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Rolling Dice and Moving Meeples

Board games as a play-type model and the emergence of meaningful play

Master's Thesis

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I have written the Master Thesis myself, independently. All of the other authors' texts, main viewpoints and all data from other resources have been referred to.

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INTRODUCTION

Rolling Dice And Moving Meeples[1]

When dealing with the traits that can distinguish art from other modelling systems, Lotman introduced the notion of play-type model as a form of secondary modelling system that engages the player simultaneously (not consecutively) in two types of behaviour: practical and abstract (Lotman 1977: 62). This text aims to apply the play-type model to the particular case of board games and explore the potential of this kind of games to generate what is known as transformative play (Salen, Zimmermann 2004).

The *Bio-equilibrium* - Looduse Tasakaal - board game, created for the Natural History Museum of the University of Tartu is used in this thesis as a practical method to test the way board games can be used as playable models of realities such as the actual problem of pollution and climate change. In this case, the play-type model is analyzed based on the relationship that emerges between the paradigmatic and syntagmatic levels, represented respectively in this case by the theme and the mechanics of the game, where a single set of rules can be used to generate a whole different text or narrative just by substituting elements to represent a different topic. On the other hand, The notion of diagrammatic reasoning proposed by Charles S. Peirce (1931) and reformulated by Frederik Stjernfelt (2007) is used here to explain the mechanics and visual components of a board game as a dynamic diagram of the relations between different elements represented in the game; relations that change permanently with every "move" the players make.

Rolling dice (Fig. 1) and moving meeples (Fig. 2) are two actions traditionally connected with the playing of board games but they also represent, in the context of this thesis, two key concepts: One is randomness, an element that in combination with regular processes creates a representation of reality where any deviation, as Lotman explains, become especially significant (Lotman 2011[1967]: 253). The second element has to do with the "playful" behaviour that players assume in a "make-believe" attitude as they take the role of characters in the storyworld of the game. This is a twofold behaviour where the players simultaneously are aware that they are participating in a not real situation and at the same time act as if it is a real one even experiencing emotions like fear or happiness.

[1] A meeple is "a playing piece used in board games to represent a player, kind of like a pawn… Meeples started off looking just like people, but now they come in all kinds of shapes and sizes.The word is said to be a combination of the words 'my' and 'people'" (Sargeantson, 2019).

Figure 1. Ivory teetotum or spinning top (left) Source: "Liman Collection of Board Games & Puzzles, John Hay Library, Brown University." and Modern game dice (right). Photo by the author.

Figure 2. French board game figurines (left) Source: "Liman Collection of Board Games & Puzzles, John Hay Library, Brown University.", and Game meeples (right). Photo by the author.

Why board games?

Board games have been around and have been part of different cultures for thousands of years; from age-old games like Senet, played in ancient Egypt around 3500 BCE, to the game of Go invented in China more than four thousand years ago and one of the most played games nowadays (Parlett 1999). Yet, with the emergence of digital video-games and their fast spread the focus of research fields such as Game studies has been directed to the analysis of video games, somehow leaving what we could call analog games in the shade. However, the arrival of video games doesn't mean that analog forms of play like as board games are on decline, on the contrary, a wave of what is known as modern board games has generated a explosion of new titles and a fast growing community making board games one of today's most active entertainment industries with a worldwide worth of USD 13.1 Billion and a

calculated annual growth rate close to 9% (Bloomberg, 2019). In this sense, we are as Paul Booth indicates, in the middle of a board game renaissance (2015: 1), which is having a notorious impact on contemporary culture.

Given this perspective, I consider that this research topic could be of great interest and value not only for the scholars of semiotics interested in the semiotic models related to play and games, but also to the growing community of board game designers and to the public in general that enjoy meeting with other persons to play this kind of games, In brief, I expect that the results of this thesis project would provide a clearer view of the role that games, and board games in particular, have in contemporary culture not only as a way to master some skills, as Lotman proposes, but also as an interactive tool to address and transform social and cultural contexts.

With this goal in mind I have formulated three fundamental and interrelated questions to be addressed in the following chapters.

1. How board games may serve to expand Lotman´s definition of Play-type Model?
2. How do the rules and material components of a board game work as a model for diagrammatic reasoning?
3. In which way chronotopical analysis may be used to explain board games as cultural texts and their impact in the cultural environment?

To answer these questions I apply a mixed methodology with theoretical and practical components as described below.

Methodology of the research

This research project uses a mixed research methodology with a theoretical component and a practical application of concepts in the form of a board game design.

Bibliographical sources on the topic of games, cultural texts, and related subjects are analyzed to find conceptual and methodological tools that could provide answers to the questions proposed for this research. Some of the theoretical models presented here were created with other kinds of texts in mind, as is the case of the artistic text model proposed by Lotman or Bakhtin's notion of chronotope, both used originally for the analysis of literary texts. However, they have been improved so they can be applied to the analysis of other kinds

of texts, for example, the notion of chronotope used by Torop for the analysis of films (2013, 2019). With this in mind, part of the methodology proposed here aims to validate how much those theoretical concepts fit the board games as objects of study, and what improvements need to be done to be able to apply them to analyze some particular aspects of board games.

The practical component of this methodology corresponds to *Bio-equilibrium,* a board game prototype about the issue of global warming designed for the University of Tartu Museum of Natural History. Along the following chapters I describe the process of creation of this game and how the different theoretical models presented in the thesis are applied in the design process and also to explain some extratextual aspects such as the ideological component embedded in the narrative of the game.

The products expected from this research methodology are, on the one hand, a robust theoretical framework, that could be used by researchers and game designers to analyse and have a better understanding on the nature and particular aspects of board games, and on the other hand, a playable prototype of a board game providing an actual example of the different concepts and methodologies described in this thesis.

Structure of the work

In the first chapter, the notion of board games as a play-type model is presented. The idea is to contrast Lotmans definition of this type of model with notions of games provided by other authors such as the Bogost proposal of fun as a key element of play (Beck 2016) and the concept of meaningful play proposed by Salen and Zimmerman (2004).

The second chapter focus is on the topological aspect of board games described as a particular type of diagram that introduces in the process of diagrammatic reasoning an element of unpredictability as presented by Lotman (1974, 2009) Also I propose the idea of board games as a form of the socially distributed exploration provided by diagrams (Tylén *et al.* 2014) and how this kind of games are a way to generate creative solutions to different kind of problems in a collaborative ludic environment.

To analyze the cultural function of board games and the emergence of transformative play, I introduce in the Third Chapter the concept of chronotope as developed by Peeter Torop (2013, 2019) based on the original notion by Bakhtin (1981). Here the modelling and diagrammatical dimensions of board games described in the first two chapters are integrated as part of the three levels of chronotopical analysis, with the diagrammatic aspect as the

topological level where the narrative structure of the game and the spatial and temporal relations between elements of the game are represented and provide the players with the possible actions they can take to move the story forward. In games, and board games in particular, the players are immersed in the psychological chronotope as they have control over the pieces that represent them in the game, so their viewpoints on the events depicted in the game affect the conception of this particular kind of text as originally intended by the creator of the game. How the manipulation of the reality modelled by the game rules and the multiple meanings derived from this process impact the cultural environment of the players is what I intend to describe in the last chapter.

The board game project *Bio-equilibrium* created for the Natural History Museum is a transversal element of the thesis and the idea is to present the design process in the mode of Interchapters that provide an example of the actual application of the concepts presented in each chapter. So, In the first interchapter, I describe the use of the board game as a play-type model of the global warming situation and the process to generate the game mechanics for this model. The design of icons and visual elements for the game is related to the diagrammatic aspect of board games and is described in the second chapter. At the end, the conceptual world that the authors of the game expect to emerge at the moment players start to make decisions and moves will be an example of the metaphysical chronotope, and a question emerges about the role of the players as co-creators of the story as it is their moves that give shape to the narrative of the game.

There are many aspects on this topic that exceed the scope of this particular research such as the integration of games and learning processes or the interrelation of game culture with broader cultural systems, but I expect this work to provide a robust framework for further research.

I hope this research will serve to complement and expand the notion of play-type modelling language proposed by Lotman by introducing elements of diagrammatic reasoning as formulated by Peirce (1931). This project is also oriented to board game designers that might find in this research a robust conceptual basis for the work they do and help them have a broader view of the impact that games have in their cultural context.

Chapter 1: Board games as play-type models

Playing games is an activity that has been part of human societies since prehistoric times where it was closely linked to ritual behaviour (Renfrew *et al.* 2018), and it is also present in non-human animal's behaviour (Caillois 1961). This activity has been studied using different approaches, from evolutionary instrumentalism (Gross 1898) to anthropology (Huizinga 1980) and sociology (Caillois 2001[1961]). Many of these approaches present the idea of play as a learning activity that allows an individual to develop the physical and mental skills required to succeed in the real world and provide a safe environment to "jump above the level of normal behaviour" (Vygotsky 1967: 16). However, an element of fun that sets the activity of play apart from productive or serious activities (Huizinga 1980; Caillois 2001[1961]) must be considered as a relevant part when analyzing games as a cultural phenomenon.

In his theories about modelling systems, Lotman incorporates the idea of play as a learning behaviour that "helps us overcome fear in the face of such situations and develops an emotional structure necessary for practical activity" (Lotman 2011[1967]: 253) and proposes the notion of play as one type of modelling activity along with science and art where the latter is described as an activity with some play-like elements but that should not be considered a form of play (*Ibid,* 264).

A *modelling system* in Lotman´s theoretical framework is "a structure of elements and rules of their combination" (*Ibid,* 250) that allows for the creation of analogies to an object of perception, cognition or organization. These structures that superimpose a special language as a secondary system on natural language become secondary modelling systems (Lotman 1974: 21) with a wide range of analytical and communicative possibilities.

Here it is pertinent to mention how the rules of combination in a model are analogue to the rules of a game that provide, as Lotman indicates, a level of regularity to this kind of activity while at the same time opens the way to the possible combinations that generate meaningful deviations from this regularity (1974: 64). This analogy will provide a key element when we start to describe board games as a model.

Science, art and play as secondary modelling systems share a structure based on a natural language and a similar productive purpose in the process of perception and organization of objects. What makes them different is the way they construct a model by highlighting some elements that other types of modelling systems ignore and the particular

rules defined for the creation and use of the model for the generation of knowledge, emotions and meaning.

When defining the place of art among other modelling systems, Lotman describes the different ways in which modelling systems operate. A scientific model, for example, of the solar system can take in account the shape of the planetary orbits or the relative position of different celestial bodies in respect to the sun, but depending on the level of detail or intended use it could include or exclude minor elements such as moons and asteroids, or ignore proportions relative to distances or size of the objects. These decisions are related to the intended use of a particular scientific model, but in general, the purpose of this kind of model is to recreate the system in a descriptive form (Lotman 2011[1967]: 266).

In contrast to scientific models, the artistic model "recreates the 'speech' of the object" (2011[1967]: 266), this model, says Lotman, functions as a "language that discreetly organizes the new perceptions (speech)" (*Ibid*, 266). In art, the world of reality is translated to the "language of our consciousness" (*Ibid*, 250) and this language, in turn, is translated to the language of a particular form of art. While in the construction of a scientific model random elements could be eliminated as accidental, for Lotman these random elements that could be meaningless in one language can become highly meaningful in the language used to create an artistic text (*Ibid*, 268).

1.1 Play and art as models of reality

In his description of art as a modelling system, Lotman finds that the kind of behaviour required for the creation and perception of a work of art has some characteristics in common with playful behaviour (2011[1967]: 260), particularly in the way that a person carries two different actions when performing an artistic or playful activity. On one hand, as Lotman explains, the person experiences all the emotions that emerge in a real-world situation but at the same time he knows that there is no need to act in response to these emotions as he would do in the real situation (*Ibid*, 260). Play also involves this capacity to simultaneously acknowledge a conventional, not real, situation generated in what Huizinga describes as "temporary worlds within the ordinary world, dedicated to the performance of an act apart" (1980: 10) but still react and behave as it would do in the real situation. Lotman uses the example of a child playing with a toy tiger who is simultaneously afraid and not afraid of the

animal representation. He knows that the tiger is not real and presents no actual threat but he manages to somehow forget this fact and behave as if facing a real one (2011[1967]: 254).

The function to provide conditional solutions to situations is another common element that Lotman identifies between these two modelling activities.

> Play and art (even a bloody spectacle like bullfighting, or tragic art) are not only (gnoseologically) means of perception but also (psychologically) means of recreation. They provide solutions, which are psychologically absolutely necessary for a man. (2011[1967]: 264).

Although there are some common elements and purposes in play and art, Lotman makes it clear that art is not a form of play. The goal of play, as Lotman explains, is following the rules, while truth expressed by the rules of a conventional language is the goal of art (2011[1967]: 265). This particular difference makes art models a powerful way to store information and develop new meanings, something that cannot be done with play which is focused on improving some physical and mental abilities. In Lotman´s words, "Play means mastering certain skills, training in a conditional situation; art means mastering the world (modelling the world) in a conditional situation. Play is 'just like an activity', art is 'just like life'" (*Ibid*, 265).

Having established the differences between different modelling systems, particularly between play and art, we can proceed to examine the play-type model that Lotman proposes and identify some possibilities to expand this notion by focusing on games as a modelling activity based on play.

1.2 Lotman's play-type model and the concept of fun

From Lotman´s perspective, there is no opposition between play and cognition. He adopts the idea proposed by Karl Groos on the importance of play in the development of human and non-human animals, and the conscious state in which the illusion generated by play is accepted as perfect, in the sense that the players react to it as if it is a real thing while maintaining full knowledge that it is an illusion (Gross 1898). Lotman sees in play an important tool to learn different types of behaviour necessary to overcome real-life situations (Lotman 2011[1967]: 253).

This evolutionary and functional approach to play provides a solid departing point to explain the emergence and development of playful behaviour in different species of animals but I consider that it doesn't account for other aspects of play, especially in human culture,

that escape this learning purpose of play and are hinted but not developed in the element of randomness that Lotman identifies in play-type models. One of the aims of this analysis of Lotman´s model is to delve deeper into the role played by randomness as a generator of unpredictability and contrast it with the notion of play as a non-productive activity as described by Caillois (1967), but before taking this path it is important to have a clear view of the essential elements that define playfulness and the boundaries that separate play-type models from other modelling systems.

The first element, already mentioned, is the function of play as a way of learning. Playful activities take place on temporary space within the conventional world that allows for experimentation, a "sandbox" where the player can face a simulated situation with the added possibility to freeze the situation in time, reconsider his actions and "move again" (Lotman 2011[1967]: 253), This element is particularly recurrent in video games where the players have "lives" that allow them to repeat a situation if they fail and there is also the functionality of saving an estate of the game to which they can return and try again if they lose.

The second element of play as a model is the "simultaneous realization (not their alternation in time!) of practical and conventional behaviour" (2011[1967]: 254). This is the structure that, according to Lotman, supports every form of game. This element is present even in some non-human animal games where it is possible to identify a shared agreement between participants to behave as they would do in a real situation, as in the example mentioned by Huizinga, of young dogs that pretend to be very angry and try to bite each other, but keeping the rule that they should not bite hard (Huizinga 1980: 1). Of course, as it occurs in human games, some players can forget that it is a simulation and experience genuine emotions like anger thus breaking the game. The art of play consists of the mastery of biplanar behaviour. If a player withdraws into uniplanar behaviour of either a serious or conventional type the specific character of play is destroyed (Lotman 1977: 62).

1.2.1 Modelling randomness if games

The combination of regular and random processes is another essential element of play-type models. The rules of the game generate repeatability and regularity, which is required for the mastery of skills but without variation, the experience stops being meaningful, and the learning process is less effective, so the introduction of random circumstances generates deviations that become especially significant as the players discover

new possibilities in every instance of the same basic game. The multiple meanings that game elements produce by this process of combination and recombination is what makes play-type models semantically richer compared to logico-scientific models (Lotman 2011[1967]: 256).

All these elements are not only related to the function of play-type models as a tool for learning but also hint at another outcome generated by playful behaviour not mentioned by Lotman and that is the enjoyment of this kind of activity which by itself is another way to generate meaning. Play provides something that, as Huizinga points out, is more than just mechanical exercises and reactions, "it generates tension, mirth and fun" (Huizinga 1980: 3).

It´s is not in the scope of this investigation to provide a thorough analysis of the notion of fun in relation to Lotman´s idea of playful behaviour, but it would not be possible to describe games as a play-type model setting aside this element that is essential to generate the kind of meaningful experience that is the reason why people play.

1.2.2 Play-type models and the concept of fun

The following fragment from Tolstoy's play *Redemption* is presented by Lotman as an example of the kind of behaviour associated with play-type (artistic) models.

> Oh, my wife was quite an ideal woman. I don't know why I should say was, by the way, because she's still living. But there's something — I don't know; it's rather difficult to explain — But you know how pouring champagne into a glass makes it froth up into a million iridescent little bubbles? Well, there was none of that in our married life. There was no fizz in it, no sparkle, no taste, phew! The days were all one colour — flat and stale and grey as the devil. And that's why I wanted to get away and forget. You can't forget unless you play. (Tolstoy, Hopkins 1919: 39)

The focus of Lotman is on the playful solutions to problems unsolvable by practical behaviour, but the text also points to something else related to the nature of fun. In this fragment, Karenin talks of flat, stale and grey days as a picture of his marriage with Lisa; a repetitive life devoid of sparkle, or in Lotman words, unexpected meaningful deviations. In an interview, game designer Ian Bogost defines fun as "finding novelty in the suffocating familiarity of ordinary life" (Beck 2016), this idea is related to the technique of *defamiliarization* proposed by Victor Shklovsky who wrote. "The purpose of art is to impart the sensation of things as they are perceived and not as they are known. The technique of art

is to make objects ‘unfamiliar’, to make forms difficult, to increase the difficulty and length of perception” (1998 [1917]: 18). This technique, says Shklovsky, was constantly used by Tolstoy in his works as a way to observe things out of their normal context (*Ibid*, 21). We can infer that this *defamiliarization* is what makes games fun to play.

In this order of ideas, play not only provides a safe environment for the mastery of skills or to generate creative solutions, but it also allows the players to experience normal situations such as hiding from a predator, fighting in a war or running a business, that in real-life could be tedious or stressful, with a sensation of unfamiliarity that transforms them into a gratifying experience that imbues new meanings into objects and situations that have become hollow.

1.3 Games as play-type models

Play, depending on the definition applied, can take many different forms ranging from the first basic representational play activities like giving food to a doll or pretending to talk on a toy phone (O'Reilly & Bornstein 1993) to extremely complex historical simulations like the board game *Here I Stand* (Beach, E., & GMT Games 2006), including activities like hand-clapping games, carnival roleplay, competitive sports, and wordplay improvisation contests like freestyle rap battles. Play can also be associated with other activities from religióus rituals (Huizinga 1980, Renfrew *et al.* 2018) to war or politics (Huizinga 1980). If we consider games as a subset of playful activities (Salen, Zimmermann 2004) it is necessary to identify the particular elements that separate games from other forms of play.

1.3.1 Thibault typology of play and games

To establish the place and boundaries of games in the wide spectrum of playful activities I refer to the typology of play proposed by Mattia Thibault (2017) where playful activities can be articulated in four steps following the zemic ontological model by professor Tarasti (2015) as represented in Figure 3.

The first step “Twiddle” is related to activities that focus on the corporeal, taking the body as an object of exploration (Thibaut 2017: 6). Here we can think of the exploratory activities performed by toddlers when they start to walk that could serve the purpose of developing some competence on their kineto-perceptual functions, but this kind of activity

seems to lack the twofold behaviour that Lotman links to play activities, neither there are "rules of the game" to follow while performing this bodily exploration. Considering this I would say that this level precedes and is a preparatory stage in the development of actual playful behaviour.

The personality of the player and the understanding of the world around him, are the elements defining the second level of playful activities that Thibault puts on the label "To toy" as a free exploration of the physical properties of signs. Here the player uses an object "Toy" as it stands for something else, exploring the possible meanings that it can acquire (2017: 7). That is the case presented by Lotman of the stuffed animal that allows a child to simultaneously behave in a practical and conventional manner, considering the toy as a real tiger to the point of feigning fear but without forgetting the reality of it as a harmless toy.

