social groups is commonplace.

The next chapter looks at the specific features of these areas that need to be considered when designing serious board games.

2. The specificities of games on agriculture and landscape

Yves Michelin, Yann Boulestreau

Agriculture involves handling living organisms, which is not easily understood by those unfamiliar with it, and even farmers may struggle to perceive all its interactions. Above all, the systemic dimension of the interactions between farming practices, social systems and biotechnical processes is difficult to convey using conventional approaches such as lectures or texts. Games therefore seem to be a particularly suitable tool for capturing this complexity. However, because of the different aspects of this complexity, designing a game that deals with agriculture or landscapes is no simple matter.

We will begin by detailing the many reasons and advantages of using games to deal with agricultural issues. Then, we will describe the various aspects of agricultural activity that need to be taken into account in a game. Finally, we will look at the specific features of incorporating landscape into the design of a board game.

Playing with agriculture: a great classic

Agriculture is an inexhaustible source of inspiration for game designers and has been so for a very long time. Aside from games that do not really focus on agriculture but use farm animals, such as the *Jeu de l'Oie* (a traditional French children's board game) or *Jeu de Sept Familles* (Happy Families), or agricultural elements, such as model machinery, a multitude of games dealing with agriculture are currently on the market. The Jeux.fr website, which has more than 35 million players in 150 countries, has announced that it had logged over 19 billion games on its platform since 2014, In 2020, it listed 61 free online agricultural games.

Based on a quick overview of the current offer, we have identified four main families of 'agricultural' games:
– Mimetic games with no real mechanisms for interaction between players. These are more or less realistic scale models that allow players to take ownership of one or more tangible elements of the farm. These miniatures appeal mainly to children interested in farming, and to collectors who pay particular attention to the appearance of the figurines and farm objects. The symbolic aspect of these miniatures has also led some agrarian societies to use them as good luck charms, votive offerings or amulets to guard against natural disasters. This is the case, for example, with *conopas*, alabaster miniatures representing farms with their buildings, fields, cows and sheep. These were highly prized in Peru throughout the colonial period.

– Games that focus on social interactions linked to agricultural activity and stakeholder dynamics. Although they can impact production, a sector or products, these are primarily role-playing games that focus on highlighting behaviour or social interactions. Examples include the *Jeu de la Banane* (*Banana Game*), designed in the 1970s to introduce high school students to the notion of an unfair supply chain in developing countries, or the *Cattle Mali Breeders*, designed by geographer Neville Grenyer for the Oxford Geography Project in 1977 to help players better understand the strategies of transhumant herders in the Sahel.
– Games that focus on the farmer's decision-making and its consequences for the quantity and quality of produce, income, or environmental or landscape aspects. Their aim is often to simulate the operation of a farm and encourage players to test different strategies in a risk-free environment. *SimFarm* is a typical example.
– Games that focus on understanding and even controlling biotechnical processes (production levels, biodiversity, herd health, etc.).

Example

These families are not mutually exclusive, as shown by the *SSol&co* game (see p. 22), which combines elements from the second (social interactions influencing the choice of farming practices), third (choice of practices and impact on soil health) and fourth (impact of farming practices on soil health).

There are many games dealing with agriculture, which can be explained by a combination of three factors. First, the subject has a very strong subjective dimension, conveying powerful emotions as it involves relationships with living things, animals and nature—aspects that are lacking in our increasingly urbanised, disconnected societies. The entrepreneurial aspect of farming—the way in which farmers shape and organise the land to suit their interests—and the way in which this activity produces visible wealth (land, crops, livestock, etc.) are all stimuli that motivate players to fully immerse themselves in the game. In addition, farming involves many hazards that require risk-taking and coordination or competition between players. The outcome of these interactions and decisions taken in situations of uncertainty has an immediate impact on the game's outcome, which is a necessary ingredient for designing a 'good' game by activating the dimension of vertigo described by Caillois (1958).

However, it must also accurately replicate the mechanisms of the real-world system it is intended to mimic, a complex agricultural world that is part of a system.

The multiple complexities of agricultural activity

Numerous studies in geography, agronomy and economics have highlighted the systemic nature of agricultural activity. The aim here is not to provide an exhaustive summary that would fill an entire book, but simply to outline a few useful milestones from different disciplines when designing a game about agriculture.

The all-encompassing nature of French geography established the systemic framework of rural geography as one of the components of social geography very early on. This challenged the idea that human activities are determined

by nature alone and paved the way for the integration of the human and social sciences with the biotechnical sciences. The former has the capacity to understand the decision-making mechanisms of land users, including farmers. The latter focus on understanding processes involving living organisms and their impact on spatial distribution, temporal dynamics and the measurement of material or energy flows. It was through the organisation of agrarian structures and landscapes that these geographers became interested in the agricultural economy and how farms functioned. In the early 1960s, as agricultural modernisation increased, agricultural geography began to incorporate microeconomic dimensions at farm level in order to create farm typologies and make regional or continental comparisons.

By the late 1960s, this agricultural geography (see Bonnamour, 1973; Chaléard and Charvet, 2004), which examined how farms functioned by integrating farmers' practices, was moving towards more pragmatic approaches led by agronomists (see Deffontaines, 1998), tropical specialists and economists. These professionals were primarily concerned with the technical modernisation and rationalisation of production in order to create efficient supply chains and ensure food self-sufficiency. This work also had a social and political dimension, aiming to improve farmers' living conditions through technical progress to help maintain a young population in rural areas. Several concepts that are very useful for designing an agricultural game were formalised at this time.

At the plot level

A cropping system is a set of technical methods used on plots of land that are treated identically. Each system is defined by the nature of the crops, their order of succession, and the technical itineraries applied to these crops, including the choice of varieties. These technical methods are logical because they are the result of decisions and have an impact on production and the environment (see Boiffin *et al.*, 2022; Doré *et al.*, 2006).

At the herd level

The concept of a farming system emerged in the 1980s to explain why some farmers were reluctant to change, particularly in disadvantaged areas of France and developing countries. Based on systemic modelling, a livestock production system is "a set of elements in dynamic interaction, organised by man according to his objectives, to produce (milk, meat, hides and skins, labour, manure, etc.) and reproduce a group of domestic animals by developing and renewing different resources". It is seen as the link between a decision-making sub-system and a biotechnical sub-system, as well as the study of practices that ensure the link between decision-making and production.

At the farm level

In reaction to the deterministic perspective derived from the theory of the firm applied to agricultural production, a holistic approach to the farm was formalised in the 1990s (see Bonneviale *et al.*, 1989; Brossier *et al.*, 1997). It aims to better incorporate farmers' perspectives within the shifting context of agricultural modernisation—driven by technical improvements—and its integration into a market economy. This approach is founded on the principle that a farm is not merely a combination of enterprises or the sum of factors of production, but an organised whole comprising interacting elements that constitute the farm's

production system (Figure 2.1). Farmers steer this production system through a hierarchy of decisions: strategic decisions (e.g. choice of production type, conversion to organic production, land acquisition), tactical decisions (e.g. land allocation for year *n*) and technical decisions (e.g. prioritising irrigation for specific plots). Strategic decisions define the production system over the medium to long term, influencing tactical decisions made on an annual level, which in turn dictate infra-annual technical decisions. Assuming that farmers always act rationally, this approach seeks to identify the system's purposes and represent them as a model of adaptive behaviour incorporating family considerations. This framework offers various opportunities for developing a game centred on the farm level. The practical aspects of this formalisation are detailed in Chapter 6.

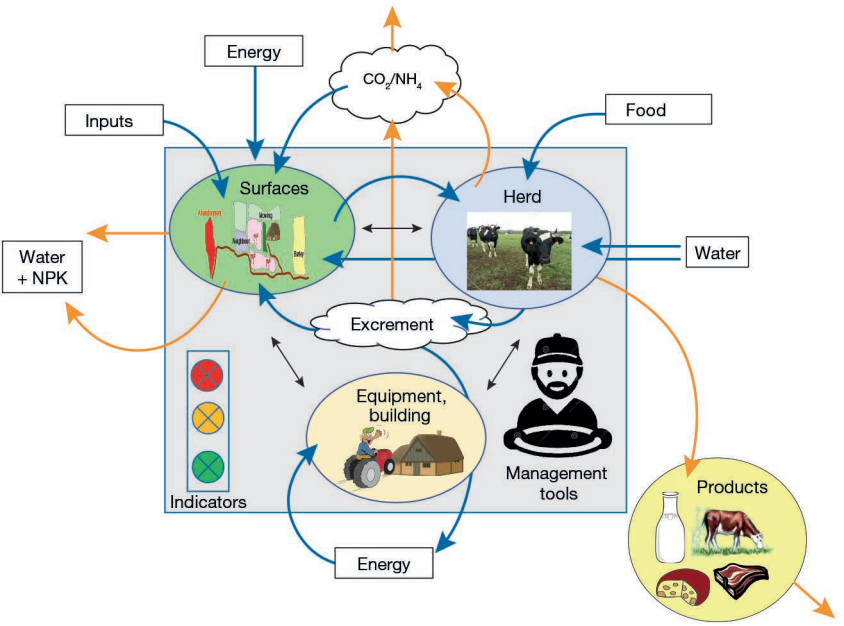

Figure 2.1. Systemic diagram of how a livestock farm operates. The steering wheel symbolises the management tools.

A livestock farm can be viewed as a machine comprising several elements that interact dynamically: grassland or cultivated areas whose function is to provide food for the animals, equipment used for production, one or more batches of animals (the herd) that produce foodstuffs that are exported in their raw state or processed on the farm. To produce these products, the system is open and receives energy, water and raw material inputs. It releases waste, such as animal excrement, some of which is recycled in the crops. Farmers control this complex machine using their knowledge, expertise and quantitative indicators such as milk production per cow and more qualitative indicators such as the appearance of the coat or the behaviour of the animals.

At the regional level

First mentioned by geographers in the 1950s, the concept of the agrarian system was taken up again 20 years later by agronomists and agro-economists to reflect the complexity of agricultural activity on spatial scales encompassing several farms within human-influenced ecosystems. This concept is widely used in comparative agriculture and rural geography, although it is often reduced to spatial and landscape organisation structures. An agrarian system can be defined as "a mode of exploitation of the environment, historically constituted and sustainable, adapted to the bioclimatic conditions of a given area, and responding to the social conditions and needs of the time" (Mazoyer, 1987). It is "the theoretical

expression of a type of agriculture historically constituted and geographically localised, which integrates and combines two components, "a characteristic cultivated ecosystem and a defined productive social system enabling the fertility of the corresponding cultivated ecosystem to be exploited sustainably" (Mazoyer and Roudart, 1997). This concept therefore provides a link between the ecological system and the social system. Indeed, analysis in terms of agrarian systems requires a combination of the levels mentioned above (see Cochet, 2011).

However, with the increasing complexity of our societies, the globalisation of markets and the growing integration of sectors, the notion of agrarian system sometimes fails to encompass all components of agricultural activity.

Over the last 10 years or so, an even broader concept has emerged: the food or agri-food system. This encompasses "all the agents, services and institutions responsible for producing, disseminating, accessing, consuming and storing food". In response to the globalised food system, which is based on corporate agriculture and the extensive integration of production into globalised supply chains, the concept of a territorialised (local area) food system has emerged. This concept aims to promote systems that are better adapted to local ecological and social contexts and that are more respectful of the environment, product quality and the social conditions of production and product processing. This approach integrates production, processing, distribution, consumption and waste management organisations and their interrelationships in a specific area Its aim is to improve the sustainability of production by favouring agroecological approaches. These new concepts are also based on the notions of the circular economy and territorial metabolism. They are eminently systemic and therefore very much in line with as the approach to game design covered in this book.

Table 2.1. Objects, concepts and interlocking levels applied to comparative agriculture (after Cochet, 2011).

Concept	Production system / Cropping system/ livestock system	Agricultural system	Food system
Object/level of analysis	Plot / herd	Farming	Village/region/ nation/world
Type of analysis	Agroecological (biotechnical)	Agro-economic	Agro-geographical and socio-economic

Agricultural practices emerge from the interaction between these various spatial and systemic scales (Figure 2.2). These complex interactions, and the phenomena resulting from them, are difficult to understand unless they are rendered visible or, better still, experienced first-hand. Representing them in the form of serious games makes this possible.

Playing with the landscape adds further complexities

There are a thousand and one ways of looking at landscapes because landscapes do not exist in themselves. They are constructions based on representation.

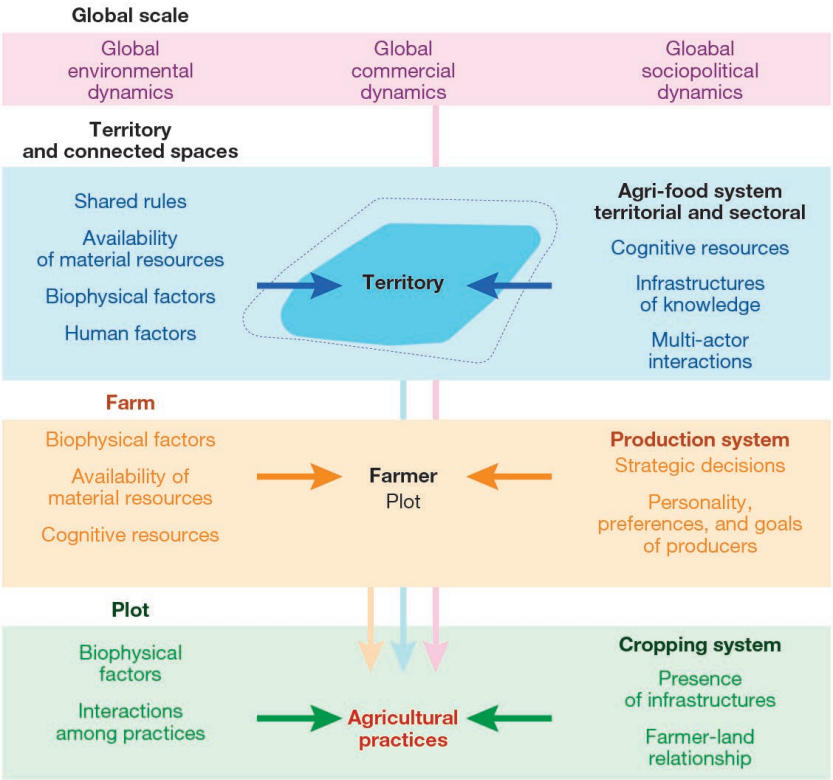

Figure 2.2. Analytical framework of the determinants of agricultural practices (Boulestreau *et al.*, 2021).

Interactions occur at four levels: the global level, which can be described as a socio-technical landscape, the territorial and sectoral agri-food system (SATS: *système agri-alimentaire territorial et sectoriel*), the farm level and the field level. The coloured arrows show how all the determinants influence farming practices. The SATS level brings together the players in the components of the food sector studied (e.g. the vegetable, fruit and cereals sectors) and the local landscape influencing the farming practices of farmers in this sector (employees, plots, equipment and facilities). The darker blue area, representing the local area, includes transport, consumption, collection/processing, research and development, farms producing X, as well as other farms. The actors represented at the border of the darker blue zone may be within or outside the local area (e.g. distribution, inputs, services, administration and civil society).

Example

The *SSol&co* game (see p. 22) demonstrates how the choice of soil health management practices in protected market gardening is determined by a range of factors at the plot level (soil type), the farm level (available equipment), the supply chain level (accessible outlets), the local level (presence of a farm equipment cooperative), and beyond (vegetable prices on the European market). These factors may lead market gardeners to maintain drastic soil disinfection techniques or, conversely, guide them towards agroecological techniques. The game enacts various roles: market gardeners, the core elements of their production and cropping systems, and the health status of the associated plots; a marketing agent who purchases from the gardeners to sell on a 'global market'; a supplier of inputs and equipment; and an R&D practitioner providing knowledge and advice. A single session simulates at least three cropping years, allowing players to experience and understand the interactions between production, social and ecological systems at the various spatial and systemic levels presented in Figure 2.2.

Therefore, even if landscape theory is well formalised (Roger, 1995), dealing with landscape in a serious game introduces an additional layer of complexity. Nevertheless, discussing landscape can bring together different categories of actors who may or may not be directly involved in its management. Starting from the representations of their landscapes enables elected representatives and other categories of local stakeholders such as representatives of farmers and foresters, associations and outdoor enthusiasts to engage in political debate. Through the landscape dimension, they can become aware of potential development projects, depending on the aspirations of the various publics concerned and the local policies initiated or planned. However, land managers are often unaware that they are producing landscapes, while landscape users very rarely have the keys to understanding the factors behind the landscapes that attract or repel them because the relationships between landscapes and the factors that produce them are often complex. Therefore, a serious game dealing with landscape issues must take into account the diversity of situations, the variety of perceptions, and the actors' level of knowledge regarding their role in producing landscapes that concern them and their evolution.

What do we mean by landscape?

The European Landscape Convention defines landscape as "an area of land, as perceived by local people or visitors, which changes over time as a result of natural forces and human activity". The word 'landscape' therefore encompasses three components:

– The support space, which is made up of an assemblage of objects. This dimension has been addressed by classical geographers (Delvaux and Nys, 2002) who attempt to describe the landscape in terms of its forms and organisation, by agronomists, who analyse the link with production systems, and by ecologists, who see the landscape as the spatial extent of ecosystems and the expression of their interrelationships. In agricultural landscapes, the question of field plots is central and relates to the systemic functioning of this supporting space, since any change to one plot can have effects on other, distant plots in order to take the functioning of the production system into account.

– Visible space (Brossard and Wieber, 2008), comprising interlocking planes and hidden areas that can be measured, quantified and mapped. However, relief, land use and distance mean that not everything is equally visible, unlike on a map, which provides a vertical view of a portion of space. Moreover, the same event can produce different effects depending on its location in relation to the observer. These aspects are often integrated into video games, but they are more difficult to take into account in games with tangible media. It is important to consider how to address these issues right from the outset of the game design process.

– The space of representations (Luginbuhl, 2012). The signal perceived by the eye is interpreted and evaluated by each viewer according to their experience, knowledge, references and values. Viewers sort and select according to their personal and collective references, which have social, aesthetic, cultural and even anthropological dimensions, because the landscape raises questions about the relationship between human beings and their surroundings. When designing the game, it is also important to distinguish between those who act directly on the landscape and those who 'enjoy' it without influencing its evolution directly.

These three components interact and the conceptual model that accounts for them is of great interest as a basis for designing a landscape game. It can be summarised as follows: The material elements of the landscape exist independently of

any observer. Landforms, vegetation textures and human structures are subject to biological phenomena (erosion, growth) or management practices (land organisation, development, abandonment, etc.). However, landscape can only exist if an observer, perceiving the image of this assemblage, decodes and interprets it by giving it meaning. Observers' personal history, as well as the value scales of their social category and era, influence their assessment of the landscape they see. This, in turn, conditions how they formulate demands for its protection, removal or improvement. These demands then translate into direct or indirect interventions on the material elements of the landscape.

Therefore, when designing a game that deals with landscapes, it is important to keep this conceptual model in mind when building the board and the elements to be manipulated, defining who plays, parameterising the decision rules, and taking account of aspects linked to visibility. The temporal dimension is also complex because the visual aspect changes at a different pace to that of simple land use. Examples include the effect of the seasons (a vineyard does not have the same colours in winter, spring, summer or autumn), inertia (it takes 10 or 20 years for a softwood plantation to have a visual impact) and the threshold effect. As a result, games dealing with landscape often have to simplify (e.g. landscape as a simple backdrop, landscape reduced to a few aspects, landscape as a support for acting, etc.).

Landscape: a concept with varying definitions across disciplines

Geographers were the first to place landscape at the heart of their research. Their initial entry point was naturalistic, particularly among German geographers, but French geographers argued for a more open conception based on the union of cultural and physical elements observed in the landscape (Pinchemel and Pinchemel, 1997). In the 1970s, Georges Bertrand (Bertrand and Bertrand, 2002) introduced the concept of the geosystem, defined as a geographically localised ecosystem—a landscape unit smaller in scale than a natural region. it is characterised by its geomorphological and bioclimatic homogeneity, as well as by its natural or anthropogenic dynamics. The geosystem comprises four interacting elements: aeromass, hydromass, lithomass and biomass. Their arrangement presents characteristics that may evolve over time according to the interactions linking them. This analytical framework is highly operational for formalising the mechanisms of a game centred on the material elements of the landscape (Figure 2.3). One can therefore consider that the landscape renders visible the links between interrelated places and natural or human organisational structures; these constitute the geographical space, which is also subject to spatial planning policies.

Since the 1980s, agronomists have also been interested in landscapes, seeing them as a tool for understanding production systems on a larger scale than that of the plot. According to Deffontaines (1998), "the heterogeneity of the environment is contingent on the production systems involved [...]. It cannot be defined outside the social context". This logic has led agronomists to view landscapes as jigsaw puzzles, with each piece representing a plot of land.

Using agronomic criteria and considering evolution over time, it is possible to group these pieces together into agrophysionomic units. In this way, "the agronomist can consider each piece of the jigsaw as belonging both to a landscape and to a farm", enabling them to define terroirs as "morphological units within which agricultural activity presents highly differentiated aspects".

Figure 2.3. In the *PayZZage* game (see p. 18), the landscape is seen as a jigsaw puzzle in which each piece represents a plot of land.

Landscape ecologists consider space in terms of three hierarchical levels of organisation: the site, where an individual's living conditions can be assessed; the landscape, where opportunities for movement and colonisation are evaluated; and the biogeographical region, where the major biological balances are understood. One of their concerns is appreciating the heterogeneity of space and spatial organisational structures. Unlike agronomists or geomorphologists, who rely on predefined objects and divisions (such as plots of land and landforms), ecologists break space down into a mosaic. Each elementary component of this mosaic is characterised by a certain number of physiognomic descriptors, such as slope, exposure, land use and management methods. They then use multi-criteria statistical analyses, factorial analyses and hierarchical classifications to highlight the levels of spatial organisation. The growing body of work in landscape ecology over the last 20 years provides a very rich basis for developing the models underlying the game.

In the social sciences, the work of sociologists and ethnologists has shed light on how the various actors behave in the landscape as a result of their diverse representations. They open up the field of 'ordinary landscapes', as they are represented and constructed by 'ordinary people' (Voisenat, 1995). Following this line of thought, the geographer Luginbühl (2012) proposes the concept of the landscape model, a kind of 'iconic postcard' that viewers seek to find when contemplating a landscape. These approaches focus on the individual observing the expanse of space in front of them and seek to understand their reluctance, motivations and the obstacles they encounter regarding the future of their landscape. The landscape is viewed as an image, often disconnected from local reality and is seen as a symbol. When designing a game, this work in the human and social sciences provides a very valuable basis for defining player profiles and behaviour. However, when working on local situations, these representations can only be explored alongside an analysis of the material structures that depend on the ways in which space is produced and organised.

In conclusion, a landscape-based game incorporates the principles of an agricultural-based game and enriches them with a sensitive dimension that stimulates player involvement. Taking the landscape into account also introduces a variety of perspectives that enhance the game's playability. However, this richness also requires careful consideration, as it means that the game designer must integrate these aspects into the game's modelling. More so than with an agricultural game, the systemic dimension of the landscape must be considered in all its dimensions—biotechnical, biophysical, social and cultural—to create a relevant operating model for the game.

Naturally, how these different aspects are formalised depends on the game's objectives and target audience. These points will be developed in Part 2.

3. Towards a typology of board games designed for agriculture and landscape

Sylvie Paradis, Sylvie Lardon, Hélène Blasquiet-Revol, Paola Braduini, Sylvie Cournut, Christel Renaud-Gentié

The aim of this chapter is to cover the wide range of objectives that can be achieved by using one or more board games related to landscape and agriculture. It sets out the different objectives that can be met by these games, bearing in mind that a single game may have several objectives, which is much more in keeping with the diversity and creative effervescence that characterises this type of system. This chapter will help you choose an existing game for a specific context, adapt an existing game, or design a new one.

For a board game to be fully relevant, it is important to ask the question 'What for?' in order to clarify the choice of one device over another. For the game to be relevant, its aims must be clear to all stakeholders to motivate the choice of the game, players' participation, and to give the game process its rightful place in any context, whether as part of a project, group dynamic or school curriculum.

We propose classifying these games according to four main types of objectives:
– Raise players' awareness of a subject or impart knowledge.
– Bring players 'together' as part of a collective project, mobilise and unite them, or enable players to become familiar with and recognise each other.
– Allow players to learn to work together, cooperate with others, or even co-construct a project or an action (making a project).
– Design and simulate/test technical solutions.

These objectives are broken down into sub-categories. It should be noted that the same game may fall into several categories, depending on the context of use and the players involved. Therefore, this is more of an open typology that enables us to ask the right questions than a strict categorisation system.

Level 1. Education or awareness-raising through board-based games

This first category of purposes aims to improve knowledge and skills without engaging the players in the search for solutions. We identify three scenarios, ranging from simple information delivery to the acquisition of technical or soft skills (see Table 3.1).

Level 1A. Games for information dissemination

The objective of this type of game is to communicate information at a targeted moment and for specific reasons. It may aim to bring certain information on a given subject to the players' attention. The game serves to convey useful elements, which the players are free to adopt or not. In this way, specific information is introduced to an audience invited to 'play'. It can also raise players' awareness of a specific situation, subject or problem, enabling them to discover a reality in all its complexity and to realise that the issue may be more intricate than it appears or that there are various ways to approach it. A typical situation can then be simulated to better highlight the consequences, changes or other factors, or to raise awareness of the complexity of what is at stake (Table 3.1A).

En campagne !

Initially, the idea was to create a fun tool for the *Fête de la Science* to explain the research activities of the Métafort joint research unit (now UMR *Territoires*) to high school pupils. The targeted themes include conflicts of use in rural areas, the arrival of new populations, population migration in rural areas and rural tourism.

Authors: Hélène Blasquiet, Marion Guillot, Aurore Mirloup.

Example

In *En campagne !* (*Into the field!*) the board represents a fictitious rural area, enabling players to experience the characteristics of rural life in terms of activities, housing, travel, etc. It is a simulated situation that provides access to a deliberately simplified complexity.

The aim is simply to promote a certain level of awareness among the different players. This can be achieved by confronting different points of view or stances on a given situation. Role-playing games often allow different key actors to express their opinions around a given issue and to explore the complexity of a system comprised of various actors. They do not claim to understand all the diversity or resolve the conflicts and controversies that will be addressed by the interplay between these actors.

Livre-Jeu

Inspired by books in which the player is the hero, the *Livre-Jeu* (*Game-Book*), created in 2016, features 36 characters and 24 stories. While some characters complete the mission, others fail. The characters suffer the consequences of the different scenarios in terms of changing landscapes and daily lifestyles. All of the content is based on real facts, characters or places, and is presented in a humorous, caricatured way.

Authors: Mathilde Kempf and Armelle Lagadec (association Un pavé dans la mare).

Example

In the *Livre-Jeu*, the two authors have created a series of characters based on their own professional experience in a design office. These characters are sometimes elected representatives, contractors, farmers or residents. The initial scene is a public meeting, triggered by the threat of the school's closing and the potential impact on the local village dynamics. Each character reveals their position and proposals. This clearly reveals the stakeholder dynamics and the possible outcomes depending on their choices.

In hindsight, improving players' knowledge or skills can help them to become more aware of the game. This could potentially influence their behaviour or modify individual or collective actions during or after the game. Indeed, if players have a better understanding of a problem or situation and of what is at stake and the levers for action during the game, they will be better equipped to react in real life or find solutions afterwards. Playing several rounds of the same game with the same players can help them integrate this knowledge and identify the best way to 'win' the game.

Example

Vitigame (see p. 18), when applied to groups of winegrowers, enabled them to recognise the environmental impacts of their viticultural practices and to identify the improvement levers at their disposal for developing new technical itineraries.

Level 1B. Games for collecting data and exchanging points of view

Designers, facilitators and their partners may aim to use a board-based game to help collect or gather information (Table 3.1B) that will be useful to them later, by consulting a target audience. The game can help to refine the understanding of a landscape, a supply chain, a technical itinerary or the interrelationships within a stakeholder system, etc. It may involve sharing knowledge or even helping to express and identify the various problems, needs, models, (inter)actions and projects that coexist, but without formal commitment from the participants at the end of the session. The game may also provide an opportunity to bring ideas to the fore, or to identify priorities or potential avenues for solutions, though it does not in itself lead to a decision-making process. The game can provide partially completed or yet-to-be-constructed descriptive support documents, or proposals to be tested to verify their acceptance and robustness.

Prospective Sensible

This game was designed as part of an Art & Science residency in Hendaye between mid-December 2019 and March 2020 by two artists and researchers. It focuses on mediation actions that can help to raise awareness of natural risks (particularly immersion and submersion) and climate change in the Basque coastal context through scenario writing. Players use small cards of critical uncertainties corresponding to the scenario to be written, alongside a table showing the links between uncertainties and the different scenarios they lead to.

Authors: Jean Bonichon and Sylvie Paradis.

Example

In the *Prospective Sensible* (*Sensitive Foresight*) game, the first stage is to share a portrait of the area. This leads to a collective writing of scenarios and the production of illustrative posters to explore possible solutions, even fanciful ones, without attempting to be exhaustive. This material can then be used to raise awareness among the general public (non-experts) and the players in a different way, encouraging them to think about the conditions and methods for moving towards a better world in the context of climate change.

The key idea here is that everyone can contribute their expertise to build shared knowledge, despite their partial and biased view of the problem or situation. Competition between players can be an important factor in identifying what is missing and helping to clarify where the issues lie, based on an inventory and the possible scenarios proposed. In this case, the collective and individual views are modified by this collaborative contribution of knowledge.

Level 1C. Games for training and capacity building

This type of game seeks to move more actively towards learning-through-play to acquire or reinforce knowledge, technical skills or even soft skills (Table 3.1C). These will subsequently be useful to participants, ensuring they are better equipped to perform the proposed actions, either individually or collectively, or to face a given problem. The game protocol may optionally include a preliminary stage to acquire or consolidate the minimum knowledge required to play (see Chapter 5).

Mymyx

Created in 2014, this game aims to promote the acquisition and sharing of knowledge around the enhancement of soil biodiversity, particularly with regard to mycorrhizae, i.e. symbioses between roots and soil fungi, for the innovative design of agroecological cropping systems. In its original version, farmers were the key target. However, it was later designed for advisory and teaching staff, as well as pupils and students enrolled in in agronomy courses.

Authors: Marie Chave, Valérie Angeon, Nicolas Giraud.

Example

The *Mymyx* game includes a preliminary stage in which players acquire and validate their knowledge of mycorrhizal networks. This is a prerequisite for the rest of the game. Players must then work together to answer questions, using cards, to determine whether they have acquired the necessary knowledge, which they can then use more effectively.

In subsequent phases of the game, players can apply this new knowledge alongside their existing knowledge and skills. However, the aim here is not to commit players to a dynamic or a project at the end of the game or to make any decisions.

Example

In the *Prospective Sensible* game (see p. 35), during the debriefing at the end of the session, the participants (high school students) emphasised the new technical skills they had acquired in collaborative writing methods and facilitation techniques. These will be of use in their future professions, even though they were not explicitly targeted by the game designers at the outset.

This board game, which is used for its 'adult education dimension', helps to foster a different relationship with knowledge and develop what Sen (2010) refers to as 'capability'. Players experiment during the game by trying out actions, making mistakes and rectifying them. This is part of the 'learning by doing' movement (Dewey, 2011). The right to make mistakes is important here because "games have a positive impact because they allow participants to

develop the logic required to solve a problem, while experiencing the problem in a fun learning environment and relaxed atmosphere" (Sauvé *et al.*, 2007), whether at school or as part of continuing education.

Jeu de territoire

Jeu de territoire (*Territory game*), developed between 2003 and 2018, is an expression game that aims to create a shared vision of the local area and encourage people to take action. It is a tool for facilitating and mediating between local actors and is used to support local development processes. Based on a shared diagnosis, it enables stakeholders to anticipate and plan for the future. The game is based on a participative prospective diagnosis, which is achieved through the collective construction of spatial representations that show the desired changes and help to evolve the stakeholders' representations.

Authors: Sylvie Lardon, Valérie Angeon, Vincent Piveteau.