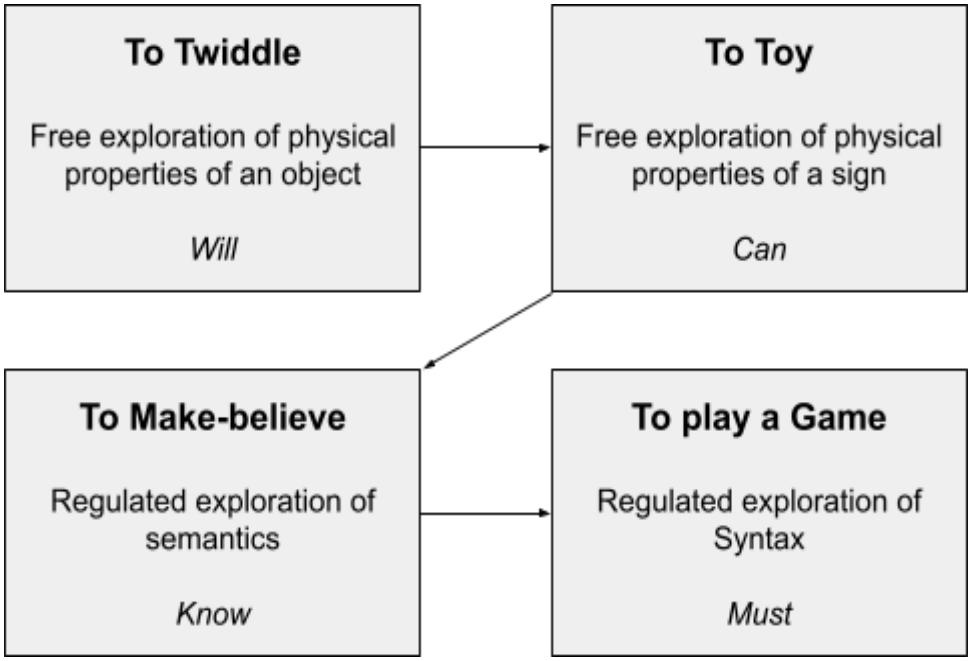

Figure 3. Thibault's model of play typologies (2017: 7)

Imagination as a capacity to imbue meaning into an object is the fuel that makes this kind of play possible and makes, for example, a doll unique in the eyes of players, and as an agent able to cry, laugh, eat or walk. for this to happen, objects like dolls, thus, require a certain degree of indeterminacy (Lotman 1992[1978]: 379). The activity of playing with toys, including dolls, is frequently shared with other participants that also assume the dual nature of the objects used in the game, however, the rules that define the accepted actions for this kind of play are usually vague or not formulated at all.

Regulation of the playful activity emerges in the third level of this typology as the elements used to play are organized on a system and put into a discursive form (Thibaut 2017: 8). Not only toys but also other physical and abstract elements are used to construct imaginary situations that serve as a model of actual objects and social structures. "To make-believe" is the form that play assumes at this level and that is how, for example, toy horses and guns are used to construct a narrative where kids wearing cowboy hats and eye masks become sheriffs and outlaws in a socially constructed recreation of the wild west stories. Some elemental rules are defined in this kind of play such as to "play dead" when someone shoots at you with the intention to keep some level of realism, but also could reflect some culturally transmitted elements (Fig. 4).

Games as the most regulated form of playfulness correspond to the last step in Thibault´s typology, where whole systems of symbolic signs are created as a model of and as a way to promote certain cultural values. It is at this level where the elements of play acquire double or multiple meanings as the result of the relation between the regularity generated by the "rules of the game" and the deviations from these rules as the product of random elements in the game.

"To play a game" as Thibault describes this kind of playful activity is the process of turning a life situation into a game, the amorphous reality is modelled by translating its organizing principles into conventional categories of "rules" and "moves" (Lotman 2011: 258). But for these rules and moves to be apprehended and be meaningful for the players, a coherent symbolic system must be designed by the creator of the game.

Figure 4. "Who is the obsolete that said PUM?" Quino. 1993. *Toda Mafalda*. Buenos Aires: Ediciones de la Flor.

1.3.2 Lotman´s definition of games and meaningful play

> He deals the cards to find the answer
> The sacred geometry of chance
> The hidden law of a probable outcome
> The numbers lead a dance.
>
> (Sting, *Shape of my heart.* 1993)

The last step in Thibaut´s typology of play is closely analogous to Lotman´s definition of games as a model of reality that translates aspects of this reality to its own rules (1974: 61). This kind of game model is not in an antithetic relation of "true vs. false" with the logical scientific model but, as Lotman explains, "but as respectively richer and poorer reflections of life, both equally true" (1974: 65). The values of richer and poorer, in this case, are related as mentioned before to the multiple possible meanings that elements can generate in a play-type model in relation to the necessary univocal meaning towards a scientific model aims.

In a game the multiple meanings of one element "flicker" manifest as dynamic synchronic slices of interpretation that could materialize or not depending on the moves made by the players, preserving the memory of previous meanings and recognizing the possibility of future meanings. (1974: 67). In this sense each roll of a dice and each player decision generates a deviation from the regularity defined by the rules of the game, that cannot be predicted by these rules. Games can be seen as machines for the random production of meanings, based on, as Sting puts it, "the hidden law of a probable outcome" (Sting 1993). This kind of activity models "the randomness, the incomplete determinacy, the probability of processes and phenomena" (Lotman 1974: 64), that's why this kind of model is better suited for the reproduction of "speech", or the material incarnation of a phenomenon that "is random with respect to language" (*Ibid*, 64).

The rules of the game determine the possible moves that players can take in a given moment of the game, but the number of possible moves must always have to be more than one because "the moment when the player has no more choices, the game has lost its meaning" (Lotman 2011[1967]: 159). The prototypical example of this is the *checkmate* situation in a game of chess, where the game ends when one of the players has no more possible moves available.

The concept of *meaningful play* proposed by Salen and Zimmerman (2004), is based on the permanent availability of choices but also on the capacity of the player to be aware of the possible moves available and the effects of these moves in the game, is in this relation

between choices and outcomes that multiple meanings can be produced. Some games fail as meaning generators because they provide only one possible and evident valid move, as it usually happens in linear video game narratives, or the player is not provided with enough information about the outcomes of a possible move, as in the case of some *Choose your own adventure* book games (Montgomery, Granger 1982).

In this sense, meaningful play works as an evaluative notion that instead of providing a closed result declaring a game meaningful or not, it allows measuring how discernable and integrated are the relationships between actions and outcomes in a game (Salen, Zimmermann 2004: 34). What I propose is that Lotman´s definition of games as a mechanism that provides awareness of the possibility of alternate meanings (2011[1967]: 264) can be improved by incorporating the emotional and psychological experience that emerges when the design of a game allows the players to understand the consequences of their choices.

1.4 Board games as a modelling activity

The word "game" can be applied to an enormous range of activities, some based on physical exertion and skill like sports, others in performative skills such as role-playing games, or in plain luck like most casino games, just to name a few examples. It would be an almost endless task to try to apply the notion of playful-type model for the analysis of all kind of possible forms of games; that is one of the reasons why the scope of this thesis is focused on board games, a particular form of games that, as we will see, also comprises a wide variety of possible forms.

Most definitions of board games are built on the basic feature that they require a playing surface where pieces are placed and moved. However, for Game historian David Parlett, the defining feature is that this type of games "are played on a pattern of significant markers[…] whose purpose is to define the movements and positions of the pieces in relation to one another (Parlett 1999: 6). This is a key definition because it liberates board games of the physical aspect so, for example, a game of chess is still the same no matter if the array of chequered squares is made over a wooden board or created using pixels on a screen. Also, it refers to a fundamental element of this kind of game and it is the diagrammatic relationship between the different components of the game that will be discussed in the next chapter.

Parlett´s definition of board games is related to a broader notion of formal games that he uses to separate games from other playful activities. "Every game is its rules, for they are

what define it" (1999: 3). This idea brings us back to the fourth step in Thibault´s typology of games, where systems of rules organize the activity of play in a syntactic way, and games become a language of their own. To understand board games as a Lotmanian playful-type model I will use Chess, one of the most traditional and widely known board games as an example of how the pieces over a board pattern create a secondary modelling system.

1.4.1 Chess as a secondary language[2]

When the players of a game of chess are preparing to start a new match first they lay out the chequered board and start organizing the pieces. Assuming that both players already know the rules, they first decide which colour they will play. Here a principle of binary semantic opposition is established, "white" pieces are under the control of one player and "black" pieces belong to the other player; actually, the pieces don't have to be black or white as long as they can be differentiated. e.g. traditional Indian chess sets use red and green figurines (Fig. 5). The colour to play can be agreed by the players but usually it involves a random generation ritual in which one player picks and shuffles two pawns of different colour and then offers them hidden in his hands to the other player who has to choose one and the colour of the piece is the one he is going to play. This ritual is important as the colour determines which player makes the first move and this could determine the strategy that each player will use during the game.

This initial detail can be so determinant for the game that many books have been writing about strategies to play chess with black or white pieces. And this is an example of how the rules of the game generate a regularity: white moves first, blacks moves second, but from this regularity, an element of randomness is introduced as the player has to adapt his game depending on the colour he is playing.

After players have defined which colour to play, they start organizing the pieces on the board based on the type of chess piece as indicated by the rules, Chess pieces acquire meaning on the paradigmatic and the syntagmatic levels as described by Lotman.

The external recoding of chess, the paradigmatic level, is based on the recreation of a military confrontation. The Indian predecessor of modern chess played during the sixth century is called *Chaturanga* which translates as "four arms" in reference to the four branches

[2] Keeping in mind that each individual move in chess is selected from the whole system of possible moves, we can call this system the *langue* of chess, and the individual moves would be *parole.* (Bignell 2002: 8)

that composed the old Indian army: chariots, elephants, cavalry and infantry (Averbach, Kasparov 2012: 20), represented by the pieces on the board, as the game spread to other places the names of the pieces changed till they acquired their modern names, some of which derived from the Arabic version as the game entered Europe around the eleventh century from the Moslem world.

Figure 5. Mughal Ivory chess set. Source: Invaluable.com
https://image.invaluable.com/housePhotos/Mallams/54/547354/H0738-L57147964.jpg

It is under this recoding of chess as a battle between two socially stratified groups that the pieces got their names and identifying shapes. However, behind this symbolism what chess materializes is the mental confrontation between two persons using wits instead of brute force to overcome the other player employing a mix of short and long term planning, at this point is where the syntagmatic level becomes relevant for chess as a language.

Pawns, rooks, knights, bishops, the queen and the king figures acquire meaning in the internal syntagmatic system of relations between the pieces and their position on the chessboard and in this sense they are similar to phonemes on a phonetic language system. Chess pieces signify not only because they resemble some object in the real world like the horse of a knight but because of the possibilities they offer according to the rules of the game.

In the same way, that phonemes like “o” or “n” generate different meanings depending on their position on a word [“on” / “no”], the contrastive relationship between pieces and their position on a board also provides a particular meaning in the context of the game, for example, a white knight can have a particular meaning if it is located on a certain position with respect to the black king, wherein accord to the rules of the game it can capture the king, generating a situation known as “check”. The possibilities offered by particular elements (tokens, cards, meeples) constitute a fundamental unit of play that Parlett calls *ludemes* (Parlett 2017: 82).

We can think of a match of chess as a conversation between the players where, instead of words, they use *ludemes* as the base units of a common language; from the start of the game each move poses a situation, a kind of question, to which the other player has to answer by selecting one move among the possible movements allowed by the rules. Each move has simultaneously a tactical value: fortify a position, block an attack, etc and a strategic goal, reduce the range of possible movements available to the opponent till a situation of *checkmate* is achieved meaning that one of the players can´t make any more meaningful moves and the game/conversation ends.

The syntagmatic structure of chess is so strict that a professional chess player can differentiate a random distribution of pieces on the board from an actual advanced game situation, and even, as some experiments demonstrate, it is easier for the player to remember the position of pieces from an actual game than when they are randomly distributed (Chase, Simon 1973). The results obtained in other investigations suggest that skilled memory in chess players is the result of a meaningful encoding of game positions (Lane, Robertson 1979), In other words, the increased difficulty to memorize a random distribution of pieces compared to recalling a meaningful game position, is based on the same principle that makes it easier to remember a known word like “elephant” than a random distribution of the same letters “hpeetaln”.

The game of chess is a clear example of a system where the syntagmatic meanings predominate over the paradigmatic ones, however, chess has been used with a predominant paradigmatic function in artistic texts such as novels, e.g., Arturo Perez-Reverte’s novel *The Flanders Panel* (1994) where the depiction of a chess match in a painting contains the clues to solve a 500-year-old murder mystery or the deeply symbolic chess match between a crusader knight and the personification of Death in Ingmar Bergman’s *The Seventh Seal* (1998 [1957]). Chess can also be invested with notorious cultural and political significance as it had during

the Cold War when the world level championships disputed between North American and Soviet Union chess players functioned as a sublimated representation of the mental and ideological showdown between the eastern and western power blocs.

It is important to keep in mind that not all board games follow the same form of meaning construction as chess; in many cases, the theme, external recoding, predominates over the mechanics, internal recoding. Actually, this difference is the basis for the classification of board games into two main categories: Abstract games, where there is no topic present or its presence is to subtle, as in the case of the game of *GO*, and Themed games in which the mechanics of the game represent a topic with an underlying narrative. *Clue* (Pratt 1948), *Pandemic* (Leacock 2008) and *Samurai* (Knizia 1998) are examples of themed games. One interesting thing about games is that it is possible to remove the thematic elements of a game and the underlying mechanics can be used to portray many other topics. For example, the basic mechanics for a historical game of colonization like *San Juan* (Seyfarth, Vohwinkel, Brück 2004) can be used for *Race for the Galaxy* (Lehmann 2007), a science fiction game. This balance between syntagmatic and paradigmatic systems is a key element to understand how board games function as a modelling language.

1.4.2 Theme and mechanics as systems of meaning in board games

In the same way that artistic texts can represent objects and situations in the real world by trying to portrait as close as possible the everyday environment of the artist or, on the contrary, "withdrawing from 'object' reality" (Lotman 1977: 232), board games and other forms of play-type models might build mechanics whose aim is to represent some particular aspect or process of the world in the most realistic and detailed form possible, sometimes bordering the limit between game and simulation as in the case of the board game *Here I stand* (Beach 2006), a complex game about the wars of reformation where the main powers of this period are represented in meticulous detail (Fig. 6). Also, as in the case of fantasy, horror or science fiction themed games; the topic might be distanced from everyday reality and the game mechanics purpose is to provide a structure for a narrative world, a separate reality "where its inhabitants, the players can perform actions that are permitted to occur in that world, but that would not make sense anywhere else" (Salen, Zimmerman 2004: 369).

Figure 6. Here I Stand Game setup (1517 scenario). Photo by Timo Pohja in Boardgamegeel.com Source: https://bit.ly/39P93i8

Independently of how close the theme or mechanics of a game are to the reality of the modelled object in the design process, the aim is to articulate the internal and external recoding structures of the game so expected, or unexpected, meanings emerge in "the moment the players set the rigid rules of the game in motion" (Salen & Zimmerman, 2004: 304). It is important to keep in mind that the activity of playing a game is always experienced within a cultural context (*ibid: 52)* This means that the meanings generated by putting the mechanics of the game in motion will always be permeated not by the creator´s worldview, but also by the worldview of the players and the place and time where the playing activity is performed.

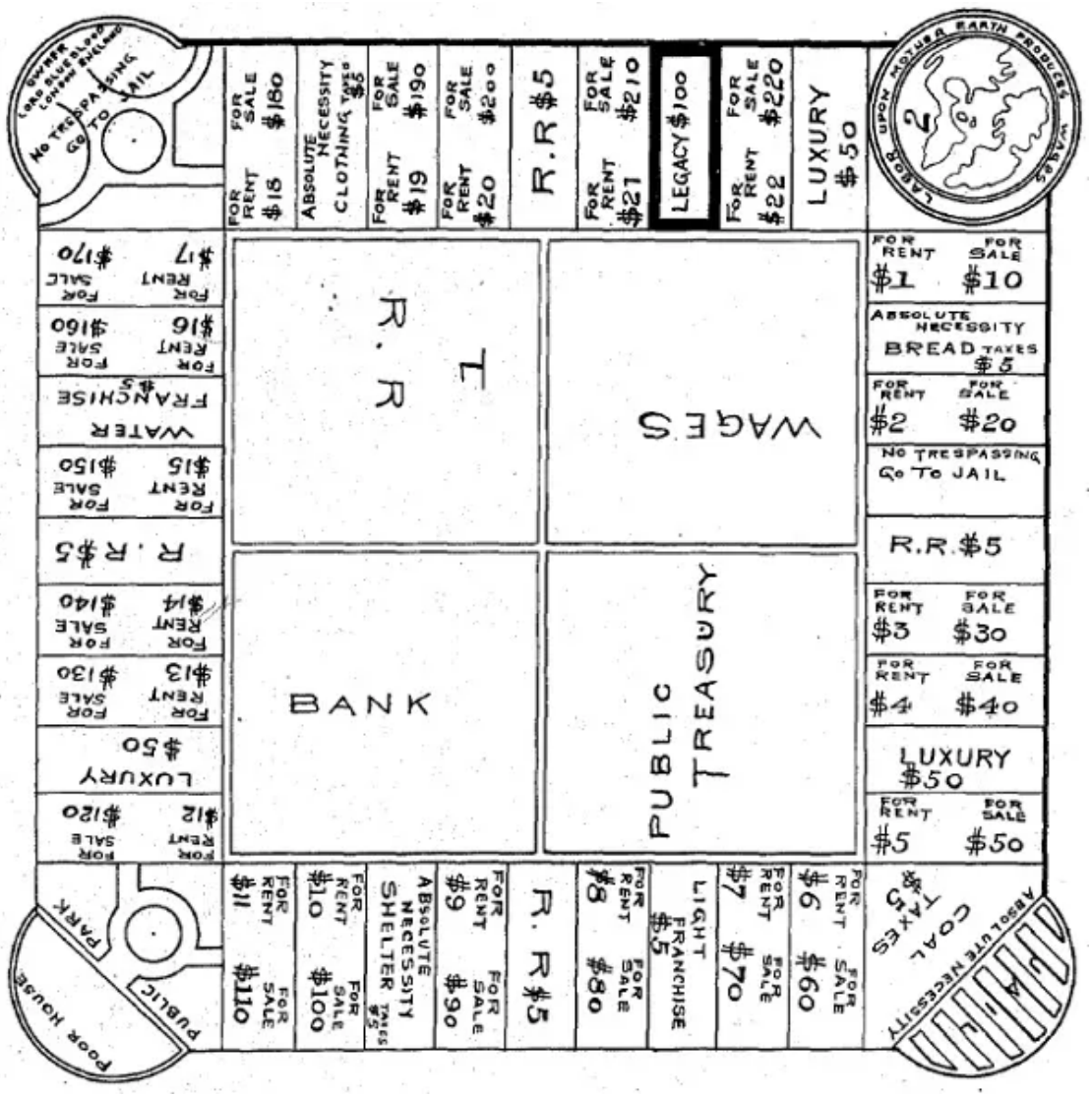

Figure 7. Original board design for the *Landlord's Game* by Lizzie Magie, patented in 1903. Source: United States Patent and Trademark Office

It is not the same to play *Monopoly* (Parker Brothers, Inc. 1935) in the first decades of the 20th century when it was created under the title of *the Landlord's Game* (Fig. 7) by Lizzy Magie as "a practical demonstration of the present system of land-grabbing with all its usual outcomes and consequences," (Maggie quoted by Pilon 2015), than to play it today in the context of a globalized neoliberal world, especially if you are playing one of Monopoly versions where the basic game is revamped with popular culture themes like *The Simpsons Monopoly* (USAopoly, Inc 2001) or Monopoly: *Star Wars*. The cultural context that surrounds board games is analysed in the third chapter of this thesis using the chronotopical framework proposed by Peeter Torop.