Example

The concept of capability is implemented in the *Jeu de territoire*, where players act as local stakeholders and learn design and facilitation rules that they can redeploy in other professional situations.

Table 3.1. First type of objective: learning, collecting or raising awareness.

1A Information dissemination	• Raising awareness (of a problem, a subject, a need, an action, etc.) or identifying what is at stake (who, what, how, why, etc., as well as obstacles/drivers, resources/potentials and limits). • Passing on or indicating information and bringing it to people's attention. • Helping to better understand complexity (a situation, a problem, the dynamics involved in time and space, the processes at work, etc.).
1B Collecting and exchanging	• Collecting and collating information, knowledge or technical skills, highlighting complexity or diversity in the face of a given problem. • Producing information and acquiring new or missing data that will be useful later on. • Testing possible courses of action or thinking about how to adapt to a given problem (without committing to anything).
1C Training and capacity building	• Reinforcing, integrating or consolidating knowledge, technical skills and soft skills. • Providing and passing on new knowledge and skills that are useful to players. • Improving/developing shared knowledge and collective and individual skills.

Level 2. Mutual recognition and building capacity for 'joint action'

A second level of purposes is to prepare for action by 'being together' (Table 3.2). The aim is to move progressively towards a collective commitment through the game, contributing to the development of collective intelligence or collective competency in support of action, either during or after the session. Unlike the first category of games, the player is directly concerned by the simulated

scenario and may even have a vested interest in the results produced. At this stage, the objective is not yet to determine a programme of actions or a strategy, but rather to influence the collective dynamic by opening a space for dialogue conducive to collective action at the end of the game. We have identified several gradations within this objective.

Level 2A. Games for debate

Board-based games can be used to open a space for debate and exchange (Table 3.2A). The aim is to give the floor to the various players—acting either in their own role or that of another—within a safe environment. This allows everyone to express their arguments, whether they are in favour of or opposed to a given situation.

The game can also help to restore players' confidence in their ability to 'work together', or at least shed more light on the complexity or richness of the game and the system of actors involved.

Example

In the *Mymyx* game (see p. 36), during one of the game phases, players must answer questions together using cards and index cards to verify that everyone has acquired new knowledge and can better mobilise it afterwards.

This is also an opportunity to apply and consolidate the new knowledge acquired through the game.

Example

In the game *En campagne !* (see p. 34), participants are invited to debate and defend their character's ideas in order to create a shared fictional living space. Throughout the game, they are confronted with differing visions, expectations and needs concerning the same local area; this encourages them, within the context of the session, to understand the complexity of a situation in all its dimensions. The game also prompts them to explore the diversity of viewpoints and stances.

Level 2B. Games for building a shared vision

This type of game offers players the opportunity to share and build a common vision to strengthen their commitment (see Table 3.2B). This allows them to position themselves relative to one another to improve coordination and better recognise the contributions of others. Participants can also identify what is

Example

This is notably the case with *Les Tréteaux du Paysage* (see p. 17), which offers various participatory workshops where invited stakeholders respond *in situ* to one or more questions. In one *Tréteaux* workshop concerning urban planning and village expansion, three project tables allowed the visions of elected officials, technicians and local residents to be compared. These differing visions were valuable to the Causses du Quercy Regional Natural Park in identifying the drivers and barriers to be considered for the next Landscape Charter currently under development. The same applies to the *Prospective Sensible* game (see p. 35), where each participant becomes a co-author of a collective story. Indeed, board-based games can serve to strengthen or initiate a shared culture, as seen in *Les Tréteaux du Paysage*.

already shared or shareable between them. In this case, players act in their own roles and are invited to contribute their expertise or personal insights to the collective.

Table 3.2. Second type of objective: self-knowledge/recognition.

2A Debate and exchange	• Opening up a space for dialogue and allowing points of view to be expressed and discussed • Arguing a stance or point of view • Revealing what coexists and the diversity of viewpoints/stances/needs, etc. • Understanding the complexity and different facets of a single problem • Clarifying a problem, situation or process
2B Sharing and uniting	• Being recognised and having an identified role that gives everyone a place • Determining what is shared and what makes sense from a collective point of view, and what is common sense • Developing collective intelligence and creating a shared vision • Strengthening or creating a collective dynamic, a network and expertise • (Getting) recognition for the diversity of viewpoints • Regulating or calming conflicts or problems related to what is unsaid or differences of opinion to break the deadlock

Level 3. Cooperation and commitment for 'project-making'

This category groups together games that allow several people to consider or decide upon actions to be carried out for 'project-making'. In this type of game, participants actively engage in support of the action. At the very least, the game serves to demonstrate that joint action is possible, but it can also enable participants to progress in the construction of a concrete project or action (e.g. for the landscape, agriculture, supply chain, etc.). Consequently, the game has tangible decision-making and operational implications, providing an opportunity to debate the meaning of agricultural or landscape actions, or the frameworks for collective commitment (see Table 3.3). We have identified three levels of commitment.

Level 3A. Facilitating and supporting collective action

The aim is for players to use the board game to facilitate decision-making and group choices within a playful framework, which helps to coordinate group or collective action. Players can then discuss the different options available and weigh up the pros and cons of each to help them decide on the best course of action. Many games with a foresight dimension offer this, with scenarios designed to simulate possible outcomes and shed light on the actions required in time and space to move towards a better, more controlled situation. Often, the process of dialogue and realisation is more important than history combined with the future. Sometimes, it is not one of its scenarios or its illustrations that shed light on the future, but rather the entire process and the materials produced, with each one complementing the others.

Example

In the *Vitigame* (see p. 18), which is based on real-world vineyard management cases documented in record sheets, the game allows students to engage with real-world scenarios by constructing a new technical itinerary within a risk-free environment. The player is subsequently free to reproduce or be informed by the outputs generated during the session.

Level 3B. Games for problem solving and negotiating solutions

At an even higher level of engagement, this type of game aims to resolve a problem or a debated situation by jointly deciding which specific actions or points must be initiated, as well as the 'where, when, how and who' of the implementation (Table 3.3B). As such, it serves as a problem-solving tool.

Example

In the *Jeu de territoire* (see p. 37), players must work together to produce a prospective diagnosis based on a provided dataset. In the final phase of the game, players must select a scenario for the local area's development and define the actions required to achieve or counter it. When the game is designed for stakeholders sharing the same local area and addresses its future, the protocol enables them to outline and negotiate actions and offer potential responses to real-world problems.

Table 3.3. Third type of objective: cooperation and commitment.

3A Facilitating and supporting collective action	• Organising, shaping and giving meaning to knowledge • Meeting, working together and interacting • Developing dialogue and listening skills • Facilitating decision-making and helping to make choices and implement mediation • Stimulating a group, collective action or project • Coordinating and organising groups, collective actions and projects
3B Solving and negotiating	• Exploring solutions that take complexity into account • Clarifying a problem or situation and specifying a need, project or action • Decompartmentalising action and experimenting with a systemic, interdisciplinary approach • Anticipating (needs, problems, etc.) and coordinating responses • Initiating a decision-making process • Reaching agreement on a project, action or approach • Initiating resolution and potentially resolving conflicts
3C Cooperation and (co)-construction	• Working together on a project and giving meaning to collective action • Involving different stakeholders in a strategic vision • Making choices with others, programming and planning together • Making decisions together (co-decision) • Taking responsibility and becoming an active participant • Developing and strengthening the ability to co-construct and come up with a design or solution

Level 3C. Games for cooperating and finding solutions together

The aim may be to implement a project or collective action, or to formalise a commitment from one or more players at the end of the game. In this case, the game is clearly action oriented. Each player organises their knowledge and skills and works with others to produce a formalised result, such as a programme of action, layout design, technical itinerary or graphic object (such as a map, logo or label).

Example

In some sessions of *Vitigame* (see p. 18), players may be set the objective of establishing a collective consensus on technical decisions regarding the management of a vine plot to reduce its environmental impact. This consensus is reached at each stage of the game, where collective decisions must be made to define the overall strategy, followed by the implementation (or otherwise) of specific operations, their nature, and the tools and inputs to be employed. In fine, in this example, this results in the design of a desired or desirable technical itinerary that is fully operational, and whose environmental performance can be calculated at the end of the session. The same game, used for a ten-year prospective exercise with a group of AOC (*Appellation d'Origine Contrôlée*) decision-makers, enabled them to identify the primary environmental challenges to be considered in the AOC's strategic orientations and the priority themes for experimentation.

Level 4. Design and testing for practical implementation

In this final category, we have included games whose stated objective is to design and test operational solutions through to their practical implementation. Compared to the previous category, this involves not only envisaging the possibility of action but using the game to construct the entire decision-making process—from the initial acceptance of a principle to the practical conditions of its fruition. This includes identifying the barriers to be overcome, the drivers to be mobilised, the range of actions to be implemented, and all direct or indirect consequences of the change. Most games in this category are linked to design and simulation; here, the proximity to reality is at its greatest. While this type of mobilisation is common in fields such as business or health, it remains vital in agriculture, where empirical testing (field experimentation) often represents a significant risk. These games are frequently used in the agricultural sector. They could also address issues of spatial planning, operational urban planning or landscape design, although we have not experimented with these. This category differs from Level 3C in that these games are not centred on co-construction, but on the search for technical solutions (Table 3.4).

Level 4A. Games for designing

Games can be used to formalise new, concrete practices by enabling players to make decisions about new forms of work and organisation (e.g. work, space, etc.), based on an initial situation linked to reality. They provide a means of rendering visible new organisational structures that are unusual and difficult to envisage directly in the real world. In agriculture, for example, they facilitate the design of new technical itineraries by combining players'

knowledge and enable the anticipation of practical applications in the field by planning ideas conceived in the game. The design approach plays a major role here in the practice of the game and, more importantly, in the conception of the gameplay.

Rami Fourrager

Designed between 2010 and 2015, the game *Rami Fourrager* (*Forage Rummy*) was created in response to a lack of tools for providing advice on grassland and livestock farming. It is a collaborative board game that serves as a physical and social platform for virtual experimentation and discussion around the design and adaptation of forage systems to complex changes in the production context (e.g. climatic or economic changes) or new objectives set by farmers. It can be described as an expert game as it requires a good knowledge of forage systems, animal feed and the biology of forage plants. As such, it is best suited to an audience of agricultural professionals or students in higher agricultural education (BTS, engineering).

Authors: Guillaume Martin, Roger Martin-Clouaire, Michel Duru, Benoît Felten.

Mission Écophyt'eau

The tool was devised in 2016 as part of co-design sessions organised for a Dephy Écophyt'eau group in Nord-Deux-Sèvres within the Civam du Haut-Bocage (Deux-Sèvres). It was updated in 2018 and again in 2023. The aim was to provide better support for co-design sessions on low-input cropping systems in order to achieve the objectives of the national Écophyto programme, which aims to reduce or eliminate the use of plant protection products from agricultural practices.

Author: Céline Vromandt.

Example

Rami Fourrager uses modelling and plot distribution to come up with new forage production scenarios for farms. Based on a given's farm situation (which could be a player's own farm), players can exchange ideas and devise a new technical plan, taking into account economic, environmental and technical constraints.

In *SSol&co* (see p. 22), players aim to manage soil-borne biopests in market gardening. To facilitate this, the group works through the case of a real farm and its stakeholder network that influences the choice of farming practices. A similar scenario can be found in *Monopoly du temps* (*Time Monopoly*), a board-based game that examines the organisation of labour in agriculture and enables farmers to rethink the management of their working time in a playful way. The *Mission Écophyt'eau* game also aims to facilitate co-construction sessions for pesticide-reduced cropping systems. Similarly, *Mymyx* (see p. 36) was created to co-design cropping systems that maximise the potential of mycorrhizal networks.

Level 4B. Games for testing and simulating reality

This is a classic application of games, but it is often only considered in the context of video games. However, board games can also simulate the real world by presenting players with situations that closely resemble everyday life and inviting them to behave or make decisions as they would in real situations. These situations may concern personal or professional matters, or even individual or collective decisions. This makes them an important learning tool, for instance when one first begins managing a farm. Simulation can also facilitate

the testing of new solutions devised elsewhere, either within the game itself (as in *Rami Fourrager*), via another game, or through the combination of several or any other external processes. In *Dessinez le verger de demain* (*Design the orchard of tomorrow*), players test new technical itineraries in arboriculture in a situation close to reality (taking geographical location, scale, weather, soil and climate constraints, etc. into account). They propose ways of organising the space, which are assessed using a scoring system that takes into account the environmental, economic and climatic consequences of the proposals.

Example

In *Dynamix* (see p. 18), players collaborate to optimise the exchange of products (such as cereals and forage) and co-products (such as slurry) between farms. By experimenting with and simulating these exchanges, they can identify the ideal situation for their local area and establish new partnerships.

Table 3.4. Fourth type of objectives: designing games.

4A Designing	• Imagining new practices • Organising tasks, activities, etc. • Designing technical itineraries • Planning ahead
4B Simulating and testing	• Experimenting with or applying knowledge, technical skills and soft skills • Simulating practices and technical itineraries • Simulating actions to observe changes in behaviour, nature, etc. • Testing new solutions

It should be noted that some games offer considerable scope for adaptation depending on the target audience or the context. In other words, depending on the participants, the same tool can be used to achieve different objectives.

Methods for formalising game objectives—by transitioning from an objective to game mechanics—are examined in Chapter 4.

Case study thread for Part 1

Nolwenn Blache

This first part describes how we, as a naïve audience of serious games, we came to understand the subject and how we transformed it into a board game aimed at a professional audience. We will describe how we set the objectives for our serious game.

Loup dans la bergerie

This game was designed as part of a final-year agronomy engineering course at VetAgro Sup Clermont-Ferrand. The module was designed to train students in modelling complex agricultural, environmental and systemic analysis situations. The project was initiated by the *Agriculture, Environnement, Santé, Territoires* (AEST) class of 2019–2020, resulting in an initial version of the game called *Loup comme un agneau (Wolf like a lamb)*. The class of 2020–2021 then took it up again and improved it, creating the final version: *Loup dans la bergerie (Wolf in the sheepfold)*. The game lists and puts into practice the protection measures that have been tested to date to protect flocks of sheep. It provides players with insight into the measures being implemented in France and abroad, their effectiveness, their cost to farmers, and the extent to which they are covered by the State. Cards also provide information on wolf species based on scientific literature. Finally, the game has been designed to give players sufficient freedom on when playing on the board and during negotiations. Everything has been done to encourage the sharing of knowledge between players.

When we started designing this game about the arrival of wolves in a pastoral area of the Massif Central, we knew very little about serious games. We therefore started with the only theoretical input available: an introductory course on systems analysis. We then quickly familiarised ourselves with the subject by watching documentaries, consulting press documents, and reading scientific articles. In parallel, the module supervisors provided several serious games (*Le Genêt Belliqueux, Syeleterr*, as well as games created in previous years), which we played. These game sessions were very important in the creative process, as they enabled us to understand the nature of board games that address agricultural issues. In fact, most of us had little experience of board games and their potential play mechanisms. The exercise we were asked to complete was quite different from a traditional training course and called more on our personal knowledge. It was therefore an essential step in nurturing our inspiration and building our confidence in our ability to complete the task.

Our knowledge and expertise related primarily to agriculture, which thus served as the entry point for our work. For us, the notion of play was restricted to the frivolous, risk-free characteristics of 'make-believe'. Given the theme of the game, which combined agricultural and ecological dimensions, we quickly moved towards a board-based game. The board represented the summer

mountain pasture where players could experiment with biological and agronomic phenomena. This board thus allowed for the integration of different spatial levels: a herd grazing at the level of a plot, a farmer managing various herds at the level of the farm, the collective of farmers occupying and thus shaping a summer pasture area, and finally the wolf predating on wildlife or livestock within its home range (Figure F1).

Figure F1. *Loup comme un agneau (Wolf like a lamb)*, the first version of the *Loup dans la bergerie (Wolf in the sheepfold)* game (© Christine Roy).

In addition to spatial scales, the game also simulated social phenomena in the area. After carrying out their actions, the players—whose roles were caricatured to make them easier to understand—had to debate and make collective decisions for the coming year. To facilitate this, the players could use the negotiation cards provided in the game or draw on their own knowledge. The educational challenge for our students was to take all these scales into account using a systemic approach, and to present the outcome as a game that was both enjoyable and capable of conveying the consequences of the arrival of the wolf from a landscape, agricultural and social point of view.

Reflecting on our experience, we realised that the arrival of the wolf in the Massif Central had evoked many fantasies among the students who found it difficult to separate the emotional dimension from the event. Bringing such a controversial issue into play is no trivial matter. From the outset, this subject was imposed on us by the module leaders. Therefore, we considered the most coherent objective in terms of both the subject and the target audience. After studying the literature, we realised that the biology of the wolf was relatively well known, although local variations remained unexplained. Conversely, there was a great deal at stake in terms of social relations, the mechanisms of which were less well studied at the time. We were only aware of the most dramatic aspect: the stark contrast between those in favour of wolves and those against them. We also realised that the measures implemented to ensure

cohabitation between wolves and farmers were not satisfactory for either party. As students at an agricultural engineering school, we wanted to create a game to address this social and ecological crisis. We therefore decided that our games target audience would be farmers and professionals dealing with this issue. This ensured that our future players would not be naïve about the subject. Given the palpable tension surrounding this issue, it would have been highly inappropriate for us to design an awareness-raising game. We also had to guard against the potential excesses associated with this divide. Therefore, we chose not to favour the point of view of any of the parties concerned, but rather to design a game for consultation, mediation and experimentation. Our aim was to bring professionals together around a table to raise awareness of the consequences of the wolf's arrival and its impact on their activities so as to encourage them to work together to find solutions.

It is worth noting that, due to the context in which it was designed, our serious game ultimately had two levels of objectives. The first objective, set by the supervisors, was pedagogical: to design a serious game to learn how to model a complex situation using a systems approach. The second objective was set by the students and related to how the game addressed the problem.

After some consideration, we decided that our game should have several objectives: to learn about existing protection methods, to experiment with new protection combinations and, finally, to encourage actors to discuss their views and work together. These were very ambitious objectives for a single game.

Part 2
Designing and building a game

A serious game combines two different, and often antagonistic, points of view: that of the targeted player who is an already experienced player, and that of the designer who assigns learning objectives to the game. For a serious game to work, it must be attractive (fun) to players and enable them to learn in line with the aims assigned by the designer or facilitator. It must therefore reconcile two opposing worlds of the school, which are based on effort, realism and submission to authority, and the world of gaming, which favours escape, fiction, transgression and even subversion (Lavigne, 2016). Naturally, most games still involve rules that must be respected. They must also reflect the values and interests of the time and capture the zeitgeist. This requires intuition on the part of the game creator, and there is always the risk of failing to find an audience if this balance is not achieved.

Monopoly, for example, was created in 1935 and glorified booming capitalism, becoming a resounding success. However, it was inspired by an earlier game, the *Landlord's Game*, created in 1902, which aimed to show the evils of capitalism. This earlier game had not been as successful (Romon, 1985; *Libération*, 9/02/1985).

As there are very few books dealing with the technical and practical aspects of game design, the aim of this section is to help future game designers minimise the risk of producing either a game without an audience or a game that does not accurately convey the intended reality. To achieve this, we will draw on our experience of trial and error, successes, but also failures that we could undoubtedly have avoided if we had had access to a helpful book at the time.

In this section, we approach the design of a serious game as a journey comprising two main phases:
– The passage from reality to an intelligible model, an interpretation of reality, which we call 'translation'.

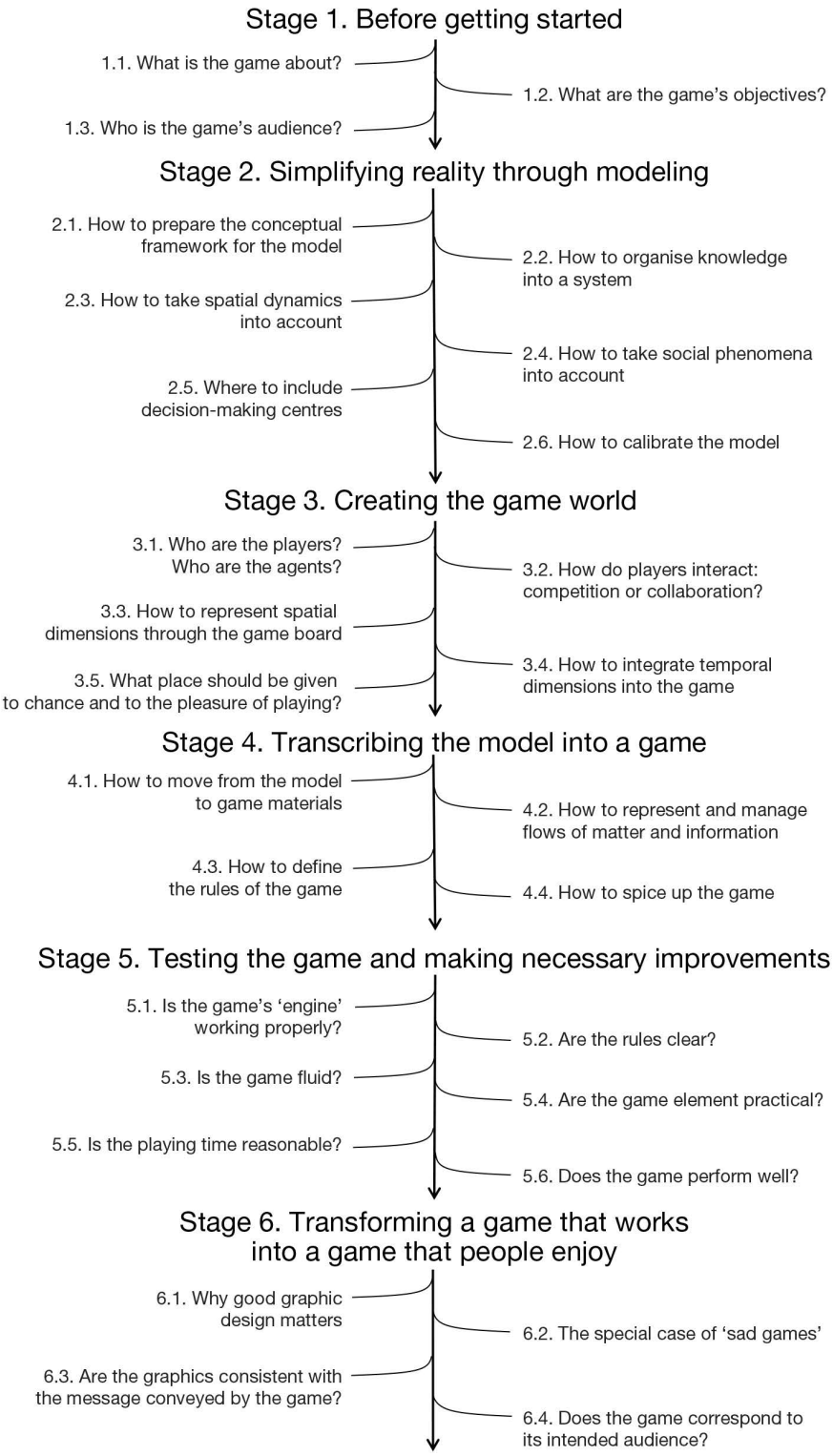

Figure P2. Schematic pathway for designing a serious game in agriculture or landscape.

– The transition from the model to the game, i.e. rewriting it in comprehensible and applicable game rules, which we refer to as ‘transcription’.

We have organised this process into six stages, which correspond to the six chapters in this section. Each chapter contains several questions that any serious game designer needs to ask themselves. We also provide practical solutions, illustrated by concrete examples from our own work where necessary.

4. Before getting started

Romain Dureau, Nolwenn Blache, Hélène Gross,
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Kuang-Yu Wang, Yves Michelin

There is no such thing as a 'good game' in absolute terms. Its relevance and effectiveness depend on how the subject is treated in relation to its objectives and target audience. This is referred to as the positioning of the game. However, several authors, including Lavigne (2016), have noted that most serious game designers consider only the designer's point of view, without thinking about how potential players might engage with the game. To avoid this pitfall, anyone tempted to design a serious game should ask themselves the following questions.

What is the game about?

The aim is to clearly identify the scope of the game:
– Which aspect is the core subject matter and must be reflected in the game mechanics?
– Which additional aspects do the designers feel are important to include (e.g. through options, special features of the board)?
– Which dimensions do the designers choose to exclude to avoid adding unnecessary complexity?

While these aspects may seem obvious, addressing them is more difficult than it appears, given the vastness of the agricultural and landscape frameworks. A single subject may involve several dimensions (ecological, agronomic, political, social, etc.). In such cases, analysing these situations is an ambitious undertaking. Berdish (2001) suggests categorising them according to the system complexity level and the social complexity level (Figure 4.1).

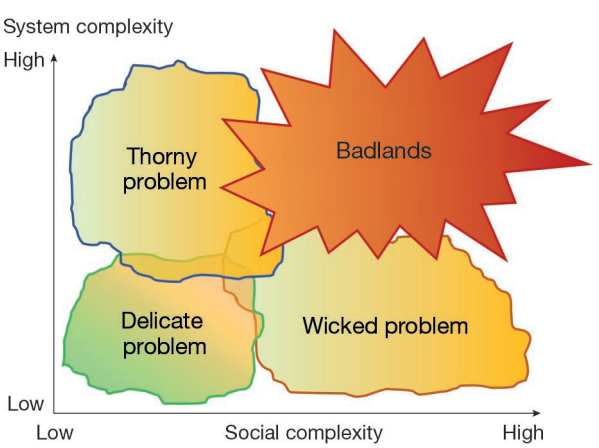

Figure 4.1. Classification of real-life situations (after Berdish, 2001).

Situations are very difficult to manage when complexity is high in both subsystems. Representing the situation as a game can therefore help actors to become aware of this complexity and consider solutions. However, depending on the objectives of the designers and the available knowledge, we can choose to incorporate both aspects into the game or focus on just one. The choice of subject can result in three types of games:

– Predominantly social or sociopolitical games. In this case, the mechanisms are based mainly on the actor dynamics: strategic choices, negotiations, legal and legislative framework, etc.

– Games that focus on biological or biotechnical aspects. In this case, it is mainly based on the functioning of a species, interactions between species, animal husbandry, etc.

– Hybrid games which combine both social and biological dimensions. However, care must be taken to avoid the temptation to try to be exhaustive and create a hybrid game. Hybrid games are bound to be more complex and take longer to develop.

CampaRISK

This serious game was developed as part of a PhD thesis in Economics (Dureau, 2020) on the collective management of a small rodent pest of meadows: the ground vole. In practice, farmers affected by vole infestations were finding it difficult to devise a collective control strategy. The game's primary objective is to provide an operational tool for leading groups of farmers in devising a collective control strategy. The second is to serve as an experimental economics tool, enabling researchers to observe players' behaviour such as decision-making, trade-off management and cooperation. Players (representing farmers) aim to ensure their herd is supplied with fodder. The game also incorporates trade-offs between managing the forage system and dealing with collective and territorial issues, as well as securing the business by managing hazards such as bad weather, pests and tractor breakdowns.

Author: Romain Dureau.

Example

When we wanted to create a game about vole infestations, we realised that the game would be completely different depending on whether the focus was on the biological and ecological mechanisms of the outbreak or the behaviour of those involved in managing this phenomenon. In the former, the players would be the biological actors involved (the voles, moles, their predators and, potentially, the farmers through their direct or indirect control practices). In the latter, the players would be the various management stakeholders, such as farmers (as in *CampaRISK*) or hunters, naturalists and the authorities. As our primary concern was to make the players aware of how their decisions impact the control of vole populations, we opted for the second option.

What are the game's objectives?

A serious game can address many different objectives for the same subject, such as conveying content (knowledge or information), developing players' skills, simulating rare or risky situations, or testing solutions. Often, the subject and objectives of the game are difficult to separate. However, this issue must

not be overlooked; it is vital to be clear on the game's objectives before modelling reality. Indeed, any such translation is a 'betrayal', as simplifying assumptions are necessary for the model to function. Subsequently, when transcribing the model into a game, further simplifications are essential for the game to be enjoyable (see Chapter 7). For these assumptions to be acceptable, their formulation must be consistent with the game's objectives. In other words, they must not limit the game's ability to reflect the reality it represents. For example, if the goal is to educate or raise awareness, the model must enable players to understand the phenomenon—be it a biological process or a socio-economic bottleneck (such as the management of the commons).

If the overall aim is to facilitate debate, share perspectives or build consensus, or if the game serves as a mediation tool for collective action, then the social dimension will be central. If the goal is to find solutions or experiment in a risk-free environment, it may be judicious to combine a precise biological model with a socio-economic model incorporating stakeholder dynamics and specific behaviours. It is often useful to analyse other serious games to deconstruct their underlying biological and social sub-models, observing which predominates and relating this to the game's objectives.

Who is the game's audience?

Generating full player engagement is a fundamental condition for a successful serious game. This requires clearly defining the primary target audience and accounting for their gaming background. While the game is not strictly reserved for this audience, specific design choices and dilemmas addressed during the design process depend on this target. The players' ability to identify with the game, its aesthetic appeal, its complexity, the flexibility of the rules, the environment, and the broader process must all be considered (see Chapters 6 and 7). It is also important to assess necessary prerequisites and whether the audience aligns with the objectives (see Chapter 4).

Example

In *Mission Écophyt'eau* (see p. 42) and *Vitigame* (see p. 18), which lead players to construct technical itineraries, basic knowledge of agronomy and annual crop management (for the former) and viticulture (for the latter) is required. This excludes audiences who lack these prerequisites.

Depending on the circumstances, players may play alone or in groups, in teams or individually, in either collaborative or competitive formats (Figure 4.2). Subgroups are often formed when the number of participants is large. These choices determine the types of interactions between players (e.g. a shared vision within a homogeneous group, or the hybridisation of knowledge in a heterogeneous one) but also condition the success of the session (notably the risk of professional insularity or conflict).

In summary, the game designer needs to decide whether the game is intended for a homogeneous or heterogeneous audience and whether that audience is divided into different teams or comprises the entire participating group. This audience could comprise professionals (in the agricultural sector, for example), elected representatives or decision-makers with varying degrees of expert knowledge and skills, or learners (e.g. school pupils, students or adult learners) with varying degrees of relevant knowledge and skills.

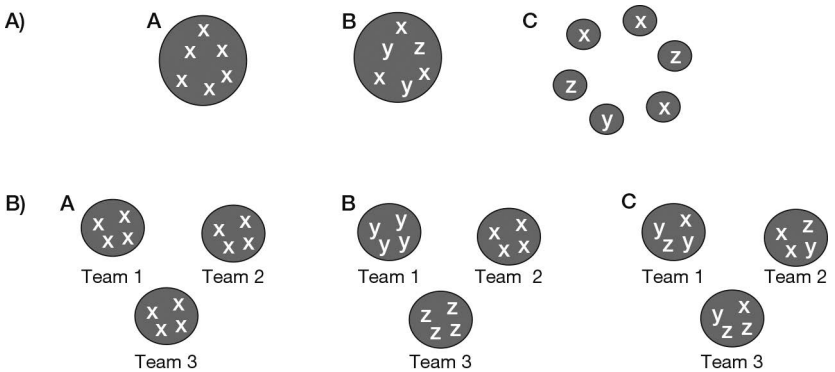

Figure 4.2. Some examples of player formations and positions depending on whether or not there are several teams or tables playing simultaneously. A) The players work together within the same group or compete against each other. B) The players are divided into several teams or tables.

Players may work together within a homogeneous (A) or heterogeneous (B) group or team, or they may work in a competitive situation (C), competing either against teams or against other participants.

Example

Table 4.1 illustrates the responses to these preliminary questions for several games we designed.

Table 4.1. Identification of the framing elements to be specified before starting, as applied to serious games by the authors.

Game title	Subject	Target audience	Objectives
Le Genêt Belliqueux	The role of grazing in opening up or closing off landscapes	High school and higher education students and the general public with no knowledge of agriculture	Understand the interactions between farming and the environment based on the principles of agroecology
Syelterr	The operation of a dairy farm and its environmental impact	Beginning agronomy students	Understand the basic principles of the whole-farm approach and livestock-land interactions
Loup dans la bergerie	Managing the arrival of wolves in an area of high pastoral activity	Local actors working on this issue	Use games as a tool for mediation and experimentation
CampaRISK	Collective management of ground vole outbreaks by farmers	Mainly livestock farmers affected by vole outbreaks	1. Encourage farmers to think of their area as a pest management unit and build a common strategy 2. Observe player behaviour from an experimental economics perspective

Example (continued)

Table 4.1. (continued)

Game title	Subject	Target audience	Objectives
Ruralis	Agroecological infrastructures and the ecosystem services they provide	Target 1: Pupils/ students (from Year 11) (facilitators = teachers) Target 2: Farmers who have not yet reached a high level of awareness (facilitators = agricultural extension officers) Target 3: Local stakeholders (coordinator = local development agents)	1. Understand agroecological infrastructures and the consequences of choices regarding the location of a plot of land and maintenance methods on different dimensions (e.g. environment, economy, work, etc.) 2. Experience concerted action, bringing together actors from diverse professions and interests

The light grey boxes correspond to predominantly biotechnical games, the grey ones to predominantly social games, and the dark grey ones to games that combine both aspects in a balanced way.

5. Simplifying reality through modelling

Yves Michelin, Nolwenn Blache, Romain Dureau, Hélène Gross, Sylvain Dernat, Camille Clément

Creating a game based on real-world situations involves analysing the functioning of observed phenomena to reliably replicate them within the game world. However, as established in Chapter 1, agricultural, environmental and landscape issues are difficult to analyse in all their complexity. In accordance with general systems theory (Bertalanffy, 2012), we consider that analytical approaches struggle to explain complex phenomena. They also struggle to transcend mental models—the representations that all humans deploy to explain the events whose consequences they perceive. Yet, what we perceive stems from multiple interactions between farming practices, ecological processes and landscape dynamics. Furthermore, action modalities must also account for social and economic stakes. Under these conditions, transitioning directly from reality to the game is risky and prone to error.

To overcome these difficulties, we propose an intermediate modelling phase with a systemic approach inspired by the work of De Rosnay (2014), particularly his original tool, the macroscope. The approach he proposes provides highly relevant conceptual and methodological frameworks for modelling a situation before transforming it into a game. It is based on three principles:
– Stepping back to get a better view, i.e. try to understand the subject as a whole, concentrating on the essential components and their interactions.
– Linking things together to understand them better. The primary aim of systems analysis is to establish connections between elements in order to create a system. The result is a capacity for evolution, the outcome of which can only be predicted if we understand how this assembly works.
– Situating to act more effectively. It is always important to clearly characterise the field of application of this systemic analysis, including the spatial location, time period and definition of spatial and temporal boundaries.

Modelling reality therefore involves simplifying the identified elements, their interactions and the underlying processes. This simplification does not, however, negate the complexity of reality. Rather, it represents a conscious selection of the elements and processes required for the model to remain sufficiently representative of that complexity. In short, the challenge at this stage is to render that portion of reality—the subject of the game—comprehensible in accordance with the assigned objectives, while simultaneously ensuring the pleasure of play. Figure 5.1 illustrates how the modelling approach plays an essential role in our proposed framework, bridging the gap between reality and the game to ensure the end product is both playable and scientifically rigorous.

To model a situation that will be the subject of the future game, we propose a six-stage process. This is not a linear process, but rather a spiral approach involving a great deal of feedback. It works by trial and error and improves as the project progresses.

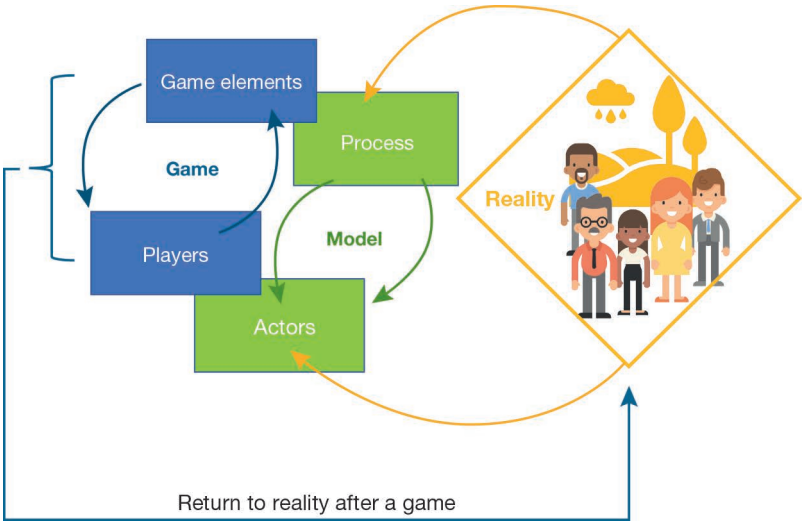

Figure 5.1. The process of transitioning from reality to games.

How to prepare the conceptual framework for the model

There are several ways of relating a model to reality.

Example

It can be applied to specific situations, as in *Jeu de territoire* (see p. 37), in which case it must be parameterised with site-specific data for each use. Alternatively, it can reflect a type of situation, as in *Syeleterr* (see p. 16), where parameterisation relied on standardised case data from the *Institut de l'élevage* (French Livestock Institute).

Therefore, before embarking on the model, it is important to have sufficient knowledge of the reality to avoid overlooking structural elements or processes. This stage aims to highlight both existing knowledge and the gaps in our analysis of the underlying phenomena, as reality can sometimes be poorly understood. This stage should be carried out—at least in part—prior to the game design process.

Three types of information are required. First, a review of the scientific and technical literature provides the analytical framework for the question formulated in Chapter 4. Second, interpreted data (such as typologies, standardised cases, documentaries, pre-existing formal models and potentially simulators) are vital for the initial conceptualisation of the subject. Finally, this work can be supplemented by empirical field data, which must not be overlooked.

How to organise knowledge into a system

Once this knowledge has been acquired, it should be represented as a system, i.e. as a set of elements that interact dynamically and are oriented towards a

goal and organised hierarchically. The whole is greater than the sum of its parts because new properties emerge from the relationships between its components and with its environment. A system is defined by its structure, its functioning and its flows. Diagrams are an extremely useful way of representing this and preparing the transition from model to game.

Defining the system structure

Here, 'structure' refers to both the system's boundaries and its internal organisation. In simple terms, a system is made up of several sub-systems and may itself be part of a larger system. The first stage is to identify all the relevant elements and the relationships among them. The limits of the system must also be defined. These can be strict, for example, the plots of land on a farm, or vague, such as the edge of a wetland. During this initial conceptualisation phase, therefore, it is important to consider the scale or scales needed to address the subject and thus establish its boundaries.

Example

To model the interactions between pastoral practices and landscape dynamics, there are at least three levels of spatial organisation: the plot, the farm and the landscape. In *Le Genêt Belliqueux* (see p. 19), we only model the summer pasture plot level, whereas in *Syeleterr* (see p. 16) which has quite similar objectives, we combine the three levels, while placing greater emphasis on the farm level.

The initial diagram defines what we intend to incorporate into the model's functioning and what remains external. However, this is not definitive; it may be modified if it proves too complex or insufficiently detailed (see Figure F2 of the Case study thread, p. 96).

Characterising system functioning

Once the constituent elements of the system have been identified, we refine the diagram. To do this, we deploy flow-model representations to define which elements function as flows and which as stocks (or reservoirs). Stocks aggregate and store entities, energy, information or matter, which then circulate through networks as flows. These flows are regulated by 'gates' that control the rate of transfer. These gates may be opened or closed based on factors—model elements whose quantity is not necessarily tracked, but which govern flow behaviour. These factors may act as constraints when they inhibit a specific behaviour, though they are not exclusively restrictive. Within any system, feedback loops may either amplify a process (positive feedback) or, conversely, dampen it (negative feedback). De Rosnay (1975) provides a graphical schematisation of these mechanisms, which is highly practical for modelling a phenomenon prior to the game design phase (Figure 5.2).

Simplifying the model

Once the structure and operation of the system have been described, it is often found that the model is too precise to be transcribed into a game. With the exception of video games, which can handle calculations involving multiple variables, tangible games (such as board and card games) can scarcely handle functions with more than two or three variables; otherwise, the underlying model becomes too complex, and the resulting game becomes unplayable.

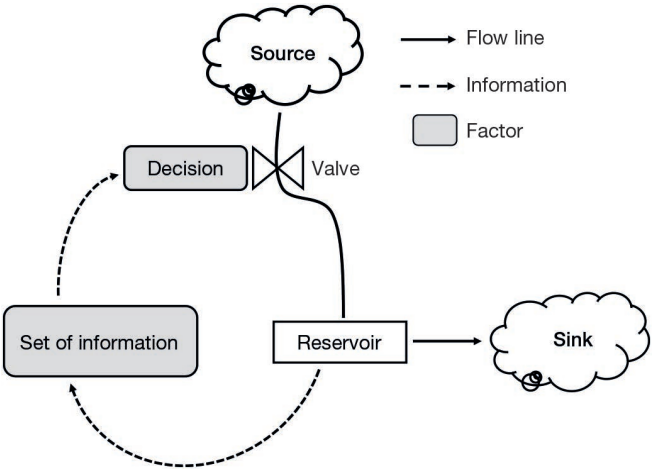

Figure 5.2. Schematic diagram inspired by De Rosnay.

It is therefore essential to make a series of simplifying assumptions. Conversely, if an essential element is missing, the game will not work, and the model will no longer represent reality accurately. Choices must therefore be made between the identified elements and their interactions. In particular, it is common to assume that certain elements or processes will remain constant within the framework of the game's objectives. While this approach is a prerequisite for implementing a serious game, it is also its weakness. When the game is deployed, the credibility of the simplifying hypotheses in the eyes of the players will be an important factor.

How to take spatial dynamics into account

The representation of space is at the heart of agricultural, environmental and landscape issues.

In the model, space can be managed in several ways. It can be an assembly of objects that have functional and topological relationships with each other, such as connectivity, contiguity, inclusion, intersection and distance. In other words, these objects of different natures coexist within the same agricultural space or landscape. As such, they have spatial relationships with each other that need to be considered in the model and that influence the outcome, such as the proximity of plots to farm headquarters, the accessibility by road and the presence of rivers. These interrelationships constitute either assets or constraints for farm or landscape management. Depending on the model's mechanisms, these relationships may appear, disappear or undergo state transitions (e.g. vegetation elements that appear or disappear over the course of the seasons or due to the action of agents). When objects have discrete boundaries (e.g. plots of land), spatial mechanisms can be processed in vector mode, as in a geographic information system (GIS). Objects are spatially referenced according to their position and relationships.

Example

This is the case with the *Syeleterr* game (see p. 16), whose model incorporates spatial objects with discrete boundaries. Figure 5.5 illustrates how space is accounted for in vector mode within this game.

Example

Figure 5.3 presents a direct application of this type of schematisation, produced using Vensim software by the students who designed the game *Loup comme un agneau* (the initial version of *Loup dans la bergerie*, see p. 45). This representation models the biological functioning of the wolf within the game and identifies the various stocks (or reservoirs). These are elements whose quantities fluctuate during the session based on gameplay actions, and which the designers need to track. Gates regulate flows—such as the reproduction or culling of the wolf—and are themselves dependent on other non-framed factors or stocks within the model, thereby forming a feedback loop.

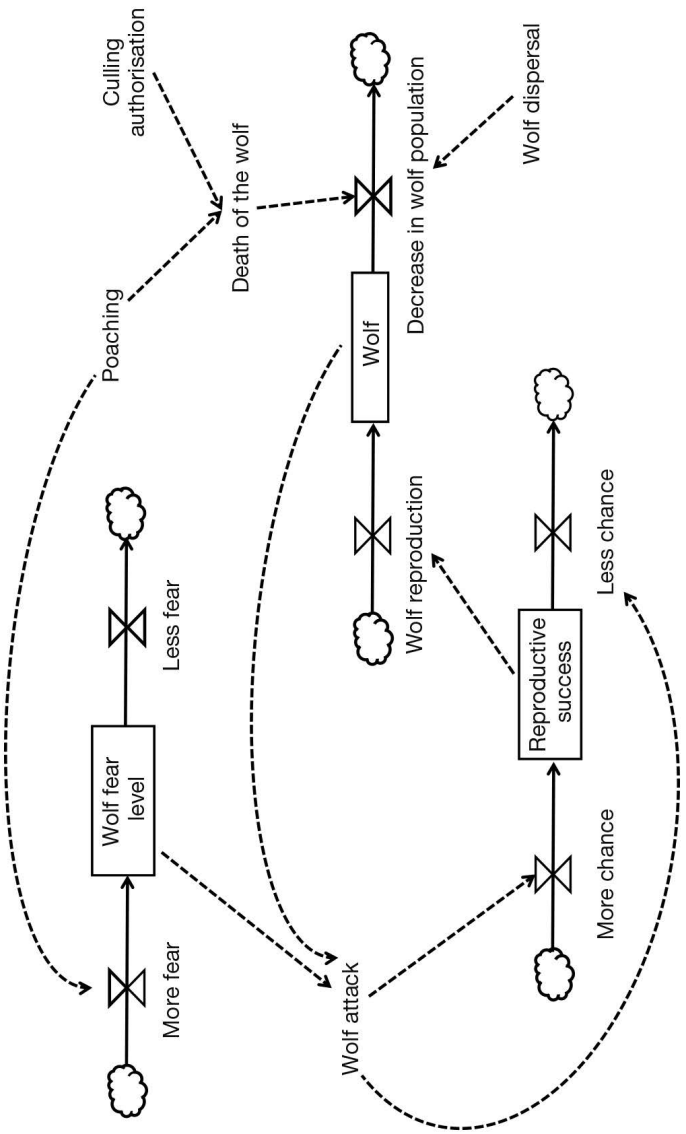

Figure 5.3. An example of a sub-model: the functioning of the wolf in the game *Loup comme un agneau*.

Example

As the focus of the *CampaRISK* game (see p. 54) is to study cooperation between players facing a common challenge, the complex agroecological mechanisms governing vole population dynamics were significantly simplified. Consequently, the technical levels of the plot and the herd were excluded from the model to concentrate on the socio-economic scales of the forage system and the landscape. Furthermore, the bioeconomic model used to design *CampaRISK* focuses on understanding social interactions between neighbouring farmers within the same local area: these interactions are not formalised within the model and are therefore unconstrained by any *a priori* assumptions.

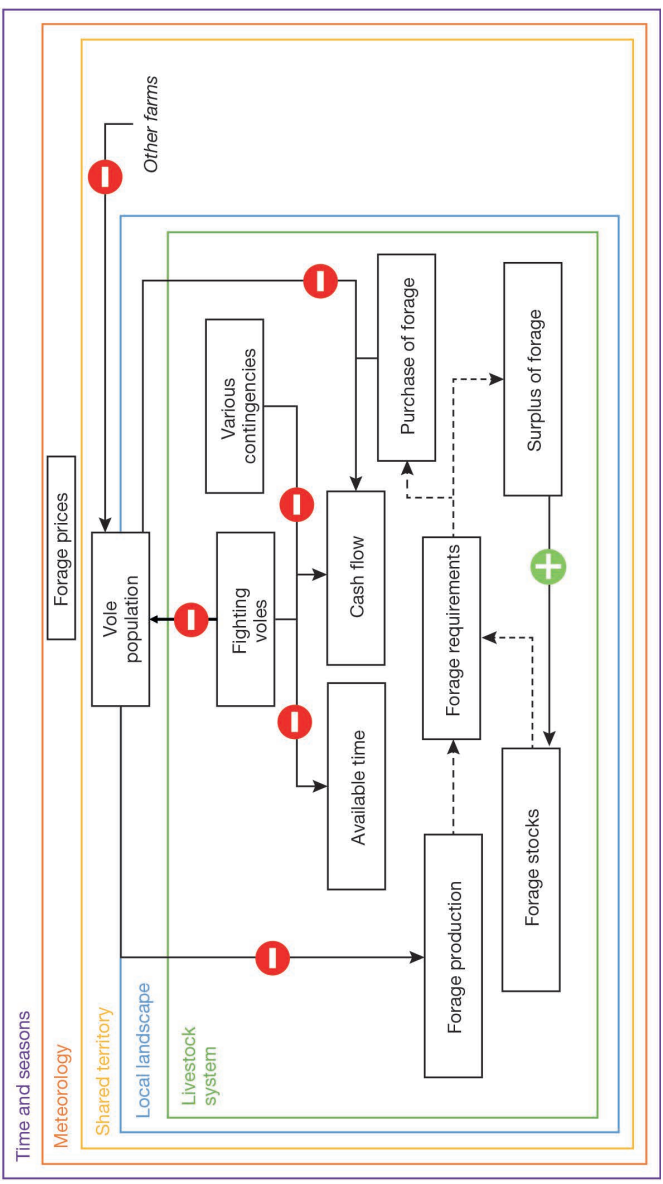

Figure 5.4. An example of the structure of the *CampaRISK* game model at this stage.

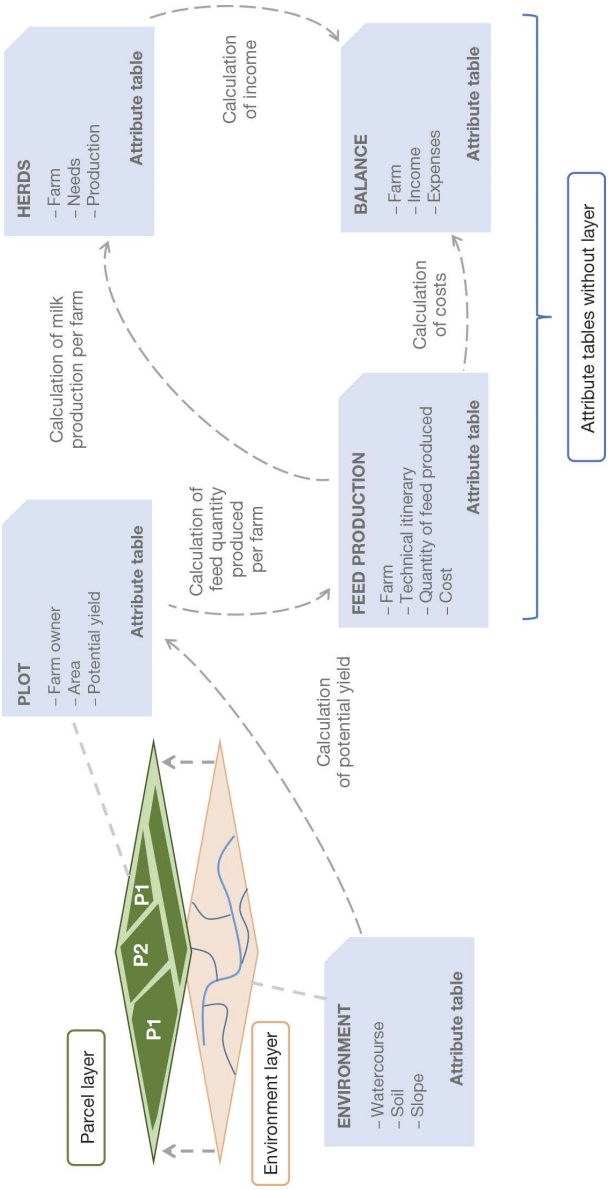

Figure 5.5. Illustration of how spatial dynamics are taken into account in vector mode using the example of the *Syeleterr* game.

As with any GIS, space is represented by superimposable layers made up of objects of variable geometry. These layers can contain points or lines, as in the 'centre' layer, or polygons, as in the 'plot' layer in the figure. Each object is spatially referenced by its coordinates. It has topological relationships with other objects and other layers (e.g. proximity, intersection and inclusion,), which enable spatial queries to be made. Each object also carries information about its nature, contained in an attribute table linked to its layer. For example, the attribute table for the 'plot' layer contains information such as the owner, the surface area and the potential yield for each plot. This is calculated using a mathematical formula from the 'environment' layer. Attribute tables that are not directly linked to a layer can be imported when the spatial representation of its objects is not relevant. This is the case for the 'feed production', 'herd' and 'balance' tables here. However, these tables still have a spatial link with the 'plot' and 'environment' layers thanks to the arithmetic formulas that connect them, which are represented by dotted arrows here. Vector mode therefore enables these attribute tables, databases and superimposed layers to be worked with simultaneously to assign information from one to the other.

When spatial objects have blurred boundaries, are continuous, or are subject to regular changes in shape and size, it is simpler to divide the space into elementary portions, each with a homogeneous value. This is the case with altitude, for example. Spatial issues can then be dealt with in the same way as in a GIS in raster mode. In this modelling approach, there are no clearly defined objects, only elementary spatial units that may or may not have the same characteristics.

Example

The game *Loup dans la bergerie* (see p. 45) models the pastoral space using hexagonal cells that can undergo state transitions if they are not grazed. Its functioning is described in Figure 5.6.

The management of spatial aspects will be developed further in Chapter 6, which deals with the creation of the game world.

How to take social phenomena into account

The dynamics of agricultural production, land management and landscape management are based on complex, changing and sometimes unpredictable social phenomena. These phenomena can be driven by power relations, negotiations and pressures, among other things. Depending on the decisions taken, as described in Chapter 4, it is possible to integrate these social and human factors alongside biological and spatial phenomena. To achieve this, we propose to answer the following questions:

– What social phenomena are at work?
– Who are the actors in these phenomena and how do they participate in these social phenomena?
– Are there any formal or informal rules governing them?
– What social phenomena should be included in the model, and which should be omitted?

For example, there are numerous regulations and institutions that provide a framework for or guide the decisions taken by farmers. Municipal or prefectorial by-laws, national legislation, European regulations and the Common Agricultural Policy are all examples of formal institutions that farmers consider when making decisions. Other institutions that affect farmers' decisions include local residents' associations, environmental associations and farming unions. Finally, farmers can interact with each other in various ways, ranging from informal dialogue such as conversations by the roadside, on the phone or at farmers' markets, to more formal working groups.

Example

In the case of the *CampaRISK* game (see p. 54), many formal institutions are involved in and regulate the control of ground voles. However, none of these institutions are formalised in the model (see Figure 5.4), as the game's objective is not to model player responses to specific regulations, but rather to encourage them to interact and devise their own collective pest control strategy. The absence of formal institutions in the game is therefore an acceptable and useful simplifying assumption, helping to achieve the assigned objectives while enhancing playability.

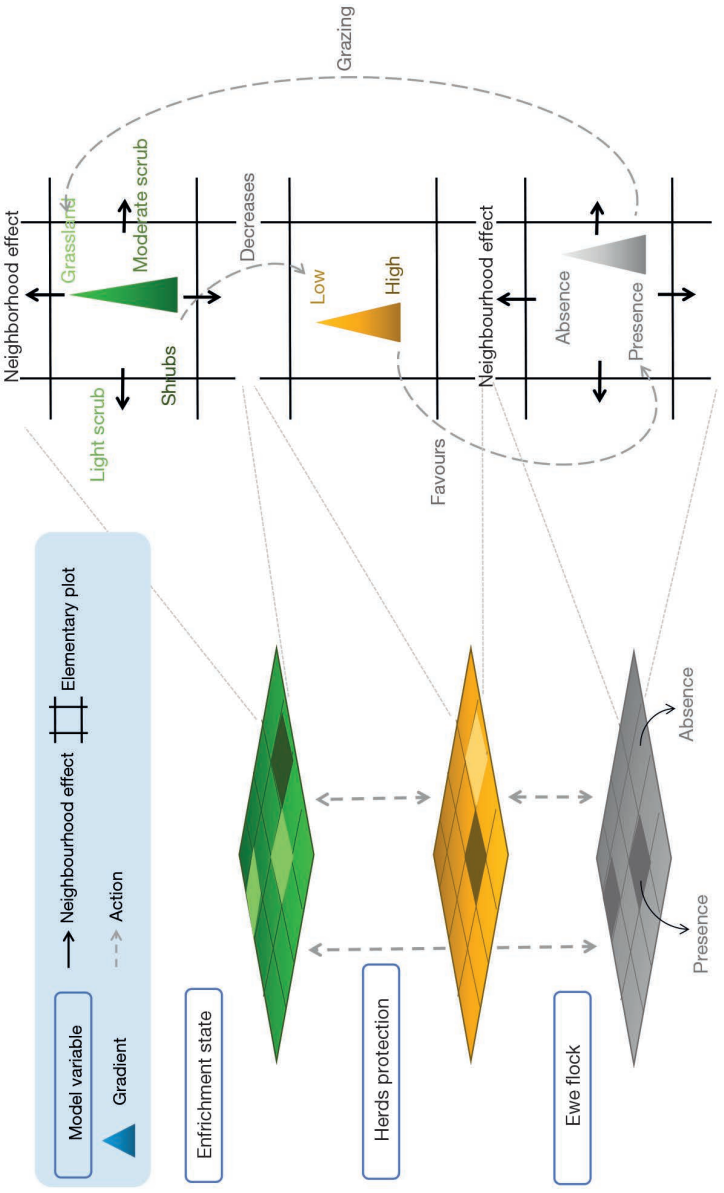

Figure 5.6. Illustration of how spatial dynamics are taken into account in raster mode using the game *Loup dans la bergerie* as an example.

Each elementary surface unit can have several states (e.g. grassland, light scrub, moderate scrub or shrubs for the 'state of overgrowth' layer). When the elementary surface in the grassland state is grazed by a flock of ewes, its state remains stable. If it is not grazed again, it changes from grassland to light scrub and then to moderate scrub if it remains ungrazed during the next turn. These two states are reversible, and the area can revert to grassland if the farmer decides to clear the scrub, at a cost. After two turns without grazing, the area becomes shrubby and can no longer return to its previous state. A change in state from grassland to scrub reduces the protection that the herd provides to neighbouring elementary surfaces, as the ewes are less visible. To manage these spatial mechanisms, three layers made up of an assembly of elementary surfaces are superimposed. The layers in question are 'state of overgrowth', 'protection of the flock' and 'flock of ewes'; these three layers form part of the model. Each cell in a layer interacts with the corresponding cells in the other two layers according to the aforementioned rules because they represent the same space (a summer pasture). This mechanism is very similar to a spatial analysis carried out in raster mode in a GIS.

Once these social phenomena have been identified, they can be embedded within the model—potentially alongside biological processes—depending on how the subject is formulated (see Chapter 4). Figure 5.7 illustrates a method for combining the bio-technical subsystem with the socio-cultural subsystem through the interface of practices and ideas.

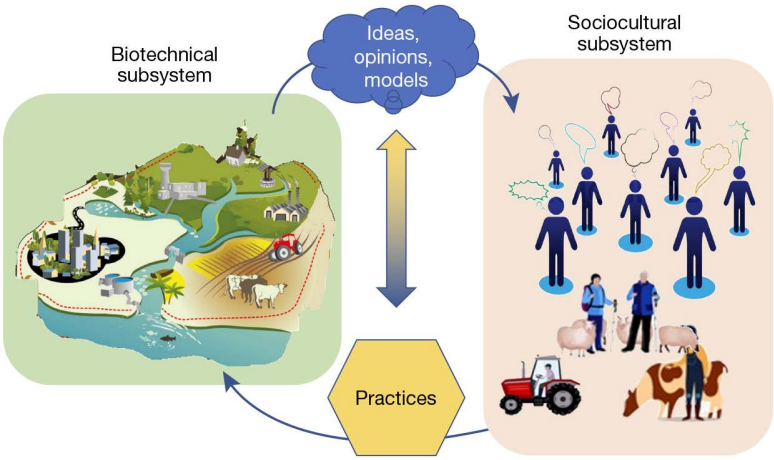

Figure 5.7. A dual connection between the socio-cultural and biotechnical sub-systems.

The practices of the actors have an impact on the state of the material elements of the biotechnical subsystem and on its functioning. Conversely, their decisions are partly influenced by their ideas about how it functions and their evaluation of these changes in appearance. Ideas and practices therefore provide a link between these two components.

Identifying which elements of the model belong to biological processes and which belong to social phenomena enables us to verify that the model has been constructed in line with the subject matter. The predominance of one sub-model over the other provides a vital indication of the direction in which the game is heading.

Where to include decision-making centres

Once the model has been stabilised, the next stage is to differentiate between the elements of the system that make decisions (the actors) and those that act in a regulated way without decision-making autonomy (the agents). In addition, there may be factors that affect the system's operation that we do not wish to include as variable elements in the model. Therefore, this modelling stage involves determining both the decision-making centres and the model elements and relationships that they can or cannot influence.

Example

In the model for the game *Le Genêt Belliqueux* (see p. 19), which is process-centred around agroecological dynamics, the plants are agents whose purpose is to colonise the pastoral space via seeds or rhizomatous suckers, depending on the species' specificities. The farmer, by contrast, is an actor endowed with the capacity to exercise choices and make decisions. Economic mechanisms regarding lamb prices are integrated as factors.

How to calibrate the model

Once the various interactions have been identified, the quantitative elements to be used to parameterise the game must be provided. The model can be calibrated using data from scientific or technical literature, or based on empirical feedback or hypotheses when such data is not available. Here are a few simple rules to guide this process:

– Start with the simplest possible model, then make it more complex as you progress.
– Give priority to the overall consistency of the orders of magnitude of the values and the balance of levels of precision between all the model's interactions.
– Mobilise all possible sources of information without preconceived ideas.
– Regularly test the model to identify any inconsistencies with reality.
– Organise this information to facilitate the transition from model to game.

In conclusion, modelling the real situation may seem laborious and difficult, but it is a key stage in successfully designing a serious game. Modelling the situation as a system enables us to plan the future interactions of the game. Moreover, the model guides the construction of the game mechanics, which we cover in Chapter 7, and helps to inform choices about simplifications that will not alter the system's overall functioning, fit with reality, and make the game playable. A dialogue will then take place between the construction of the model, the creation of the game world, and the shaping of the game. These aspects are addressed in the next two chapters.

6. Creating the game world

Romain Dureau, Yves Michelin, Nolwenn Blache, Hélène Gross, Michel Bouchet, Sylvain Dernat, Camille Clément

The stance a designer adopts when creating a game world varies significantly based on their familiarity with, and affinity for, serious games and tabletop games in general. Game design is a creative process; a designer may begin with an intuitive phase, allowing inspiration and creativity to flow, provided these initial ideas are later refined. It is entirely possible to conceptualise the game world before establishing the precise systemic model (see Chapter 5). Conversely, a novice designer may find it difficult to invent and assemble mechanisms into a seamless, engaging and intuitive experience. For such designers, it is generally simpler to start with the subject matter itself before defining the game world—identifying the players, their interactions, the spatial and temporal scales of the experience, and the methods for ensuring player engagement. This chapter addresses these questions methodically to support the novice designer. However, the process is not linear; it involves constant iteration between these stages. Choices made regarding the game world may necessitate modifications to the model, and *vice versa*.

Who are the players? Who are the agents?

A straightforward way to define player roles is to identify their tasks and their decision-making agency. If players are restricted to pre-established tasks, they quickly lose interest, and the game loses momentum. In such cases, it is better to treat the entity as an agent (see Chapter 5) governed by an automated mechanism—such as draw cards, tokens, programmed actions or an external app. Intuitively, a player is associated with a decision-making hub (an actor). However, the game allows for a certain departure from reality: a model agent can become a player if granted sufficient agency to make strategic choices.

Example

In *Le Genêt Belliqueux* (see p. 19), the plants are players rather than agents, as they are in the underlying model. They can choose actions that either hinder or support other players. While this does not occur in reality, it functions as a role-playing element, where players act as proxies for the vegetation. The game effectively removes the intermediary—those who usually speak for nature, such as environmental or landscape protection associations. This design choice is discussed during the debriefing. When adopting a 'benevolent' stance, the 'plant' players can explain their dispersal mechanisms to the 'farmer' players, thereby facilitating knowledge transfer between player categories.

During the design process, an entity's status as an agent or actor may evolve.

Example

In *Loup comme un agneau*, the first version of *Loup dans la bergerie* (see p. 45), the 'wolf' player spent most of the session following instructions to adjust trackers. This role lacked ludic value and was a design error. Consequently, in the second version, *Loup dans la bergerie*, the wolf's population dynamics and predation are managed by the Game Master. Between these two versions, the wolf transitioned from an actor to an agent.