In conclusion, as Lotman explains, the game mechanism "does not consist in the static, simultaneous coexistence of different meanings, but in the constant recognition that there may be other meanings besides those perceived at the moment" (1977: 67). The articulation between theme and mechanics in a board game does not provide a static model of an object but models the incomplete determinacy, an open set of probabilities that the players explore to get that "sparkle" that gives new meanings to ordinary activities. How this process of meaning-making is experienced by the players of a game as they engage in the dialectical activity of play is described in the section of the third chapter corresponding to the psychological (3.1.2) and metaphysical (3.1.3) levels of chronotopical analysis.

Interchapter A. Modelling the climate crisis situation with a board game

The board game *Bio-equilibrium (Looduse Tasakaal)* is a project commissioned by the University of Tartu Natural History Museum – Loodusmuuseum – with the aim of raising awareness in the visitors of the museum about the dangers of climate change and most important, about the actions that individual persons and communities could take to contribute to the solution of this global situation. This game was developed by a team conformed by Nature education specialist Elen Kontkar of the Natural History Museum, and the author of this thesis in the role of game designer. The project was funded with a grant for environmental education projects awarded by the City of Tartu.

The game design process followed for the creation of the *Bio-equilibrium* board game is presented in this thesis as a practical component of the research project. In the interchapters of this thesis, I will describe the different activities that our team carried out during this design process as a practical example of the application of the theoretical concepts developed in each chapter.

The first step in the design process for a board game is to decide if it is going to be a theme or mechanics driven game, described in section 1.4.2. In the case of *Bio-equilibrium,* we already have chosen the topic of climate change, which made it a theme-driven game, our next step in the design process was to select or create the game mechanics that will better serve to construct a reliable and, at the same time, engaging play-model of this situation.

With this in mind, it was possible to define a core statement for the game narrative. Doing some background research on the impacts of global warming we found the report presented by the Intergovernmental Panel on Climate Change where it is stated that "Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels" also that "Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate" (IPCC 2018). Assuming that these affirmations are based on sound scientific evidence we have translated them into a core statement for the game: humans, represented in the game by the players, can have a direct effect through their individual and group actions and decisions in the global warming situation. Any decision in the game design process must support this core statement of the game starting with a content analysis on the topic to find and select the most relevant elements that are related to it.

A.1. Content analysis for a play-type model

A board game understood as a play type model is constructed with the aim of providing a grasp of some complex reality "by exchanging the immensely complicated rules of the reality for a simpler system" (Lotman 2011[1967]: 264). To achieve this, a previous analysis of the reality to be modelled should be performed to identify the relevant aspects that should be represented in the system and the meaningful relationships between these aspects that will allow, as explained in the second chapter, the collective manipulation of this model to achieve the goal of conditional solution of situations (*Ibid*).

The process of content analysis starts with a mix of background research and brainstorming with the aim of gathering abundant information on the topic and related concepts also to generate a set of game ideas of how these elements can be represented in the game, there is no strict filter on which ideas or related words should be put on the list (Dodge 2011), the selection of relevant ideas is done in a later phase. For this project, Ellen and I organized and studied research material on environmental issues provided by the Natural History Museum, some of it related to ecological problems in Estonia, as well as material from other sources, such as reports from the Intergovernmental Panel on Climate Change (IPCC), and the Climate Change Action plan by the World Bank Group.

The product of this first part of the content analysis was a list of key elements including notions like human activity, climate system, climate-related risks, land and ocean

ecosystems, social effects, adaptation measures, among others. Of course, these notions had to be understood as part of complex climate models used to study processes and interactions in the global climate system.

The second part of the content analysis is to establish relations between these elements that could provide a starting structure for the game model, this allows to determine the most relevant elements and discard some words and ideas that might not be a necessary part of the model. This step will be of particular importance in the creation of a diagrammatic model as described in the following chapter.

As a result of this step, complex models of climate change were obtained and the goal of the following step was to synthesize these models into a simpler game mechanics system that could be easily understood by young players while being as analogous as possible to the reality modelled while keeping the focus on the implications of this phenomenon for the future of human societies. However, the game also requires an element that allows the player to experience this reality in a new and engaging way.

A.1.1. "Make believe" and the concept of fun in *Bio-equilibrium*

Aside from the creation of a reliable model of climate change for the game, our aim with the design process was, on the one hand, to allow the players to become part of the narrative of the game, in this sense they may experience play in the form of "Make-believe" as described by Thibault (2017: 8); in the other hand. we want them to perceive and experience the modelled reality of global warming in a novel way, not as a conventional learning exercise, in the words of Elen Kontkar, the aim is "To make a game that is both fun and educational."[3]

To achieve these goals, the content analysis should provide the elements to create a narrative world where the players could become active characters able make decisions based on the goals assigned to each one. By assuming the role of citizens, farmers, entrepreneurs and politicians, the players may experience the reality of the global warming situation not as kids, students, parents or their own real occupation, but as someone else with a different perspective and relationship with this reality. This would introduce the element of *defamiliarization* described by Victor Shklovsky generating novelty and making the game fun

[3] Elen Kontkar, email to the author, April 15, 2021

to play. However, the game world also requires a set of rules that brings coherency and at the same time introduces the element of unpredictability in the play-tipe model.

A.2. Defining game elements and the concept of resources in the game.

There are some basic categories that can be used to organize the different elements of a game topic to create a basic game structure, Principles, Patterns, Paths, Probabilities, Prices and Pieces (Dodge 2011). Here I show how the particular elements related to the notion of resources were categorized for the *Bio-equilibrium* game. It is important to mention that this is an iterative process where some elements are moved from one category to another, or simply eliminated if they are not particularly relevant to the core statement of the game.

One of the key factors in the global warming situation is related to the management of natural resources, as explained in the report by the International Institute of Sustainable Development (IISD 2003). The exploitation of natural resources necessary to sustain human communities causes an impact on critical ecosystems that help regulate temperature variations, at the same time, climate-induced changes affects the flow of resources critical for livelihood sustainability (*Ibid,* 8).

To get a better understanding of the notion of resources as an element in the Bio-equilibrium game we have resorted to the notion of resources by Almo Farina (2012) where they represent "every natural element (abiotic and biotic) as well as to any man-made element, material or immaterial, which, after having been used/consumed, regenerates itself by way of its internal, independent mechanisms. (Farina 2011: 20). This element may be represented by "matter (e.g. proteins), energy (e.g. warmth, light, potential energy), information (e.g. choices, discrimination, convention, rules, psychological and behavioural conditions), meaning (sign processes), and culture (established knowledge)" (*Ibid,* 20).

In the design of Bio-equilibrium board game, the resource criterion defined by Farina was translated from the field of ecosemiotics to the language of game rules, following a process similar to the one described by Lotman (2011[1967]: 253). This should allow the players to experiment with the idea of resource management as a key factor in the construction and preservation of what Rapport & Maffi (2013) describe as healthy eco-cultural systems.

At a first glance, and considering the different functions given to the concept of resources in ecology studies and game design, the use of this concept seems to be quite distant

between these two fields. On the one hand, the Resource Criterion as proposed by Farina (2012) aims to provide a robust standard model to describe the complexity of ecological systems and the relationships between organisms and their ecological context (*Ibid,* 21). On the other hand, resources in the context of games are related to the ways in which the players can produce meaningful interaction with the game and among themselves. Board game designer Bastian Reinik proposes a somewhat raw definition of resources as "anything within the game a player can use to alter the state of the game" (Reinik 2016).

However, It's not that difficult to start noticing some parallelism between the use of resources in ecology and games. Relationships, among organisms or players, and between them and their contexts – ecosystems and games – provide a common element that could allow building a translatability of the ecological realities into the cultural object of a game. But to have a solid starting point for this kind of translation process, it is necessary to closely examine the use of the resource concept in both cases.

In games and particularly in board games, resources are the elements allowing the players to take actions that alter the state of the game (Reinik 2016). Material and visual components such as meeples - game tokens - for example, in the shape of trees, persons, or fruits; can be used to represent material items like food, building materials, workers, weapons or land; and immaterial elements like time, knowledge, courage, willpower, or even magic.

Game mechanics define what kind of actions the players can do to obtain or use resources. In some games, players can use one kind of resource, for example, activate worker tokens to produce other types of resources like building materials and then use a worker token and these materials to create a building that could provide new kinds of resources. Other mechanics require that the player expend time as a resource to obtain some rewards.

A.2.1. Game principles (If/then statements)

The first level of elements categorization is defining principles that dictate how the world of the game works. In some games like the ones based on fantasy settings, the internal logic of the world doesn't have to follow the logic of the real world as we know it, but in the case of *Bio-equilibrium,* the aim is to be as accurate as possible in relation to actual climate change knowledge, with this in mind here are some principles for the game:

- If global temperature rises, then the chance of harmful events occurring increases with effects on the players economy, well-being and productivity. Following this, if the global temperature is reduced, then the chances of adverse consequences decreases and favourable effects are more likely to appear.
- The degradation and destruction of ecosystems have a direct effect of increasing global warming as the environment capacity to regulate temperature is reduced.
- If pollution and waste levels increase, then the global temperature will rise as a result of the accumulation of greenhouse gases and other elements that contribute to trapping heat in the earth's atmosphere.

Regarding the idea of resources as elements in the game that allow players to take actions that change the situation of the game, we have defined the following principles.

- If a player wants to play an action then he must expend a certain amount of resources determined on the impact that the action has on the game.
- The generation of new resources have an impact on biodiversity and waste levels.
- Scientific knowledge is a resource generated by spending other resources like time and money. If a player wants to play a technological action card, then he has to invest knowledge as a resource to do so.

As explained by Farina, the notion of well-being for any organism is directly dependent on access to resources (2012: 27), which leads to two of the most important principles for this game:

- If a player’s access to resources is reduced, then his state of well-being, represented by the individual goals score, will also be affected.
- If global warming increases, then the player’s access to resources will be reduced producing negative effects in the achievement of their goals.

A.2.2. Climate change and patterns of entropy

The game principles establish relations between different elements of the game, these relations lead to the emergence of patterns that the players can identify and use to reach their goals. These patterns can also generate positive or negative feedback loops that impact the game experience, increasing or reducing the difficulty to achieve the player's goals.

On the topic of resources, one of the most important and complex patterns that the mechanics design for this game generates is related to the principle of entropy, the permanent increment of disorder and chaos in a system. In the case of human societies this factor takes the form of waste heat and pollution that is generated when harvesting and producing the resources required to achieve a state of well-being (Farina 2012: 27).

At the core of the environmental crisis problem lies the paradoxical situation generated between the need to achieve a state of well-being and entropy, which is clearly explained by Michio Kaku when describing the possible scenarios that humanity could face in the future:

> If civilizations of the future blindly produce energy [...] they will create so much waste heat that their home planet will become uninhabitable. Entropy, in the form of waste heat, chaos, and pollution, will essentially destroy their civilization (Kaku 2012: 397).

To achieve the goal of limiting global warming to 1.5°C in the next 30 years, the IPCC panel has come to the conclusion that it is necessary to implement changes in land and urban planning practices, as well as deeper emissions reductions in transport and buildings, along with practices enabling deep emissions reductions that include various energy efficiency strategies (IPCC 2018). These actions and strategies could lead to what Kaku defines as an "entropy conserving" civilization with the capacity to overcome the aforementioned paradox using science and new technologies to control excess waste and heat (Kaku 2012: 398).

Players should be able to identify patterns that emerge from the game mechanics that reflect the entropy factor described before; as they try to obtain and secure resources to improve their well-being, they discover that this leads to the generation of pollution and waste and to the destruction of natural ecosystems. However, the game also provides the means for the players to generate knowledge that could be used to access more efficient ways of acquiring resources that reduces waste pollution and the impact on the environment.

A.2.3. Probabilities and introducing uncertainty in the game

The combination of regular and random processes described by Lotman in relation to games (2011[1967]: 256) is present in the case of the *Bio-equilibrium game* with the creation of a set of rules to determine the actions that each player can perform, while randomness, as described in section 1.2.1, is incorporated using a mechanic of card drafting, where the players can take a number of randomized cards from a pile with the possibility to decide which ones to keep and which ones to discard, this method gives them some level of control and the opportunity to build a solid strategy to achieve their goals.

A similar mechanic is used to generate events that can potentially change the state of the game. Depending on the actual global temperature, represented by a thermometer track in the board, the players have to take event cards from one of two card piles: one representing a more critical global situation where disaster situations related to global warmings such as epidemics and draughts can affect the players overall well-being and availability of resources, the other pile represents a more controlled situation where situations are less critical and more beneficial effects could appear. This mechanic generates positive and negative feedback loops where the game becomes more difficult to win as global temperature rises or if the players manage to reduce global warming, future efforts to solve this crisis become more effective.

Knowledge as a resource is introduced in the game in a way that allows players to gain some control over the random elements in the game; for example, some research cards allow some players to take a look at or even remove event cards, so they can know in advance and be prepared for upcoming critical situations.

A.2.4. Prizes and conflict

In the description of the strategy board game *Settlers of Catan*, conflict is mentioned as an element that emerges as a product of the "tension between diplomacy and self-interest" (Salen, Zimmermann 2004: 378) that is generated between players as they trade resources with each other – resources that they need to achieve their goals but at the same time can be used by their rivals to score more points at the end of the game.

Prizes are valuable elements in the game that the players strive to acquire usually because they give them the possibility to do more actions (resources) or generate a direct and significant effect towards achieving a victory condition in the game. Some game mechanics

are aimed to create a direct conflict between players for the acquisition of prizes, auctions are an example of this kind of mechanics making players compete with others by expending valuable resources to obtain what they consider a strategic advantage.

From the point of view of the resource criterion, conflict can emerge when different species have to compete for assets such as territory, reproductive sites or food (Farina 2012: 25) but also can be present in human societies when, for example, a territory can provide different uses to solve conflicting necessities (tourism-agriculture, protected areas, logged areas, urban sprawl-agriculture) (2012: 27).

In a semi-competitive type of game like *Bio-equilibrium*, conflict should emerge when tension is created between the individual goals of each player and the shared need to avoid falling into a negative feedback loop that could lead to a losing situation for all the players. This would lead to negotiation dynamics that allow the players to get to different types of agreements such as investing resources on other players research efforts that could provide benefits for all.

One remaining category of game elements corresponding to the pieces will be described as part of the process of construction of a diagram.

A.3. Design of game mechanics to model global warming

The previous categories in which the elements of the game are organized and relationships are established between them, provided us with the building blocks to start constructing the underlying system for the game that allows the players to actually interact with the elements of the game and with other players.

Salen and Zimmerman define a core mechanic as “the essential play activity players perform again and again in a game” (2004: 316). Some games have simple mechanics such as winning a race by moving a pawn past a certain point on a track or collecting sets of cards to get the best possible combination under certain values defined by the rules of the game. More complex games combine different game mechanics to provide the possibility of trying different strategies to win the game. However, it is important to keep in mind that even simple mechanics can generate complex interactions between the players, The ancient game of GO is a good example of this.

For the Bio-equilibrium game the intention was to make the game "simple enough for it to be understood very fast"[4] The reason for this is that the game is intended to be played during the school student visits to the museum with no time to explain complex rules. So the core mechanic of the game had to be easy to explain in a short time but, at the same time, able to recreate to a certain point the difficulty of looking for solutions to the global warming situation. After testing different mechanics for the game we as a team decided to use two core mechanics for the game: Voting and resources management.

A.3.1 Voting mechanics in the *Bio-equilibrium* game

Taking in account the semi-cooperative style of *Bio-equilibrium* where the players have to coordinate their actions in order to achieve a common goal, in this case keep global temperature below a certain level; the game mechanic that better fitted this concept is that of voting. In this case, one of the players in the role of the politician proposes some laws or projects presented as cards that if approved provide some benefits for the players but have some cost in the form of resources or by incrementing pollution and waste levels. The other players may discuss the positive or negative outcomes of passing the law and then they can proceed to a votation phase by playing an "approve" or "reject" card. This mechanic allows for the possibility of negotiations between the players to approve or reject some laws in exchange for doing some actions that could benefit other players.

A.3.2 Resources management in *Bio-equilibrium*

The other main mechanic for the game is directly related to the notion of resources as previously described. Players have the option of playing different actions as presented in cards that they obtain randomly; these actions may contribute to the achievement of the common goal of the game or to their own agendas and usually have some cost in the form of money or effects in the pollution or biodiversity levels. The idea is to keep the players in a constant necessity of obtaining and securing resources needed to play the actions they want to do to achieve their goals.

Along the game players will find that some laws or actions will allow them to quickly obtain important resources usually by contributing to the increase of global warming, but also

[4] Elen Kontkar, email to the author, April 15, 2021

that investing some resources in things like new technologies may not provide immediate resources but with time they start generating other benefits that contribute to their personal and common goals.

The way this game mechanics created for the *Bio-equilibrium* board game are presented to the players in the form of a diagrammatic model is described in the following subchapter. The third chapter will use the method of chronotopical analysis to explain how the elements of the play-type model created here are interrelated at different levels generating a connection between the authors of a game, the players and the sociocultural space in which the playing activity takes place.

Chapter 2: Board Games as diagrammatic models

The rules of a game create, as Lotman explains, a language that could be used to reproduce some aspects of reality (1977: 62); they also provide a structure that supports a clear relationship between the actions that players can do and the effects of these actions on the state of the game, thus generating the necessary conditions for the emergence of meaningful play (Salen, Zimmermann 2004: 33). Taking into account the definition of board games as those that "are played on a pattern of significant markers[…] whose purpose is to define the movements and positions of the pieces in relation to one another" (Parlett 1999: 6) then we can infer that the movements and positions of the pieces on the game board are the way to visually represent the relationship between actions and outcomes and ultimately to generate new meaningful insights on some aspect of reality.

However, this description of board games as play-type models is not enough to explain how this kind of games are created and how players can interact with them in order to generate new meanings. My proposal is that the explanation of how board games function as a model can be found in Peircean semiotics, particularly in his theory of diagrammatic reasoning.

2.1 Peirce's Diagrammatic reasoning, a machine for mental experiments

> Two monks were arguing about the temple flag waving in the wind. One said, "The flag moves." The other said, "The wind moves." They argued back and forth but could not not agree. The Sixth Ancestor said, "Gentlemen! Iis is not the wind that moves, it is not the flag that moves, it is your mind that moves."
>
> Wu-Men (Mumon), (Aitken 1991: 184)

In the book chapter about diagrams as a centerpiece of Peircean epistemology, Stjernfelt introduces the idea of diagrams as "Moving pictures of thought" (2007: 89), this idea comes out in contraposition to visual pictures of a non-moving kind (*Ibid,* 304), based on a question by Husserl regarding the possibility of pictures within ordinary perception, "Why does nature, a landscape, function as a 'picture'?" (Husserl 1980, — *cited in* Stjernfelt 2007:304) Here, the act of observing things from a certain distance seems to objectify them and this somehow makes them static, they are frozen in the mind. However, when looking at a static picture of a landscape, the observer can "phantasize" himself into the picture and start moving around it so the image becomes a moving picture in the mind.

This relation between fantasy and a picture from a Peircean viewpoint the observer "may investigate the picture due to those diagrams he may construct on the basis of bodily action possibilities" (2007: 306). The experiments made by the observer with the parts of a picture and their interrelations are part of the diagrammatic reasoning process. Is in this sense, that as declared in the perplexing koan by Zen master Wu-men, when we look at a flag undulating in the wind, is not the wind or the flag that moves but is our mind moving in the picture that we are perceiving, and we can think about diagrams as objects that put the mind in motion.

Diagrammatic experimentation is based on the status of diagrams as icons following the operational definition (2007: 99). This definition takes observation as the starting point of a complicated process of icon manipulation that Peirce describes in his text *On The Algebra of Logic*.