However, without lapsing into pure determinism, players' behaviour can still be controlled very precisely. This occurs when prior studies or empirical work have enabled us to characterise behaviour well, and when the game's aim is to help players understand a situation that is already well known (subject matter or social mechanisms). However, we can also give players much more freedom to adapt their behaviour. This is the preferred approach when the aim of the game is to study the behaviour of a group of players or when players assume the same roles in the game as in real life. However, allowing this freedom means designing a model that accommodates unforeseen cases and directs the game towards qualitative aspects such as the sharing of points of view and the organisation and operation of deliberative processes.

How do the players interact: competition or collaboration?

The competitive or collaborative nature of the game has a major impact on the interaction between players and the extent to which objectives are met. In this section, we explain how to set up a collaborative or competitive game.

First, it is important to question whether there needs to be a winner, as this is not always necessary, even though winning can motivate players. It is also important to specify the conditions for winning the game. The number of winners is also a key decision. Competition will be exacerbated if there is only one winner. Conversely, collaboration will be encouraged if several players can win simultaneously. It will be compulsory if players can only win together, or if one player's defeat automatically results in all the others' defeat. With conditional victory, collaboration can be explicitly stated in the game rules. These practical aspects are discussed in Chapter 7.

Example

In *Loup dans la bergerie* (see p. 45), the farmer cannot win if the wolf has disappeared from the area; the prefect loses if the landscape undergoes scrub encroachment (managed by the farmers); and the pro-wolf association loses if a farmer's morale drops to zero.

Furthermore, the pursuit of individual goals is conducive to competition when players have diverging victory conditions or different means of achieving them. Nonetheless, this format remains entirely compatible with collaboration. The intensity of collaboration or competition within the game thus depends on the designer's objectives and the clarity of the victory rules. However, a serious game may result in neither victory nor defeat; instead, the outcome focuses on the player experience. For instance, a reflexive analysis may involve examining the session's events, player perceptions and the resulting interactions

(see Chapter 10). In such cases, the players themselves may decide whether to define a winner and determine who it should be. This approach necessitates alternative methods for fostering cooperation and competition.

The challenge of a collaborative game is to encourage players to work together to achieve their goal. One way of encouraging cooperation is to distribute essential resources among the players. For example, if each player has a different piece of the game, they will all have to work together to discover the overall design. This method is called 'puzzle play' and is inspired by Aronson's (1978) work in education.

La Grange

The *La Grange (The Barn)* game is based on a model developed by a group of researchers during the Collective Scientific Appraisal (CSA) project, "The roles, impacts and services of livestock farming in Europe". This project focused on European livestock farming systems and their products. Drawing on a major international literature review, the researchers analysed their roles, economic, social and environmental impacts, and the market and non-market services they provide to society. The results suggest ways in which the various farming systems can be improved. This model has been transformed into a game that can be used to consult on livestock farming. This non-competitive board game involves communication and negotiation and is played in teams. The aim is for players to co-construct a barn, i.e. a synthetic representation of a livestock farming area, which will evolve over time in line with identified constraints, as well as shared aspirations and wishes. The game falls into the category of learning games, which enable players to acquire knowledge or enhance their skills.

Authors: Sylvain Dernat, Bertrand Dumont, Dominique Vollet.

Example

Jigsaw-style mechanics are also utilised in *Jeu de territoire* (see p. 37) and *La Grange*. In these games, the turns allow each player to disclose information that they exclusively hold and to make choices based upon it. Without these individual contributions from every player, the sessions cannot advance and the game reaches a deadlock.

In this case, asymmetry is a source of cooperation, as victory is impossible for a single player, but achievable through the combination of each player's unique actions. Generally speaking, a collaborative game is one in which it is difficult to win, and the players must join forces against the game itself, as in escape games. Alternatively, it can be a no-win game, where the important thing is to keep the game alive. This is known as a play-based game.

Conversely, in a competitive game, the opponents are the other players, not the game itself. For this reason, if the game is based on the accumulation of resources such as money, food, victory or points, competition is favoured when the total amount of resources available to the players is less than the sum of their individual needs. The same logic applies to space. It is also possible to add a time limit. The player who reaches the objective first wins, as in a race. Alternatively, the fastest players have the right to occupy certain spaces if they expand faster than the others. It is important to note that the nature of the game can evolve according to the needs of the players (for example, beginning with collaboration and alliances, and ending with competition, or vice versa). It is therefore possible to combine collaborative and competitive elements in a 'semi-collaborative' game.

Ruralis

This game was designed in 2017 during the Biodiversity and Agriculture RMT workshops. Its aim is to set up agroecological infrastructures on a farm plot and discuss the effects from different angles, such as economic and environmental factors, and from different points of view. Initially, it was not intended to be a game, but the teachers and advisers who participated in the workshops emphasised its educational potential. The idea then arose to turn it into a serious game. to the game helps players to discover these elements and their benefits in terms of the ecosystem services they provide for farming and, more generally, for the region (e.g. water quality and landscape). It also helps players to understand the trade-offs that need to be made between these benefits and the constraints (e.g. working time and regulations). Players are invited to adopt the point of view of various stakeholders (farmers, agricultural extension officers, elected representatives, etc.) to understand the differences and the necessity for compromise. Although it is played on a board representing a mixed crop-livestock farm, the lessons learned can be generalised as the agroecological infrastructures and the agronomic, ecological and social processes involved apply regardless of the type of farm.

Author: RMT Biodiversity and Agriculture.

Example

In *Ruralis*, each player has their own objectives to achieve, which may be incompatible with those of other players (competition). However, for a player to win the game, they must have achieved common objectives, and at least three-quarters of the players must have achieved their own objectives (collaboration). Ultimately, all the players either win or lose together, but some of them will have to compromise.

The game is more enjoyable if collaboration or competition is necessary for victory, but difficult to achieve. In a collaborative game, rules can hinder communication. For example, players may not be allowed to talk to each other or divulge certain information. They will then have to devise a strategy to overcome these difficulties. These disadvantages also help players recognise the importance of working together to solve problems. Conversely, in a competitive game, it can be great fun to give players the chance to impede their opponents' progress. However, to ensure a competitive game runs smoothly, it is essential that all players have an equal chance of victory from the outset. Otherwise, you risk drawing players' attention to certain unfair situations. In that case, you will not see the game through to the end, and you will have to review the mechanism that gave certain players an unfair advantage. This is the principle behind *Monopoly des Inégalités (Inequality Monopoly)*, an unofficial adaptation of the famous game developed by the *Observatoire des Inégalités*, which could be adapted to agricultural issues.

How to represent spatial dimensions through the game board

Board games dealing with landscape or agricultural issues are often based on explicitly identified and materialised spatial objects, such as a plot of land or a farm. The board is the spatial object par excellence because it represents a portion of a plan. Its appearance is a translation of reality. Maps, models or schematic representations (of an agricultural area, a landscape, etc.) are the

Example

Table 6.1 illustrates the range of board formats used in the games we have designed. This overview is by no means exhaustive.

Table 6.1. Description of the types of game boards designed by the authors.

Name of the game	Type of board	Role of objects	Realism	Comments
CampaRISK	Race (like Snakes and Ladders) (vector mode, see Chapter 5)	Moving pieces	Symbolic board	The board simply provides a basis for evoking the spatial dimension of the subject
Syeleterr	Land plots and morphological features Assembling landscape elements (vector mode, see Chapter 5)	Land use, fertilisation practices, production counters	A schematic board with a visible link to reality	The board is like a cadastral map, helping players understand how land is managed and the impact of agricultural practices on production and the environment.
Loup dans la bergerie	Assembly of elementary surfaces (raster mode, see Chapter 5)	Changes in surface condition, moving herds	Mapping representative of reality (satellite image broken down into individual sections with different land uses)	The spatial dimension is integrated with notions of neighbourhood, movement, distance from buildings, etc.
Ruralis	Farm plot (vector mode, see Chapter 5)	Change of state (players draw agroecological infrastructures)	Cartography representative of reality (contour lines, buildings, watercourses, etc., schematised)	The spatial dimension is important because the position, length and connectivity of agroecological infrastructures, as well as the use of these infrastructures to create smaller plots, are at the centre of the players' reflections.

most common basic materials used to create the game board. These can be supplemented by descriptive cards (weather, vegetation, livestock, etc.) or other useful data to evoke elements linked to the agricultural area or landscape and better set the scene during the game. In some games, these maps or datasets can be created during the game using tables, cards and grids that participants fill in as they discuss.

These spatial objects that occupy the game board can also contribute to the players' construction of an area of land . They contribute to the composition and description of the spatial context and the landscape or agricultural scene in which the game takes place. However, the status of the board may differ depending on the subject and objectives of the game. For example, it can serve as a simple physical support for moving pieces, as in a game of Snakes and Ladders. Alternatively, it can change its appearance depending on the objects it supports, either in a highly symbolic way, as in *Monopoly*, or in a more realistic way.

How to integrate temporal dimensions into the game

The question of time can be approached in three different ways. First, it can be the time of the game, i.e. the total duration or each of the stages or phases of the game. Second, it can also refer to the time of the reality to which the game relates, such as a year or an agricultural production cycle. Finally, time can be understood as the time horizon or era in which the game takes place. In all cases, time is not a material object. It is an intellectual construct whose existence we can only measure through our actions or the changes we perceive. Therefore, we must find ways of expressing it in the game.

The first question to answer is how long you plan to play for. It is important to think about this beforehand, because it determines the type of game you can set up. A 15-minute game will not have the same support or rules as a 2-hour or all-day game. The length of the game also means you need to consider how dynamic it will be and whether it will be possible to take breaks or 'save' the game.

Once this has been decided, the time of the game can be represented in a straightforward manner, for example with an hourglass or stopwatch to limit the time allowed for each action. Depending on the actions performed, time can also be measured by a gauge that fills up until it reaches a maximum level. Another non-linear way of delimiting the game is to set a number of 'game turns' or use 'end of round' or 'end of game' cards inserted randomly into a stack of cards.

The real-world time in which the game is situated must be reflected in the context of the actual situation and the calibration performed (see Chapter 5). It may be continuous or structured into time steps per round.

Example

In *Le Genêt Belliqueux* (see p. 19), each completed round represents the passage of one month. After six rounds, winter arrives. The animals are removed from the board—representing the summer pasture—and the players conduct a seasonal review before a new year commences. In *Syeleterr* (see p. 16), the seasonal technical itineraries performed by each player materialise the passage of time.

This time can also pass in a non-linear way and more quickly than in reality so that the game can cover the necessary period to obtain tangible results. This does not cause any major issues for players if the game leader or the rules explain that this acceleration of time is a specific feature and advantage of the game compared to a real experiment.

How old is this landscape?

This game was created in collaboration with the Salterio Museum (MuSa) and a workshop on taste and landscape in Zibido San Giacomo in Milan's suburban agricultural area. The game focused on the historical and current agricultural landscape around the museum. The main aim was to identify the historical permanence of a landscape and its age, and to demonstrate that agricultural landscapes are the result of slow, gradual transformations over time and contain many permanent features than might appear at first. A second objective is to work together to gain a deeper understanding of a landscape, creating a shared culture across an area through collaborative map work. The collaboration aims to co-construct diachronic and synchronic maps of the landscape.

Author: Paola Branduini.

Example

A Scots pine requires approximately ten years to reach reproductive maturity. In *Le Genêt Belliqueux* (see p. 19), it reaches adulthood in a single season—equivalent to six rounds of the game. This conceptual artifice enables players to understand the mechanism of scrub encroachment resulting from undergrazing within 18 rounds (less than two hours of play). Some games even travel through time, as seen in *Quel âge a ce paysage ?* (*How old is this landscape?)*

Finally, the time horizon of the game may be immediate, focusing on what is happening here and now, or it may be part of a cycle that unfolds during the game. For example, it could focus on one year of agricultural production (or several successive production cycles). Sometimes the game focuses on the past, sometimes it explores the present situation, and sometimes it projects into the future, often in the form of scenarios with a variable timeframe: short, medium or long term.

Example

When utilizing *Jeu de territoire* (see p. 37) to address the planning of an ecological zone, the projection is set at ten years, whereas it extends to fifty years for forest management. In the *Prospective sensible* game (see p. 35)—designed to anticipate issues related to climate change—and in the 'high-stakes areas' exercise—aimed at identifying agro-landscape sectors or units presenting specific problems—the horizon is fixed at twenty-five to thirty years. This duration best aligns with an action-orientated logic without lapsing into science-fiction speculation.

Sometimes, the game combines these different temporal dimensions to reveal the connections between the past, present and future. This helps us to better understand the interrelations at the root of change and to better define seemingly complex situations involving technical itineraries and agricultural sectors or landscapes, as well as linking landscape and agriculture. In this case, the board game extends the diagnostic process to include the region, landscape, agricultural sector and farm.

What place should be given to chance and to the pleasure of playing?

Serious games are often criticised for being too serious and not allowing enough room for enjoyment. Table 6.2 lists the points to consider in this respect, as well as suggestions for striking the right balance between the two.

Table 6.2. Points to consider when designing serious games, based on Caillois's (1958) criteria.

Criteria characterising a game	Risk linked to the serious nature of a game	Points to consider, suggestions
Freedom The player decides whether or not to play	The degree of freedom is reduced or even eliminated if the game is incorporated into a training or learning system by authority.	Allow for the possibility of refusal to play Encourage people to play
Separation from the real world The game must be completely separate from everyday life	If playing time is limited by the length of the training session, players may stray from the spirit of the game.	Make the game session a special moment that sets it apart from the usual training time
Uncertain The outcome of the game cannot be predicted	The uncertain nature of the game may be threatened if the designer makes a certain course compulsory in order to meet the educational objectives.	Leave room for chance in the game Compensate for any lack of comprehensiveness by encouraging players to share their experiences or by increasing the number of play sessions
Unproductive The game must not aim to produce results in the real world	Risk of overlooking the unproductive aspect of the game in favour of searching for tangible learning outcomes Risk of wanting to measure or even evaluate these results	Find a compromise between the desire to assess the educational effectiveness of the game and its unproductive aspect, which frees up the player's creativity. Plan the game at the beginning of the session so that you can delve deeper into the elements identified during the game.
Rule abiding The game must follow rules	Risk of designing overly complicated rules in an attempt to reflect the complexity of the subject as accurately as possible	Find a compromise between the degree of complexity of the rules and their playability
Fictitious The game must not have any real-life consequences	Some serious games strive for realism and are more like simulators than games. Risk of losing the fictional aspect if the result is assessed/sanctioned	'Derealise' the elements of the game to distinguish it from reality No assessment/sanction

One of the most important points is therefore to find a good compromise between the deterministic aspect of many models and the unpredictability needed for enjoyment, which reinforces the need to define the simplifying assumptions clearly.

Example

When the *Syeleterr* game (see p. 16) was in the design phase, the first version was entirely deterministic, allowing players to familiarise themselves with the complexities of managing a dairy farm—a daunting task for the uninitiated. However, players noted that the rules were repetitive and ultimately tedious, leaving them with no room for manoeuvre (agency). While this stage was essential for the target audience (first-year agronomy engineering students) to acquire the fundamentals of farm management, we added a second phase to increase the game's appeal. This phase incorporates climatic hazards and commodity price fluctuations. A 'weather wheel' was introduced to inject an element of chance, forcing players to make strategic choices. However, this extension of the session is not always compatible with the rigid constraints of educational curricula; consequently, the game is now played in several parts, disseminated across multiple pedagogical sequences.

By the end of this stage, the designer has established the framework for the game. The subject is defined, the players identified, and the collaborative or competitive dynamics established. Furthermore, the designer has a relatively clear conception of the board and the temporal scale of the game. The next stage is to implement these choices, which is the focus of the following chapter: the transcription of the model into a game. Nevertheless, before delving into the technicalities of this transcription, it is an opportune moment to ensure that the initial game concept aligns with the objectives and characteristics established in Chapters 4 and 5.

7. Transcribing the model into a game

Nolwenn Blache, Romain Dureau, Yves Michelin, Sylvain Dernat

Experience has shown us that designing the game mechanics without first creating a model is, at best, a waste of time and, at worst, results in an unplayable, incoherent and non-fluid game. The designer has already built the way the game works, so implementing the game mechanics and media simply follows on from the choices made in previous stages. In this chapter, we propose a method for easily progressing to the next stage, avoiding writer's block and mistakes. To ensure success at this stage, we recommend that future designers play games (serious or otherwise), as the greater their gaming experience, the more their creativity will be stimulated and the greater their chances of finding relevant mechanisms.

How to move from model to game materials

The distinction between the model and the game may seem artificial. However, if the modelling phase is carried out carefully, the construction of the support materials and the rules of the game will be more effective. During the transcription process, it is therefore important to relate the elements of the game to the elements of the model. To guide the reader in this task, we propose a summary table based on the specifications developed in previous chapters, which can assist with this formalisation. The advantage of this approach is that it ensures that all the elements and relationships of the model are correctly transcribed into the game. This is, of course, a generic proposal that any designer can adapt to their needs and the situation they intend the game to address. Creating such a table for an existing serious game is an effective way to understand the method and discover different game mechanics. Through this exercise, designers will find other ways of transcribing the model into the game, either through their own inspiration or by using the table as a guide.

How to represent and manage flows of matter and information

In Chapter 5, we examined how the model manages flows of matter, energy and information. The next task is to determine how to transcribe these into the game. Certain flows require physical embodiment, whereas others can be managed without being materialised as components. To achieve this, we rely on the model, which may comprise a vast number of stocks (or reservoirs). However, not all stocks in the model necessarily feature in the game design. To avoid detracting from playability or cluttering the board, we must first identify

whether a stock exerts a significant influence on other model elements through its quantity or fluctuations. Some may be treated as static (refer to the model simplification stage in Chapter 5). For the others, it is essential to define whether specific thresholds constitute loss conditions or victory conditions. For all those retained as dynamic variables during a session, we must determine if certain thresholds trigger effects in other compartments or restrict available actions.

Table 7.1. Conversion table from model elements to game elements, based on the authors' work.

Model elements		**Game elements**
Reservoirs, springs and wells	Container (see Chapter 5)	- Boxes, containers and places - Tables - Gauges/trackers - Bank - Non-material
	Contents (see Chapter 5)	- Counters - Numbers and lines in tables - Cards - Facsimiles, banknotes and symbolic objects
	Flows (see Chapter 5)	- Game actions (move, record, modify)
Factors (see Chapter 5) (elements of the model that impact the behaviour of agents in specific ways)		- Rules of the game - Cards (hazard, attack, defence, etc.) - Game Master (neutral) - Etc.
Constraints (see Chapter 5) (elements of the model that determine whether or not actions are possible)		- Rules of the game - Counters (positioning on the board, for example) - Cards - Game Master (neutral) - Software
Agents (see Chapter 5) (elements of the model that evolve in a deterministic way under the influence of factors)		- Counters - Cards - Gauges - etc.
Decision-making centre (see Chapter 5)		- Players - Game Master (active stance)
Spatial parameters (see Chapters 5 and 6)		- Board - Counters, pieces - Cards (card composition) - Tiles, bricks - etc.
Time (see Chapter 6)		- Rules of the game - Gauges/trackers - Stopwatch, hourglass - Dials, tokens - etc.
Laws of probability (see Chapter 6)		- Dice - Draw pile - Roulette wheel

For illustration purposes, the mechanisms used in the game described in the book's case study thread example are shown in red.

Alternatively, it may be preferable to simply track the numerical value without fixed thresholds to facilitate post-game analysis and derive insights for real-world applications.

We have identified at least three ways of tracking quantities:
– With real or symbolic objects (banknotes or coins for money, counters representing quantities, circulating cards, pebbles, etc.). The advantage of this method is that it is highly visual. Players can easily manage exchanges using these objects, and depending on their design, they can enjoy handling them. However, these objects can quickly clutter up the game board. There is also a greater risk of losing them as the game advances.
– With tables or point counters, in which one of the players or the game master writes down quantities. The board can be used to manipulate large or decimal numbers. This brings the game closer to reality. It gives players an overview of their data and enables them to keep track of changes as the game advances. Players can also easily choose whether to make their data public or hide it. However, this mode of representation is ill-suited to frequent or two-way exchanges. It is not very enjoyable. You should also be wary of cases where counting requires calculations, as these are a source of errors and can slow down the dynamics of the game, causing it to lose its playful dimension if the calculations are too complex.
– By quadrant-type trackers or gauges fitted with a pointer. Like the table, this method of representation is fairly synthetic. It is easy to handle and does not clutter up the game board. It can also be used to hide information easily.

The choice of media depends on the subject matter, the specific design choices (see Chapter 9), and even the intended player behaviour.

How to define the rules of the game

As with any group activity, the rules are important for organising the game and regulating interactions between players during the different phases. They also ensure that the game runs smoothly in terms of time and space, guarantee good playing conditions and the well-being of all players, and ensure that the desired outcome is achieved.

Writing the rules is an essential part of ensuring the game's success, especially if there is no game master, as the players will only have the rules to help them understand and adhere to how the game works. If the model has been well formalised, it will be easier to write the rules. This chapter focuses on how to formalise and write them.

The rules of the game enable a group of people who do not know each other to take part in the same activity quickly and efficiently within a clearly defined timeframe, even if they are unfamiliar with the location. In particular, rules specify how to play, win and finish a game. They must be clear, concise and rigorous, and should be illustrated with concrete examples that the target audience can understand, if possible. Specifying the length of game phases or the game's overall length, for example, helps players become more involved, build their own strategy, compare it with others, and develop their ability to make decisions and ask questions within the time available. These rules can be set out in advance or repeated orally as the game progresses. It is important that everyone understands what is going to happen, in what order, and what their role will be.

To ensure the game is self-sustaining, these rules must be written down, even if they can take very different forms. For example, if the game is intended for people from different cultures or with limited language proficiency, illustrated instructions would be more appropriate and easier for everyone to understand. Having a facilitator (or game master) who manages respect for everyone, the rules, the actions taken, who gets to speak, etc. and who keeps the session on track can also be helpful.

The time needed to understand the game can range from five minutes to over an hour. The longer it takes, the greater the risk of discouraging potential players. The shorter is the time, the simpler the game mechanics need to be. The key is to strike a good balance between the complexity of the model and the freedom given to players, taking into account the target audience, the objectives and the context of the game.

In our experience, the rules of the game should contain the following elements at least:
– A concise summary at the beginning of the text explaining the aim of the game and how players can achieve it, the aim being to clarify the purpose of the game for the players, so the focus here is on the fun part rather than the serious part.
– The number of players required to play, their age or school level (which can sometimes be more meaningful than an age) and the playing time.
– The contents of the game box should be illustrated and the name and description of each piece of equipment should be provided (e.g. cards, counters, dice, etc.).
– A presentation of the game board and how it works.
– The initialisation of the game.
– How a round is played, broken down into stages if necessary.
– A presentation of the players, their characteristics and roles, if necessary.
– The conditions for winning, ending the game and scoring points.

This list is not exhaustive, however, and can be adapted to suit the type of game. It is important to realise that incomprehensible game rules render the game unusable. Therefore, a great deal of time must be devoted to drafting them. The style must be clear and concise, leaving no room for doubt in the reader's mind.

How to spice up the game

At this stage, it is essential to consider the pacing established by the mechanics and the rules that orchestrate them. The game's flow can be defined by the frequency of actions and the tension experienced by the players. A session typically progresses through several phases, each operating at a different tempo. Initially, as players internalise the rules, the pacing is naturally slow and staccato. Gradually—provided the rules are clear and intuitive—players transition to a 'cruising speed'. At this point, designers must ensure all players remain equally engaged. This is the optimal time to detect pacing anomalies, such as abnormal periods of downtime (see Chapter 8). These lulls may result from poor player interaction, overly complex or protracted turns, or role imbalances (for instance, where certain players conclude their actions significantly ahead of others). The underlying causes are often multifaceted.

If the players reach cruising speed without a hitch, congratulations! This means that the game is capable of running, but not that it is fun! Even a fast pace can become monotonous if it remains constant. The trick is to create suspense by

incorporating elements such as a time lag between the decision and the result, or an element that accelerates the game and breaks the monotony. This could be implemented as a new game rule that takes effect after the start of the game, for example. Alternately, we could imagine a chain reaction that suddenly puts a lot of pressure on the players, such as an increase in level. The key is to give players the impression that everything is moving forward quickly, and there are many different ways to achieve this. This sudden acceleration is what makes serious gaming enjoyable for players.

At this stage, the designer can move on from the model to an initial game prototype that incorporates all the characteristics identified in the previous chapters. Contrary to what we might think, the design phase does not end here. In practice, it is unlikely that the first version of the game will be operational in terms of either playability or relevance to the initial positioning. For this reason, the next chapter deals with an essential stage in the design of a serious game, namely, testing and improvement.

8. Testing the game and making necessary improvements

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Nolwenn Blache, Sylvain Dernat, Sylvie Paradis

Once the game prototype is ready for use, a phase of testing and improvement begins. During the initial testing of the game, many malfunctions may occur. While this is perfectly normal, it is important to carefully record all the points that need to be improved. It would certainly be risky to propose a game analysis grid here, as each serious game is unique in its operation and objectives. We do, however, propose a set of questions to guide the analysis of how the game works to enable improvements to be made.

Is the game's 'engine' working properly?

The first question to consider is whether the game works properly: can it unfold, i.e. start, progress and then finish?

During the 'test' sessions of the game, it is important to note improvements to be made as and when difficulties arise. If a major malfunction is identified, it is a good idea to decide on an immediate solution to allow the test to continue while making a note of this improvement. If the test is taking place with players who have not been involved in designing the game, it is also possible to plan a questionnaire for them to complete or arrange an individual or group debriefing session. This gives testers the opportunity to suggest improvements to the game or its underlying model, particularly if they are familiar with the subject matter.

Are the rules clear?

Whether or not the game requires a game master to organise the session and guide the game, it is important to ensure that the players fully understand the rules. To achieve this, we recommend approaching the test as if the testers were opening the game box on a rainy Sunday afternoon. The document presenting the rules of the game must be easily identifiable. Players should be allowed to familiarise themselves with it. Often, one player will read the rules aloud while the others set up the game board and its various elements. These discussions are useful for the designer, as they ensure that the rules are clearly understood. Make a note of any major difficulties or potential misunderstanding so that you can make any necessary changes. Finally, players will naturally refer to the game rules regularly, particularly at the start of the game. If they cannot easily find the information they are looking for, the document will certainly need to be reorganised.

Is the game fluid?

The advantage of a serious game over any other training method is that it places players in a situation while mobilising a certain number of playful elements. To ensure good results, you must pay close attention to how well these elements engage players by carefully observing how the game session unfolds. If the game takes too long to start or if there is too much downtime or too many 'empty' moments, players can become bored and less engaged. We believe that the more constrained the context in which the game is used (e.g. compulsory training, work meeting, etc.), the more fluid it should be. Beyond the time required to start a game, a good indicator of its fluidity is the amount of time players spend passively waiting for their turn without being involved in what is happening elsewhere. If the game is played in teams, it is also important to pay attention to the involvement of the different players, especially if there are more than three players in each team.

When the game requires a facilitator or game master, a facilitator's guide is often necessary, and it is important to test it. This guide should be read before preparing to play the game, often independently. At this stage, you could consider delegating the task to a volunteer who has already played the game. You can then interact with them before the game and observe how they run it, identifying any points that still need to be clarified or improved.

Are the game elements practical?

A board game consists of a set of tangible elements that players manipulate during their turns, such as counters, tokens, cards, banknotes and dice. The greater the number of these elements, the more complex the game can be to set up and the greater the risk that pieces will be lost quickly. The greater the number of these elements, the more complex the game will be to set up, and the greater the risk of pieces being quickly lost. To make the game more practical, the different elements need to be identifiable (through colours and shapes, for example), easy to count and easy to handle. After an initial test, it may be necessary to review the calibration of the model or change some of the units of account. For example, if the sums of money to be handled in a given game are large, it is a good idea to convert them to a scale that allows for easier calculations. Initial tests carried out on incomplete prototypes, provide invaluable information for shaping the next stage of the game.

Is the playing time reasonable?

The duration of a serious game can vary greatly, from a few minutes to several days. The time needed to complete a game must not be overlooked. In fact, in the context of training courses or various scientific activities, duration is often a limiting factor for the deployment of a serious game. If the game lasts more than an hour or two, it is preferable to offer sequences separated by breaks or spread over several days. If the game is shorter than expected, you should ask yourself whether all the identified objectives have been achieved. Conversely, if the game takes longer than expected, it may compromise its effectiveness, and you may need to rethink the sequences or certain rules.

Does the game perform well?

Creating a serious game serves specific objectives. It is therefore vital to evaluate the game's performance in achieving these goals. While this is detailed in Chapter 11, performance must be addressed during the earlier phases to identify clear misalignments between intended objectives and the results achieved by testers, allowing for iterative development.

To evaluate this, we propose the performance triangle (Figure 8.1), which considers three criteria:
– Effectiveness refers to the achievement of satisfactory results in relation to the initial objectives. This is assessed using indicators that determine whether or not the objectives have been achieved. For example, if one of the objectives is to impart knowledge, one method of assessing this would be to administer a questionnaire to players at the outset and again at the end of the game. This enables you to assess how players' knowledge has changed and properly evaluate the effectiveness of your game. It is advisable to construct the indicators according to the SMART principle, i.e. specific, measurable, achievable, relevant and time-bound.
– The relevance of the game corresponds to the alignment of the resources deployed with the objectives pursued. If an objective has not been achieved, perhaps the resources deployed are incomplete or inconsistent, in which case the game will have to be repeated.
– Efficiency corresponds to the quality of the results obtained in relation to the resources deployed. Some serious games are based on heavy machinery, and the justification for this must be based on the results obtained and whether other alternatives could achieve the same objectives at a lower cost or in less time.

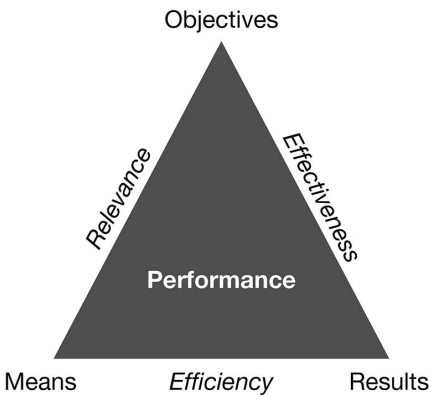

Figure 8.1. The performance triangle (after Gilbert *et al.*, 1980, source Wikimedia Commons).

In the case of tests with players who were not involved in designing the game, it is also useful to take note of their reactions (e.g. description of their behaviour, verbatim reports, etc.).

Example

During a test of the *CampaRISK* game (see p. 54)—which focuses on managing the risks of vole outbreaks—a player's exclamation of "It's very stressful!" partially validated the game's ability to replicate the uncertain and potentially stressful conditions that livestock farmers face in their daily operations.

Once the initial game tests have been completed, it is common practice to make changes to the game prototype. This is why you should not neglect the testing phases before moving on to the next stage of transforming a game that works into one that people will enjoy playing. We have just outlined a process for evaluating the game as part of the initial testing phase. This phase will continue until major changes to the game are no longer necessary. Improving playability must not compromise the consistency of our intended message about reality. It is a question of balance: you need to ask yourself questions about each modification to ensure that the game remains faithful to the objectives set at the outset.

9. Transforming a game that works into a game that people enjoy

Yves Michelin, Michel Bouchet, Nolwenn Blache,
Romain Dureau, Nils Ferrand, Sylvain Dernat

At this stage, your game is working. The internal testers have found it interesting, and their feedback shows that you have at least partly achieved your objectives. The prototype is operational, and you can stop there if you only plan to use it once in a specific context. However, given the efforts made, and if the game meets the expectations of the target audience, you may be asked to use it regularly, and sometimes there will be requests to market it. In the past, this situation led us to work in areas with which we were not very familiar. We would like to conclude this section by offering a few practical tips to designers who are tempted by the idea of producing graphics and finalising their game for commercial purposes. However, we would remind you that graphic design is not something you can improvise, and it is preferable to turn to professionals for this task.

Why good graphic design matters

The game's appearance is the player's gateway to the game. If they are not attracted by the exterior or contents of the box, they may not want to play. In today's society, players, especially the younger generations, are increasingly demanding more from analogue and virtual games. Sloppy graphics risk reducing their commitment during the game or requiring the game's facilitator to make major efforts to motivate them. This may not be a problem in a serious game, as players usually have no choice and the objectives are not focused on entertainment, since the session is part of a professional setting. Nevertheless, it is the designer's duty to ensure players are fully committed to achieving the set objectives.

The prospect of dissemination and marketing means that the game design must strike a balance between the fun aspects (such as aesthetics, graphics and amusing or original objects), which will encourage players to engage with the game and put them in a positive frame of mind, enabling them to effortlessly assimilate content. At the same time, the professional aspects (such as rigour, austerity and realism), must be considered to ensure the game sequence and its outcome are credible, allowing players to apply them to real-life situations. This is no simple task and often requires working with specialists.

The special case of 'sad games'

In serious games, the player's context is often professional. Depending on the player's profile, the ludic, recreational or 'fun' elements may be too far removed from their professional standing.

Example

During a test session for *Le Genêt Belliqueux* (see p. 19), where the pieces were small figurines from a children's toy farm, an engineering student remarked: "I didn't survive two years of intensive preparatory classes and get into an elite grande école just to go back to nursery school."

In this instance, the ludic connotations prevented the player from engaging with the experience. Consequently, the designers and facilitators cannot evaluate the game (see Chapter 11), as it was never truly 'played'. The designer must identify audiences specific to the serious games sector and adapt the game to their attitude toward play. An effective solution is to remove anything reminiscent of purely recreational games. The graphics can be streamlined, for example, and professional tools like spreadsheets can replace ludic trackers and counters. The goal is to replicate the codes that a player of a serious game recognises to create a context for engagement. This is what some authors call a 'sad game'.

Are the graphics consistent with the message conveyed by the game?

It may seem anecdotal, but objects and colours are signs that express ideas outside of verbal discourse. Peirce's semiotic approach (Everaert-Desmedt, 1990) is very useful for understanding how game elements communicate with players. This is important for the proper design of game elements. Peirce's semiotic process brings together a sign, an object and an interpreter. In the case of game elements, the sign is the physical material included in the box, the object is what it represents in reality, and the interpretant is the idea or meaning it produces in the mind of the interpreter. Here, the interpreter is first the person who created the game, then the one who shaped it and finally the player. Therefore, there are many possible interpretations. These depend on social norms and habits[3], meaning that we attribute a particular meaning to a particular sign in a context with which we are familiar. This establishes a fixed reference between a sign and its meaning, enabling interlocutors to swiftly agree on the reality within a given communication context.

In Western societies, the colours red and black are often associated with danger and have negative connotations. Green is perceived positively, blue evokes water and yellow, light. In Chinese culture, black is the symbolic colour of water and, by extension, secrecy. Red is the colour of luck and joy because it is linked to the heart, the source of joyfulness. Green often has negative connotations associated with infidelity, while yellow represents glory, wisdom and harmony. If the language of colours is at odds with the message we want to convey in the game, we run the risk of undermining the intended effect. For example, if bonus counters are coloured red and malus counters green, Western players might fail to recognise the link between the colour and the positive or negative nature of the associated action.

The semiotic approach is also extremely useful when it comes to choosing the form of the game's elements, which Peirce describes as signs. It suggests

3. A great deal of work has been done on the perception of colours and their interpretation in relation to emotions from an anthropological, sociological and psychological point of view. See, for example, Pastoureau (1990) or Granet (1934).

classifying the relationship between these signs and the objects or events they represent into three categories. Either the element resembles what it represents, in which case the link is mimetic (iconic), or it merely indicates the object. Finally, the link may be symbolic, a simple convention.

Example

In *Le Genêt Belliqueux* (see p. 19), the elements within the box belong to all three semiotic registers. The sheep-shaped pieces are an iconic representation of the flock and an indexical representation of the 'farmer' player. Adult plants are represented by two pieces of the same colour stacked one on top of the other; this is a symbolic representation, by analogy with the game of draughts.

Naturally, these cultural and psychological considerations should not restrict the artistic dimension and creativity required for designing a game, as these are essential for players to accept a new game. Simply put, it is in the game designer's best interests to consider the symbolic and representational aspects, prevent them from coming up with shapes or colours that contradict the message conveyed by the game's serious nature.

Does the game correspond to its intended audience?

At the end of the design process, the game must be tested to ensure that it is suited to its target audience. Once the prototype has been tested internally and the graphics produced, the designers can organise a real-life test with typical players identified by the designer. The selection of this panel is crucial and, in this case, quality should be prioritised over quantity. In fact, a panel of four to five people is enough if they are chosen well. This will ensure that people who largely correspond to the target audience and who are used to playing games or who are knowledgeable on the subject matter will be able to provide invaluable, constructive and in-depth advice on the improvements to be made to the serious game before its release.

The test session can be organised in many different ways. We suggest observing what happens and providing a questionnaire for the testers to complete after playing. This questionnaire will help guide the initial discussion, ensure nothing has been forgotten, and keep a record of what was said to inform future improvements. We propose a list of points to address, which is of course just an example, as there are other ways of doing things that are better suited to designers' expectations:

– Clarity of the rules of the game.
– Graphics.
– The pace of the game.
– The usefulness of all the elements.
– Player involvement.
– Areas for improvement.
– The amount of time the player wants to spend on the game.
– Three qualities of the game.
– Three shortcomings of the game.
– Correspondence with the game's target audience.

Several sessions with several people from the identified panel will probably be necessary before an optimum result is achieved. At the end of each session, it is often useful to have a discussion about what has just happened to improve understanding of the problems identified by the testers. It goes without saying that the game will have evolved considerably between the first test session and the last.

Designing a serious game is, above all, a distortion of reality. Simplifications are essential for an analogue game to be operational, engaging and relevant to its target audience. However, these simplifications must not alter the intended message of reality that the designers want to convey through their game. Designing a serious game is therefore no easy task and inexorably brings designers back to Paul Valéry's quote: "What is simple is false. What is not simple is unusable". In this section, we have tried to guide the reader through the design process, helping them to avoid the common pitfalls of design and sharing our experience: imperfect, but full of lessons.

Case study thread for Part 2

Nolwenn Blache

We designed the game *Loup comme un agneau* (see p. 45) as part of an educational module intended to teach the principles of 'systems thinking'. The game was co-created with 20 students over a three-week period. This section provides an opportunity to review the general project management implemented, our motivations, and our reflections throughout the process.

During the course of the module, after some theoretical input, we held brainstorming sessions to analyse the serious games we had played, identifying their modalities (see Chapters 4 and 5). The aim was to replicate the underlying ecological and social models. Studying the various games enabled us to decide what we wanted for our own game. We were then able to start building the model of the real situation. One advantage of participatory design is that 20 people can absorb a large amount of knowledge. The disadvantage is that it takes time to compile all this data to develop a global, logical, coherent and fair model. We therefore divided up the work according to the actors identified as being involved in the management of the arrival of the wolf. We then created a sub-model for each stakeholder. We held major pooling sessions to link these elements, validate the other groups' models, and to ensure that we had not forgotten anything or drifted too far from the objective and limits of our game. The design of the game was developed in parallel with the model.

We alternated between small-group work and synthesis sessions, as well as phases of reflection on the model versus reflection on game mechanics (Figure F2). Consequently, rather than a linear methodology, our approach consisted of iterative loops between the world of modelling and the world of the game.

Ultimately, we found that one of our roles, that of the wolf, was heavily influenced by the actions of the other players. Testing with players not involved in the design revealed that they did not have enough freedom to make decisions, and that their roles were not ultimately playful. This was because we had wanted to determine the parameters of the game before finalising the model. In fact, the wolf did not act as a decision-making centre, but as a set of quantitative variables that changed in response to the players' choices. The wolf was therefore an agent. Had we read this chapter, it would have given us a precise roadmap to follow and helped us ensure we did not miss any checks. The following year, with a view to continuous improvement, another group took over the project and corrected the shortcomings of our first game. A new, more complete, version that was more faithful to reality emerged under the name *Loup dans la bergerie (Wolf in the sheepfold)*. In this version, the wolf is no longer a player. Ensuring that the game and the model work together coherently is essential to achieving a result that is both enjoyable and faithful to reality. This is what we have tried to convey in this section.

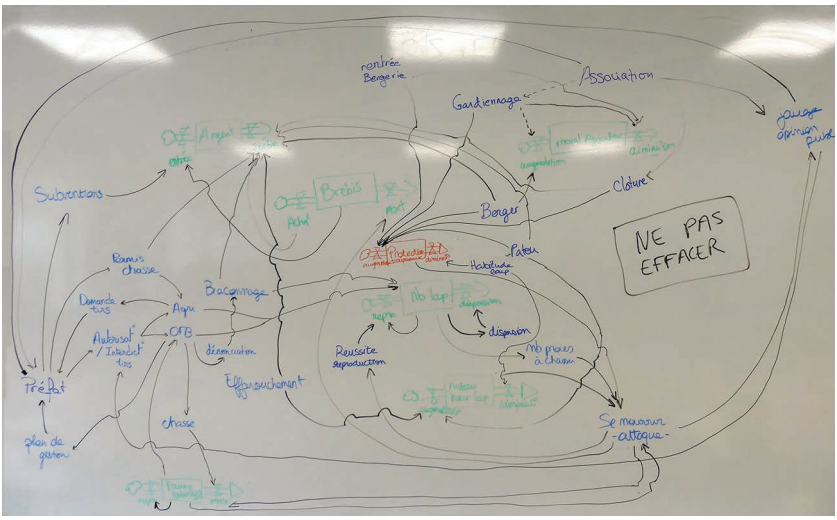

Figure F2. Results of a pooling session on modelling the real situation (© Yves Michelin).

Part 3 Facilitating, evaluating and disseminating a game

This section deals with what happens after the game has been designed. The game has now been developed and tested and one or more prototypes are available. It then enters its operational phase, i.e. it must now serve its intended purpose. However, many designers find themselves at a loss when they reach this stage. It is not easy to set up game sessions with the public and demonstrate the value of your game in order to attract the interest of potential users—both facilitators and players.

In this section, we address three key points.

The first concerns game facilitation. This stage must be anticipated; it is often overlooked or under-resourced, yet it is essential for a game's success and for guaranteeing a real impact on players, regardless of the objective. From preparation and the facilitation itself to the debriefing and conclusion, the entire process is complex and must be taken seriously. This is the focus of Chapter 10.

To measure a game's effects, it is also necessary to evaluate the sessions. This requires significant reflection from designers and users, as it depends on numerous factors: initial objectives, audiences, available resources and tools. Evaluation allows for medium- to long-term improvements by studying how players and their environments are affected. This process also provides a solid analytical basis for better understanding the dynamics at play both inside and outside the session. These aspects are developed in Chapter 11.

Finally, even if a game has a real impact and achieves its goals, it is not yet ready for dissemination. This necessitates a significant effort in valorisation[4] and outreach—work that is often ignored at the project's inception. It is necessary to characterise the game in relation to existing tools, its ambitions and its motivations, while addressing questions of Intellectual Property (IP) and potential dissemination channels. These practical aspects are gathered in Chapter 12.

4. Translators note: We have retained 'valorisation' as a formal technical term. It aligns with current European Research Area (ERA) and Horizon Europe terminology, where it is defined as the process of transforming research results into sustainable solutions for society.

10. Facilitating a game session

William's Daré, Sylvain Dernat

In most serious games, players are not left to their own devices when it comes to the rules, which have been drawn up. The facilitator's role is to bring the group of players to life and accompany them throughout the game session. Their role may vary according to the different phases of the session, but their personal qualities support them throughout. To energise the group and support its dynamics, the facilitator must possess certain professional skills (competencies, techniques and cognitive resources) in order to provide, receive and reformulate feedback, and ensure that the group functions well. Based on our experience, we have identified six such skills:

– Neutrality. The facilitator's role in a gaming session is to facilitate discussion between the various participants. They therefore need to adopt a certain neutrality to give everyone balanced access to the floor. This means listening to and empathising with everyone to understand the points of view expressed.

– Empathy. Empathy is the ability to identify with another person in order to intimately understand what they are feeling. The facilitator must therefore be able to respect different viewpoints and understand others. The opinions expressed by the players are not always understood by everyone. Empathy should be distinguished from sympathy, which is compassionate in nature. The facilitator does not need to have any particular sympathy.

– Active listening. It is important for the facilitator to be an active listener, i.e. attentive to what everyone is saying, rephrasing what they say and ensuring that those who have already spoken do the same.

– Authenticity. The participants must deem facilitators' behaviour authentic. There must be no cognitive dissonance between their words and actions. It is better for facilitators to acknowledge deep-seated unease than to pretend everything is fine. This will be immediately apparent to the participants. If they acknowledge their discomfort, the participants will appreciate their honesty. If a facilitation team exists, they can temporarily call on other members to replace them.

– The ability to trust the group. Finally, facilitators who have devised a scenario and mastered the objective of the session are not obliged to limit themselves to a single scenario. They trust the group and follow it, especially when it collectively decides to take an unexpected route, test a new idea, propose a new rule with which everyone agrees, or introduce a new practice. Allowing players a certain degree of freedom is essential for exploring the game situation, and this degree of freedom can vary depending on the objective and the constraints of the game design. These surprises can then be revisited during the debriefing.

– The ability to tolerate the unknown. The outcome of a game session is always uncertain and unique, so it is important to know how to adapt. To carry out their task successfully despite the uncertainty of how a game will unfold, facilitators

rely on their qualities and the facilitation techniques they have mastered, which they use differently depending on the phase of the session. You cannot just improvise yourself as a game facilitator, you need to acquire certain skills and practice, for example by running test sessions of the game.

Some theoretical points of reference

Multi-stage interactions

Research into the social psychology of small groups has shown that, in meetings where several people are invited to answer a given question, the group goes through phases of interaction where emotions alternate with a focus on sub-tasks that enable them to construct answers to the posed question gradually. When the meeting leader states the question that has prompted the meeting, everyone expresses their point of view and personal position without necessarily making a direct link with the proposed subject. The group then enters a phase of divergence. With the help of the facilitator, everyone is able to express themselves freely. Then, as points of view clash, controversy and tension may arise, and positive or negative emotions may be expressed. The group then enters the turbulence zone. The challenge for the facilitator is to guide the group to complete the task. Their experience enables them to highlight the points of convergence between the different opinions expressed and reduce tensions using different facilitation techniques. In this way, the facilitator enables the group to enter a zone of convergence where it can gradually overcome the various stumbling blocks, pitfalls or problems identified in the previous phase. In so doing, the group is able to construct its own answer to the initial question.

A group serious game session has the same characteristics as those described here. The facilitator may work alone, as teachers do with their pupils, or they may be part of a facilitation team, in which different roles can be distinguished (when the game is used with professionals). So, how will the game facilitator or team use the game to produce meaningful results in real-life situations, such as teaching sequence or professional practices?

Conflict mediation through gameplay and the symmetry/asymmetry of roles

Play is important in managing so-called 'asymmetrical' relationships, i.e. when the roles of the actors around the table differ. This is often the case in discussions about agricultural and environmental issues, where farmers, government representatives, elected representatives, associations, citizens, businesses and so on, sit side by side. These differences in status can lead to confrontation and cause inter-individual conflict in projects. The game helps to overcome this difficulty by organising the regulation of asymmetries.

Attention must always be paid to conflicts based on social comparisons of players' social status, as these can cause those who feel attacked or dominated to develop defensive strategies. Such asymmetries can hinder the free exchange of ideas and prevent representations from evolving. They can also lead to relational conflicts that participants will want to avoid. For example, individuals who perceive themselves as inferior may be inclined to maintain their perspective and remain centred on their thought models, while feigning adoption of the dominant viewpoint. The game

should therefore be seen as a means of regulating these relationships by enabling players to escape reality. Players adopt a role different from their own and have to cooperate in situations in which their opinion counts as much as that of the other players.

Collectively, we often observe in the real world that the majority viewpoint tends to prevail to the detriment of alternative proposals. Conforming to the dominant model is also a way of reducing the risk of conflict. However, minority opinions can be beneficial, particularly when it comes to resolving a social crisis or finding innovative technical solutions to problems arising from dominant ways of thinking. Games can therefore be used as a means of expressing and valuing minority opinions. Initially, the majority will tend to reject the minority's alternative point of view, but will then be obliged to develop new arguments to counterbalance it. This creates a decentring mechanism that encourages people to step outside their traditional way of thinking and develop a new way of learning. This can lead to a cognitive resolution of the conflict, provided that cooperative relationships based on mutual respect are fostered rather than relationships of constraint based on respect for hierarchies.

However, so-called 'symmetrical' relationships (although this can always be questioned) can also be problematic. It is not uncommon for participants who have run out of arguments to question the skills of those who do not share their opinion, particularly among adults and young adults. This limits the decentring of the person being challenged and prevents them from changing their point of view. Points of view focus on relational issues and concern only social comparison and the judgement of individuals' skills. The discussion focuses only on others and not on the task at hand. This is a major trait of many audiences. Their skills and knowledge stem from prior experience and contribute to the development of their identity over the course of their lives. Any conflict may call their experience and identity into question. If the challenge is too great, it will prevent the processes of regulation and learning.

There are three forms of regulation:
– Complacent relationship regulation: one player tries to avoid conflict by adopting the views of others or giving answers that suggest they share their point of view, even if it is incompatible with their own opinion, to maintain the status quo of the relationship.
– Protective relational regulation: one player feels less competent than another and imitates them to create the impression of having the same level of competence.
– Competitive relational regulation: one player feels more competent than the others and undermines their arguments and skills in order to assert their own.

For the group relationship to remain constructive, there should be no winners or losers at the end of a conflict, only in-depth exchanges of ideas. This is a paradox of the game: it can be designed to be competitive, but it must also regulate conflict. To achieve this, it is important to avoid players making judgements about each other. At the start of the session, the game facilitator can remind players that everyone's contribution is valuable and must be respected. The game set-up should also help focus players' attention on the tasks to be carried out during the game and incorporate ways of managing the different points of view of interacting players. Similarly, players who cannot answer a question should not be devalued; comparison between players should be positive, especially when they are working with the same information.

Finally, some players focus solely on their own performance, which can be detrimental to the expected learning behaviour. Conversely, if the game prioritises the group's collective mastery of the task rather than individual performance, this could increase players' engagement and motivate them to solve the problem posed in a collaborative manner, encouraging them to understand different points of view and adopt a positive view of others. These two elements are the driving force behind decentralisation.

In conclusion, in order to run a serious game effectively, it must correctly reflect the intended reality and create conditions for dialogue focused on the relevant knowledge (theoretical and pragmatic) and attitudes.

Preparing the game session

This takes place before the actual game session. The primary aim of a game session is to meet one or more precisely defined objectives. It is important to distinguish between the objectives of the game session (i.e. the goals and aims) and the overall objectives of learning, consultation or change. The search for answers to these objectives has led the organisers of the session to design the various elements needed to set it up. The main elements of a game session are the materials used, their tangible or computerised supports, the venue and the organisation of the gaming area, the number and type of participants, and the monitoring and evaluation protocol (observing the players and monitoring the effects on participants). Therefore, it is essential to consider all these elements before inviting actors to participate in a session.

Organisation of space and time in the game

The gaming session takes place in a dedicated physical space. This is the room in which the session will take place. It must be reserved in advance to allow sufficient time for preparation, running, debriefing and tidying up (do not wait until the last minute to use the room). Depending on the needs of the game, this room can be a single space or subdivided into several sub-spaces, for example to represent disjointed spaces, create an asymmetry of information between several roles, or make a common space for dialogue explicit as opposed to a private, individual space.

However, games can also be conducted across multiple spatio-temporal units (Figure 10.1), necessitating the repetition of the aforementioned guidelines for each specific location. This can be formalised—though not exhaustively—based on whether the format involves recurrent sessions (A), a game spanning multiple sequences (B), or the simultaneous repetition of the same game across several rooms (C). Alternatively, players may rotate between different rooms and activities within a single game (D), or different games may be conducted in parallel (E). In each instance, the rules and the session flow will differ.

The timing of the game also needs to be carefully defined. It must take into account the objectives assigned to the game, of course, as well as external constraints. For example, in a farming context, the agricultural calendar (e.g. mowing season or harvest time) can have a significant impact on participation in game sessions. It is also often inappropriate to invite local representatives before or after of an election. You should also allow plenty of time for gaming and debriefing to avoid time constraints.

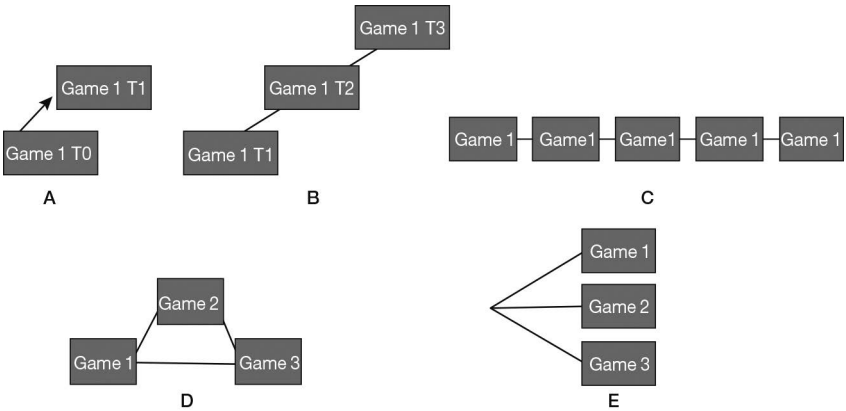

Figure 10.1. Five different ways of combining space and time in the game.

(A) A game where the units of time, place and objective are identical (prospective at time *t*). (B) A game with an identical objective, but with different units of time and place. (C) A game in which the same activity is repeated in different places along a route. (D) Games involving different activities in different places. (E) Different games with different objectives that can be played in parallel.

Conviviality must remain at the heart of the game, which can be accompanied by snacks (breakfast, coffee break, etc.) or meal for the participants, depending on the time of day. These moments often provide an opportunity for informal exchanges that reinforce interactions.

Preparing the material

The game material provided to players, as well as the descriptive elements that enable them to immerse themselves in the game world, should be prepared and organised before players arrive. This material will sometimes be computerised, depending on the advantages and disadvantages of the different options. While tangible elements encourage direct interaction between players through the manipulation of physical objects, computerised elements enable interactions to be reproduced at an accelerated rate over time, over a larger area, and with greater complexity than is possible in the real world. Therefore, the two types of element may complement each other, depending on the situation of the game.

These materials are thought out in advance to ensure that each player has everything they need for their role in the session, such as a role description sheet, counters, dice, playing cards, a map of their area, forms to fill in, etc., as well as notepads, boards, stickers or Post-its if necessary. Acquiring game materials is often problematic. Either an existing game is used, in which case enough pieces and boards must be bought or borrowed to ensure high-quality facilitation or the game has just been created or is not widely available, and you have to produce the materials yourself. In many cases, this production activity is carried out in a very traditional way, for example by cutting out cardboard or wood using tools such as scissors and saws, and painting or colouring pieces with felt pens.

However, an increasingly popular solution is to have the materials developed or to develop them yourself with the help of a fab lab. These labs offer an alternative to expensive game publishers who often require large production runs. These fab labs are increasingly accessible everywhere and have modern, semi-professional machines to facilitate the entire production process. 3D printers, laser cutters, vinyl cutters and cardboard cutters are all available

to help produce high-quality materials that enhance the facilitation. While the background and facilitation of the game must be central, players' interest in beautiful, well-made media is real and contributes to a successful experience. For games centred on agricultural themes, which are increasingly linked to environmental issues, we encourage you to use sustainable materials for producing game pieces, such as recycled paper, recycled wood or wood from certified producers, or recycled plastic (which is possible with 3D printers), to avoid any disparaging remarks (principles of coherence and congruence).

Example

In France, the GAMAE platform workshop in Clermont-Ferrand specialises in creating games about agri-environmental and food issues for local areas. Much like a fab lab, it enables the production of professional, high-quality prototypes or small series of games. A 3D printer (left) or a vinyl cutter (right) can easily produce parts. This type of workshop exists in many fab lab locations.

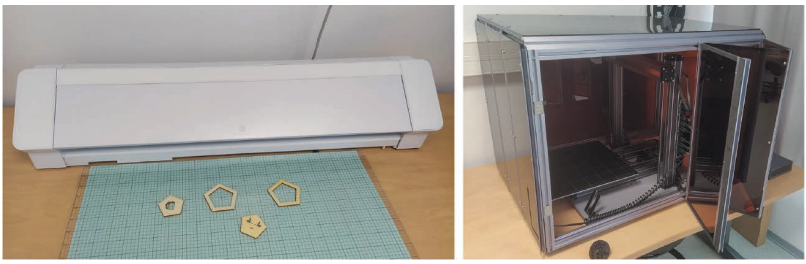

Figure 10.2. The GAMAE platform workshop.

Example

Figure 10.3. Session of *La Grange* and *Jeu de territoire* with a large number of players.

In this session, which combined the *Jeu de territoire* and *La Grange* games, over a hundred players were brought together with around a dozen facilitators. Such large-scale sessions require meticulous organization to ensure that the objectives assigned to the game are met. It is essential to organise the space to avoid interfering noise between the game. Preparing the gaming equipment took two weeks.

In addition, cardboard, paper, glue, flipchart paper and felt-tip pens may be useful for the facilitator during the game, so these items should be optimally positioned before the participants take their seats. The digital elements must be designed so that they are visible to everyone, without focusing the players' attention all the time, as this can be detrimental to interaction. Often, video projection is used to remind participants of the rules of the game and how it will be played. This is an additional way of facilitating the game, but you need to provide the necessary equipment and support in advance.

Example

In an adaptation of the game *En campagne !* (see p. 34) conducted with Master's students, an individual sketching phase of the rural landscape was integrated. This complemented the standard collaborative output on the main game board (Figure 10.4) by transforming the initial board into multiple 'subjective interpretations'.

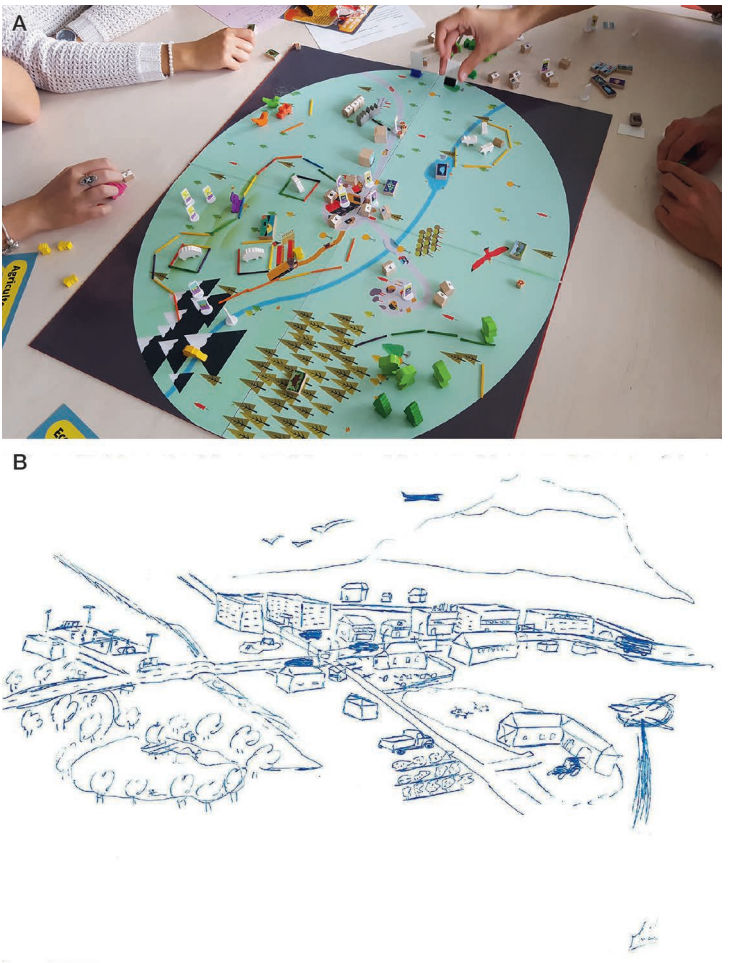

Figure 10.4. Individual versions of the *En campagne !* game.

A. The basic version of the game (usually played with high school students) involves the installation of modular elements to create a collective vision of a rural area on the game board. B. The version of the game designed for Master's students, with an example of an individual drawing of a rural area.

The schedule for some games can be adapted to fit the context in which they are used, to compensate for unforeseen circumstances, or to align better with the action process or the theme. Sometimes, a key actor may only be available for a short time on the desired date, or the expected number of participants may be uncertain. That is why it is always a good idea to have the necessary equipment ready in case the group is larger than expected.

Choosing the participants

The number of participants depends on what is defined in the game.

However, the same role can be given to several players, or a player can take on several roles. The objectives of session organisers also influence the type of participants invited to a session. For example, if the aim of the game is to show the challenges encountered by a particular profession through the eyes of another actor in the same field, it would be beneficial to invite both individuals to participate in a session where their roles will be represented in the game. Even better, if conditions allow, it can be stimulating to reverse the roles in the game in relation to reality, so that each participant can experience the constraints of the other's role. This is particularly relevant in latent conflicts based on a lack of knowledge of the constraints of the other's profession or of what informs another person's point of view.

If the objectives and circumstances allow, it is preferable to mobilise players with diverse profiles in terms of origin, gender or profession. Good knowledge of the participants' profiles is a great help when facilitating a gaming session. Without being intrusive, it is important to gather as much information as possible about the players beforehand. This will help you organise the gaming tables, the floor, etc.

The cultural context of the participants is often overlooked and underestimated. However, it is a vital factor in success. Different countries have very different social rules, traditions and customs, so it is best to familiarise yourself with them before you start playing. Many games fail because of a lack of knowledge regarding the implicit social rules associated with the context in which the game is played. One example is the importance of the meaning of the colours used, which is presented in Part 2 and depends on cultural context.

Inviting players

You can only think about inviting participants once all these logistical elements have been defined. Not everyone has the same legitimacy to issue invitations. The capital of the organisers of the session is essential. This can be straightforward, such as in the case of a teacher with their pupils, or more complex if elected or local representatives are involved. If organisers feel that they lack sufficient legitimacy with their intended invitees, they should consider requesting the intervention of an individual or institutional sponsor who is recognised as being more legitimate. Without this person, those invited will probably not attend, as they are often approached by others as well. Convincing participants of the value of taking part in a gaming session can take more or less time. This is particularly the case with political decision-makers, who *a priori* consider taking part in a games workshop to be a waste of time, precious time that they cannot waste on what they might consider to be childish activities.

The roles of the facilitator

During the briefing

Once the logistical conditions have been defined, the next step is to welcome the participants. It is then time for the session briefing.

The key moment of introducing the game session to the participants

From a group dynamics perspective, this corresponds to the initialisation phase of the session. This is a moment that is all too often 'rushed', because the organisers focus solely on the game. However, it is a crucial time for engaging the players and establishing an atmosphere of trust, respect and conviviality. It is important to be available. During the introduction to the session, the organisers should remind the players of the terms of their invitation and share the general objectives of the session. They should then outline how the session will run, covering the briefing (which has already begun), the actual game phase and the debriefing, which provides an opportunity for reflection on the session. They should also specify the estimated duration. However, this does not mean that the organiser will specify the number of rounds of the game, as there is a risk that the last round will be unusable if the players take ill-considered risks in anticipation of the end of the game. The organisers should introduce the various members of the team, such as facilitators, observers and technicians. Depending on the objective of the session, it may not be necessary to introduce the participants if they already know each other (e.g. a class), if the objective is mutual discovery, or if the aim is to help resolve conflicts between players.

Explaining the rules of the game

The facilitator's first task is to explain the rules of the game and describe the world in which the session will take place. In this case, the world consists of physical or spatial entities and resources available to the players. The facilitator explains how the game space is laid out, including any subdivision into rooms to represent the subdivision of local entities. Players are also informed about the organisation of game time, including the representation of a game turn and the succession of different game phases, particularly individual or collective moments. The facilitator also describes the dynamics of these physical entities without necessarily going into detail, as these dynamics may be discovered by the players during the session. Finally, they specify that the game is not strictly linear and that hazards may occur during the game or information may be given at certain moments during the game (without specifying exactly when). Surprises are part of the game's overall dynamic!