> ... all deductive reasoning, even simple syllogism, involves an element of observation; namely, deduction consists in constructing an icon or diagram the relations of whose parts shall present a complete analogy with those of the parts of the object of reasoning, of experimenting upon this image in the imagination, and of observing the result so as to discover unnoticed and hidden relations among the parts. (1885: 363).

It is by the possibility to subject the interrelated parts of an icon to experimental change that diagrams appear as a type of icon, described by Stjernfelt as a "skeleton-like sketch of its object in terms of relations between its parts" (2007: 94). As a type, diagrams are ideal entities communicated through particular tokens, and to build and read them a certain set of rules must be followed (*Ibid,* 96), Thus, the diagram type is constructed following a Kantian intuition-concept duality with a diagram token, the particular visual representation of an ideal entity and the set of rules of interpretation for that particular type (*Ibid,* 97). In this sense, diagrams are individual physical objects that in the reasoning process are interpreted as tokens of types (Tylen *et al.* 2014: 265). In the construction of the diagram, some properties of the token are ignored, while others become the focus for the diagrammatic reasoning.

Following this description, maps, geometrical representations, data graphs and even gestures can be included in the diagram type and, taking into account some structural aspects, I consider that some kind of games and board games, in particular, can be understood as a form of diagrammatic modelling, but to support this proposal it is necessary to describe the process for the construction and use of diagrams.

2.2 Phases of the Diagrammatic Reasoning Process

The core process of diagrammatic reasoning was summarized by Michael May using the following model (May 1999, 186) (Fig. 8).

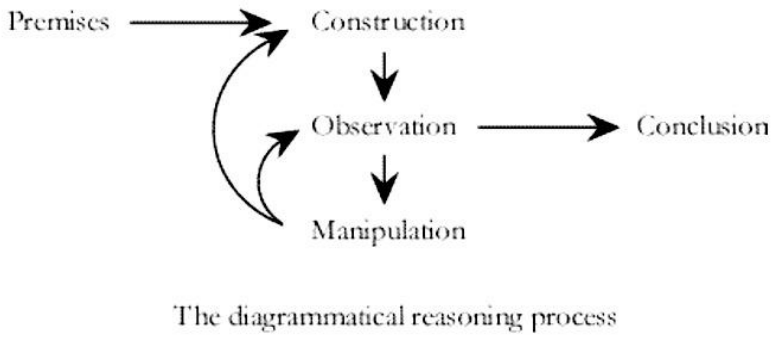

Figure 8. **The diagrammatical reasoning process**

For Peirce diagrammatic reasoning is an iterative process of construction, manipulation and observation of the relations between different elements of the modelled object (*Ibid,* 186). Premises assert a state of things that are to be examined and from which a continuum of possibilities are derived. In a game of chess, the initial alignment of the pieces represents the opening premise that is the same for any match, and from which an immense number of possible moves can derive but only a tiny fraction will be actualized in a single game. From the premises an "Initial Symbolic Interpretant" is determined that will provide the basis for the drawing of a diagram that shows the preexistent condition of the object, thus starting the reasoning process (Stjernfelt 2007: 93)

Deduction is at the centre of the diagrammatic reasoning process and has to do with the actual construction of the diagram "whose parts shall present a complete analogy with those of the parts of the object of reasoning" (Peirce 1885: 363). This doesn't mean that the diagram has to be an exact replica of the object up to the small details, actually, some features of the object can be discarded "One contemplates the Diagram, and one at once prescinds from the accidental characters that have no significance" (Peirce NEM IV: 317); something that has some resemblance to the construction of a scientific model where, as Lotman explains, random elements are eliminated as accidental (Lotman 2011: 267). However in the construction of a play-type model, as is the case of board games, accidental or random elements are not necessarily eliminated because they can generate meaningful possibilities not

contemplated when constructing the model. This aspect of randomness in games as diagrammatic models is discussed in section 2.3.

After the construction phase of the diagrammatic reasoning process, the diagram is available to be used by other persons aside from the creator. The first activity that can be performed when using a diagram is to observe the relations between its elements and try to read the diagram following the rules of interpretation used. Lotman and Stejernfeld present maps as an example of how people use models and, or, diagrams. A tourist driving a car through the countryside will stop for a moment to open his map, identify his current position and plot the next part of his route. On the map he will observe some elements Dots representing cities, lines as the roads that connect them, some icons to indicate touristic locations or available services, etc; But, as Alfred Korzybski pointed out, "The map is not the territory" (1958), and what the tourist imagines when looking at the elements of the map not necessarily correspond to what he would actually see when he gets to the places represented, but the relationships between the elements of the map should be consistent with their actual positions on the territory represented and will allow him to find the best route to get where he wants to go, which leads us to the last phase of the process.

Once the tourist is able to read the map following the rules of interpretation for this particular kind of diagram, he can start performing mental experiments on the map, measuring distances and comparing different routes. Maybe there's a direct route to get to his destination but according to the map a different route will allow him to enjoy the view of the sea. All these different possibilities are available on the map as a diagram and become evident as the tourist experiments with it. However, the full possibilities offered by diagrams appear when they are actively manipulated, for instance, by moving or adding parts according to certain rules, for example, the representation of a triangle is not enough to fully understand Pythagoras's theorem, "a proof is made by the addition of auxiliary lines, e.g. by drawing squares on the three sides of the triangle and grids enabling the comparison of their surface. (Tylen *et al,* 2014: 266)

The manipulation of the diagram produces a transformed diagram, a rational interpretant of the initial diagram, providing a conclusion (Stjernfelt 2011:113) But sometimes the manipulation of the diagram does not lead to the expected result, so an iterative trial-and-error process starts looking for new relations that can be manipulated or even to the phase of construction of the diagram to include elements or relationships that were left behind and maybe significant considering the results of experimentation with the original model.

One example of this is the evolution of the diagram of the planetary movements in the solar system from the Ptolemaic model to Kepler's diagram, Ptolemy used an earth-centered configuration to arrange elements and describe orbits (fig. 9a), This was not consistent with further data obtained with more powerful telescopes, so fourteen centuries later Copernicus made a simple, but highly significant rearrangement with a sun-centered perspective. maintaining epicycles where planets were moving on cycles (fig.9b). Just a few decades later, as a result of actively manipulating Copernicus' model, Kepler refined the model (fig. 9c), "keeping the relation between the nodes but simplifying the trajectories from complex epicycles to ellipses." (Tylen *et al.* 2014: 271)

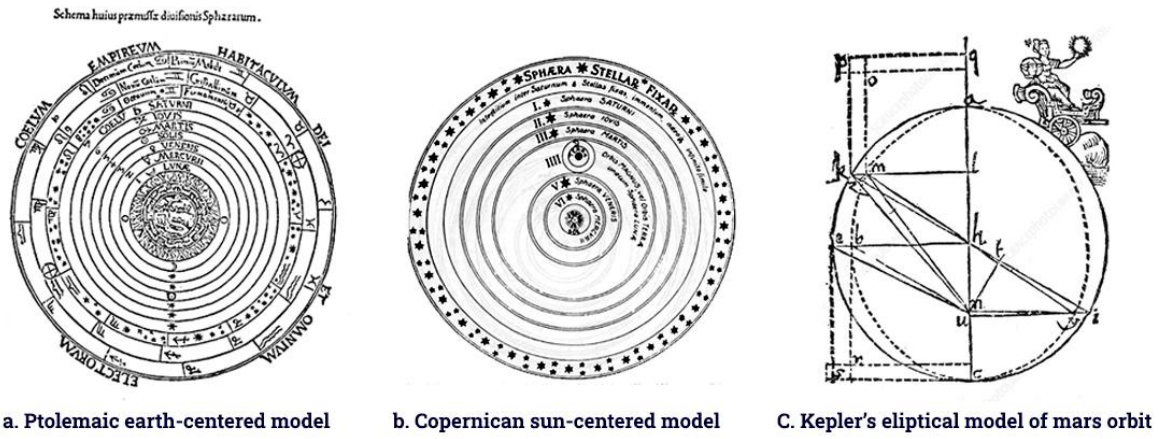

Figure 9. Planetary movement models. a. Source: Peter Apian, *Cosmographia* (1539). Reprinted in Alexandre Koyre, From the *Closed World to the Infinite Universe* (Baltimore; Johns Jopkins, 1957). b. Kepler's illustration of the elliptical orbit of Mars, 1609 Source: Oxford science archive c. Copernicus system according to Michael Maestlin in *Rethicu's Narratio Prima* (Tübingen, 1596)

Following the same structure of scientific models as described by Lotman, the diagrams in Peirce's theory seem to set aside accidental random elements so even the iterative process of trial and error produces univocal predictable conclusions. However, this doesn't mean that it is not possible to incorporate randomness in the diagrammatical reasoning process to create play-type diagrams.

2.3 Games and randomness in diagrammatic reasoning

> Chaos in the technical sense is not random at all. It is completely determined, but it depends hugely, in strangely hard-to-predict ways, on tiny differences in initial conditions.
>
> Richard Dawkins (2018: 88)

The manipulation of diagrams follow certain rules that guarantee that all token instantiations correspond to the nature of their governing diagram type, so only possible logical conclusions are obtained. However, these rules for manipulation can in some cases be implied by the structure of the icon itself and in other occasions imposed by the regulating symbol, as a consequence, the results of the transformations cannot be predicted (Stjernfelt 2007: 82). This unpredictability is the key element that leads, as Peirce pointed out. to the discovery of new regularities.

Unpredictability is also a key concept in Lotman´s theories where it becomes fundamental for the significance of history understood as complementarity of statics and dynamics (Torop 2009: xxxix). Lotman had a particular interest in imagining the consequences that different choices could have produced on pivotal moments of cultural explosion (2009: xxx). The passage of the duel between Onegin and Lensky in the novel *Eugene Onegin* where Pushkin describes possible futures that spread for that moment is an example of the way in which Lotman regards the idea of multiple simultaneous trajectories.

> [...] at the moment when the shot takes place, there is no predetermined future – there is only a cluster of equally probable “futures”.Which of these is ultimately realised cannot be predicted beforehand. Chance is the interference of an event from another system. (Lotman 2009: 125)

This idea of unpredictability due to the interference of multiple factors that cannot be taken in account when trying to predict the outcome of a situation is closely related to the “parallel universes" or “many-worlds" interpretation of quantum phenomena derived from the thesis by Hugh Everett III (1957), which has permeated culture in the form of “alternate history”, a genre based on genetic and entropic models of history described by Karen Hellekson (2000: 2). In these models the element of randomness functions as a generator of different courses of history resembling Borges *garden of forking paths,* an invisible labyrinth where the forking takes place not in space but in time (1971). This will be

discussed in-depth in the next chapter about the chronotopical analysis framework proposed by Torop.

For Caillois a game "consists of the need to find or continue at once a response which is free within the limits set by the rules" (2001[1961]: 8). This freedom is not possible if the outcome is known in advance, and this situation is "incompatible with the nature of play." (*Ibid,* 7). This idea resonates in Lotman´s approach to the topics of entropy and games of cards in Pushkin' story *The Queen of Spades*. "[T]he heroes move in turn from the predictable into the domain of the unpredictable and back again, now coming to life and now turning into dead (literally and metaphorically) automata". (Lotman 1978: 469) Here, Pushkin views inflexible laws that generate perfectly predictable outcomes as a form of death, while life is related to hope that depends on the possibility no matter how remote of "winning" as a result of chance.

Introducing random generators in the construction of diagrams is a way to model the behaviour of complex dynamic systems. One example the projection and visualization of hurricane paths, where an iterative process using current data on the location, speed and bearing of a hurricane and historical records of previous hurricanes feeds an algorithm that generates multiple probable paths following different models and randomly inserting data variations (Cox *et al.* 2013) The result is a *spaghetti model*, a visual representation that comprises a web of probable paths generated by the algorithm (Fig. 8) this type of diagram can be used to alert people living in the possible paths of the hurricane to prepare themselves in case the hurricane heads to their location.

In the case of hurricane spaghetti models of hurricanes, only one of the projected paths will materialize but it would change the outcome for thousands of people that without this information would not have enough time to prepare for the strike. In the end, the actual path of a hurricane is stored in a data structure and used to generate future models.

Going back to the example of the duel in Pushkin's novel, it is possible to use game mechanics to simulate the moment of explosion described by Lotman and generate a tree of paths with statistical outcomes of the duel that could be represented as forking paths that from the moment of the first shoot could lead to different outcomes, from one of the adversaries dying from a killing wound to a harmless interchange of missed shots to the unfortunate accidental death of a third character. These possibilities can be modelled using, for example, the rules of role-playing games.

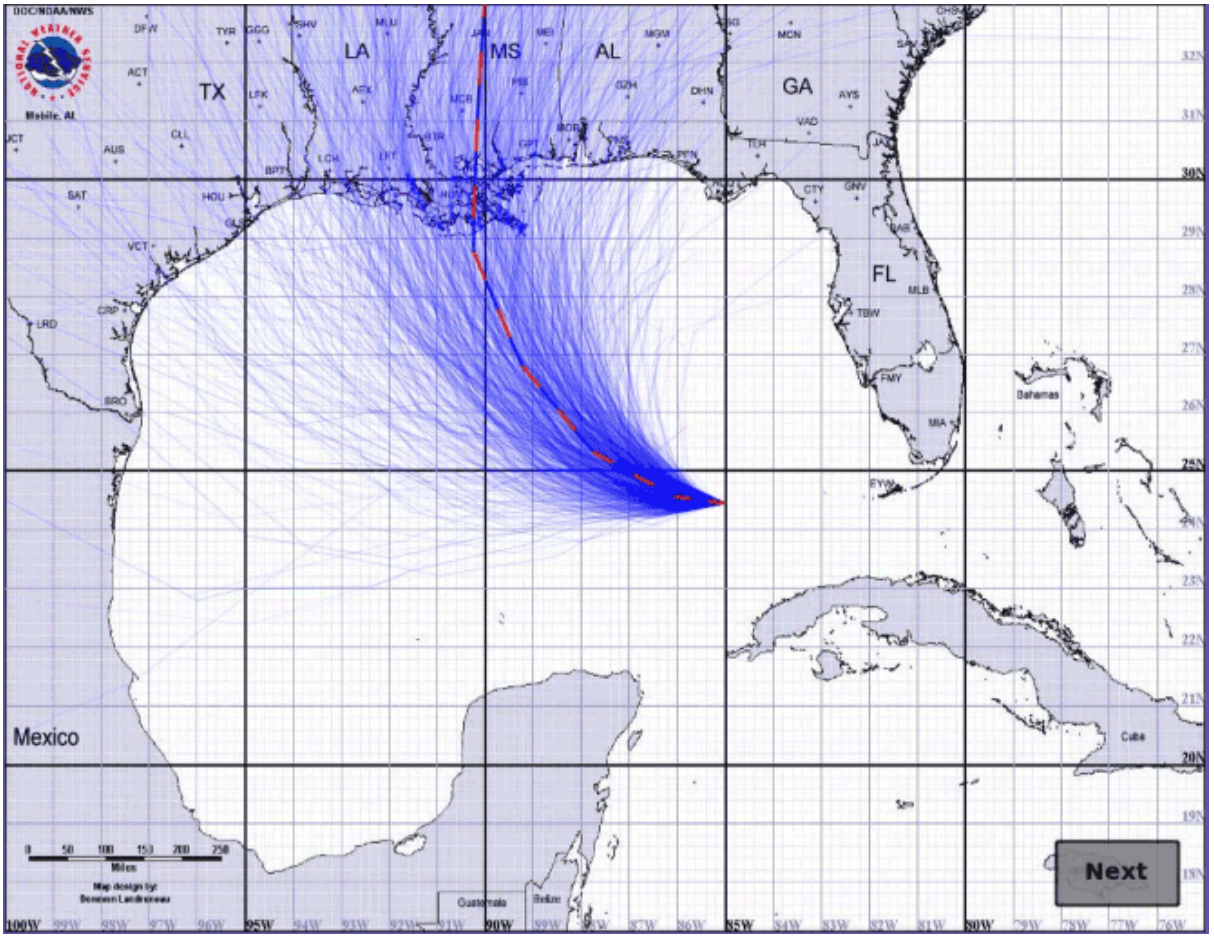

Figure 10. Diagram of Projected Paths for Hurricane Katrina (Cox *et al.* 2013)

2.3.1 Modeling Eugene Onegin's Duel with roleplaying mechanics.

Tabletop Role-playing games like Dungeons and Dragons are systems for generating narrative play where the different elements of the story characters, settings, conflicts and goals are structured following a set of rules that define what is possible inside the overall settings and backstory of the narrative world (Salen, Zimmermann 2004: 404). In most roleplaying games, one of the players takes up the role of the *Game master*, which depending on the game can have different titles: StoryTeller, Dungeon Master, Keeper of the arcane lore, etc. The game master has the responsibility of laying out the story to the other players, becoming in some sense an interface between the players and the narrative world, he becomes the eyes, ears, noses and tongue of the players as he describes what they see, listen, smell, touch and taste. The other players acting as the characters they have created react to the situations described by the Master by declaring actions that their characters would like to do: Travel to a certain town, speak with the bartender of the Inn, shoot an arrow to the dragon that

is attacking the city, etc. To determine if the characters succeed in their intended actions, dice and other random generating elements are used, which according to certain rules assign a success/fail value to the result and some consequences derived from it.

Translating the duel scene of Pushkin novel into the narrative system of a role-playing game, we can picture Onegin and Lensky as game characters controlled by the players; they have a set of attributes (strength, dexterity, intelligence, etc) and skills (horse riding, dancing, fencing, shooting, etc) with some numerical values that determine how good this attributes and skills are. So let's say that Onegin, a dandy, accustomed to dancing, parting and flirting is not as good at shooting as Lensky "a student of the German university" (Lotman 2009: 123) with more experience in the use of pistols. In a perfect simple world with strict deterministic laws the outcome of the duel, given that both duelists have the intention to kill their opponent, the result should be always the same with Lensky inflicting a deadly wound on Onegin, as it would happen on a western movie where the deadeye gunslinger always overcomes less skilled adversaries. But this would not work on a game as it takes out the element of unpredictability necessary for a meaningful play.

So in recreating Pushkin´s scene, where none of the duelists wants to reach a tragic result, a player assuming the role of Onegin declares that he intends to shoot first and from a distance trying not to cause a deadly wound, while the player representing Lensky would say that his intention is to move quickly and let Onegin have the first shot and then with his superior expertise shoot aiming to a non-vital part of Onegin's anatomy.

In the novel, the result of the duel is determined by the poet's intention (Lotman 2009: 123) and fate declares that against his intention Onegin strikes a deadly wound killing Lensky. But in the context of the roleplaying game, this result is decided by the roll of a dice. So once both players have declared their intentions to the Game master and concede that Onegin will have the first shot, he asks the player to roll a twenty-sided die whose result will be compared against a results table based on the character's shooting skill.

Given that Onegin shooting skill is not that good, let's say a 6 on a scale of 1 to 20, He will have to get a result of 6 or less on a roll of the 20 sided die to have a successful shot with critical success or failure effects depending on how far the result is from the target score, defined in the following made-up table.

Die result (D20)	Effect
1	Perfect shot - Opponent is deadly wounded and cannot be saved
2-3	Well aimed shot - Opponent is heavily wounded and will die if not healed soon.
4-5	Incapacitating wound - Adversary will not die but cannot take any actions.
6	Superficial wound - Adversary can take an action (Shot back)
7-9	The shot misses - no effects.
10-15	The shot misses but wounds another character instead of the opponent
15-19	Lousy shot - Character falls down and shoots himself causing a serious wound
20	Critical failure - Character falls down and shoots himself causing a deadly wound

Table 1: Shooting duel roll effects

It is possible to add more possible effects to specific scores but this table provides eight different outcomes that would open very different courses of events. However, only two of the twenty possible results will be irreversibly tragic for any of the characters. It would not be necessary on an actual roleplaying game to visually represent the different paths that could derive from the scene, but it could be possible to create a diagram, probably a forking paths structure, incorporating for example the results if Lensky is not killed and makes a dice roll to see what happens when he shoots.