The second function of facilitators is to allocate roles to each player and provide them with the necessary information. This allocation of roles is carried out strategically according to the objectives of the session, particularly in terms of learning. Facilitators can provide this information either publicly or in secret. They should explain to each player the materials created to help them understand their role. Depending on how the game was conceived by its creators, not all players will necessarily have access to the same types or numbers of resources. Often, it is this asymmetry of resources, capital or information that will drive players to interact with each other to advance in the game's world.

When explaining the rules, the facilitator should bear in mind that it is often tedious to explain them all to the players. A balance must be struck between providing enough information to play and avoiding cognitive overload, which can lead to disengagement. Even if the rules can be written down in an accessible format, players often lack the time to read and understand them all at first. Moreover, it is important to remember that some the rules are hidden (for example, certain biological and ecological dynamics are discovered through exploration, which is an important part of the learning process). Therefore, minimal explanations will enable players to move through the world and interact with each other. The first round of the game is often an opportunity to answer any additional questions players may have. One useful tip is that even if all the rules have been written down, the facilitator does not necessarily have to try to explain them all at the start of the game.

During the game session

The succession of rounds corresponds to the group's entry into zones of divergence, or even turbulence, before gradually returning to the zone of convergence. The facilitator's main objective during this phase is to help the group of players complete the tasks in an atmosphere of mutual respect and friendly exchange.

Facilitators' primary role is to ensure that the time and rules of the game are respected. They are the guarantor of the framework that establishes the contract of trust. Given that the game must include a certain number of rounds to achieve the objectives of the session (e.g. discovering certain knowledge or learning) and that participants have a limited time, facilitators play a fundamental role in ensuring that the session runs smoothly. They ensure that the rules set out in the introduction are respected so that interactions are not anarchic. The facilitator sets the pace of the session, introducing new events according to a scenario agreed with the game designers. Having prepared this scenario does not mean that it is set in stone; the facilitator must leave room for surprises arising from the interactions between the players, provided they do not contradict the objectives of the session.

The second function of facilitators is to guarantee the relational framework within which the players will interact. As the game proceeds, tensions may arise between players. Some of these may have been anticipated by the designers in advance, for example to address a recurring conflict between different users. The satisfaction of individual objectives can sometimes fuel these tensions. However, other, more unexpected sources of tension may also arise, particularly when players disagree about their values or the controversial issues they are defending. However, detailed the rules of the game may be, they can guide the players' roles, but cannot dictate how each player will respond to them. Each player's responses are constructed based on their experience, psychology, values and so on. These elements help them to interpret the rules, enabling them to act, make decisions and perceive situations differently from other players. The emotions experienced can be positive or negative. It is essential that facilitators intervene to ensure that these emotions do not prevent the participants from carrying out the intended tasks. Guaranteeing a playful atmosphere is therefore fundamental.

During the debriefing and the transition back to reality

Remember that the game has been designed to meet a limited number of objectives. The debriefing marks the transition from the simulated world back to reality. It is highly likely that not all players will have seen all the dynamics

at work during the game session. This is partly because each player is usually immersed in their role and may have interacted with some players but not others. They may also not have been in the same room as certain players or only have had partial information. The debriefing is therefore the moment to put the dynamics back into perspective and give them coherence by relating each player's experience, providing everyone with an overall view of the dynamics that emerged throughout the game session.

From a small group dynamics perspective, the players are entering the end of the convergence phase. The role of the moderation team is to support the players as they transition back to the real situation. This involves encouraging them to reflect on the session's outcomes and consider how these can be applied to address their own problems and generating solutions and exploring fresh approaches to the issue that brought them together. However, the facilitator is not alone in doing this. They can draw on the information gathered by other members of the moderation team (observers and technicians), as well as the players.

The primary responsibility of the facilitation team is to structure the discussion. If the game goes well, the players will experience intense emotions and actions. Players often want nothing more than to share their experience. If the facilitation team does not have a clear idea of how to conduct the final stage of the game, chaos can quickly ensue. Drawing on several studies, Hassenforder et al. (2020) suggest organising the debriefing into five stages:

– Sharing emotions. Players may have experienced positive or negative feelings. It is essential that they are able to express these feelings before focusing on the objectives of the session and the activities they have carried out. This initial phase is fundamental. Without it, negative emotions such as frustration and lack of understanding risk polluting the learning that lies at the heart of the gaming experience. Emotions are indicators that reveal where we need to 'dig deeper' to understand what leads to frustration or incomprehension, or conversely, what makes the participants' happy.

– Sharing information and events. The players are confronted with different events introduced by the game facilitator. These events may have been planned in advance to elicit a reaction from the players. In addition, some players may have been given information that others were not. Sharing information and events therefore gives the players a better comprehension of how the game session unfolded and allows them to see the logic behind the individual elements. It allows everyone to see the actions taken by each player and the consequences of the events produced. It also helps reveal how the local area evolved as a whole and distinguishes between routine and disruptive phases.

– Explanation of how the session went. This activity can be combined with the previous one. However, it is distinct in the sense that the facilitator gives the floor to the players, who can then explain to the others their logic of action, strategy and reasons for acting in a certain way at a specific moment in the game. The same fact may be perceived or interpreted differently depending on a player's objectives or the point at which it occurred in the game. This time is therefore essential for deciphering player behaviour. Depending on the session that has just been played, it can be useful to think about speaking in this context.

– The return to reality. This is when reality is reintroduced to establish a link with what the players have just experienced. In the previous three stages, elements may have been distilled by players. Here, the facilitator asks the players about the link between a specific action or decision and a real-life situation. It is important to check the validity of the hypotheses that went into designing the

game: some will be confirmed and others refuted. The facilitation team must pay particular attention to any surprises or unexpected actions observed during the game, so that they can be discussed with all the players.

– Projection into the future. A single session is insufficient to satisfy the gaming experience. In this final phase, it is important to consolidate what has been learnt, as well as the questions that remain unanswered. This involves clearly defining with the players how the results of the session will be used by participants in future.

Example

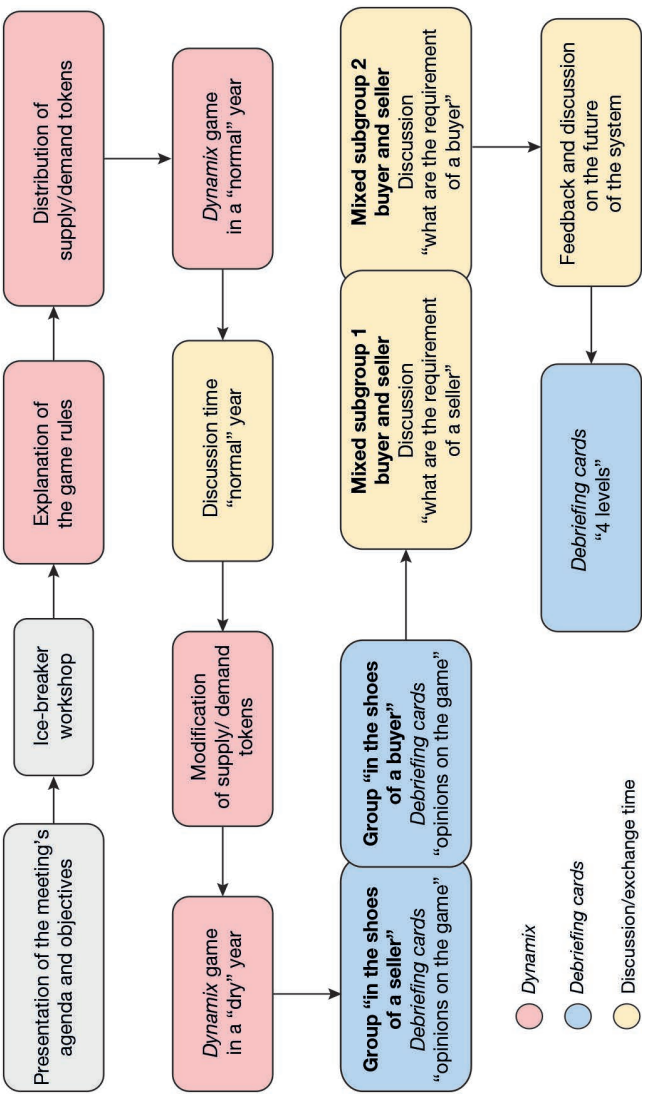

Figure 10.5. Session flow for a facilitation of the game *Dynamix* (see p. 18) conducted with farmers, showing the various phases of briefing, play and debriefing**.**

It should be noted that more time was devoted to debriefing than to playing the game in this proposal. Each part of the *Dynamix* game lasted only 15 minutes whereas the first phase of debriefing and post-game discussions lasted almost an hour and a half.

Facilitating the playing of a game should not be considered a menial task comparable to designing and mobilising a game (which is unfortunately often the case). Facilitation requires a certain amount of experience, skills and careful preparation before each session. Thorough preparation and testing your facilitation in advance are all key to successful running of a game session.

11. Evaluating the game

Sylvain Dernat, Valérie Angeon, Yves Michelin

Evaluating the game is an essential stage in its development. Evaluation is understood here as the comparison between expectations (those of the game designer, the user and the players) and the actual situation (what the game has produced). This process enables multiple objectives to be achieved, such as how the game works, assessing its educational value, and evaluating its impact. It also facilitates improvements and corrections and provides an account of what happened during the game sessions. Although there is a wealth of literature on the evaluation of serious games, it is sometimes highly theoretical and imprecise, making it difficult to apply. However, for a more in-depth look at the generic elements presented in this chapter, it is possible to refer to the articles by Mayer *et al.* (2014) or Den Haan and Der Voort (2018).

Setting up an evaluation requires the anticipation of a few simple principles, which can also be useful in the context of participatory approaches. Indeed, these approaches are increasingly at the heart of game design and mobilisation initiatives. This is particularly true of agri-environmental issues. In this context, the evaluation process can be participatory itself. Therefore, the construction of what is presented, or what makes sense to the participants, needs to be considered. In this case, a major challenge may be co-constructing each stage of the evaluation (or part of it) with the participating actors, whose scope must also be considered. Are they the players? Potential facilitators? Actors involved in the subject matter of the game? Citizens? etc.

In addition to the stages presented in this chapter, a few simple principles should guide the evaluation process, whether participatory or not:
– Transparency. Participants should be made aware of the evaluation process as soon as the game session is presented, or even as soon as they are invited to take part. The presence of observers, cameras, questionnaires and a survey can be destabilising for players, who will not adopt an appropriate role if they are not warned. By transparently announcing your intention to carry out an evaluation as early as possible, you can considerably reduce this pitfall, sometimes even eliminating it altogether.
– Understanding. The evaluation must be easily understood by the players and other participants. An incomprehensible evaluation process is ineffective. A simple and clear presentation of the evaluation content should make the objectives, method, processing, protection and valorisation of the data understandable.
– Adaptation. There is no one-size-fits-all evaluation framework. It must be adapted to each use, context and audience. Assessment must therefore be reconsidered for each session, taking into account its specific features.
– Anticipation. The evaluation is not determined a few minutes before the game session begins. It has to be prepared in advance: the method must be tested, potential observers must be trained, and the equipment must be prepared. Evaluation must be an integral part of preparing for and following up on the game session.

– Triangulation. Evaluation often involves a combination of methods (observations, recordings, questionnaires, etc.), which provides a better overall view and helps to achieve the objectives set. This triangulation can also be achieved by using several methods to process the data or by involving several people to analyse it, thus providing several points of view.
– Processing. Evaluation requires time to process data and identify the salient points. It is unrealistic to expect an analysis to be carried out in just a few minutes, as it is bound to be partial and biased.

However, it is important to bear in mind that evaluation is a task that can be more or less easily achieved because it requires careful consideration of the context in which it is implemented. Therefore, it is not a question of adapting 'off-the-shelf' solutions in line with initial expectations. This chapter is intended to help game creators and users adapt the evaluation process to their own objectives and constraints. For example, technological tools may not be available due to the location, process or actors involved in the evaluation. The ability of actors to evaluate or be evaluated and their availability to participate in the evaluation are also criteria that need to be considered from the outset. Evaluation can also be very time-consuming, so it is essential to take this into account at the design stage of the game or when implementing it in a teaching or support process.

Some principles of validity for understanding reality

Reality encompasses a set of multidimensional and systemic phenomena. It is therefore inherently complex, singular and difficult to comprehend. This is why it is so important to understand reality and make it intelligible. Play makes this easier to grasp, particularly through experience. However, accounting for this production and its diversity raises the question of the validity of the resulting knowledge. This, in turn, raises questions about the origin and nature of the knowledge produced.

Games as a means of making reality intelligible through experience

Games attempt to replicate the conditions of confronting reality, enabling us to understand it through experience. Experience is about living. It involves the individual in their relationships with themselves, the material and immaterial worlds around them, and others. Experience can be individual or collective. The games we are looking at provide a framework for interaction between actors. The situations in which actors find themselves, and the dynamics of their interactions during the game, constitute essential material that makes it possible to contextualise the results obtained. For the designers of the game, it is a question of gathering the meaning and importance (i.e. the values) that actors attribute to agricultural and environmental phenomena and facts. During the game sequence, particular credit should therefore be given to stories, language and narration. The practice of the game, which closely blends facts and values, can be associated with participatory and non-participatory observation methodologies, monographs and longitudinal analyses. These methodologies imply a presence and immersion in the field being studied.

This approach to observing reality (i.e. experiencing it) requires us to comprehend the relationship between the player, who is also the knowledge producer (i.e. the knowing subject), and the phenomenon or phenomena being studied. In this case, the knowledge considered valid is not validated according to evaluation procedures subject to external judgement aimed at producing so-called 'objective and verifiable' observations. In terms of their conception of reality, how they produce knowledge, and their validity criteria, the games developed to understand agricultural and landscape issues are based on a particular vision of the status of knowledge. This vision considers that reality exists in terms of

Example

Figure 11.1. A session of the game *La Grange* (see p. 73).

In this session of *La Grange*, which took place in several rooms simultaneously, the players at the two tables experienced the game differently. Their experience was influenced by their own initial representations, the interactions during the game, the experience of the game, and the game master's role (their instructions, how they regulated the game, etc.). When evaluating this session, it is important to take into account the unique circumstances experienced, rather than simply comparing how the two games were played (e.g. which game pieces were chosen and the decisions made during the game) and the outcome (the number of barns created). It will not be possible to generalise the results directly, but it will be possible to understand the processes uncovered by the evaluation (e.g. what the players' choices depend on).

our experience of it. These approaches are based on paradigms described as constructivist or interpretivist. They adopt the following position on the status of reality and the ability of actors to grasp it: first, there are no objective realities; second, the knowing subject (i.e. the player) cannot understand reality beyond their experience of it. With reference to these approaches, the game processes we are interested in more or less explicitly postulate that the world is made up of interpretations. These interpretations are constructed and are the result of individual or collective representations. They are therefore linked to interactions between individuals (in this case, players) and emerge in specific contexts. The knowledge produced is therefore situated and progresses through iterative processes of interaction between individuals.

It is therefore important to pay attention to what happens during a game sequence. This means understanding how players make sense of and interpret the realities in which they live, evaluate the changes they initiate or undergo, and consider the rules within which their actions take place, whether these rules are imposed on self-imposed. This approach acknowledges that there are many different views of the same phenomenon.

The principle of knowledge validity in the context of the game

Questions about the status of the knowledge produced are posed in terms of the internal and external validity of the results obtained. These principles of validity refer to the procedure for verifying and evaluating results. They relate to the quality and reliability of the results.

Some of the material collected through the game cannot be directly observed. This leads the game designer or facilitator to infer reality by revealing relationships between events or knowledge expressed through the game. For example, the practices declared by the farmers during the game cannot be observed as the game does not take place on the farmer's farm. However, the facilitator can deduce these practices based on those revealed in the game or verify them in the field. The internal validity of this type of approach implies that the results are accurate, authentic and plausible in relation to the field studied. Internal validity therefore consists of ensuring the relevance and consistency of the results generated during the game sequence.

The principle of external validity refers to the generalisation of results. Nor can the analysis claim to exhaust all dimensions of reality or be exhaustive. Therefore, the external validity of case studies does not aim for statistical generalisation. The robustness of the work relates to the phenomena and processes uncovered, rather than the number of observations. Both concepts relate to the idea that the results produced provide an understanding, at a given point in time, of a reality that emerges in specific circumstances. However, they do not claim to provide an exhaustive understanding of all situations.

Defining your evaluation: understanding the real

Game evaluation is based on specific, and sometimes complementary, expectations that are reflected in the processes implemented in and around the game. Defining the evaluation process is therefore an essential prerequisite before

considering the tools. As with any other subject of evaluation, it is all too often the case that 'turnkey' tools that are supposed to reliably meet expectations are put forward rather than a genuine evaluation approach. Assessment tools can only be considered as part of a specific process. If it is to be effective, assessment expectations must be matched with the availability of resources. This means, at the very least, defining the level(s) of assessment, the envisaged scope and the subjects to be assessed. Even if it only applies to a simple, one-off evaluation, we can easily talk about an evaluation protocol (Figure 11.2). This avoids the major pitfalls of subjectivity, which are often rightly blamed on evaluations that are not properly thought through beforehand.

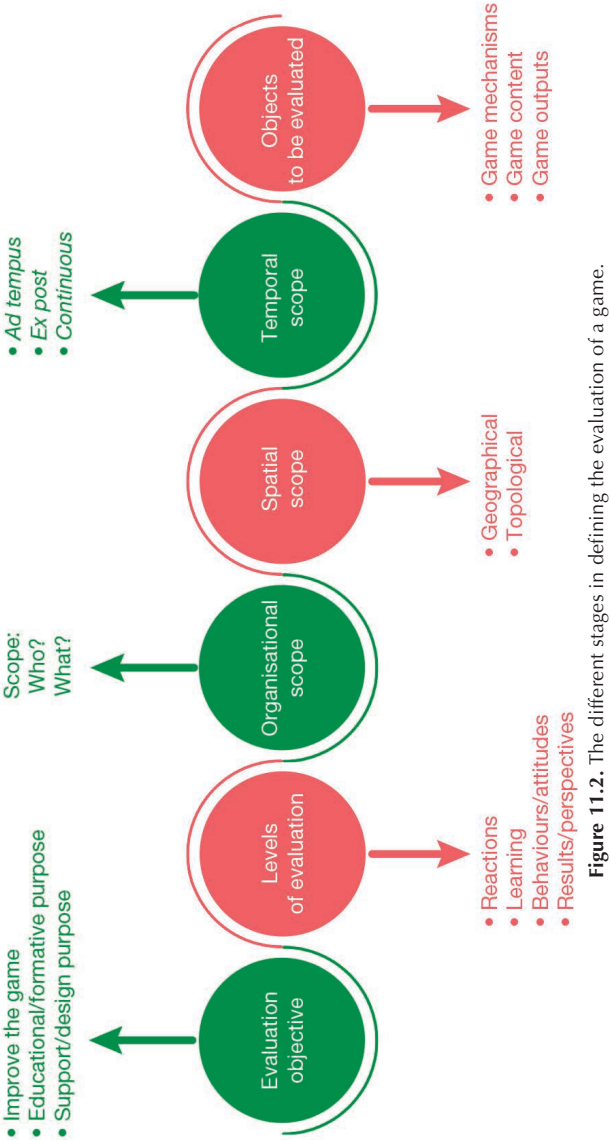

Figure 11.2. The different stages in defining the evaluation of a game.

Defining the objective of the evaluation

From this book's perspective, we propose summarising the objective of game evaluation into three main areas. These are evaluation to improve the game itself, so-called 'pedagogical' evaluation, which focuses on the knowledge and skills acquired, and evaluation for action, which to refers to the use of the game with stakeholders to bring about change or help with design. Expectations can therefore be opposed or complementary. For example, a designer may want to assess whether the proposed gameplay works well, while a teacher may want to evaluate the knowledge acquired by pupils through the game. The expectations are different, so the assessment must take this into account.

Evaluating the game for its improvement/adaptation

The main objective of evaluating a game is its ongoing improvement over time. We must not forget that games are dynamic tools, meaning that they must adapt to changes over time. All too often, novice game designers forget this aspect. If the game is produced but not evaluated over time, its relevance will gradually diminish, and it will eventually be discontinued. As a result, many games fall into oblivion due to a lack of adaptation resulting from a lack of evaluation. From this point of view, evaluation is necessary not only when the game is first used, but also on a regular basis, even during each game session. Changes resulting from evaluation can be thematic: the knowledge used for the game mechanics can evolve. This is often the case in the fields of agriculture and the environment (in order to meet the challenges of sustainable development and ecological transition and to adapt to controversies). Therefore, it is necessary to periodically review whether the knowledge or data used is still valid and viable for the game, and if not, adapt the game accordingly. This should be an ongoing task. Changes can also be made to the gameplay. The game often needs to evolve to suit new types of player or new areas of use.

Example

In one instance, the *Dynamix* game (see p. 18) was used with dairy farmers; the game was adapted to the specific local context and the farmers' current situation. The initial simulation model, which utilized a computational calculator, was significantly simplified to prioritise dialogue and knowledge sharing over a narrow focus on technical data. This shift was dictated by field constraints and the specific objectives assigned to the session, thereby optimising the game's outcomes. The gameplay evaluation was conducted accordingly to assess the impact of these adaptations.

It is essential to consider how to ensure that the game is 'maintained' over time and how best to conduct this evaluation, for example through feedback from players, online forms and so on. Furthermore, the world of games is evolving, and new forms of games are emerging. The game must be able to adapt to these new methods. Examples include the transfer of a board game to an online game, the use of board games in remote modalities, or the use of new game design tools such as digital tablets and 3D printers. It is crucial to assess all these dimensions to ensure the game's longevity and relevance over time.

Educational evaluation of the use of games

The second issue is educational. When games are used as a learning tool, they need to be evaluated specifically, whether for young people or adults. Teachers must ask themselves what knowledge or skills they want to pass on through the use of the game, as well as what sensations learners experience: well-being,

feeling at ease, feeling understood, feeling misunderstood, feeling left out, or wanting to give up on the session. While serious games primarily serve an educational purpose, the pleasure of playing must also be an objective in its own right. Ideally, most learning should be achieved through fun, even if serious games are not always about having fun.

Evaluating a game from a pedagogical point of view is not necessarily an easy task, as teachers often miss certain elements that the game brings to the classroom. Some knowledge is tacit. Even if the game does not enable clear knowledge to be learned, in the teacher's opinion, it may nevertheless have enabled the learner to understand mechanisms or patterns that are less easily assessed formally. For example, the learner may have developed an understanding of the systems approach to agriculture. The same applies to so-called soft skills, such as interpersonal and social skills, which are often overlooked in assessments.

Educational evaluation must therefore be based on all these dimensions and be central to the teacher's thinking when using the game. It is therefore often necessary to mobilise assessment tools that go beyond the traditional normative framework and target specific objects and a specific scope of assessment.

Example

When *La Grange* (see p. 73) was utilised with agricultural students, they were required to evaluate their gameplay experience 'through reflective practice'. Initially working individually and subsequently in groups (based on their respective game tables), they identified the knowledge acquired, the skills practised, the challenges encountered and the potential applications of the game in their future professional practice. The students' assessment for this pedagogical module was based on a plenary oral presentation of these reflections.

Evaluation of support/design through games

A third evaluation issue arises when the game is used as a consultation or design/simulation tool, rather than in real-life situations with professionals. Here, the aim is not to evaluate knowledge and skills acquired, but rather the impact of the game on action. In this case, we need to see how the game influences behaviour and enables us to propose actions and changes in the field. Evaluation is concerned here with the real impact of the game. It allows us to measure the effect of support through play and to identify biases, limitations and transferability to other contexts. The evaluation can also act as a report for various partners, participants and so on.

This is one of the most complex aspects of evaluation because it calls into question the scope and perimeter of action of the game. Indeed, it is obvious that the game is never the only element of action at this level. Players are also caught up in other activities or relationships that influence them. To assess the game at this level requires a certain objectivity, which will be reflected in an in-depth study of perceived or real changes. For example, we can study changes in stances, perceptions and world views prior to action. More specifically, we can also study the effect of the game on new working methods, new organisations, changes in practices and new rules.

The possibility of self-assessment

Evaluation is a role that can be entrusted to the players, particularly in terms of reflexivity. In some cases, involving only the facilitators or external experts means not taking into account what the actors have to say about what they

have understood or learnt. In fact, this deprives the facilitator of the feedback needed to improve the game, the learning situation, or the inputs and situations created outside the game. Encouraging actors to discuss the situation is an effective way to enhance its performance. This self-assessment can cover the entire assessment process or just part of it.

Defining evaluation levels

In order to evaluate a game, it is necessary to define the level or levels on which the evaluation will be based. It is often difficult to tackle all the levels in a single block due to time constraints and limited resources, whether human or financial.

We can apply 'Kirkpatrick's evaluation framework' here to differentiate each level of a game's use, allowing for a more precise targeting of objectives (Figure 11.3). This model is highly regarded within the Learning & Development sector and is particularly well-suited to practitioners due to its conceptual clarity. Each subsequent level of evaluation is more in-depth, aiming to capture increasingly precise results.

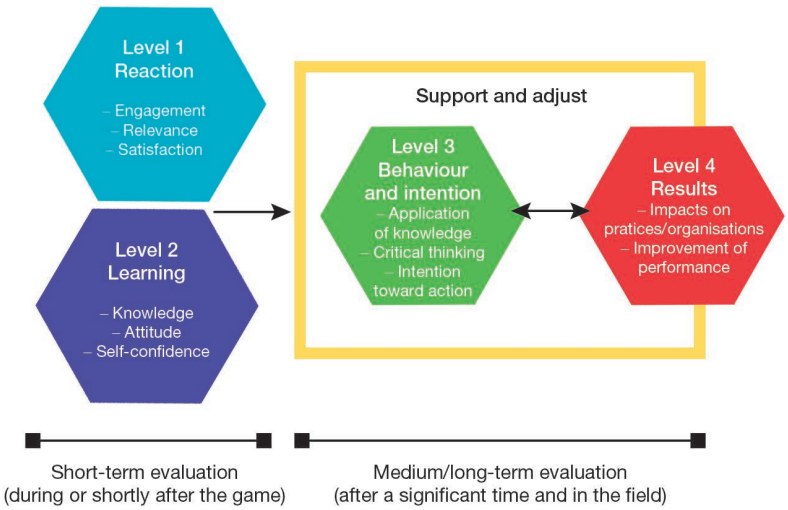

Figure 11.3. The Kirkpatrick evaluation model (adapted by Étienne *et al.*, 2023).

The difficulty of the evaluation increases with the level studied. The first level is relatively simple but provides little information on the game's actual impact, while the final level requires a thorough and time-consuming evaluation methodology but enables us to accurately measure the game's real-world effectiveness. Therefore, when using a game, there is significant cost/benefit trade-off between what we want to evaluate and the feasibility of doing so.

The first level of evaluation, which is the satisfaction level, corresponds to reactions. This is the satisfaction level. This is the most commonly used and the simplest level. It provides an indication of rapid perception but not really give an idea of learning.

The second level focuses on learning, assessing the knowledge or skills acquired during the game. This level is most often used in educational evaluations of games. It uses the concept of a test for evaluation purposes.

The third level builds on this by examining how the knowledge, skills or abilities acquired are subsequently applied in real-life situations. This goes beyond evaluating knowledge and skills, as it assesses how what has been done or learned in the game is used again.

The final level, the 'result' level, aims to define what has been produced in the real world by the game, i.e. the new structures, new practices and new standards it has induced. This level goes beyond the previous one by examining the effects of applying what has been learned in the game to real-life situations. It also looks at the effects of remobilising what has been learned in the game in real situations. Support processes are generally evaluated at all levels.

Define the organisational and spatial scope of the evaluation

In general, the game is part of a medium or long-term process, such as a teaching sequence or a support/design approach. To be effective, evaluation must therefore be based on specific objectives, levels and criteria. This level is usually organisational and reflects expectations. It is therefore important to understand that it is not necessarily the players who are being evaluated. It could be the designers or the players, or indeed any other individuals concerned by the game, its facilitation and its consequences.

The game itself may involve various designers, funders or other actors. These individuals may be external observers, facilitators or staff performing a technical function, such as IT. Evaluating the game therefore calls into question the processes involved in designing and producing the it. At an educational level, this often involves teachers and other educational actors. It is more difficult to define the scope when the game is aimed at a variety of actors acting on a real-life situation. In these cases, the scope is defined in consultation with the actors and according to their specific expectations. For example, the evaluation may focus on the members of an industry, an administrative body such as a municipality or a group of farmers or citizens. The choice is not trivial as the wrong scope can distort the evaluation by giving certain individuals too much prominence. This criterion therefore requires particular attention.

Given this approach to organisational perimeters, it is easy to see that the evaluation of the game also has spatial perimeters, particularly in agricultural, environmental or landscape games. Indeed, when the game is about a particular local area or agricultural practice, the evaluation must take this dimension into account. It is therefore often necessary to define the area to be assessed, which could be the area in which knowledge has been passed on, the area in which new practices have been devised, or the area for which these practices are intended. The notion of spatial scale is therefore very important. It is difficult to conduct an evaluation on a scale wider than that which has been played. It is therefore important to link the scales of evaluation.

However, the spatial aspect does not have to be understood solely in geographical terms. A topological approach can provide a relevant assessment by examining, for example, issues of proximity between actors or existing or evolving actions. This brings the spatial perimeter closer to the organisational perimeter, and the two can and should generally be dealt with together. Moreover, even when a precise spatial or organisational framework exists, the evaluation, can take place *in situ* at the location of the game or the location/space on which it focuses, or at any other necessary location to meet the

defined expectations. For example, a game about farming practices can be played close to the location at the heart of the game but evaluated by farmers from other areas who have benefited from the players' input.

Example

In *La Grange* (see p. 73), players address the challenges of livestock farming within a defined area. Consequently, the evaluation must align with this same spatial perimeter. However, the game also reveals proximities between actors and thematic areas that lack a direct geographical link (for instance, between various state agencies). This is referred to as a 'topological approach' to evaluating these connections. This approach can also be applied when examining the relative proximities between players during the session.

Defining the temporal approach for evaluation

An important element to take into account in the evaluation is temporal reflection. To evaluate a game in terms of its objectives, objects and scope, it is necessary to establish a temporal framework. This temporal analysis can be broken down into four approaches, which may or may not be combined.

Example

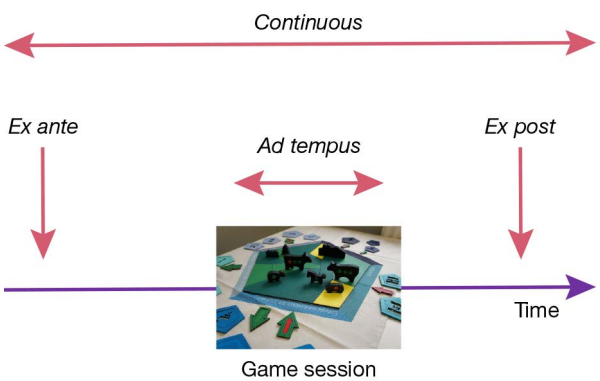

Figure 11.4. Types of temporal evaluation of one or more game sessions.

***Ex-ante* evaluation** takes place before the game begins. It enables the situation to be identified and the decision to stage and play the game to be taken. In this case, it is a tool that helps with the design of the game and its adaptation to a specific situation, as well as its execution. It also makes it possible to update the data used in the game over time, ensuring its maintenance. This type of assessment can also be used to define an initial pre-game situation, enabling changes to be measured in terms of both educational expectations (e.g. players' knowledge or skills) and the reality of the field on which the game is played. This forms the basis of levels 2, 3 and 4 of Kirkpatrick's model. The definition of this initial situation must therefore depend on whether or not the game has been communicated to avoid individuals making assumptions, whether they are players or not. Several pre-game moments can be used to collect the necessary evaluation data.

***Ad tempus* evaluation**, i.e. evaluating gameplay at the time the game is played, is a fairly classic approach. Although it is not possible to clearly determine whether all the game's objectives have been achieved, it is the best way of

assessing how a game is working. This method is also commonly used to evaluate the social aspects of the game, such as interactions between players, forms of discourse, and strategies deployed. Finally, evaluating the game while it is in progress sheds additional light on how it works, enabling us to understand elements that will be examined in greater depth *ex post*. This is particularly useful at a pedagogical level to understand why certain knowledge has not been acquired or understood.

***Ex-post* evaluation** is the most frequently used method. Although very useful, it greatly benefits from the aforementioned evaluation stages. This type of evaluation enables us to identify the effects of the game on the players and their environment more precisely after the event. In the short term, immediately or shortly after the game, it enables us to obtain the players' reactions to the game—in other words, to access level one of the evaluation. In the medium term, i.e. one to six months after the game, it is still possible to measure more considered reactions, even if memories of the game session may have begun to fade. At this stage, it provides a better assessment of the knowledge or skills acquired or added by the players (level two). However, the evaluation of the effect of the game on behaviour and the introduction of new practices, organisations or standards (levels three and four), is more complex and often requires long-term (one year after the game) or very long-term (several years) evaluation approaches. This requires us to adopt a humble approach.

For example, using a game to encourage the development of a prospective vision for a region cannot be limited to a short-term assessment. Implementing new policies and new collective practices takes time. The potential effects of the game can only be validated after many months or years.

The final form of temporal evaluation is ***continuus***, i.e. it is thought of as a continuously evaluated process. This calls on all the aforementioned temporal dimensions. This approach is traditionally used to develop gameplay through ongoing evaluation. Milestones are set throughout the design and deployment of the game to evaluate it. This allows the game to be adapted to changes in content, player attitudes, new knowledge and skills and so on. While setting up this type of evaluation facilitates maintenance of the game from an organisational point of view, it requires ongoing human resources, which is not always easy.

Defining the evaluation objectives

Identifying the objective and level(s) of the evaluation helps to determine the different types of subject to be evaluated. These subjects fall into several categories.

Game mechanics

Gameplay. It is useful to evaluate a game's gameplay, whatever your expectations. Of course, it is also essential for the evaluation of the game itself. Gameplay allows us to assess the balance between the rules of the game, how they are understood, and how they are used or misused by the player(s). Theoretical tools, such as the model of gameplay bricks proposed by Alvarez (2018), can help define this evaluation.

Player styles. Understanding the different types of player is essential for analysing their suitability for the game. Several simple models exist for this purpose. One example is Bartle's model, a typology of players that the evaluator can adapt to gain a better understanding of player profiles according to their gaming objectives. There are four player profiles based on players' actions or

interactions in the game (with the game environment or with other players): Killers, Achievers, Explorers and Socialisers. While playing, an individual may exhibit characteristics of multiple profiles, although one profile will typically remain predominant.

Immersion through gameplay, or flow. This is an important element of gameplay to take into account in the evaluation. Flow helps maintain attention and interest in the game. This is particularly true of professional actors in sectors such as agriculture and the environment, such as farmers, who are not accustomed to using this type of tool. The evaluation aims to analyse whether players remain involved in the game, i.e. whether any players remain on the sidelines, lose interest or pay little attention. This is also an indicator players' satisfaction and enjoyment during the game. A lack of immersion in the game can be a sign of several types of malfunction that need to be resolved. For example, the level of the game may be inappropriate: players may find it too easy or too complicated in terms of knowledge or skills. They may then lose interest. The model behind the game often comes under scrutiny and deserves to be examined. This may also mean that the players have been chosen poorly. For example, during a group game session, players may be at different levels, creating an asymmetry of skills. The same can be true of online games, which may involve people who are unaccustomed to using the internet or regular players who may find the game too simplistic. Finally, a lack of immersion may also indicate that the gameplay is inappropriate for the desired theme.

Game content

Knowledge. This is one of the most common ways in which games are used in teaching, but it is also relevant to all other applications. Knowledge can exist at several levels. It can be linked to the game's knowledge models, i.e. the models used to make the game work. It can also be knowledge developed by or thanks to the game, particularly through interaction between players.

Skills. Serious games are often used to develop skills or acquire new behaviours, such as using a tool or understanding a model. These are typically technical skills associated with a specific practice, profession or activity. Such outcomes are often deliberately sought through gameplay. However, they can also be soft skills, i.e. cross-disciplinary skills that can benefit players with a wide range of profiles and in various contexts, such as critical thinking, problem-solving, public speaking and teamwork.

Interaction. At the heart of the game, players exchange ideas, argue and sometimes contradict each other. These interactions are obviously at the heart of the analysis of the game, in terms of both the content and form. Non-verbal data also needs to be taken into account. This includes body language such as physical attitudes, facial expressions, gestures and variations in voice timbre, with behaviour such as glances, smiles, yawns, nods, whispers, shouts, leaving the room, positioning oneself in the centre of the group, or pointing. Finally, we should not forget that the physical game is itself an actor, a player in the game. Players interact with the pieces, the board, the cards and so on. In particular, the type of materials used can affect players' interactions. For instance, modelling clay allows for flexible shaping of forms.

The outputs of the game

Projects/scenarios. Many serious games aim to generate new partnerships or projects by encouraging players to work together or think ahead. Therefore, the scenarios produced by the games, as well as the projects they subsequently

generate, can be evaluated. In particular, they can be used to analyse how the game is translated into the real world and embraced by more than just the community of players.

Actions/practices/behaviours. The development of professional practices or adaptation to transitions (e.g. climate or digital) are often the driving forces behind the creation of serious games. Their aim is to encourage players to adopt new practices or behaviours that need to be identified. However, the difficulty lies in the fact that these changes occur at different rates for different players due to the context in which they live and also because the changes are not always those anticipated by the game designers or facilitators. One way of overcoming this is to identify concrete actions that reflect these changes in players.

Rules and norms. Games can encourage the emergence of new rules and regulations within communities. Identifying these rules and norms shows the fundamental changes that the game may have helped to generate. They can be explicit and shared both orally and in writing (e.g. new rules). They can also be tacit, in which case a deep understanding of the community in which they are used is required to effectively identify them.

Assessment tools

Once all the elements of the definition and evaluation strategy have been determined, a number of tools can be used to carry out the evaluation. The following is a non-exhaustive list corresponding to the different levels of evaluation mentioned above.

Level 1 tools: reactions to the game

The attendance list. This is a fairly simple tool. It allows you to count the number of players who are present or absent. It also serves as a record of how the game has been used at different times. In game design, it can highlight links between gameplay and the number of players and their profiles. In support or design processes, it is useful for repeated game sessions with the same or different players.

Satisfaction surveys. This is another fairly simple tool. It is the classic 'on the spot' evaluation tool. Questions are used to quickly and easily identify players' perceptions. It is common to use a scale graded from 1 to 5 or 1 to 7 to measure attitude. Elements that frequently come up in these surveys include the atmosphere, the welcome, the logistics, the game, the interactions and the knowledge acquired. A simple descriptive statistical analysis provides an initial indication of players' reactions. However, care must be taken with these data, as they are highly dependent on the atmosphere of the gaming session. As a player, you can sometimes be very satisfied in the short term, even if the session had no real effect, simply because it was original or enjoyable. Conversely, a well-run game can be ruined by a single logistical factor, such as a bad meal or being late, or an over-reaction to an event.

Debriefing. As previously discussed, the debriefing also serves as an evaluation tool by capturing players' reactions, which tend to be more substantive in this format. The quality of this phase often depends on the preparation of the facilitator(s). One common challenge is ensuring that all players have the opportunity to speak—a task that can be difficult to manage. Furthermore, evaluating reactions during a debriefing can be lengthy and tedious.

To address this, designers can use gamified tools specifically designed for serious games, such as the debriefing cards from Open Serious Games (Figure 11.5). These cards feature questions aligned with the Kirkpatrick model to facilitate dialogue across all levels of analysis—ranging from immediate 'satisfaction' to deep 'critical reflection'.

Figure 11.5. Debriefing cards are a useful tool for debriefing a game. They are freely available thanks to their open licence.

To assist with evaluating the debriefing process, readers can refer to the work of Crookall (2014) and Hassenforder *et al.* (2020).

Level 2 tools: what has been learned/produced in and through the game?

Knowledge tests. Teachers routinely assess knowledge in the form of tests and exams, but it can also be assessed in games for action or consultation. Simple quizzes or more in-depth tests involving role-playing can be used to check whether players have assimilated the knowledge in the game model or in the interaction between players.

The results and documents produced by the game. Many games produce interesting results in their own right. For example, a game can model future local areas, agricultural practices or new landscapes. It can then be interesting to look at the outcome of the game as an object of evaluation. This requires a good comprehension of everything that happened during the game. More specifically, the results of some serious games take the form of real documents that can be used, such as maps, proposals for action, economic exchanges and simulation results.

Game observation and debriefing reports. Observers can be useful for analysing game sessions. However, you will need to set aside time to train them and establish a relevant observation grid together. These grids often include a legend in which you record the observation time (stopwatch time) and the stage of the game, as well as signs, acronyms and brief notes on the elements you intend to observe. These steps are essential before observing a game. Observers often participate in organising the game, but this may also be done by outsiders with whom a relationship of trust needs to be established, and with whom the objectives of the evaluation and how it will be carried out must be shared.

Example

Figure 11.6. Two examples of recording devices.

These two photos show a multi-channel audio recorder (A) and a camera (B) in use during game sessions. Ideally placed, these devices do not interfere with the players in any way and are quickly forgotten about. They provide comprehensive data on the progress of a session. However, participants must authorise the recording before the session begins.

At least two observers are needed to provide sufficient critical distance. The resulting observation grids and reports are generally very informative and can provide information on the timing of the game, player interactions, how players interact with the board, arguments and non-verbal elements such as glances, movements or laughter, etc. However, analysing observation grids is fairly time-consuming. For more in-depth information on how to observe a serious game, readers can refer to the publication by Hassenforder *et al*. (2020).

Videos and audio recordings. These are the counterpart to the previous observation. Audio and video recordings can be made instead of, or alongside, observations to rework the identified elements. While the logistical organisation of this type of data is cumbersome, it provides rich and complete material for tracing an entire game session. It requires appropriate equipment (e.g. image and sound quality, storage), which can be expensive. A great deal of preparation is required prior to the gaming session in order to collect and use participants' data in accordance with the regulations in force. The angles of view to be analysed and the strategic locations for sound recording must also be clearly defined. Once the recording has started, both the players and presenters will easily forget about the device during the game. At the end of the session, it is essential to put the equipment away and save the data. The analysis is then carried out using specialised software, which can be time-consuming, although

Level 3 and 4 tools: the effects of the game on players and situations

Documentary analysis. In the medium to long term, a game session can result in the creation of new rules, standards, practices and organisations within the groups to which some or all of the players belong. Monitoring these changes often requires an analysis of documents produced by players' organisations (e.g. companies, local authorities, farms, industry, etc.). Examples of such documents include internal regulations, guides to good practice, charters, project documents, media articles, equipment purchasing documents and technical data (e.g. milk inspection). These documents can be used to identify the real effects of the game.

Interviews. After the game, it is often useful to talk to the players about the game and its effects. The time interval between the game and the interview depends on the time frame being assessed. Although time-consuming, this work often provides valuable qualitative evaluation material. There are numerous interview methods, including individual methods such as comprehensive, explanatory and life story interviews, and collective methods such as focus groups and practice analysis groups. The method used depends on the objective of the evaluation. A guide will be prepared to ensure that the key elements are discussed with the players. The post-game interview can be combined with pre-game interviews to carry out a pre/post analysis of the game's effects on the players.

Follow-up of practice tests. This is a classic element in agriculture, where field experimentation is often a means of substantiating a collectively debated or simulated proposal. This is another example of on-farm experimentation. The aim here is to analyse the experiments carried out after the game and their relationship to it. Conducting these practical tests in the field can be beneficial for understanding the limits of the game and reframing its facilitation and knowledge model. However, this requires a strong technical command of agricultural and landscape issues.

Example

Figure 11.7. A *Rami Fourrager* game session (see p. 42) and its field-based counterpart.

When *Rami Fourrager* is used with farmers, the practices revealed during the game session take on their full meaning in the field. Once the game has been set up, there is a post-game period during which the effects of the game can be observed in the field. In this case, this takes place on a farmer's plot where a new type of grassland is being tested.

It is essential to carry out an evaluation that is appropriate to the objectives assigned to the game, the game itself and the context, as well as to the constraints and resources available. If the evaluation is overestimated or underestimated, it will not be very effective. A balance therefore needs to be struck using the resources in this chapter.

12. Devising a strategy for disseminating the game

MédullineTerrier-Gesbert, Orlane Gadet, Anne Brunner

Like all games, serious games are designed to be played. This is their primary purpose, even more so in the case of the so-called 'serious' game, which pursues objectives over and above mere entertainment. The desired impact—the acquisition of new knowledge, the development of practices, dialogue between actors, etc.—depends directly on the extent to which it is used.

It is therefore essential that the game is disseminated in such a way that the actors for whom it was designed can access and use it. This involves designing and implementing a valorisation strategy, i.e. a plan of action to enable the game to be used (establishing functional utility) and embraced (played, organized or facilitated) by its target audience.

In this chapter, we propose a methodological approach for identifying the most appropriate valorisation strategy for the game being disseminated. From project to accessible, usable game, this journey is marked by a series of stages associated with a few key questions to guide designers in their choices. To help you answer these questions, this chapter also presents tools and basic knowledge to help you confidently tackle subjects that may seem abstruse at first, such as intellectual property.

This chapter is divided into four sections. The first section provides an overview of the methodological approach we propose for serious game developers. The subsequent sections explore each stage in detail: the initial baseline profiling of the game (stage A), the analysis of the game from legal and intellectual property perspectives (stages B1 and B2) and, finally, the dissemination of the game (stage C).

Valorising your game: questions to consider in advance

Before you start

Before embarking on a project to design a serious game, it is wise to take the time to question the motivations behind the project, the objectives associated with the game, and the resources available to bring the project to fruition. Unfortunately, promising projects often fail, leaving games at the prototype stage unused due to a lack of time, funding or interest from the intended actors.

To offset this risk, Table 12.1 provides a non-exhaustive list of key questions that game designers must ask themselves regularly in an iterative approach as the

project progresses. For a game to be widely disseminated and adopted its target audience, it is crucial to think about the project from a valorisation perspective from a very early stage.

Table 12.1. Ask yourself these questions throughout the creative process to facilitate and optimise subsequent valorisation.

What are the motivations behind the game design project?	What exactly is the purpose of the game? How does the game add value compared to other formats?
What is the context, and what resources have been allocated to the game design project?	Who will take part in the project? How much time is involved? Is the project supported (internally, by potential partners, etc.)? What funding is available (design, testing, use of service providers, manufacturing, etc.)? How can the budget be supplemented if necessary? What skills do we have? Do I need new skills or additional resources? Will I need to call on outside skills (e.g. for game design, graphic designers, etc.)?
Who is the game designed for?	Who is the game intended for? Who are the different target audiences: players? Game facilitators? Game session organisers? Advocates? What 'proof' do you have that these target groups are interested in or receptive to the subject and format of the game? How, and under what conditions, can games meet the needs of these different target groups?
How will the game design process be organised?	Will the game's targets be involved in the design process and, if so, how? How will successive versions of the game be tested? Who will contribute to the various stages of the game's design? What skills are required for the different stages, and what skills are available?
What format will the game take?	Why is this format important? Are other formats possible? What are the consequences of this choice with regard to intellectual protection? What about the constraints and costs of production and dissemination?
Is the game generic or problem-specific?	How many potential users can we expect? Should we consider increasing the genericity of the game to increase the user base (and remove dissemination constraints)? What does an increase in genericity imply? In terms of methodology, what about the precision of the processes described in the game, gameplay, etc.?
How will the target audience get to grips with the game?	What additional resources should be provided so that users can get to grips with the game? Training courses? MOOCS? Videos? Teaching scenarios? etc.
Is the game original?	Are there other games on the same theme? Are these competing games aimed at the same audience? How does the game differ from what already exists, what is its added value?
Under what conditions will the game be of interest to the target users?	How can the game fit into the practices of the actors it targets?

A roadmap for designing and implementing a game valorisation strategy

As the design project takes shape and an initial prototype is conceived, it is time to specify the game's valorisation strategy. To guide you through this process, we propose a three-stage approach, illustrated in Figure 12.1. Each stage is described in more detail later in the chapter.

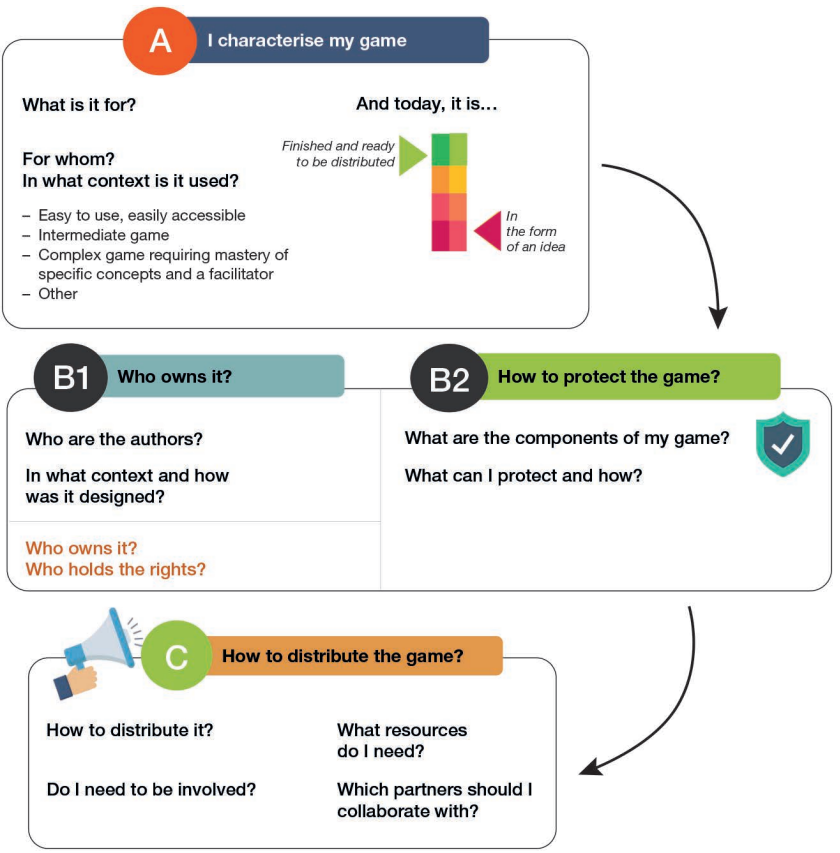

Figure 12.1. Three stages in developing and implementing a strategy for dissemination and valorisation of the game.

Stage A. Baseline profiling of the game to guide valorisation and define an action plan

The first stage in devising a valorisation strategy is to carry out an initial diagnosis. This involves characterising the game at time *t*, along three axes: the type of game, the level of maturity, and the current situation. This enables the project leader to choose from a range of possible valorisation options and to identify the actions required to achieve this.

A typology of games centred on valorisation

To help project leaders in identifying the valorisation pathways to be explored, we propose starting by specifying the game in its current state (at point *t*), using three key questions.

What will or can the game be used for?

Today, actors from all walks of life and with a variety of intentions are embarking on projects to design and develop serious games. The objectives pursued by the game's designers are fundamental in determining the ultimate scope and trajectory of the project's valorisation. In the previous chapters, three main types of serious game were distinguished according to their purpose: games for scientific mediation, games for teaching and games for action. What distinguishes these three types of game is the relative importance attached, on the one hand, to transmitting scientific knowledge and, on the other, to providing tools for actors to address a real and situated problem (Table 12.2).

Who are the potential direct and indirect users?

The valorisation pathways for the game are closely contingent upon the nature of its targeted users. A distinction can be made between first-level users (those who play) and second-level users (those who facilitator or organise games), as well as advocates. These advocates are actors whose objectives are partly aligned with what the game enables them to do, but they are not the target audience of the game (level one and level two users). They therefore have an interest in the game being used and can play a role in its dissemination (see stage C): for example, they can be relay actors for public policies, regulatory or educational systems, or heads of association networks and technical institutes.

How complex is the game?

The level of complexity of the game is also a determining factor in the valorisation strategy to be developed. Depending on the prerequisite skills needed to play the game, the time and effort required to master its rules, any necessary equipment, and the length of a game session, three levels of complexity can be distinguished: simple games, games of intermediate complexity and expert games.

Three main types of game

The answers to these questions allow us to categorise the game into one of three main types and direct it towards different avenues of valorisation: games for the 'General public or young players', 'specialist' games and 'expert' games (Table 12.2).

Games for the general public or young people tend to be simple and easy to access, similar to educational board games available from mainstream publishers. The mechanics of the game make it easy to play quickly and autonomously. The main aim of these games is to raise players' awareness of a particular issue.

In contrast, the games we describe as 'specialised' are based on a number of 'expert' concepts, which makes them difficult for the general public to access. Based on a simplified representation of socio-(agro)ecosystems, these games offer a straightforward way to gain an understanding of complex issues. The games can be played in under half a day. Game leaders need to invest time beforehand to prepare. Often, the game needs to be clarified, and the session

Table 12.2. A few questions help to place the game in one of three broad categories.

Key questions	General public and young players	Specialist games		Expert games
		For education	For action	
What will/might the game be used for?				
Passing on knowledge	+ +	+ + +	+ +	+ à + +
Tools for action and change	+	+ +	+++	+ + + +
	Raising awareness	Passing on knowledge, facilitating learning	Share, co-construct and simulate diagnostics or courses of action	
Who are the potential direct and indirect users?				
First level	All ages (depending on the game)	Students in learning institutions (from high school to five years of higher education)	The aim of the game is to inform, raise awareness of, encourage dialogue with, encourage action on, etc. Stakeholders sharing a management issue in a given area Professional communities	
Second level	-	Trainers/teachers	Practitioners involved in community engagement in a specific area (agricultural extension officers, nature conservation officers, etc.) Support and facilitation professionals specially mobilised to propose/implement a collective dynamic (specialist consultancies, for example). Research or research and development actors	
Advocates	Organisers of events and activities (scientific outreach, communication, etc.)	Inspectors, people involved in developing training guidelines, educational design and teacher training	A wide variety	

Table 12.2. (continued)

Key questions	General public and young players	Specialist games		Expert games
		For education	For action	
How complex is the game?				
Need for prior knowledge	No	Requires understanding of some of the scientific concepts at the heart of the game	The game requires mastery of specific concepts linked to the subject of the game	
Facilitator needed	Not necessary	Not systematic	Mandatory	
Need for additional resources (other than the game rules)	No	Other resources may also be useful: videos, a guide to facilitating a game, feedback from other users, resources related to the subject, etc.	Always Depending on the complexity of the game: session moderation guide, training, etc.	
Game duration	Short: from a few minutes to around one hour	Up to 2–3 hours	Often over several sessions Upstream data collection often required	

flow needs to be capitalised upon, so that it can be used by people other than the initial designer. To make it easier for facilitators to get to grips with the game, it should be disseminated with additional resources.

To guide designers towards the most appropriate valorisation options, we propose distinguishing between games specialised for action and those specialised for teaching. Although these two categories are not mutually exclusive, on the one hand, 'specialised' teaching games are designed to facilitate the transmission of theoretical knowledge and active learning through game-based situations. On the other hand, 'specialised' action games are primarily designed for use in action support systems, particularly when the aim is to build and share an initial diagnosis or to work on a multi-actor problem where each is an expert in a small part of the problem, over a short period of time (at the start of a system, for example).

The third category is made up of what we call 'expert' games. These are similar to specialised games but differ in that they are more complex. Some use a simulation tool, others do not. However, they all require considerable data prior to the game. This data enables the game to be tailored to a specific problem formulated by specific actors. Some of these expert games are therefore 'tailor-made' games based on a generic methodology.

These three types of game are associated with different valorisation[5] pathways (see Table 12.3). These pathways will then be refined during stages B and C, the latter of which aims to operationalise the dissemination of the game.

The game's development stage: the readiness scale

In addition to the typology, we recommend enriching the initial diagnosis by characterising the game's level of maturity or readiness at time *t*. Reflecting on the game's position on this scale helps to identify how far it still has to go, and the resources needed to get there.

To this end, we propose a seven-stage scale based on the TRL (Technology Readiness Level) scale, which is widely used to support the valorisation of innovations (see Table 12.4).

While all these stages can be identified throughout the life of a game, from design to use, they are not necessarily handled by the same people. For example, stage 1 of knowledge production often initiates a game design project within a research institute, whereas in many other cases, the designers draw on existing knowledge. In the latter case, the design process begins at stage 2.

Levels 6 and 7 are particularly concerned with the dissemination of the game. Experience has shown that two things are particularly important for a game to reach this level of maturity:
– involving the game's target users, for example by organising test sessions. In addition to potential users, it is often useful to approach and involve the game's dissemination partners (trainers, facilitators and publishing or dissemination partners). These actors (users and dissemination partners) will then be able to express their needs or constraints, and influence certain characteristics of the

5. This 'valorisation' typology was developed through the analysis of serious games resulting from INRAE's research, which was supported by the Partnership and Transfer for Innovation Department (DPTI) and INRAE Transfert, its development subsidiary, over the last three years. Around 30 games were examined.

Table 12.3. Suitable valorisation options depend on the type of game. The options described in this table will be explored in greater depth in stage 3.

	Possible valorisation pathways	**Points to consider**
Games for all ages	Publication and dissemination of game boxes by a publisher specialised in educational games Print & Play* format, with free Internet access to files enabling you to build the game yourself	Ensure that the game's aesthetic appeal (a game for the general public needs to be attractive!) and level of hardware sophistication are suited to the target audience and wide dissemination (watch out for production costs!) In Print & Play, pay attention to the time and complexity of manual production
Specialised educational games	Structuring partnerships at regional (academies and decentralised state agencies) or national (national education, national teacher support unit, etc.) level Published by specialist educational publishers Print & Play format with free access The game can be reworked (simplified) to target the general public	Ensure that the game meets the needs of the target audience and fits in with their professional practices Ensure that the ancillary resources enable users to familiarise themselves with the game in a reasonable amount of time
Specialised action games	Clearly identify the needs of the practitioners (which ones? In what areas? For what activity? etc.) that the game could meet, and situate it in relation to existing products (market study) The game can be reworked (simplified) to target the general public	
Expert games	Facilitator or game master training Clearly identify first and second level users Identify potential trainers for game session leaders Once simplified, these games can be used for teaching purposes	Due to the complexity of the subject matter and the specific nature of the game, it can be difficult to find dissemination partners once the game is almost finalised. Forming alliances with potential dissemination partners at an early stage and taking their constraints and expectations into account is beneficial The game's lack of versatility can be a real barrier to dissemination if the target audience is too small. Reworking the game so that it can be adapted to more situations could be beneficial

* Dissemination of digital files to game users so that they can make copies of the game. This can be done using different materials, depending on the equipment available to the user, for example, paper or cardboard with traditional printers, or wood with laser plotters or 3D printers.

game, such as the medium for disseminating the game, the materials that can be used, or the game design;
– ensure that the financial and human resources (including skills) available are sufficient to see the game design project through to release. For example, it may be worth hiring a professional graphic artist to improve the form of the game, or even a game designer to refine the game mechanics once the intended use is clearer.

Having the necessary budget is also essential. There are various types of funding available to support project for creating and valorising serious games: public subsidies, patronage, sponsorship and participatory funding.

Finally, as mentioned above, the success of the game will depend in part on its ability to arouse interest and become part of the practices of its target audience. To identify where the game stands in relation to what already exists, and to understand how it might fit into the practices of its future users, it is useful to carry out a survey. This involves conducting a small market study and interviewing a few potential users to gain a better understanding of their activities

Table 12.4. Serious games maturity scale.

1 Knowledge production	Acquire new knowledge on the subject covered by the game (and independently of the game).
2 Idea of mediation through play	The idea of designing a game emerges. The designers work on formalising what the game could be (central concepts, game principles, medium, etc.).
3 Validation of feasibility	Design of the first game prototype: the main principles of the game are decided (key concepts, game objectives), and the first version of the gameplay is proposed, possibly with the help of a game design specialist. At this stage, the 'play material' is homemade.
4 Successive prototypes	Iterative testing (and improvements) of the game within a small group (designers, project partners, lab members, etc.). Production of a second prototype: design of the game's graphic identity (illustration, graphics) and production of the first version of the game materials (in digital or physical format).
5 Medium-scale tests	Prototype 2 (available in a very limited number of 'physical' versions) is being tested on a larger scale. It is being used for teaching purposes or at special events.
6 Demonstrating the benefits of the game	Requests for access to the game are increasing, and the few available prototypes are insufficient. We need to define a strategy for valorising the game on a larger scale (manufacturing, publishing, dissemination). At the same time, feedback from users can help identify ways of improving the game. The change in scale could provide an opportunity to rework the game (gameplay, graphics) according to the target audience. Depending on the type of game, the target markets can be more clearly defined thanks to the increased number of interactions and uses, and this can be done in collaboration with the game's valorisation partners (publishers, etc.).
7 Dissemination	Wide dissemination of the game: the game is accessible (via a web platform or publisher, etc.) and its dissemination is ensured by appropriate communication.

and how they might use the game in light of their constraints and level of interest. If access to the game is going to be paid for, the survey can be used to ask potential users about their willingness to pay. This exploratory work can often be carried out by the project promoters.

Stages B1 and B2. Who owns your serious game and how can it be protected?

As already mentioned, designing a serious game often calls on a range of different skills: scientific, subject-specific, educational, graphic design or illustration and IT skills, among others. Therefore, creating a serious game is rarely the work of just one person, but rather a whole team with a wide range of complementary skills. The creative process then takes place within the framework of partnerships that can take different forms, such as collaboration or service, which will have consequences for the ownership of the game.

Therefore, before any valorisation or dissemination of the game, it is essential to clarify ownership by asking the following questions: who holds rights to it? What kind of rights are involved? To whom does the work belong? This stage (stage B1 in Figure 12.1) is essential because, by definition, all owners have rights over the game and its dissemination. In order to respect the rights of all those who have invested intellectual or financial resources in the design of the game, whether individuals or legal entities, it is important to identify the owners early on and obtain their agreement. This ensures that the consent of all stakeholders is obtained once the valorisation strategy and the resources required to achieve it have been defined.

Once ownership of the game has been clarified, it will be possible to draw on industrial property tools to support and strengthen the dissemination approach, thanks to varied and complementary protection systems (stage B2 in Figure 12.1). This work can be carried out regardless of the valorisation strategy envisaged, whether economic or free. To answer these questions, we must examine the various ways in which the game can be protected: which rights should be applied? How can the game be protected? How does this help the dissemination project?

Stage B1. Determining who owns the serious game: an essential stage to respect everyone's rights

This first stage in identifying the potential owners of a serious game can resemble archaeological work, as it may require a long and meticulous search of the game's contributors. This involves identifying every individual or legal entity involved in designing the game throughout the creation process, which can sometimes take several years. The involvement and contribution of each person must be traced, because it will have consequences for the ownership of the game, as we shall see. It is also necessary to refer to the contractual framework within which the game was created, since rights may have been granted to partners involved as collaborators, service providers or funders. This stage is essential and indispensable prior to any valorisation, since the agreement of all the co-owners is required before any action can be taken. This stage will lead to the drafting of a set of co-ownership rules that define the rights and obligations of each party.

At the end of this chapter, we will see how ownership of a serious game can be approached in France, and more broadly in countries that have ratified the Berne Convention on copyright, through the application of copyright law within the partnership framework.

Copyright

As mentioned in the second part of this chapter, a serious game can take many different forms and be embodied in a variety of media. In most cases, it can be classified in one of the following three categories: board games, card games and video games (which are not covered here). However, whatever their form, serious games are above all intellectual creations and are therefore protected by copyright in all the countries that have signed the Berne Convention for the protection of literary and artistic works (181 signatory countries in 2022). This means that creators have the means to control how their work is used, by whom and under what conditions. This convention is an international legal instrument on the basis of which the contracting states draw up their own legislation. It establishes the fundamental principle of automatic protection of the work from the moment of its creation, without the need for any formalities, and sets out a minimum set of common rights. Copyright thus protects all literary and artistic works, regardless of the mode or form of expression, provided they are original. The Berne Convention also provides for a 'moral right', i.e. the right of authors to claim authorship of the work, as well as the right to object to any mutilation, distortion, modification or infringement that would be prejudicial to the author's honour or reputation.