The particular magic of this kind of play-type model is that different players in different play sessions can recreate the same scene with a wide range of different results that would result in completely different stories. This leads us to another possibility that diagrammatic reasoning offers, collective and temporally distributed forms of thinking.

2.4 Collective and distributed diagrammatic reasoning

Diagrammatic reasoning, independent of the type of diagram used or its intended purpose, has some fundamental properties.

> i) relies on external structures, ii) making abstract relations perceivable, iii) and manipulable, iv) in a public space, therefore enabling collective and temporally distributed forms of thinking (Tylen *et al.* 2014: 265).

Diagrams can be created by a single person to solve some particular issue without the intention share it with others, but even in this case, they can serve as a tool for some kind of Bakhtinian inner dialogues wherein the process of construction and manipulation of the diagram the person at different moments may ask himself questions about the properties and relations represented and thus arrive at some conclusions. However, the potential of diagrams as a medium for cognitive processes resides in the property of enabling these processes to be enacted by multiple individuals on different time scales, as shown in the aforementioned example of the manipulation and refinement of the solar system diagram in the course of some centuries, from the geocentric Ptolemaic model to the heliocentric ellipsoidal model proposed by Kepler (Tylén *et al*. 2014: 271).

The construction, observation, and manipulation phases of diagrammatic reasoning become more effective when carried out by different persons, especially when the process enters into an iterative cycle. Diagrams ``through their instantiation in manipulable media (e.g. drawings on a whiteboard, two or three dimensional models, scribbles or graphics) [...]invite for manual exploration: they can quite literally be poked, prodded, pulled apart and reassembled" (Tylén *et al*. 2014: 272). As different people experiment with a diagram previously unforeseeable consequences are discovered that could lead to a reformulation of the conceptual structures and maybe to a reconstruction of the original diagram, producing new transformate diagrams which in turn become new starting points for new experimentations, including comparisons between different transformate diagrams with the same original token.

2.4.1 Board games as an example of socially distributed experimentation

New ideas and meanings can be generated when people engage in "epistemic explorations of a shared diagrammatic medium" (Tylén *et al*. 2014: 274), for example, the use of maps and props that represent operation areas and the location and deployment of forces and key objectives in the planning of military operations (Fig. 11). In these cases, the individuals participating are not limited to observe the consequences of their own manipulations but they can also witness the results obtained by other participants which could lead to detect hidden problems and generate creative solutions to evolving situations.

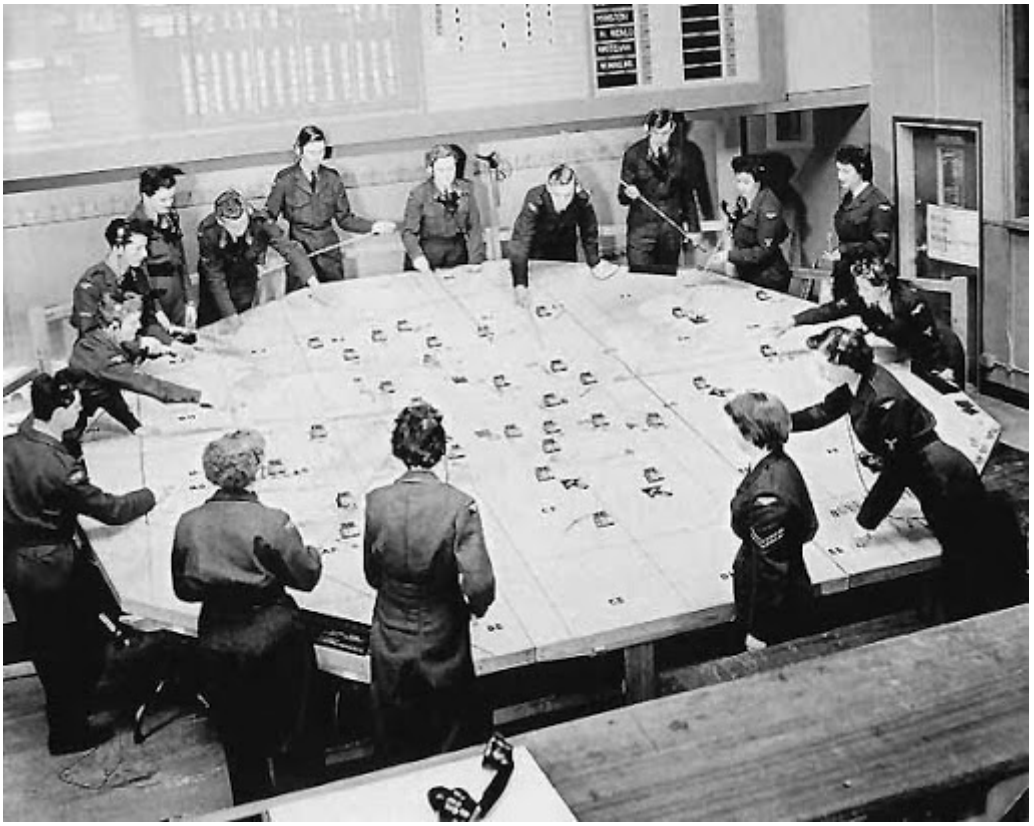

Figure 11. The Operations Room at RAF Fighter Command's No. 10 Group Headquarters, (Source: Goodchild A (F/O) Royal Air Force official photographer. Imperial War Museum)

In the case of military operations maps, previous actions and their effects on the current strategic plan can be visualized and new tactical manoeuvres can be plotted and discussed including possible tactical responses by the enemy army.

Wargames is a term that has been coined in reference to military simulations and tactical exercises where real soldiers and military vehicles participate, but also it has become a kind of hobby where strategy aficionados use miniatures over tabletop maps and dioramas to recreate historical and fictional battles.

In miniature wargames such as the popular *Axis and Allies* or *Warhammer* (Fig. 12), two or more players can participate in a simulated battle that is visually represented using maps or terrain dioramas, where miniature representations of soldiers, vehicles, monsters can be deployed and moved following clearly defined and sometimes extremely detailed rules for resources management, units building, terrain movement, line of sight, combat and other available actions.

Figure 12. A game of Warhammer Fantasy (photo by RedCraig 2011)

One particularity of this kind of games is that they usually involve a competitive element, which means that each player does his own process of manipulation and experimentation deciding on different moves that the rules allow with the intention to achieve a victory over the other players, but even under this circumstances, players can observe and learn from other participants as they try different strategies, that could be tested in future games.

Wargames are just one of the many categories of tabletop games, meaning games that, as the name indicates, can or should be played over a table, and some can be included in the category of board games as defined in this text, but I will move the focus to examples of more prototypical types of board games. Let's take for example the popular and award-winning game *Settlers of Catan (Die Siedler von Catan)* created by Klaus Teuber (1995).

> Picture yourself in the era of discoveries: after a long voyage of great deprivation, your ships have finally reached the coast of an uncharted island. Its name shall be Catan! But you are not the only discoverer. Other fearless seafarers have also landed on the shores of Catan: the race to settle the island has begun! (CATAN 1996).

In *Settlers of Catan*, from now on referred to as *Catan,* the players participate in an economical simulation where they take the role of the new inhabitants of an unexplored island; gathering resources, building roads and towns, and trading with other players as they compete to have the most successful colony. The game board is put together using hexagonal tiles that represent different types of terrains where the players can extract different resources: hills produce bricks, forests produce lumber, pastures produce wool, etc. (Fig. 13).

Figure 13. Starting map and resource tiles for a game of Catan (Source: Catan Base Rules and Almanac by Teuber Klaus. Retrieved from https://www.catan.com/service/game-rules 06.04.2021)

Unlike other games like chess, where the initial configuration is always the same for all matches, In *Catan,* the distribution of the tiles is randomly generated by shuffling the tiles before putting them on the table; but there's an additional mechanic to randomize the game configuration by putting tokens with numbers from 2 to 12 over the terrain tiles, this number

is linked to the rolling of two six-faced dice that determines the probabilities that a given terrain will produce the respective resources, as indicated in the following probabilities table.

Odds for Dice Rolls		
2 & 12 = 3%	3 & 11 = 6%	4&10 = 8%
5 & 9 = 11%	6 & 8 = 14%	7 = 17%

Table 2: Result probabilities when rolling two six-sided dice.

At the start of the game the players, select the colour of the pieces that will represent them on the game and starting with the oldest one, put a house token representing their initial settlement on one of the points where the corners of three terrain tiles meet as shown in the figure #. This means that the player will have access to the resources produced on those tiles, and the basic strategy dictates that the players will look to put their initial piece over tiles with high production probability numbers on them: 5, 6, 8, 9. The Number seven is reserved for a special event in the game where players can move a Robber token that temporarily stops the production of resources on the terrain where it is located (CATAN 1996).

After all the players have put a house token on the board they take turns to perform the available actions on the game: Roll the dice to generate new resources, represented by cards (or move the Robber piece), Trade resource cards with other players, or build roads and settlements by paying resource cards to put new tokens on the board following some basic rules. The game continues till one of the players reaches a specified number of *victory points* that are obtained by building settlements and cities and meeting some special conditions like building the longest road on the map.

As a diagram, the board of a game of Catan can be viewed as something similar to a conventional map, indicating some geographical features, the location of particular places like cities and the roads connecting them; but there are at least two particular characteristics of the game board that makes it different from a map. First, the map created by the tiles in the game doesn't represent any territory in the real world. Second, the map in the game changes and evolves as the players take actions to build new roads, settlements and cities. In this sense, we can say that the map is the territory as the actions and outcomes not only are represented by the game pieces on the board but the actual value of these moves is connected to the way they transform the game diagram.

What is translated to the particular langue created by the rules of Catan is not a geographical reality but a set of real-world activities performed by people: settling and expansion of land property; resources production and management; trade, etc. Tiles and wooden colour pieces function as icons representing resources and player assets, but on the game board, they also enter in a net of relations with other elements of the game and become diagrams of the evolving relationships between the players. With some knowledge of CATAN game rules, an observer looking at the distribution of pieces on the board can tell which player has an advantage over others, or who is trying to limit the moves available to other players by strategically placing tokens on key locations.

The players of *CATAN* can manipulate the diagram constructed by the game board and the pieces generating a playful form of socially distributed experimentation. In each match players experiment with different strategies looking for better ways to score victory points, this leads to different conclusions based not only on their own moves and results but also on the decisions and outcomes by other players. The insights obtained could be applied to future games and they can be extrapolated to generate creative solutions to real-life situations involving resources management, negotiation and other related skills.

Board games cover a broad range of genres and topics, from apparently simple abstract games to extremely complex political or economical simulations and vast and detailed storyworlds. However, I would say that ignoring these differences, board games in essence behave as diagrams providing a conceptual framework fueled by playful behaviour that "catalyze and support innovative thinking processes and interpersonal communication" (Tylén *et al.* 2014: 263).

In the following chapter I will explain how this kind of diagrams may generate transformative play, an experience that changes the structure of the game and the context in which the game is played.

Interchapter B. Visual Design and diagrammatic reasoning in *Bio-equilibrium* game

Following the design process for the *Bio-equilibrium* game, we arrive at the creation of physical and visual components of the game. In the first interchapter, a content analysis process provided a list of words and ideas related to the topic of global warming that is the core topic of the game. These elements were put into different categories of principles, paths, probabilities and prices, looking and defining relationships between them that reflected the actual relationships of these elements in the real-world phenomenon. In this Interchapter, I will show how these elements and their relationships are codified into visual and material representations with pieces that the players can move around in the form of an interactive diagrammatic model.

One thing that is important to mention is that the elements and interactions defined in the content analysis could be represented in a simple way with just text and numbers; in fact, game mechanics were tested using data spreadsheets using formulas to calculate the effects of some game elements in a mathematical way (Fig. 14). This is a form of visual representation that is helpful to visualize the dynamics of the game mechanics during the design process but it needs to be translated into a different visual language that is more accessible to the players.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Bio-Equilibrium Card list												
2	Green Event Cards												
3	Card Name	Global Temp	Bio-diversity	Biodiversity next round	Pollution Waste	Pollution every next round	Money (all or specific player)	Money every next round	Comfort/health	Farms	Votes	Money Business	Research (all)
8	Mandatory flowerbeds ?		2										
9	First Malaria cases						-1		-1				
10	Short winter (bad for seals, less heating)		-2				1						
11	Unexpected heavy rains						-2			-1			
12	Fish mortality (Fertilizers)		-1		1		-1						
13	Tourism Increase - Clean environment						3		1				
14	Lot of snow in winter	-1			1		-2						
15	Random changing spring temps		-1							-1			
16	very heavy storms		-1				-2						
17	Sea Pollution reduces tourism		-1		1		-1						
18	Forest fires	2	-2		1								
19	People eat less meat, waste less		1		-1		2						
20													
21	Average Effects	2	-2		-1		-2		0	-1	1	0	2
22													

Figure 14. Card effects spreadsheet for the *Bio-equilibrium* game.

The design process that we followed for the *Bio-equilibrium* game is based on the concept of meaningful play understood as an experience that emerges when the relationships between actions taken by the players and the outcomes of these actions are both discernable and integrated (Salen, Zimmermann 2004: 34). In this context discernable means that "the

result of the game action is communicated to the player in a perceivable way" (*Ibid,* 34), on the other hand, if the actions taken by a player at some point of the game affect the play experience at a later point we can say that the relationship between action and outcome is integrated into the context of the game (*Ibid,* 35).

In order to generate meaningful play, feedback is required as a way to communicate the outcome of an action to the players. Without feedback the player can´t know if moving a piece on the game board will have a positive or negative effect on his personal agenda, getting him closer or farther to a winning condition (*Ibid,* 34).

Bio-equilibrium is a semi-cooperative game where the players work towards a common goal, reduce global warming, but at the same time they compete with each other trying to achieve their own personal agendas: make money, get votes, live comfortably, etc. This generates a particular tension in the game as the players discover that the actions that contribute to their particular goals can have a negative impact on the overall situation of the game, something that we believe is an accurate representation of the problem with environmental issues that usually are the unintended effect of human activities aimed to fulfil basic necessities and improve the standard of life. This relationship between human activities and the impact they have on the environment is what we intend to represent using game mechanics, however, the feedback functionality is supported mainly on the visual design.

B1. Visual signs in the feedback functionality for a board game

To better understand the feedback functionality, we can refer to the example provided by Peirce about the command "Ground arms" given by a military officer to a squad of soldiers (1931: 5-473). The act of giving the order constitutes a sign that if correctly understood by the soldiers should generate as feedback the sound of the muskets as they are brought to the ground. Here it is important to keep in mind the Peircean notion of sign, explained by Tony Jappy as "the special case where the representamen produces an effect on an animate, and most interestingly, on a human, interpreter" (Jappy 2013: 13). At this point, it is important to mention that signs, including visual signs, are created to fulfil different purposes simultaneously, as Marcel Darceny explains.

> We construct a sign not only because we want to refer to something for practical purposes or to classify it within some useful category, but also because we wish to interpret the world in specific sensory-affective ways. (Danesi 2017: 5)

The aim of the visual design process for a game is to create signs that generate an emotional response in the players as they manipulate these signs with moves performed while playing. In the case of the design for the *Bio-equilibrium* board game, I will focus on two types of visual signs as described by Peirce: symbols and diagrams.

B1.1. Symbols as representations of abstract ideas in the *Bio-equilibrium* game

One of the aims of the game design is to facilitate the identification of the elements that can be affected by the player's actions in the game: temperature, biodiversity, pollution, resources, wellbeing, votes, etc; and do this with the least dependency on written language, the way to achieve this goal is through the creation of a set of graphic symbols (Fig. 15) to represent these elements in different game components.

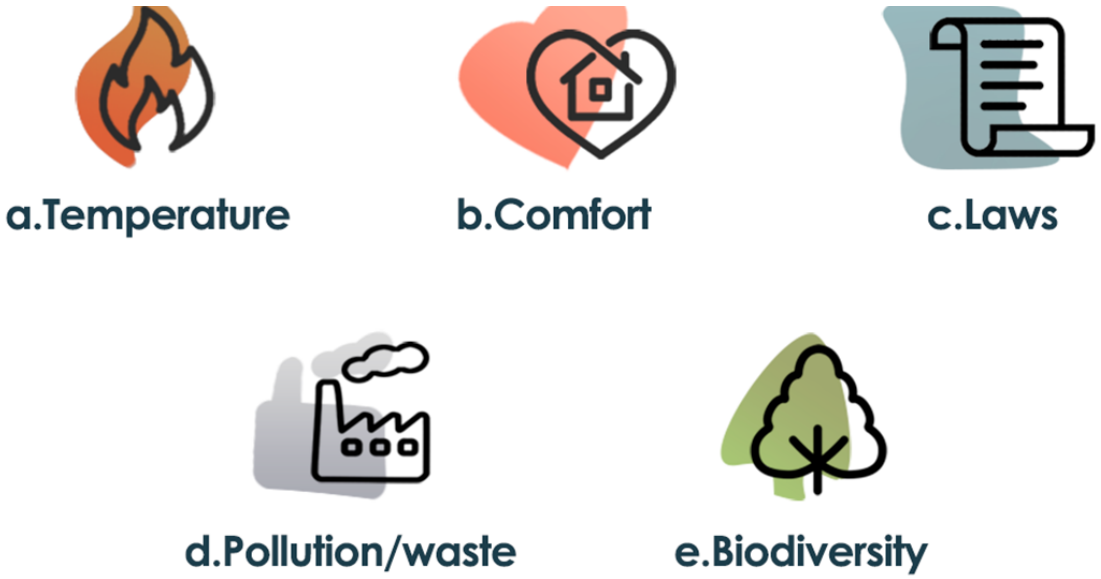

Figure 15. Symbols for the *Bio-equilibrium* board game.

The symbols created for the game work as a way to denote abstract objects, following an association of general ideas as explained by Peirce in one of his definitions of a symbol (1931; 2-292). Abstract notions such as comfort or biodiversity are not entities that could be represented in the form of an icon resembling some of their characteristic features, but they encompass a variety of associated ideas such as well-being, happiness and tranquillity in the case of comfort, and variety of species, life, and environment in the case of biodiversity, that

can be used as a basis to select visual elements which the person following certain rules of interpretation can understand in the context of the game.

The communicative strategy employed in our design process is based on the idea supported by some visual rhetoric scholars that "images work less through cognition and more through affect, emotion, and embodiment" (Danesi 2017: 2), following this ídea we paired shapes and a colour scheme, such as the shapes of a heart and a house with a warm red colour to arouse in the player emotions associated with the idea of comfort (Fig. 15b) or the tree shape and the green colour for the biodiversity symbol (Fig. 15e). Of course, the association is not automatic and outside the context of the game these symbols can be interpreted in many different ways, but once the rules of the game are explained to the players, the use of these symbols should become clear. However, it is important to go through a phase of game testing with actual persons to observe how the players make sense of these symbols and can relate them to the available actions they can perform.

B1.2. Diagrams and collective experimentation in *Bio-equilibrium*

Based on the premise that global warming causes and effects could be controlled by implementing mitigation measures that require transitions in energy, land, urban, and infrastructure systems (IPCC 2018), The design of *Bio-equilibrium* has the purpose of introducing a process of diagram manipulation in which the players could test different pathways proposed by climate scientists to limit global warming while maintaining a sustainable economy.

Taking into account the remarkable results that have been obtained by using diagrams to generate a kind of visual thinking that allows "for experimentation with reality to occur in the imagination (Danesi 2017: 2), we expect that the players of the *Bio-equilibrium* board game get to achieve similar results by implementing game mechanics and visual representations that allow for a process of collective experimentation, see section 2.4, where the individual decisions taken by the players are combined, generating outcomes that affect all the players. This means that to achieve their individual and collective goals players have to coordinate their actions to avoid or generate negative or positive effects in the situation of the game.

On a game board, visual and material components are used to represent the relationships of different elements of the game and the effects of the player's actions on these

relationships. This goes in accordance with the definition of diagrams as "schematic drawings using basic visual elements (points, lines, shapes, and so on) to show how something works or to clarify the relationship between the parts of a whole" (Danesi 2017: 9). In the case of board games, the diagrammatic manipulation can be done by the movement of tokens on the board or the use of cards that could work as diagrams on their own. The effect of the manipulation in the distribution of components in the board generates the feedback required to make the player actions discernable and integrated. In the design process for *Bio-equilibrium,* we aim to generate the mechanisms that allow the players to manipulate the game components and generate results similar to the ones described below.

> The joint manipulation of public representational formats (materially instantiated models, figures and diagrams, even linguistic representations, etc.) enables participants to stimulate each other in ways that may make a group perform better — as a whole — than the mere sum of its members' contributions (Tylén *et al.* 2014: 266).

In the first subchapter, I focused on the concept of resources as how it was applied in the field of ecology studies and in the context of game design, Here I take this element again to explain how abstract concepts are translated and integrated into the visual structure of a diagram, so they can be used for collective experimentation by the players.

B1.3. Visual and material representation of resources with pieces and paths

As previously explained, One central component of the design process is to create a symbolic system to represent the principles, probabilities and prizes defined for a board game, a process similar to the phase of premises declaration for a diagram, see section 2.2. This system should be easily understandable by all players and most importantly, must provide a clear integrated representation of the actions (moves) that the players can perform at any point of the game and of the effects that they have in the status of the game. In the case of the resource, criterion understood as any natural or man-made element, material or immaterial that by some internal, independent mechanism can replenish itself (Farina 2011: 20); the aim of the visual and material design for the *Bio-equilibrium* game is to represent available resources: time, money, knowledge, biodiversity, technology, etc. and how the players can gather, manage, and use these resources to achieve their goals.

The availability of resources is affected by different factors that in the board design are represented by tracks, including global temperature (Fig. 16), biodiversity, pollution and waste levels (Fig. 17).

By moving pieces over these tracks the players can have an idea of how their actions affect not only the general conditions of the game but also their access to resources in the form of time and available actions. Most of the game information, including the players own resources, is openly available to all players with the intention to reduce deceiving tactics like bluffing and allowing for better-informed decisions by all players.

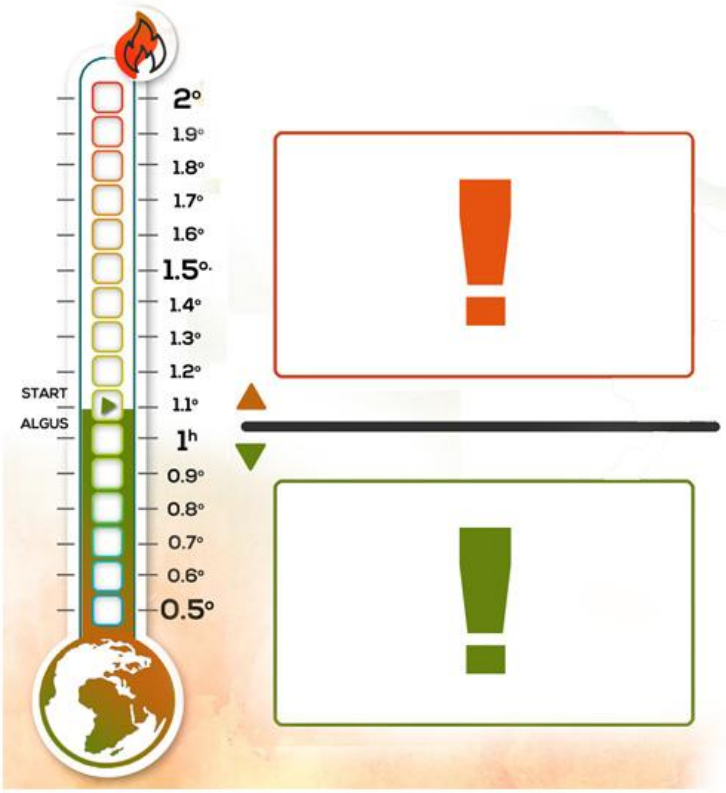

Figure 16. Global temperature track and event decks spaces in the *Bio-equilibrium* board game.

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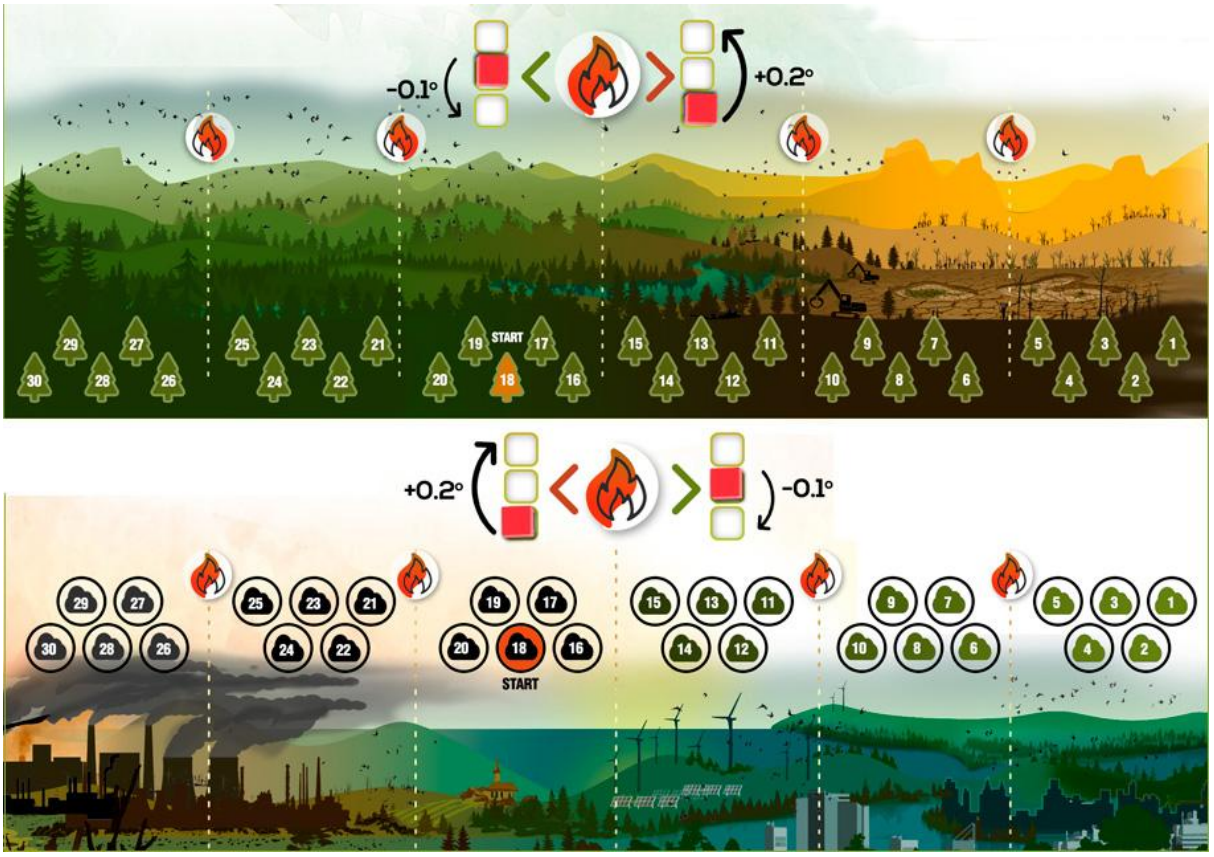

Figure 17. Biodiversity (top) and Pollution/waste (down) tracks

During the game the players can expend resources to play action cards (Fig. 18) with icons that represent pollution (Fig 15d) or biodiversity (fig. 15e) and an associated value that instructs how much the corresponding tokens move along the corresponding biodiversity or pollution tracks (Fig. 17), if the token crosses some points in the track indicated by the global temperature icon (Fig 15a) this means that the temperature marker must move up or down in the global warming track (Fig 16). The position of the temperature marker indicates what kind of event card should be revealed in the next turn of the game that could have potentially harmful effects, red exclamation card deck or normal events, green exclamation card deck (Fig 16), generating a positive or negative feedback loop that makes more or less difficult for the players to achieve their common and particular game goals

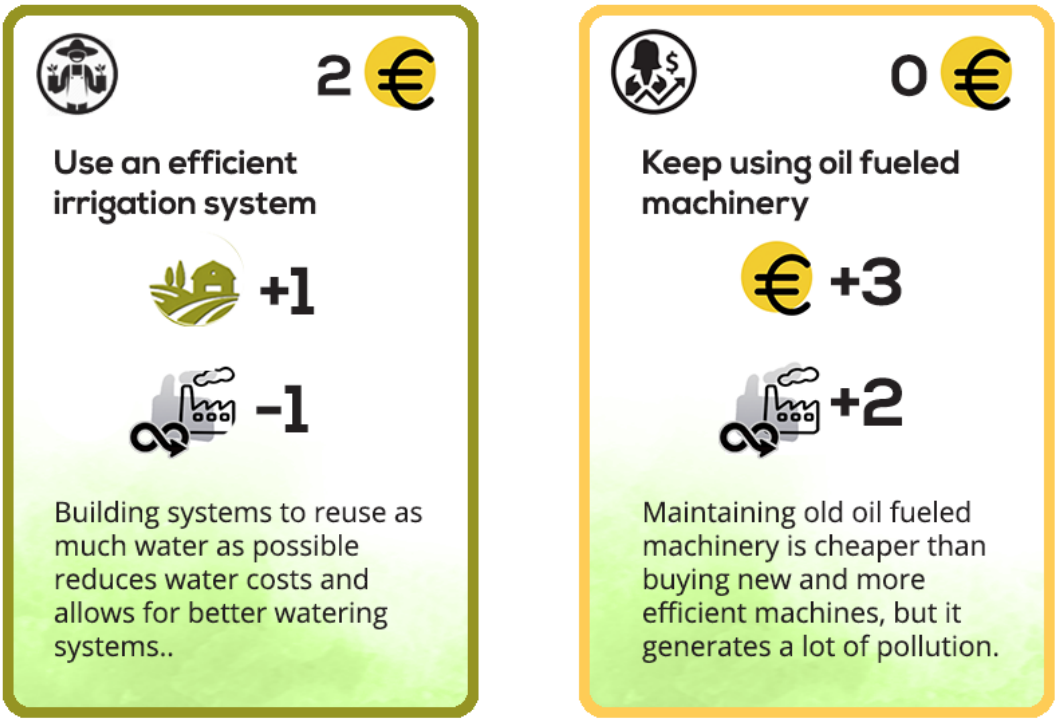

Figure 18. Player action cards

The game also includes personal player boards for each of the represented characters, where the actual situation in terms of resources and individual goals is presented to the players (Fig. 19).

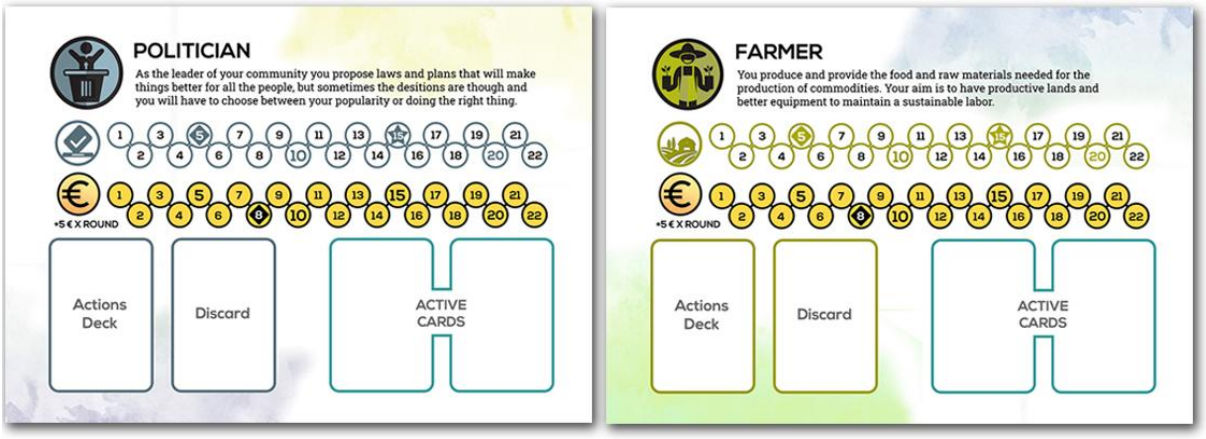

Figure 19. Bio-equilibrium Politician and Farmer player boards.

The result of the game design process is an integrated board diagram (Fig. 18) where all the information pertinent to the game is visually represented in a way that is accessible to the players and allows for different forms of manipulation following some basic rules. The

idea of entropy is introduced to the game in the form of random cards generating unpredictable situations that the players will have to solve by means of negotiation and cooperative actions. In some games poor decisions and lack of coordination could lead to failure collectively as the temperature marker gets above the critical level, In others, they could manage to keep the temperature low while some players manage to achieve their goals. In either case, the insights obtained not only can be applied to future games but, hopefully, will allow the players to view the global warming issue from a new perspective where they can get a better understanding of the impact they can have on this situation and maybe even become generators of creative and effective solutions.

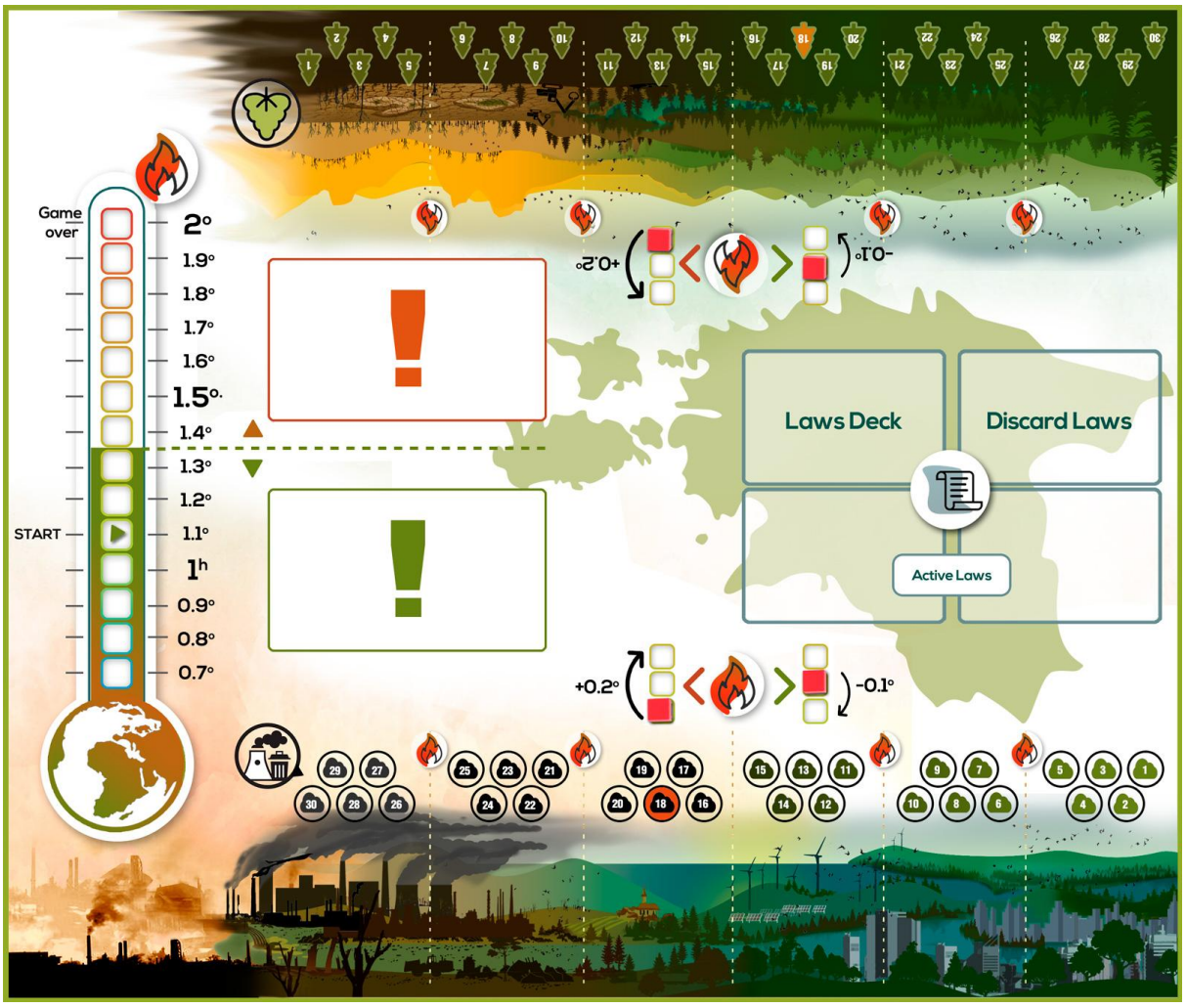

Figure 20. Bio-equilibrium mainboard design as a diagrammatic model of global warming.

Chapter 3: Chronotopical analysis of board games

In the previous two chapters, I have described how board games can work as play-type models of objects and events in the real world, and how these models are translated into visual and material representations constructing diagrams that allow for individual and socially distributed experimentation (Tylen *et al*, 2014) generating new insights and meanings. However, these descriptions are not enough to account for the role of board games as an object of cultural mediation and cultural auto-communication that "enter into complex relations both with the surrounding cultural context and with its readers" (Lotman 1988: 55), or, in this case with the players. This role must be analyzed so we can explain how *transformative play* (Salen, Zimmermann 2004: 34) emerges from the interaction between the players and the game as a cultural object.

This chapter aim is to expand the notion of cultural chronotope as developed by Torop (2000, 2013, 2019), based on the original notion by Bakhtin (1981) by applying the method of chronotopical analysis to the particular case of board games; but to do this, it is important to examine how the notion of chronotope is used by Bakhtin as a category for literary analysis and how it evolved into a multifunctional framework for a transmedial approach to different languages of culture such as cinema (Torop 2013; 2019) and other research fields as in the case of landscape experience analysis (Remm, Kasemets 2020).

3.1 Chronotopical analysis as a methodological framework

The notion of chronotope as the "intrinsic connectedness of temporal and spatial relationships that are artistically expressed in literature" (Bakhtin 1981: 84) was borrowed from Einstein's theory of relativity that first introduced the notion of a unified space-time structure (*Ibid)*. Of course, the mathematical description of the space-time continuum proposed in the field of physics is quite distant from the psychological and cultural description of time and space proposed by Bakhtin, although some elements like the incidence of the observer frame of reference on the interpretation of an event may have some resonance in the notion of chronotope.

The original intention of Bakhtin was to create a methodological framework to explore and understand how time and space take on flesh and become visible and integrated into artistic literary texts, how they define genre and generic distinctions (1981: 85) and constitute

an entrance to the world of meanings. The concept of the chronotope as proposed by Bakhtin may present some analytical difficulties as the scope has changed during the years in his texts (Holquist 2002) from a local understanding of specific literary narrative forms where the chronotope has effects on the life of a single person, such as the protagonist of a Greek romance (2002:110), to a more general treatment in the notes written in 1970-71 (Torop 2013: 244), where he attempts to provide a more robust framework that expands the scope of the chronotope to include the author, the readers and the way meanings generated by the text enter into their social experience (Bakhtin 1981: 258).

Torop uses this general scope of the chronotope to create a universal model of intersemiotic translation processes (2000). This model is applied initially for the analysis of literary screen adaptations (2000, 2013) but the scope expands to other cultural media. The chronotopical view aims to enrich analytical tools for a deeper and more productive understanding of different kinds of texts, artistic, cinematographic, performative, etc. (2000).

In the case of board games, the experience of meaningful play depends on the creation and use of diverse signs: spaces on the board, icons on cards, dots on a dice; whose relations with each other are explained to the players using a verbal or visual rendering of the rules of the game; but, as mentioned before, the aspects of space and time in the boundaries of a board game have to be dealt with initially on two different levels, one of the real space-time sphere where the game is taking place, and other at the level of the spatio-temporal universe represented on the board. There is a possible additional level of analysis related to the conceptual chronotope where we can observe the relations between the world represented on the game board and the world where play occurs. Bakhtin is aware of this process of exchange between levels where "the work and the world represented in it enter the real world and enrich it, and the real world enters the work and its world as part of the process of its creation" (1981: 254) and considers that there is a special creative chronotope where this "exchange between work and life occurs" (1981: 254).