The partnership framework

In addition to the intellectual participation of the authors, the design of a serious game may require the establishment of partnerships between public-sector structures and companies. For example, this could be in relation to funding or the performance of very specific tasks outside the remit of the game designers. In all cases, when working with third parties, it is advisable to draw up a contract to secure the relationship and define each party's rights and obligations to ensure that the partnership is effective, reliable and, above all, compliant with legal provisions.

When drafting these contracts, extreme care must be taken to ensure that the commitments made are compatible with copyright, since only authors hold the rights to a work. There are two main types of partnership:

– Collaboration. Most of the time, this is formalised by a contract that expresses the pooling of human, intellectual or financial resources to achieve the final result. Co-ownership is often the consequence of this co-creation.

– Service procurement. Designers frequently engage service providers to access specialised expertise (artistic, IT, etc.) for specific tasks aligned with defined Technical Specifications (see 'Stage A: Baseline profiling to guide valorisation and define an action plan'). The contract formalising this arrangement must include a specific clause ensuring that the commissioning party retains sole and exclusive ownership of the work produced. Without such a clause, the commissioning party acquires no ownership rights over the works produced by the provider. This provision is of strategic importance and must be drafted meticulously.

Navigating serious game ownership in France

In France, the regulatory framework governing authors' rights (transposing the Berne Convention at the national level) is established within the Intellectual

Property Code (CPI). The CPI stipulates, on the one hand, that copyright protects artistic creations—including literary, musical, graphic (paintings, photographs, films, etc.), and visual (sculptures, etc.) works—as well as software (Article L. 112-2 of the CPI). On the other hand, it specifies that authorship status can only be legally attributed to natural persons.

For copyright to apply, a work must meet two conditions: it must be original and it must be expressed in a certain form. It must bear the stamp of the author's personality, regardless of quality or aesthetic merit. Moreover, copyright does not protect ideas, but only the original form in which these are presented.

Once these two conditions have been met, the CPI grants the authors of a game, by the sole fact of its creation, an exclusive incorporeal property right enforceable against all over their creation. This copyright covers two types of rights:
– Moral rights, which are intrinsically linked to the creation of the work. They confer on authors the right to have their names affixed (right to authorship of the work) and the right to respect for the work as they created it (right to the integrity of the work).
– Economic rights, which give authors ownership of their work and allow them to authorise or prohibit its use. These rights include right of performance or communication to the public, the right of reproduction, the resale right and the right to determine or control the use or purpose of the work. However, unlike moral rights, economic rights can be transferred and are valid for 70 years after the death of the author or after disclosure if the work belongs to a legal entity (company or association).

Finally, it is important to note that copyright is acquired automatically upon creation of the work. Nevertheless, in the event of a dispute, authors must be able to provide proof of the date on which their work was created. This is why, when developing a project, it can be useful to provide proof of your creation's existence on a given date. When several contributors are involved in creating the same work, the CPI distinguishes between three types of work depending on how the contributions were organised:
– A work of joint authorship involves several individuals whose contributions are identifiable, even if they are not individualized, particularly if they are of different genres. This type of work is managed under the joint ownership regime, which requires unanimous agreement of all co-authors to decide on any act of exploitation. To facilitate the exploitation of a work of joint authorship, the co-authors should draw up a joint ownership agreement appointing one of them as manager of the joint ownership.
– A composite work is a new work that incorporates a pre-existing work without the collaboration of the authors of this work. It is the property of the authors who created it, "subject to the rights of the authors of the pre-existing work". This means that its creation may be prohibited if the authors of the original work have not expressly authorised it and that it may only be exploited in accordance with the original authors' rights.
– Finally, a collective work is a work initiated by a natural or legal person. They have directed its creation with precise instructions and must be able to provide proof of how they coordinated with the various contributors. In addition, it must not be possible to associate any individual contribution with one or more authors. Collective works are therefore rarely applied to serious games, where the contributions of each individual can often be identified. In the case of a collective work, authorship and copyright vest in the natural or legal person who directs the design of the work and publishes it in its name.

It is important to note that economic rights are initially reserved for the authors of a work. Indeed, it is unlawful to assign rights to a work prior to its creation (Article L. 131-1 of the CPI). Consequently, rights agreement must be drafted as and when the creative outputs are produced. However, within the creative industries, the conditions for this transfer of rights are frequently predefined and stipulated within the employment contract. Even where no such provision exists in the contract, an employee may assign their economic rights to their employer once the work has been created; similarly, a trainee or student without an employment contract may assign them to their host institution or school. Table 12.5 summarises the key questions a game designer must address to identify the owners (holders of economic rights) of a game, as well as the holders of moral rights, should they differ from the former.

Table 12.5. Questions to ask when determining the ownership of a work (in France, and countries signatory to the Berne Convention).

1 **Is the work an intellectual creation?**	Is the work formalised? Is the work original?
2 **Who was involved in creating the work?**	Which individuals took part? Did these people have any intellectual input?
3 **What type of work is it?**	Is this a: - collaboration? - collective work? - composite work?
4 **Do authors retain their economic rights?**	Do authors wish to assign their economic rights? Have any authors undertaken to assign their economic rights? Are there any rights assignment contracts to be drafted?
5 **What is the contractual framework for designing the game?**	Have any contracts been signed? Collaboration, provision of services, contracts with third parties? What funding did the authors receive? Were there any quid pro quos? Have any commitments been made? What are the consequences of ownership of the work?

Stage B2. How can the game be protected? Tools to support your valorisation strategy

In addition to copyright, serious games can be protected by industrial property rights. The latter is of interest in the case of valorisation, as it gives its owner(s) a monopoly on exploitation (see Table 12.6). These industrial property rights can reinforce the planned valorisation strategy by protecting the work and facilitating its transfer to a publisher through a contract for the assignment or exploitation of industrial property rights. They can also be used to take action in the event of infringement or fraudulent use of the game or its name. For example:

– The name of a game can be protected by a trademark, either simple or collective. A trademark identifies and distinguishes the game from other games, products or services, informing consumers or users (in this case, the users of the game) of its origin. By prohibiting a third party from using the same name for a different game, the trademark prevents one game from being confused with another game with the same name.

Table 12.6. Characteristics of types of protection.

Protectable game elements	Type of protection	Basic conditions	Filing	Characteristics
Aesthetic elements	Copyright of artistic creations	Your creation must be original and purely artistic or in the applied arts. The author automatically holds the primary rights to their original work as soon as it is created, without the need for any formalities.	You must be able to demonstrate that you created the work, own the rights, and did not copy it from anyone else. Copyright laws differ from country to country	To prove the date of your creation: - the Soleau envelope (in France) - filing with a ministerial officer (notary, bailiff) - registration with a society of authors
	Design & Model	The design or model protects the appearance of your products, for example their lines, contours, colours, shapes or textures. You must be the owner of the design or model (holder of the economic rights) in order to register it with the intellectual property protection office (INPI in France) as a Design or Model.	In order to be protected, your aesthetic creation must be new, sufficiently different from existing designs and not dictated by the product's function. It must be clearly visible and require no dismantling You must provide a representation of your creation using visual elements such as drawings, photographs, or samples under certain conditions	Registered with the intellectual property protection office (INPI in France) You alone can operate it for a maximum duration (of 25 years in France) You can deter and prosecute counterfeiters
The name	Trademark	Trademarks protect the distinctive signs of your company and your products or services.	Your trademark must be available, i.e. it must not have been registered by a competitor Certain signs cannot be registered, such as misleading indications, descriptive designations of the characteristics of your products, signs representing official institutions, names contrary to public policy, etc. It can be renewed as many times as you wish, for a fee.	Registered with intellectual property protection office (INPI in France) You alone can use it in France for a fixed duration (10 years in France) You can deter and prosecute counterfeiters

INPI: *Institut National de Propriété Intellectuelle* (French National Institute of Industrial Property).

– The aesthetic elements of a game—its board, pieces and cards—can be protected by a design patent for 2D elements, or a model patent for 3D elements. Originality is a requirement for distinguishing the game from others. Design registration is recommended for games with high commercial stakes.
– Finally, serious games could implement specific innovative systems and be the subject of patent applications. However, due to the demanding patentability criteria (novelty, originality and industrial application) and the considerable costs associated with filing and maintaining patents, this form of protection is rarely feasible for valorising a serious game.

Stage C. Disseminating your game

The game is ready for dissemination (level 6 on the TRL scale). Before making it accessible to users, the following four conditions must be met:
– Potential users (players, game session leaders/organisers) must have access to the game's media as well as ancillary resources, such as training in game leadership (essential for specialised and expert games), which may be key to the game's dissemination.
– The game must be brought to the attention of its target actors.
– The owners of the game must have the necessary human and financial resources to implement knowledge valorisation initiatives.
– The licences for the game must be appropriate for the chosen dissemination strategy.

In the case of games targeting several types of audience (e.g. agricultural training students and farmers), these conditions and their implementation must be considered independently for each audience.

Condition 1. Make the game materials and associated resources accessible

Production of the game materials

Print & Play involves making computer files available to users so that they can print and build the game themselves using simple, inexpensive materials. This is often the most accessible option for game owners, since it requires little investment. However, communication and publicity remain essential. The constraints of manufacturing the game by the user (cutting and pasting in particular) must be taken into account in the game design to minimise the manufacturing costs. Print & Play games can be free or paid for, and Print & Play can be combined with the production of game boxes.

The production of game boxes by the game owner(s). This frequently concerns games aimed at 'small' markets, which are of little interest to professional publishers. In this case, the production of the games requires an investment on the part of the game owners. From a supply chain management perspective (production, storage, dissemination), it is rarely possible to operate on a just-in-time basis. Therefore, it will be necessary to invest in the production of boxes and store them prior to purchase and/or dissemination to users. It should also be noted that if the game is not widely disseminated and there are no economies of scale, the unit cost of the game boxes is likely to be high, which may be unacceptable to users. In this case, you could consider self-producing the games (via a fab lab, for example), setting up a crowdfunding project (which allows you to specify the exact number of boxes produced without having to advance the money), or using service providers who can print on demand at an affordable price. In France,

for example, the GAMAE platform in Clermont-Ferrand enables small production runs in the agricultural and landscape sectors. Sharing this investment with partners and/or finding potential financial backers are also possibilities. As we can see, it is vital to have a good understanding of the ecosystem into which the game could be integrated, as well as the potential partners. It is also essential to consider how sales will be managed administratively in advance (order management, invoicing, etc.) and where the game boxes will be stored.

Delegating the production of game boxes to a professional. For print runs of more than a hundred boxes, this is a particularly attractive option as it allows you to delegate administrative tasks such as sales and stock management, and to benefit from the expertise of these professionals in areas such as production, communication and investment. However, in order to convince a publisher to invest, it will have to be shown that the investment is low-risk, and evidence of a market and real demand for the game should be provided where possible. Carrying out a market study, as mentioned in Part 2, can help to estimate the game's potential sales volume. The publishing contract signed with the producer will include a number of clauses, such as:
– the financial return to the owner(s) of the game, which is usually calculated as a fixed amount per game box sold;
– exclusive use of the game by the publisher, which must be limited *to a minimum* period and/or subject to a minimum number of sales per year;
– termination clauses (in the event of insufficient sales, for example);
– the possibility of taking into account possible future developments in the game, particularly when it is reprinted (See Table 12.7).

As we have seen, the publishing contract may also allow for co-publishing with a Print & Play version.

Access to games resources for facilitators

Some games require someone who is trained to use and run the game to be present at each session. This characteristic of 'expert' games, and to a lesser extent 'specialist' games, is a key factor to consider when disseminating them. These games often target two categories of user: first, the game session facilitators (second-level users), and second, the players (first-level users). These second level users, the facilitators and the organisations they work for, are the intermediaries without whom your first-level targets will not be able to play. Identifying them correctly is therefore a strategic move, because once trained, a facilitator will be able to disseminate the game widely to players. You will also need to think about the training arrangements for these facilitators.

There are two main situations to consider with regard to training:
– Via access to additional resources, such as tutorials and MOOCs.
– By organising training sessions (particularly for 'expert' games) for facilitators and even 'facilitator trainers'.

Whichever option you choose, you will need to consider how you make accessible these resources, e.g. free versus paid, open access versus qualification process.

Condition 2. Publicise your game

To ensure that as many potential users as possible are aware of the game, appropriate communication must be put in place. It must, of course, appeal to future users and address a desire or need.

Table 12.7. Each of the three editing methods has its advantages and disadvantages.

	Characteristics	Benefits	Disadvantages or points to watch for
Print & Play	Provision of files enabling users to produce a game board on the internet (printable board, counters, game rules, etc.)	Real-time updates possible Low cost for the game designer and potentially for the player Independent choice of game dissemination strategy	Possible loss of 'attractiveness' of the game with a Print & Play format The communication must be produced entirely by the designer(s)/owner(s) of the game.
Management of the production of game boxes by the game designer(s)/owner(s)	Sales management by the game designer(s)/owner(s) Self-production or production of game boxes via professional service providers	Possibility of producing 'small batches' Independent choice of game dissemination strategy	Self-production takes time Managing sales and administration can be time-consuming Upstream investment required The communication must be produced entirely by the designer(s)/owner(s) of the game.
Delegation of game box production to a professional	Use of professional publishers for production and marketing	Product quality Professionalism Often has appropriate dissemination and communication networks Print runs often exceed 500 copies Taking charge of box production and associated investment	Negotiating returns with publishers is sometimes complex, and publishers demand exclusivity. The importance of a balanced publishing contract to avoid feeling 'dispossessed' of one's game Generally only works for games targeting fairly substantial markets The name(s) of the game's designer(s)/owner(s) on the game box may be relegated to the background, behind the publisher's name

To communicate effectively—beyond mobilising your own resources and developing a communication plan—we recommend, where possible, collaborating with partners such as strategic advocates. These may act as communication or dissemination partners; they share a strong interest in the game's dissemination, as it offers an opportunity to fulfil certain objectives or missions of their own. For example, environmental associations can serve as dissemination partners for games aimed at broad or youth audiences with outreach and awareness-raising goals. Identifying these partners requires a thorough understanding of the game's ecosystem, or perhaps a targeted study (see Part 2) to better define the diverse expectations of various stakeholders regarding the theme and application of the game. It is therefore essential to present the game clearly, detailing its functionality as well as its intended effects and impact.

Once you start promoting your game, you may wish to register its trademark with the intellectual property protection office, as we saw in stage B2 of Figure 12.1.

It is worth noting that if you delegate the production of the game boxes to a professional publisher, they will be responsible for some of the communication. It will be in their interest to publicise your game on their website, in their catalogue and at trade fairs in order to sell as many boxes as possible. In addition, the owner(s) of the game can carry out their own communication actions.

Sometimes, publishers offer to take responsibility for the marketing and dissemination of the game alone. In this case, the owner(s) of the game are responsible for printing the game boxes. The publishers then receive a commission on each game box sold. This intermediate solution allows you to benefit from the publisher's expertise in terms of administrative management of sales and communication.

Condition 3. Have the necessary resources to disseminate and maintain the game

At this stage, you need to be able to list all the actions required to valorise the game, along with their associated costs. For each of these actions, differentiate between those that you will carry out and those that will be handled by partners or service providers. Once you have calculated the costs that you will incur, you need to develop a business model that will enable the game to be disseminated in a viable way. At a minimum, this involves balancing costs (communication, management, production, etc.) and income (sales, training, subsidies, donations, etc.).

It is also important to think about the maintenance of the game, in terms of both the evolution of the model and the changing needs over time. Many agricultural and landscape games depend on evolving data and knowledge. In these cases, the game must be updated to avoid obsolescence and remain relevant. Similarly, changing needs may require new elements to be added, game mechanics to be improved, or extensions to be created to suit new contexts of use. It is easier to make changes to a Print & Play game than to a boxed version. A website can be used to announce updates or extensions, just as a mailing list can inform users of changes to the game. The maintenance and availability of the game must be taken into account in the business model to ensure that the necessary human, technical and financial resources are available.

Condition 4. Implement your dissemination strategy by choosing the right licences

Licences are essential to ensure that users and partners (including publishers) comply with your dissemination strategy and therefore to the best possible dissemination of your game. It is important to choose and set the licences that will be attached to the game only after you have considered and validated the above points. Licensing is a tool that serves this strategy, not the other way around. Choosing licences too early could lead to the implementation of a dissemination strategy that has not been fully optimised.

What is a licence?

As we saw in the section 'A typology of games centred on valorisation', games are largely protected by authors' rights (copyright). This protection is automatic; no formal action is required to invoke it. Consequently, any copyright-protected work may not be utilised by a third party without the express authorisation of the owner(s). This is where licences become essential. A licence is a contract stipulating the terms and conditions under which a user may employ a work (in this case, the game). Without an associated licence, no use of the game is legally permitted.

There are two types of licence. These are the most common, although there are others.

Creative Commons licences are commonly used in the world of games. They "are a set of licenses governing the conditions of reuse and dissemination of works [...] developed by the Creative Commons organisation" (source: Wikipedia). These licences allow anyone to use a work free of charge. However, the conditions of use differ from one Creative Commons licence to another thanks to a combinatorial binary system. The various possible conditions and constraints on use are as follows:
– CC-0: the holder of the rights waives as many rights as possible within the limits of the applicable laws.
– BY: the author(s) of the original work must be mentioned.
– NC: commercial use is not authorised.
– ND: modifications are not authorised.
– SA: any creations derived from the work must be shared under the same licence.

Creative Commons licences have the advantage of being simple, easy to understand and familiar to everyone. Owners simply need to indicate the Creative Common licence they choose to apply on their work using the corresponding pictogram. The terms of the Creative Commons licence apply to everyone unless a waiver is agreed by mutual agreement between the owner of the work and a third party.

However, one drawback of Creative Commons licences is the vagueness surrounding the notion of commercial use. If you use a CC-NC licence, we recommend specifying your definition of commercial activity when disseminating the game. Creative Commons licences are ideal for the free dissemination of games on the Internet and in Print & Play format.

Proprietary licences are 'made-to-measure' licences that take into account the characteristics and specific features of each game. They can be free or paid for. Unlike Creative Commons licences, they are usually signed bilaterally between the owner of the game (or co-owner with a valorisation mandate) and a third party.

These licences may also be publicly displayed as an official licence applicable to anyone wishing to use the game. Naturally, contractual freedoms are possible when drafting these licences, but they are always limited by the legislative framework. These includes respecting the moral rights of the creators of the game, such as acknowledging their authorship of the work if they so wish or allowing free use of the work for private purposes. Like Creative Commons licences, proprietary licences involve transferring rights to use the game as a work. They can be used for disseminations with flexible constraints that can be adjusted in each licence contract.

What rights does a buyer have over the game?

By purchasing a game, the purchaser does not acquire any rights to the game itself, only to the medium in which it is presented. Moreover, since no transfer of copyright is granted, the purchaser may only use the game for private purposes. Reproducing the game for dissemination outside of a private context or using it commercially without the author's permission is prohibited. Publishers frequently add the words "All rights reserved" to the game boxes to remind buyers of this. These notices help to establish a business model based on game sales. They can also be used for Print & Play in the case of paid downloads, for example, to reimburse past investment in the game or communication costs.

A publishing contract is an example of a proprietary licence. It grants the publisher the rights to reproduce and market the work under negotiated conditions, particularly financial conditions, which may differ from one contract to another. It is a bilateral contract with conditions for the transfer of the game's economic rights that differ from those in a Creative Commons licence.

It is also possible to combine a Creative Commons licence with a proprietary licence. This combination is intended to remove, under certain conditions, certain constraints of Creative Commons licences in the context of proprietary licences. Take the example of the Creative Commons licence, which does not authorise commercial use of a game. However, it may be possible to disseminate the game under two separate licences. In parallel, it is possible to:
– Print & Play the game under a CC-NC licence;
– at the same time, market commercial use rights for the game by means of a publishing contract for the sale of game boxes, or other types of licences/contracts authorising third parties to create paid-for sessions using the game.

Two illustrative examples

To illustrate how the valorisation strategy can support the dissemination and use of games in concrete terms, we describe two examples below. The first, *Mymyx*, is now being valorised as a specialist teaching game. *Rami Fourrager*, our second example, is an expert game aimed primarily at livestock professionals.
– ***Mymyx*** (see p. 36) is a 'specialised' serious game designed to support the agroecological transition by facilitating knowledge-sharing regarding a key soil biodiversity process: mycorrhizal networks. It comprises cards, teaching aids and a game board. In 2015, an initial version was conceived by and for research purposes within projects supported by INRAE and the Ecophyto plan. In 2017, a project to redesign *Mymyx* for initial agricultural education was initiated in collaboration with agricultural education. This took the form of a three-year pilot study in partnership with the Directorate-General for Education and Research (DGER) and the teaching teams of four agricultural colleges.

This project served as the basis for educational sciences research into the redesign and evaluation of a tool originally developed for research and subsequently mobilised for new applications.
– ***Rami Fourrager*** (see p. 42) is an 'expert' board game used to initiate and support collective reflection on the forage systems of ruminant livestock farming. In workshops ranging from two hours to half a day, players—primarily farmers or agricultural extension officers—can work in groups to test a wide range of systemic adaptations in response to specific projects or constraints (such as climate). Participants thus share their expertise and perspectives. The game consists of a board, cards and contextual elements that can be adapted to the workshop's objectives (e.g. climate and grass growth data). It also includes a computer module (an Excel-based database) that allows the facilitator to evaluate the scenarios developed by the players throughout the session. The game was designed by INRAE in partnership with the French Livestock Institute (IDELE), a national-level body.

Table 12.8 presents the main characteristics and the actions implemented to valorise these two games.

Conclusion

Developing a game valorisation strategy involves asking yourself a series of questions iteratively throughout the creative process. The answers may influence the final design of the game. The right strategy depends largely on the characteristics of the game, the uses and habits of the target users, the ecosystem into which the game will be integrated, and the resources available to bring the project to fruition. In conclusion, we would like to stress once again the importance of carefully studying:
– The expectations of the ultimate players, with a rapid estimate of the size of the potential market based on interviews or market research.
– The ecosystem of actors and the role that the game could play in it. The creation of partnerships is definitely an asset that needs to be developed as early as possible in the design of the game.

Table 12.8. Examples of valorisation strategies for specialist and expert games.

	Mymyx	***Rami Fourrager***
Type of game	Specialised game	Expert game
Audience	Agricultural education Secondary: agricultural consultancy	Livestock professionals: groups of farmers led by agricultural extension officers Secondary: agricultural education
Intellectual property	Trademarks and copyright (filed Soleau envelope) All economic rights belong to INRAE (transfer of economic rights to INRAE for all authors, service providers and employees), as does the trademark	Trademark and copyright (on the game and the software, the latter having been registered with the APP) The economic rights belong to INRAE and IDELE, in a proportion negotiated and indicated in a joint ownership agreement.

	Mymyx	*Rami Fourrager*
Maturity scale	Mature game: development of the game using public funds (INRAE funds) with the services of a game designer	Mature game: the game is disseminated and widely used
Supports	Print & Play and parallel box sales	Game boxes including a USB key with the computer part of the game + URL link to databases for adapting the game
Facilitation of play	By teachers, for activities that require little or no specific training in games (note professional skills may be required)	By agricultural extension officers (or teachers) who have been previously trained by IDELE in training courses of 2 to 3 days.
Licence	Print & Play licensed under CC-BY-NC and boxes marked "© All rights reserved".	The co-ownership contract is sufficient insofar as it contains a section defining the terms and conditions of commercial exploitation by IDELE
Partnership (training, dissemination, communication)	Agricultural education and the Canopé network	IDELE is responsible for producing and disseminating the game, communication and training in its use.
Publishing	No publishing contract for the Print & Play version, a publishing contract derogating from the 'non-commercial' clause with Educagri The publisher takes charge of the printing of the game boxes	No publishing contract

Case study thread for Part 3

Nolwenn Blache

In this part of our throughline example, we will review the final stages in the life of our serious game, namely the organisation of a facilitated game session, evaluation and valorisation. To evaluate the module, we organised a test session with actors who were likely to correspond to the target audience for our game. We therefore invited six professionals corresponding to the number of players in our game. A small working group of six students was responsible for the logistics of the test day. With the help of our teachers, we identified the professionals we wanted to invite. We then organised the flow of the session. The game was very long, requiring an hour or an hour and a half to familiarise oneself with it and understand the rules, and at least two hours of play to explore its full potential. Moreover, we decided to include an introduction to help guests understand the context of the subject and its creation, as well as the objectives of the session. The aim was to give constructive feedback on the game as a student production. We also wanted to include a debriefing session so that the players could reflect on their experience: how did they feel during the game, did they win or lose (it is up to the players to take stock, as the rules of the game only provide guidance on 'eliminatory mistakes'). Finally, we planned to provide feedback on the game itself: its playfulness, playability, consistency with the real situation and usefulness.

On the day of the test, three students and one of our supervisors were on site. Despite the tight schedule, we decided to hold the session over just one afternoon to maximise the chances of getting all our players to come. It is easier to block off an afternoon than a whole day in the professional world. To fit this busy programme into a limited timeframe, we gave the facilitator more responsibilities. The facilitator's role was already integral to the game, which could only be played with a game master. We decided to add other functions to this role: explaining the complex rules to facilitate their integration, acting as timekeeper, and ensuring that the debate ran smoothly. For the most part, this entailed supervising discussions in the event of tension, but the role was intended to be very minimal during this phase. One student was in charge of general moderation, while the other two provided support to the players in the event of any misunderstanding of the rules. As a result, it was challenging to fulfil these roles while observing the game session simultaneously. To overcome this problem, we invited a student from another course to film the session. These adaptations enabled us to condense the session to three hours.

The facilitator was therefore crucial to the success of the session. At the time, we felt somewhat overwhelmed by the importance of this task. Therefore, we decided to consult our social science teachers in preparation for the day. We wanted to find out how to conduct the briefing and debriefing phases and to organise everything so that the whole afternoon was coherent. The briefing was divided into four parts: first, we introduced everyone present. Then, we spoke

about the issues. Next, we explained the context of the creation of the serious game, i.e. that it was part of a learning module. This enabled us to explain the objectives of the game and of the session. Finally, we concluded with the schedule for the half-day session.

We planned to play for between two and two-and-a-half hours and then move on to the debriefing phase. The debriefing also took place in four stages. First, we analysed the game using the indicators (number of ewes killed, farmers' morale, wolf population, etc.) recorded by the game master in a monitoring table throughout the session. We then asked the players to leave the game and share their experience and the emotions they had felt while playing. Next, we asked them what they had learnt from the game in relation to the wolf issue, and asked for feedback on the game itself: what had they enjoyed? What would they like to change, etc. Finally, we asked them to fill in an evaluation rubric, rating the game session and providing comments and feedback.

We discussed at length the methods to be used to achieve our objectives, as well as conflict management and the role of the facilitator as mediator. This role is particularly relevant because, as we mentioned above, the subject of wolves is a source of many conflicts. However, among the players, we had invited both a shepherd and a fervent defender of wolves. Therefore, the points of view were not neutral, and there was a real risk of conflict breaking out. With the benefit of hindsight, this manual would have provided us with all the knowledge necessary to feel prepared for this exercise, which was just as challenging as designing the game itself.

As previously noted, the test session focused on evaluating the game itself, and by extension, our own work. To recap, the module's objective was to teach us the nature of systemic analysis and how to implement it by tasking us with designing a serious game around a thorny issue. Our supervisors' underlying premise was that if we succeeded in operationalising such a problem through play, it would demonstrate that we had successfully constructed the underlying systemic model (see Part 2). Consequently, we used video recordings of the test session (approximately three hours of raw footage) and feedback from the testers to evaluate the game. Our evaluation rubric was intentionally straightforward, based on a qualitative analysis of player feedback and their verbatim accounts. Chapter 11, which covers evaluation, would have provided us with a formal methodology to implement—one significantly more robust than the approach we adopted. In parallel, a second assessment was conducted, focusing specifically on the learning outcomes and progress of the student designers.

Conclusion

Sylvain Dernat, Yves Michelin, Nolwenn Blache

To conclude this book, it seems important to return to three key ideas that should guide readers as they finish it.

This book is a practical guide, not a step-by-step manual.

It focuses on board games based on agricultural and landscape themes. However, above all, the authors wanted to provide the reader with an overview of the key stages of reflection. Readers should feel free to follow their own impressions and desires. The book should serve as a reference, not as a ready-made recipe.

There are many ways to create a game: the authors' share their extensive experience in this book. It is certainly open to criticism in many respects. Professional game designers will undoubtedly find fault with the various proposals. Many of these have more to do with tinkering and craftsmanship than industry and mass production. Nevertheless, it is useful for anyone who wants to create a game that is useful to others and addresses issues surrounding agriculture and the landscape. This book will be particularly useful for small, isolated initiatives. This brings us back to the introductory comments on the commons and the third way of collective action.

This book does not advocate viewing games as an end in themselves.

Of course, our discussion focused on the game itself and sometimes went beyond that when talking about evaluation or dissemination. To change things and truly achieve the objective assigned to the game, we must not forget that it takes place within a specific environment.

All too often, play is considered the only necessary element, with what goes on around it being neglected. Whether in an educational context, mediation or consultation, the game unfolds amidst a multitude of events and processes. If the game is seen in isolation from these events and processes, it risks becoming an ephemeral object with no effect.

The chapter of the book dealing with evaluation provides some insight into this. However, it is important for the authors to reiterate this in the conclusion to avoid misleading the reader: designing or running a play session is not enough. You must support it to ensure its relevance to the context. It must also be brought to life by being adapted to each session and changed in line with new practices and new knowledge. A static game is a dead game.

Finally, to paraphrase Wittgenstein, you know what a game is when you see one because it works. A game is fun.

Entertainment plays an essential role. Playing games and encouraging others to play games maintain the light-hearted nature of the game at all times. Even serious play does not eliminate this dimension, despite its assigned objective. For the authors of this book, this idea is extremely important and should never be overlooked. Throughout the book, both theoretical and more practical

aspects have been addressed, enabling us to move from an idea to a game that works and is enjoyable to play. Entertainment often gives way to reflection on the complex elements that make us think of games as technical objects.

However, and this may seem counter-intuitive to the reader, in the field of agriculture and landscaping, the need for entertainment is perhaps even greater. The stakes are enormous in terms of environmental and social change. This often leads to radical positions being taken, brutal confrontations, and inward-looking attitudes that leave little room for compromise, co-construction or sharing. Each side sticks to its guns, refusing to put itself in the other's shoes to better understand the basis of their ideas, arguments and worldview.

Teaching is no exception: just as with landscape, agriculture is an object of science and engineering. Complex biological, economic and social models are taught. A rigorous approach is required, and imagination is rarely a priority when it comes to adapting agricultural systems to meet our planet's sustainability needs. Above all, we learn to provide stakeholders with solutions based on tried and tested methodologies.

Well... This is where games and their frivolity come in useful. They enable us to gather around a table, or rather a board, and escape everyday life for the duration of a game session. The otherworldliness created by the game allows us to introduce new forms of knowledge and imagination alongside established academic knowledge. These are developed by a group of people and require us to take a step back: we understand each other's strategies, work out a plan together, and do things together, all while having fun.

Playing is, above all, a social adventure that is enjoyable, and in this way, playing produces new learning, new ideas and new actions. All game designers and developers must remember this. That is what this book is all about.

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There is currently a marked increase in the development of board games related to agriculture and landscape, both in France and worldwide. Too often, however, this enthusiasm leads to isolated initiatives based on trial and error, with varied success that can prove challenging for beginners.

This guide draws on years of collective experience to support the design, facilitation and evaluation of new games in agriculture and land management. The social environment is central to this approach, serving as the driving force behind the gameplay, the resulting learning, and the shifts in attitudes and actions.

The authors provide a highly operational, step-by-step methodical approach for building a game from an initial agricultural or landscape issue, moving from theoretical concepts to evaluation of the final product. Each chapter features a detailed case study to illustrate the design process. Built on decades of expertise, this formalised methodology is designed to be a practical field tool for novice designers everywhere.

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