Assuming that board games are one type of text with a particular nature that set them aside from scientific and artistic texts, my idea is to observe how the parameter of the chronotope is manifested in this kind of games at different levels, given certain particularities of games that will become evident as we delve into the different levels of chronotopical analysis.

3.1.1 Torop‘s Chronotopical analysis framework

Chronotopic analysis, as Torop points out, “is not limited to the comparison of analyses of time and space, a chronotope as a space-time must add something new” (2019: 72). This something new emerges as the analysis allows us to observe how abstract elements of a text take on flesh and blood as they gravitate towards the chronotope (Bakhtin 1981: 250). Also, the chronotope is an effective tool to analyse other aspects of a text such as the authorship and the ideological status of the text related to other texts in the cultural environment where it is produced and consumed. (Torop 2013, 2019).

In the case of board games, the relationship between time and space is represented in the form of diagrams as described in the previous chapter, and, as it happens with other texts such as film, the structure of space-time can be reshaped in different ways, compressing or expanding it like a plastic material to fulfil the narrative needs of the author. When the players put the rules of a game in motion, a “magical circle”, as described by Huizinga (1980), is created where special rules apply and time flows at a different pace; years or centuries can occur in the lapse of some minutes or a scene that would take seconds in real life could take various minutes of playtime. What is notorious is that every person involved in a game is aware of this particular spatio-temporal structure and able to act in a way that is coherent and articulated with other player actions. This occurs simultaneously at the different levels that chronotopical analysis involves, as illustrated with some examples in the next section.

3.2 Levels of chronotopical analysis applied to board games

Chronotopical analysis comprises four questions that address the different and interconnected levels of the chronotope (Torop 2019: 71). The first question is about the way an event or succession of events is depicted in the story over a space-time structure. How much the point of view of the characters in the story stands out as typical or atypical in relation to some common forms is the question addressed in the second level of analysis. At the third level, the question involves the worldview of the author and the conception of the text. Torop introduces an additional question about the sociocultural context in which the text is created and the possible interpretations that can emerge in other times and places. This level, presented as the creative chronotope, resonates with the short fictional text by Borges about the curious enterprise attempted by a French writer of the early twentieth century of

rewriting the paramount novel by Cervantes in *Pierre Menard, autor del Quijote* (1971), where he shows how the same text can be interpreted in very different ways just by changing the temporal and geographical context of the author.

3.2.1 The topographical chronotope

The structure of time and space in board games is represented in a quite different way to the usual linear structure followed in books and films. As described in the previous chapter, board games work as diagrams where the relations between the different elements of the object or event represented are laid out on the visual design of the board and in the material components that allow the players to manipulate the diagram by moving meeples and other pieces over the game space.

Unlike books or movies where you can go back some pages or skip to another scene if you're using a dispositive like a video player, in board games is very difficult to return to a previous state of the game unless someone is keeping a record of the movements done, and almost impossible to jump to a future state of the game as this involves some level of uncertainty produced by randomizers or just the internal mental process of the players. Even in chess where it is possible to anticipate some of the moves of another player, one of the core strategies is precisely to make moves that the opponent has not expected. Additionally, there is an idea that each time a board game is played, it is different to other games. Of course, for some simple games, this is not entirely true but in general, you can have from thousands to mind-blowing numbers of possible variations in games like chess or go.

All this means that the structure of time and space in board games is not conditioned in such a strict way as it is in most books, paintings, theatrical plays or movies. However, there are some interesting experiments to introduce some level of variation on different kind of texts, for example, in experiments of collective creation where multiple writers continue a story proposed by other persons, something that has become popular in *fanfiction* (Colás *et al.* 2017) or by playing with the time structure of events in a movie, something that Warren Buckland has named *puzzle films* (2009), in which the spectator is involved in some kind of deductive where he has to figure out the actual timeline of events that might allow him to discover some kind of secret meaning that is not accessible without this sort of mental play.

On a topographical level, board games use the bidimensional space created by the board to represent in different ways a physical space or the passage of time, as in the next

examples of vintage board games. In *European travellers* (Fig. 21) the European continent is effectively represented by a map, with the particularity that illustrations of notorious landmarks or activities from each region are incorporated in the respective space. One common way to represent time visually is using a linear structure as in the case of *The New game of human life* (Fig. 22) where the different stages of ageing are represented in a sequence of spaces over the board, each one containing a particular aspect of human virtues and flaws that should be emulated or avoided, for example, "The Studious Boy" in space 7 or "The Drunkard" in space 63. In these examples, the players don't have too many possibilities of creating a play strategy as the movement over the board is defined by rolling numbered spinners, which indicate how many spaces the player moves. In some cases, the spaces have special rules that move the player onwards or backwards or allow for a second spin. But this is mostly outside the control of the players, so it would be possible to view this kind of game as a representation of the idea of fate or chance as the forces that guide human life.

Figure 21. Representation of space in *European travellers, an instructive game*, Edward Wallis 1845. Source: "Liman Collection of Board Games & Puzzles, John Hay Library, Brown University."

In the previous examples, we can see physical space or time represented over the bidimensional space of the board, but the articulation between these two elements is weak or nonexistent. I'm going to introduce *Tokaido* (Bauza 2012), a recent or "modern" board game where the representation of space and time is more articulated and the development of game strategies by players is fundamental for the purpose of winning the game.

Figure 22. Representation of time in *The New game of human life* by Edward Wallis and Elizabeth Newberry 1790. Source: "Liman Collection of Board Games & Puzzles, John Hay Library, Brown University."

Antonine Bauza, a French game designer and author of *Tokaido*, explains that the idea for the game is based on the landscape series by Japanese *ukiyo-e* artist Ando Hiroshige titled *The Fifty-three Stations of the Tōkaidō* (1832). Bauza mentions that his intention was to create a "Zen" game, to replicate the experience of being an artist in feudal Japan looking for inspiration while travelling through the awe-inspiring landscapes of this land (Bauza 2008).

Figure 23. Tokaido main board, Source: (Bauza, 2012)

The famous historical Tokaido road that connected the cities of Kyoto and Edo (present-day Tokyo) following the south-eastern coast of Honshu is the setting for the story depicted in the game. In those times, it took the travellers about two weeks to complete the 514 kilometres long route, stopping to rest on one of the 53 rest posts along the road. This route is visually represented in the game by the line of circles and icons depicting temples, fields, shops and Inns (Fig. 23); each spot linked to some actions available to the players that move their meeples there.

Contrary to the vintage games mentioned before, *Tokaido* is not dependent on a random generator to define the player's movement, each player in their turn can decide how far they want to move their meeples along a stretch of the road depending on the strategy they have chosen (Fig. 24). The element of uncertainty comes from the difficulty to figure out what moves the other players will make and how they can help or interfere with a personal strategy.

The line of circles on the board not only represent the spatial dimension in the game but also the temporal dimension; each section of the road corresponds to a period of time used by the travelling characters before stopping to rest in one of the Inn spaces. Zen tradition plays an important role in the temporal aspect of the narrative because it subverts the genre of *Race games* where the players move their pawns trying to be the first to cross a finish line; Contrary to this, in *Tokaido*, the goal is that the travelling artists take as much time as possible enjoying and recreating in artistic ways the many experiences that the Tokaido road had to offer. So more than a frantic competition of speed, the atmosphere of the game is of zen contemplation and quietness.

Figure 24. Tokaido meeples on the board, Source: (Bauza, 2012)

Tokaido is a good example of how the timespace (chronotope) could be presented as a diagram on board games, providing not only a base structure for the story but a mechanism that allows players to experiment with the narrative producing a vast array of unexpected meanings as they become in some way characters on the story, which lead us to the next level of analysis.

3.2.2 The psychological chronotope

The world of the semiotic states, thoughts, words and actions of the characters constitutes the psychological chronotope (Torop 2013: 246). This is also the chronotope of the narrator (Bakhtin 1981: 356) as a hero of the story. At this level, we can find again a fundamental difference between games and other forms of texts. From a temporal point of view in novels, films, and other linear texts, all the decisions made by the protagonists and their effects in the story are already present in the pages or photograms and the readers and spectators are limited to observe how the plot unravels; following a kind of fate decided by the author. But in games, there is no such predetermined fate and the players can become the characters in the story and make the decisions that would define how it will end.

At this point, it is important to mention again the balance between mechanics and theme in board games. Not all board games involve characters or a conventional narrative, this is particularly evident in what is known as “abstract games” where there´s no theme or it

is used only as a superficial coating to give some colour to the mechanics. The ancient game of go is the perfect example of an abstract game. However, we can say that in these cases the narrative leaps to a metalevel where the event of playing the game is the story and the players themselves are the protagonists. But that is another story and shall be told another time.

In the scope of this research, I will focus on the category of thematic board games, where the balance leans more in the thematic aspect of the game and the mechanics are designed to provide a solid structure for the development of the story. And here again, Bauza´s *Tokaido* provides a good study case.

Figure 25: Tokaido characters cards, Source: (Bauza, 2012)

Many questions appear during a game of *Tokaido*. Will Hirotada the priest stop at the next temple in the road to make offerings to the *kami* or would he prefer to finish his painting of the mountains? Would Sasayakko be able to visit the local shop to buy fine clothing and souvenirs before taking a relaxing bath in the next hot spring? As the players move the meeples representing their characters on the board they advance the storylines that interweave creating the tapestry of the game story (fig 25). In this sense, the players are at the same time participants but also authors of the story, which lead us to the third level of the chronotopic analysis.

3.2.3 The metaphysical chronotope

The third level addresses the question about the author's conception of the text (Torop 2019: 71), and how this is a reflection of the spatial and temporal point of view in which the creator is situated (Bakhtin 1981: 256). With board games, as it happens with other media like films or comics, is not usual to find a single author but a team of authors instead. The game designer might be in charge of creating the mechanics, rules and storyworld for the game, while a visual designer has the task to translate these elements into visual and material components that should be visually attractive for the players and, at the same time, able to convey to the players the network of relations between the elements of the game and generate meaningful play. This adds some complexity to the metaphysical chronotope as it becomes a conversation between different levels of the play-type model where different points of view may converge or even collide.

However, aside from the situation of having a team of authors in the creation of a board game, there is the additional situation that board games are not closed texts but open ones in the sense described by Umberto Eco, where "the reader finds his freedom (i) in deciding how to activate one or another of the textual levels and (ii) in choosing which codes to apply. (1979: 39). The collaborative activity of actualizing the text performed by the reader acquires a new dimension in board games because it allows the player to generate new meanings as he explores the possibilities generated by random elements and may become a collaborative experience since multiple participants contribute to actualizing the text.

We can say that in the case of board games the authors, creating a narrative with a specific purpose, provide the storyworld and the rules that allow the players to interact with the text to create new storylines, but it is up to the player's decisions to define how the narrative of the game evolves, which could lead to readings that depart from the author´s original conception. As in the case of *The Landlord's Game* by Lizzie Magie where the original conception of creating the game to show the negative consequences of land-grabbing policies turned into a narrative promoting the ideals of capitalism when the game was rebranded as the widely known game of *Monopoly.*

3.2.3 The creative chronotope

Situations similar to the example of the *Monopoly* game and the way the original conception of a text can be transformed lead us to the level of the possible world of interpretation of a text (Torop 2019: 71). As with any other types of texts, the author's sociocultural behaviour when creating a text such as a board game does not necessarily correspond to the behaviour of the players when they play it in other socio-cultural contexts. The meaning of the pieces and the rules of the game of chess when it was created by an unknown person living in India two thousand years ago, is not the same that it had for a player of chess in the European Renaissance or a world-class champion like Gary Kasparov in a game against a chess-playing computer (Fig. 26)

Figure 26. Deep Blue versus Garry Kasparov 1997 (AP Photo/George Widman)

Figure 27. Colonial ideology in *The Noble Game Of The Elephant And Castle, Or Travelling In Asia* by William Darton, 1822. Source: "Liman Collection of Board Games & Puzzles, John Hay Library, Brown University."

The question of ideology, as Torop points out, can be raised at the different levels of chronotopic analysis (2019: 72) but it takes particular relevance at the level of sociocultural behaviour, where ideology permeates the process of intersemiotic translation; an example of

this is *The Noble Game Of The Elephant And Castle, Or Travelling In Asia* (Fig. 27), one of the popular travel games in the British Victorian era that, along with the educational purposes, reflected the imperial ideology where the countries in the colonial world are view through the lens of exoticization while establishing a distinction between uncivilized customs of foreign people and the civilizing influence of the empire.

In contemporary board games, we can observe other forms of the ideological aspect of the chronotope, particularly in games based on other narrative mediums, where the authors have to find strategies to translate the topographical and psychological elements of the source into mechanics and visual and material components of the game.

The board game *The Pillars of the Earth* (Fig. 28), designed by Michael Rieneck and Stefan Stadler (2007), based on the novel with the same title by Ken Follet (1996) provides an interesting study case of intersemiotic translation in board games. In this game, the players take the role of medieval builders trying to achieve prestige helping in the construction of a gothic cathedral for the fictional British city of Kingsbridge.

Figure 28.The fictional city of Kingsburg as a topographical chronotope in *The Pillars of the Earth* l (Photo by Natalia Alejandra Arango, 2020).

To achieve their goal of becoming the most prestigious builders, the players must use the game mechanics of *worker placement*, explained below, to obtain and manage the resources and artisans required for the construction. By the end "the player who has used his or her gold, craftsmen, and time most efficiently will be the winner" (Rieneck & Stadler: 2007:1). This game can be studied as an intermedial translation of Follett's novel, which, in turn, is a translation into the language of literature of the Gothic cathedral as an artistic text and a model system of the world in the middle ages.

The gothic cathedral is a good example of architecture as an artistic text as proposed by Lotman, it is "designed in an attempt to reproduce the structure of the universe... the cathedral is perhaps best understood as a 'model' of the medieval universe" (Von Simson 1952:16). This model also defines the social and political structures of the time; the clergy, the monarchy, the nobility and the commoners were bound in the medieval society in a "vision of organic unity emanating from heaven" (Scott 2003: 232), the gothic cathedral and other religious buildings were "important settings for expressing this unified order and its link to heaven"(ibid.)

The novel by Ken Follett's becomes an intersemiotic translation of architecture into literature, where the relations between political power, religion and the life of common people represented in the language of stone and geometry are incorporated in the structural tapestry for the narrative and embodied in the characters of the novel. Follett mentions in the introduction to the book that he aims to map the network of "scientific curiosity, commercial interests, political rivalries, and the spiritual aspirations of earthbound people" (1996) that explains why the construction of a cathedral was a meaningful project for the people of the Middle Ages in a similar manner that exploration of outer space is for people nowadays.

The interrelations generated in the project of building a cathedral, represented in the different layers of Follet's novel, are translated into the rules of the board game. The players are given the role of "Master Builders" (Fig. 29) with a clear objective: "You will work together on the monumental building, each using their workers and competing to make the largest contribution to the cathedral's construction" (Rieneck & Stadler: 2007:1). This work requires the players to be ready to face unexpected circumstances.

> No cathedral builder could predict weather, famine, drought, plague, or war, or if sufficient funds would be available to keep the building project on course. But he could control how the construction work was organized. (Scott 2003: p.140)

The players then must experience the difficulties of harvesting the materials for the project, hiring and organizing specialized artisans and resolving unexpected situations randomly generated by the game mechanics that are similar to the ones faced by actual cathedral builders in that time.

Figure 29. Master Builders and resource tokens on the game board (Photo by Natalia Alejandra Arango, 2020).

The process of translation of architecture into literature and this into the *parole* of board games is not only limited to the reinterpretation of topographical or psychological chronotopes by the author of the novel or the game designers, but also generates an overlapping of ideologies and sociocultural contexts that, in the moment of playing the game, are also subjected to the particular view of the players that may have the experience of visiting a gothic cathedral, or read the novel, or seen the TV adaptation; so the different interpretations that the players can produce are in a higher or lesser measure influenced by their own experience and sociocultural behaviour; something that emerges as they put the rules of the game in action and make decisions while assuming the role of a medieval builder, and leads to transformations that not only change the structure of the game itself but also may have effects at the social level and in the cultural structures, that, for example, in this case shape the perception that players have about the medieval world but also the way they

understand their own socio-cultural environment. This is what Salen and Zimmerman call transformative play (2004: 305) a process that I will try to explain in the final inter-chapter where I apply a chronotopical analysis to our *Bio-Equilibrium* game design project.

Interchapter C. Chronotopes of the *Bio-equilibrium* game and transformative play.

To do a chronotopical analysis of our project *Bio-equilibrium,* I have decided to go on a top-down process starting with the creative cultural chronotope and descending to the level of the topographical chronotope that has been described in the previous interchapters.

The history of our project begins at the start of 2019 in Tartu Estonia, during one of the warmest winters on Estonia's climate records (ERR 2021). The Nature Education office of the University of Tartu Natural History Museum - Tartu Ülikool Loodusmuuseum, asked for an educational game aimed to the visitors of the museum, particularly school students, on the topic of climate change to give them a better understanding of the causes behind situations such as the short warm winters and how any person could contribute to the solution of this problems.

In the words of Elen Kontkar, nature education specialist of the Natural Museum, the *Bio-Equilibrium* game "helps to understand that although taking action NOW is difficult, dealing with the results of not taking any action to prevent the problem is much more difficult"[5]. It is clear that the game project responds to an actual intention not only of providing some information on climate change but to motivate the players to behave in real life in ways that contribute to the solution of the problem modelled on the game, In this sense, the aim of the game is to generate transformative play as described by Salem and Zimmerman (2004: 305)

C.1. Ideology at the levels of the creative and metaphysical chronotopes

As the designers of the game, we are conscious that our conception reflects a particular ideology related to the ideas of the environmentalist movement that in the case of Estonia has a close relationship with the independence movement and the construction of a

[5] Elen Kontkar, email to the author, April 15, 2021

national identity (Auer, 1998). However, as Torop points out, it is possible that at the moment of play many different interpretations may emerge leading to ideological reorientation and ideological polyphony (2019: 71). This is something that we expect and even try to encourage in the players; the aim is not to push some particular ideology but to let the players assume different positions and point of views and experiment with different ways to deal with the problem of global warming.

It is not realistic to pretend that as authors of the game our standing is perfectly objective and the final text in the form of a board game is not the result of our socio-cultural behaviour. The most that we can do is to create a model based on actual and accurate data from sources such as the Environmental Agency of Estonia - Keskkonnaagentuur - and the Climate Change Knowledge Portal by the World Bank Group. This model designed in the form of a diagram as explained in the previous interchapter should allow the players to visualize and manipulate the data presented, to establish relationships between the different elements portrayed and through a process of collective experimentation to generate their own insights and conclusions on the problem of global warming.

As mentioned in point 3.2.3 regarding the metaphysical chronotope, board games have the particularity that they are usually not the product of a single author but of a team of authors; that is the case of the *BioEquilibrium* board game, a collaborative work between Ellen Konktar, nature education specialist of the Natural History Museum and me, Carlos Guzmán, in the role of the visual and game designer. The core concept of the game is then the result of a dialogue between two different approaches to the same issue where the notions and ideas provided from the point of view of nature education had to be translated to the rules and visual components of a game while trying to preserve the underlying concept.

The conceptual world of the *Bio-Equilibrium* game is constructed around the core idea that humans have a direct effect on the global warming situation through their individual and group decisions and actions. The mechanics developed for the game and the visual and material components have been created to support this concept.

Climate change is a phenomenon that has multiple contributing factors, natural and human-related which makes it an extremely difficult problem to solve. It would be impossible to generate a play-type model that could integrate all these different factors into a single game, so a big part of the game design process has been to decide which of these factors should be integrated into the narrative supporting the core idea of the game.

C.2 *Bio-equilibrium* player roles and the psychological chronotope

Entropy is the main concept behind global warming, as the physicist and science advocate Michio Kaku explains, the amount of energy that one civilization requires to sustain itself will unavoidable generate entropy in the form of waste heat, chaos and pollution (2012: 397) and as the civilization grows the amount of generated entropy increases as it has happened in an accelerated rate during the last two hundred years of human history.

Human individuals and communities have a set of basic necessities that cannot be avoided: growing food, moving from one place to another, gathering and processing huge amounts of information, etc. all these activities impact in one way or another the surrounding environments. The solution to this situation, as Kaku points out, is not to stop the activities that humans need to do to survive and grow but how to create ways to control the excess of waste and heat (2012: 398) to maintain a sustainable global society where the needs of all humans are covered without making the planet uninhabitable.

One of our main problems as designers of a board game about climate change was to find a way to reduce the problem of entropy production to a human scale where the players could act as protagonists that through their actions may increase or decrease the levels of waste heat and pollution. To do so we decided to create five archetypal characters representing not only a single person but a segment of the population in a modern country like Estonia. After a process of content analysis and filtering we came up with five basic characters: The citizen, the politician, the farmer, the entrepreneur and the scientist (Fig.30) Each one with a particular set of goals and actions that contribute to transforming the overall state of the game and the final outcome. Tuus creating a non-symmetrical type of game where the initial conditions and possible moves are not identical for all the players.

Figure 30. Character icons for the Bio-equilibrium game

As a diagrammatic model, a network of relations is established between the player's characters and the world represented in the game (Fig. 31). The farmer produces the basic goods that citizens and entrepreneurs require, but as farming land increases natural ecosystems disappear contributing to the environmental damage; the entrepreneur provides goods and services that citizens need to increase their quality of life but in doing so they generate industrial waste deteriorating many ecosystems. Research of new technologies that allow entrepreneurs to create new products is one of the roles of the scientist and also the production of scientific knowledge that could provide solutions to environmental problems. The politician may present laws and projects that the other players may approve or reject by votes, increasing or decreasing his popularity index.

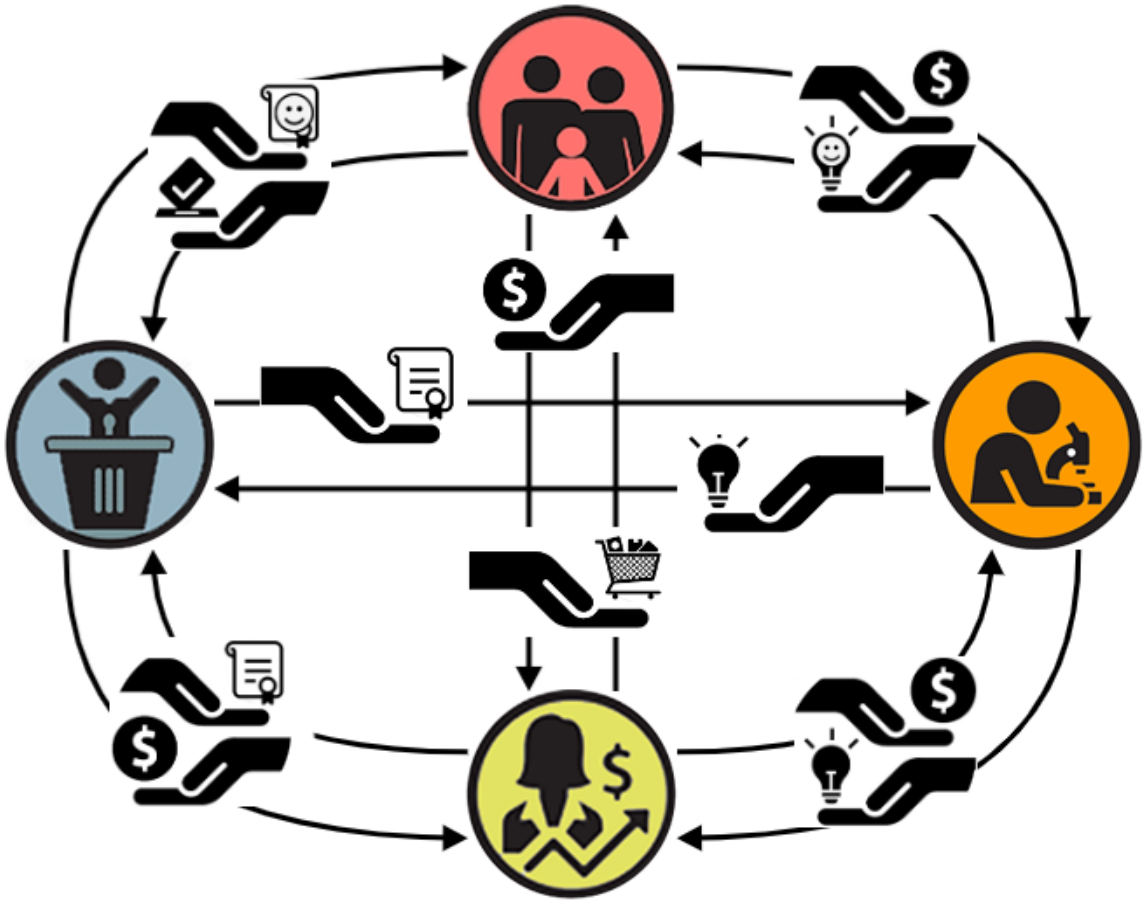

Figure 31. Diagram of the interactions network between characters in *Bio-Equilibrium*

Again, an ideological component is necessarily present in the narrative behind the roles created for the game. For example, the idea of the entrepreneur as a person whose only

interest is monetary gain as this is the goal assigned in the game may lead to the interpretation of industrial activities as intrinsically "evil", same for the role of the scientist that might be portrayed as the hero that creates magical solutions to difficult problems. However, the game mechanics allow the players to decide how they want their characters to behave. Will the entrepreneur invest in green technologies that reduce the energy consumption and waste production of his company? Will the players approve a new law from the politician that generates more money for all at the cost of destroying natural ecosystems?

These individual and collective moves work as a collective manipulation of the game diagram whose results should give the players the opportunity to analyse and discuss how their decisions bring them closer or farther from their goals, and how these insights can be extrapolated to their role as habitants of this planet.

C.3 Ideology at the level of the topographical chronotope

The visual and material representatión of time and space in the *Bio-equilibrium* board game has been described in detail in the second interchapter with the game board presented as a diagrammatic model of the interrelations between the player's actions and their effects on the game. As the simultaneous time frames of the play activity and the narrative play of the game history moves forward, decisions made by the different characters of the game trigger different effects that could improve or decrease their chances of achieving their individual and collective goals.

In this section, I want to focus on the way that visual representations of concept elements of the game somehow introduce an ideological aspect to the chronotope of the reality depicted in the board game as a text. Particularly I will refer to the case of the visual representation of pollution and biodiversity in the game.

During the design process, as we decided to establish the concepts of waste/pollution and biodiversity as key factors that directly influenced the global climate value in the game, the problem that emerged was how to represent the adverse or beneficial effects of the player's decisions related to these elements. A first idea was to use icons and meeples with the shape of black clouds to represent pollution and green trees to represent biodiversity (Fig. 33).

Figure 32. Black cloud - Pollution and Green Tree - Biodiversity tokens.

However, the representation was still too abstract and failed to convey the idea of how the different levels of pollution or biodiversity had an effect on the topographical world of the game. Elen Kontkar proposed an interesting solution consisting of creating an illustration where the players could see the different stages of pollution and destruction of ecosystems.

As the visual designer of the project I had the job of translating Elen´s idea into game art, the result is two illustrations where different stages of pollution (Fig. 33) and biodiversity (Fig 34) are visually represented. These illustrations clearly represent a visual rhetoric where the colors and iconic elements are used with the intention to generate some emotional response and hopefully a measured analysis of the game situation.

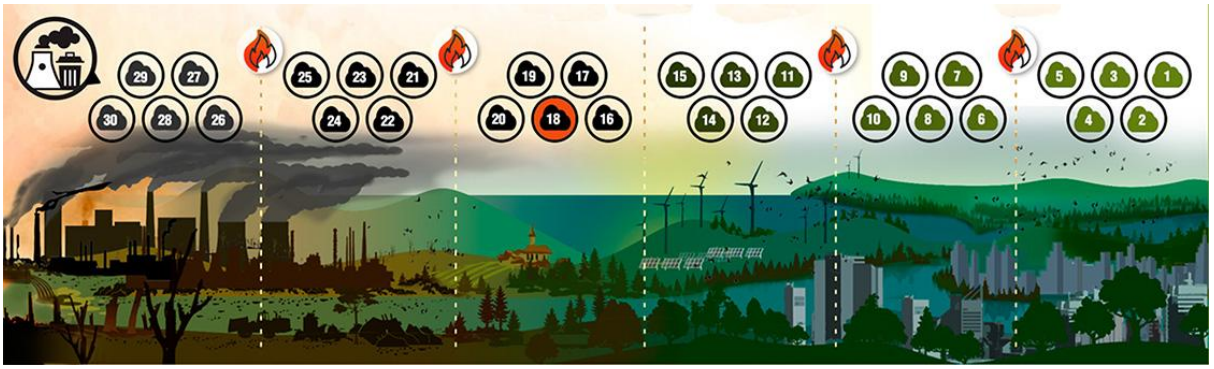

Figure 33: Waste / Pollution track

As the players add or remove cloud or tree meeples from the tracks they get a visual cue of how close they are to a catastrophic situation; crossing from one stage to another, represented by the flame icons increases or decreases the global temperature, and if the tokens fill or are totally removed from one of the tracks it means the end of the game as a commun victory or defeat.

The sum of these components in a diagrammatic model, should provide the possibility to experiment with the different factors that have an influence in the global warming

situation, but in particular, as it has been the goal of this project, to let the players to put themselves as key actors in this situation with the power to generate and implement creative solutions to this real problem.

Figure 34: Biodiversity track

CONCLUSIONS

Considering the growing popularity that board games have acquired recently in the competed industry of entertainment and the increase of their complexity both in their internal mechanics and in their themes; this thesis aim is to provide a theoretical framework that could be used to analyse different aspects of this kind of games and the impact they may have in the cultural context where they are created and played.

The research work for this thesis is based on a mixed methodology that involves, on the one hand, a theoretical component with the analysis of conceptual tools to build a framework for the study of board games as cultural texts; and on the other hand, a practical application of this tools in the creation of *Bio-equilibrium*, a board game on the topic of global warming for the University of Tartu Natural History Museum. Here I will summarize the products and insights generated by this project.

Three questions were formulated at the start of this thesis about different but interrelated aspects of board games as a cultural object.

The first question had to do with the possibility of using board games as a model of reality and how this model is different from the scientific and artistic modelling systems, this question is addressed in the first chapter of this thesis.

Connected to the first question, a second one asked about the form in which the play-type model described in the first chapter is presented to the users and how the particular characteristics of board games allow for collective experimentation. The notion of the diagrammatic model is introduced in the second chapter to provide an answer to this.

In the last chapter, chronotopical analysis is used to address a final question about the way board games as play-type models may have an impact in their surrounding cultural contexts in the form of transformative play, this as the result of the contact between the creators, the players and the socio-cultural environment in which the activity of playing a game takes place.

One product of this research process is a theoretical framework for the analysis of board games supported by three interconnected legs.

The first leg is represented by the play-type model introduced by Jury Lotman, This notion was expanded in the first chapter to include the notion of *fun* as the result of using a technique of *defamiliarization* similar to the one that Victor Shklovsky proposes as part of the artistic activity (1998 [1917]: 18). With this enhanced notion of a play-type model, we are

able to understand the balance required between the purpose of games as a tool for learning skills and mastering real-life situations, as described by Lotman (2011[1967]) and the element of novelty and freedom that makes the games engaging and enjoyable.

The balance between learning and fun required in a board game is observed in the process of design of the *Bio-equilibrium* board game as a play-type model of the global warming issue. This process, described in the first interchapter, involves a phase of content analysis where the most relevant elements of the reality depicted in the game are selected and organized in some categories, looking for internal relationships between these elements that give shape to the structure of the game. This is followed by a phase of mechanics design where the actions that the players can make while playing the game are defined.

To evaluate the learning outcomes or the quality of fun of a board game like *Bio-equilibrium* is a complex activity that requires the design of evaluative tools to be applied during an iterative testing process which escapes the scope of this research project. It remains a task for future research to design a protocol for observing the behaviour of people playing a board game like *Bio-equilibrium* and collect valuable data about the understanding of the game mechanics and underlying topic, strategies devised by the players, unexpected situations and the insights generated by playing the game.

The notion of the play-type model is not enough to explain the material and visual components of a board game, so the concept of diagrams as machines for thought developed by Stjernfelt (2011) to extend Peirce´s idea of diagrammatic reasoning is presented as the second leg of the framework for board game analysis.

The design process for the *Bio-equilibrium* board game has provided a good example of how the creation of a board game follows a similar process as the one described for the construction of a diagram, starting from the definition of the represented object, the analysis and selection of relevant elements and their relationships and the graphical representation of these elements in a way that allows for the manipulation to generate new conclusions from the model.

The prototype of the *Bio-equilibrium* game is the result of a diagrammatic process where the phenomenon of global warming is represented as a network of relations between different elements such as natural resources management, pollution, biodiversity and politics. These elements are represented in the visual design of the game board where material components like cards and tokens can be manipulated by the players following certain rules to generate changes in the diagram of the game. This relationship between the actions of the

players and the effects they have on the game as a diagram is what allows for the emergence of meaningful play (Salen, Zimmermann 2004). This is something that Ellen Kontkar and myself expect to observe in play test sessions with visitors of the Natural Museum.

The third foot of the framework aims to provide an explanation of how board games as conceptual models and diagrams provide new ways to interpret and generate changes in the real world. To achieve this, chronotopical analysis is presented as a way to approximate the complexity of board games as a text. Because of the particular nature of games, where the structure of space and time of the story is not fixed but changes each time a game is played, I had to do some modifications to the methodology proposed by Torop (2019).

At the level of the topographical chronotope, I introduce a change in the notion of storyworld to accentuate the view of it as a flexible structure that is constantly transformed as the players take actions during the game. The greater degree of randomness that a play-type model generates is a factor that must be kept in mind when doing an analysis of this kind of games.

Another particularity of board games is that in many cases the players can assume the roles of the characters of the story in a "make-believe" attitude (Thibault 2017: 8), thus erasing the boundaries between the viewpoints of the characters and those of the players at the level of the psychological chronotope. This allows the players to introduce their own subjective perception into the storyworld generating unexpected changes in the story as the characters they represent take actions that change the course of the story. This also has effects at the level of the metaphysical chronotope as the author's conception may be transformed by the behaviour of the players in the game.

All these changes in the way that chronotopical analysis is applied to board games are related to the notion of transformative play (Salem, Zimmerman 2004: 305) where the mechanisms of the game allow not only to generate changes in the internal structure of the game but also in the player's perception of their sociocultural contexts.

The theoretical approaches described above as the three feet of the proposed framework for the analysis of board games may be used separately depending on which aspect of a game is of interest for a researcher; and of course, there are many other semiotic theories that could be used for the analysis of this kind of objects. However, after applying this methodological framework to the study case of the *Bio-equilibrium* game I have great confidence that the use of these three approaches may be of big help to other researchers interested in board games as cultural objects.

Board games have proved to be a complex and diverse object of study, with many internal components from mechanics and rules to visual components of different kinds that deserve a more detailed research analysis. On the other side, board games comprise a wide range of genres, mechanics and styles, each one with their own particularities that also provide interesting paths of research, for example, in the case of board games used as a component in transmedial narratives.

Although the *Bio-equilibrium* board game was created with an educational purpose in mind, the possibilities of using board games in learning activities escaped the scope of this thesis. However, there is much research material on this topic to which I hope the framework proposed here might be a valuable contribution for future research on this topic, specially for the development of social skills related to the process of cooperative problem solving in different scales.

In relation to the topic of problem solving processes, this thesis connects with my previous research work on what I call the *trickster's mind*, which I describe as a set of particular cognitive skills that are very useful for the creative solution of unexpected and complex problems in ways that sometimes involve some deceptive and subversive behaviour. One particular question that I would like to answer is related to the way that creative and subversive mentality can be promoted in educational environments and I consider that games, and board games in particular, provide an excellent tool for this considering the amount of cunning and resourcefulness they usually involve. But that line of research requires a solid framework for the analysis of board games as generators of transformative play that this thesis aims to provide.

With this in mind, one topic that I would propose as part of my doctoral research project is the study of games in the construction of a tricksters mentality on individuals and social groups and how these skills help people to deal with the complexities of political systems and discourses.

KOKKUVÕTE

Täringute veeretamine ja meeples/minimesed[6] liigutamine. Lauamängud kui mängulaadne mudel ja tähendusrikka mängu esilekerkimine

Lauamängud on olnud inimkultuuri osaks juba pikka aega, näiteks Senet, mida mängiti Egiptuses 3500 eKr ja Hiinas tuhat aastat tagasi leiutatud mäng Go, mis on seni üks enim mängitud mängudest kogu maailmas. Viimastel aastatel on lauamängude loomine üks kiiremini kasvavam osa meelelahutustööstusest ning on kujunemas suure mõjuga kultuuriliseks fenomeniks paljudes riikides. Magistritöö eesmärk on pakkuda raamistik lauamängude kui eraldiseisva teksti ning selle mõju uurimiseks kaasaegsele kultuurile. Tartu Ülikooli Loodusmuuseumile loodud mäng "Looduse Tasakaal" koos reeglite ja kogu visuaaliga on selle uurimistöö praktiline osa, mis võimaldab rakendada töös loodud lauamängu analüüsi teoreetilist raamistikku.

Magistritöö ülesehitus kirjeldab kolme erinevat kuid omavahel seotud lähenemist lauamängudele. Esimeses peatükis, otsin vastust küsimusele, kuidas lauamängud suhtestuvad Juri Lotmani mängu-tüüpi mudelitesse ning kuidas teatud tüüpi mängud võivad seda mõistet laiendada mõistetega lõbu ja tähendusrikas mäng. Järgneb vahepeatükk, kus kirjeldan kuidas mängudisaini protsess on rakendatud Looduse Tasakaalu mängule, et luua globaalse soojenemise mängu—tüüpi mudel.

Teine peatükk keskendub lauamängudele kui skemaatilistele mudelitele, mis võimaldavad kollektiivset eksperimenteerimist et, leidma erinevatele probleemidele lahendusi. Teises vahepeatükis on kirjeldatud kuidas "Looduse tasakaalu" mängu visuaalne ja komponentide kujundus on osa skemaatilisest mudelist.

Kolmas peatükk tutvustab kronotoopilist analüüsi kui tööriista, et mõista kuidas mängijad kogevad lauamängu autori loodud kontseptuaalset maailma olles mängu narratiivses ülesehituses pakutud rollides ja kuidas sellest interaktiivsest kogemusest tekkiv transformatiivne mäng loob muudatusi mitte ainult mängu ülesehituses vaid ka sotsiaalses kontekstis, kus mängu mängitakse. Viimases peatükis on analüüsitud Looduse tasakaalu kronotüüpe, et selgitada mängudisaini ideoloogilist aspekti ning kuidas mängudisaini protsessi eesmärk on kujundada transformatiivse mängu kogemust.

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[6] Meeples/Minimesed: Mängunupud ehk mängijate või mängus kasutatavate objektide tähistused.

Järeldan, pärast töös läbiviidud teoreetilist ja praktikalist osa, et lauamängud on mahukad ja keerulised kultuuriuuringute objektid, mis nõuavad erinevaid teoreerilisi tööriistu, et analüüsida mängu mitmeid kihte ja aspekte. Selles töös pakutud raamistik võibolla kasulik alguspunkt eri tüüpi lauamängude semiootiliseks analüüsiks. Samuti võib töö olla kasulik lauamängude loojatele, et paremini mõista enda loomet ning seda, kuidas loodud mängud mõjutavad kaasaegset kultuuri.

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