Playing in 7D

An Action-Oriented Framework for Video Games

Universidade do Porto
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An Action-Oriented Framework for Video Games

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Abstract

Grounded on a perspective in which action is a defining trait in video games, this work proposes the development of an action-oriented framework focused on the analysis of the relationships between the player and the game system centred on the existence of actors, which we define as entities responsible for the actions that affect the game – a category in which the player and the game system are included. We describe the grounding principles of this framework as focused on a transformation of action into experience, exploring how relationships are grounded on communicational systems that provide structures for the dynamic formation of distinct networks of actors from which diverse behaviours emerge. These, in turn lead to the enactment of diverse sequences of events building up narrative, which ultimately is a source of experience of the player.

Upholding this framework, we unveil 7 dimensions that serve as foundations for the action-based relationship between player and game system: *chronology, responsiveness, thinking and actuation, transcoding, focus, depth,* and *traversal.* Overall, they serve as an analytical model of the player-system action-based relationship, a model that, despite framing both player and game system as actors, takes into account their distinct natures and roles.

This work is not an ultimate theory of action in the context of video games, but a proposal that these can be regarded and analysed as action-based artefacts. With this in mind, it is also a call to awareness for game designers, posing the thought that by designing for action, they are working with fundamental concepts on which video games are built upon.

Keywords: *Action, Chronology, Depth, Design, Focus, Framework, Responsiveness, Thinking and Actuation, Transcoding, Traversal, Video Games.*

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Resumo

Baseado no princípio de que ação é uma característica determinante nos videojogos, este trabalho propõe o desenvolvimento de uma *framework* orientada para ação, focada numa análise das relações entre o jogador e o sistema do jogo centrada na existência de atores, que definimos como entidades responsáveis pelas ações que afectam o jogo – uma categoria em que o jogador e o sistema de jogo estão incluídos. Descrevemos os princípios basilares desta *framework* como focados numa transformação de ação em experiência, explorando como as relações são sediadas em sistemas de comunicação que fornecem estruturas para a formação dinâmica de distintas redes de atores através das quais diversos comportamentos emergem. Estes, por sua vez, originam diversas sequências de eventos que constroem narrativa, que é por fim uma fonte de experiência do jogador.

Através desta *framework,* revelamos 7 dimensões que alicerçam a relação baseada em ação entre jogador e sistema de jogo: *cronologia, responsividade, pensamento e acionamento, transcodificação, foco, profundidade,* e *travessia.* Estas servem como modelo analítico da relação baseada em ação entre jogador e sistema de jogo, um modelo que, apesar de os considerar a ambos atores, tem em atenção as suas distintas naturezas e papéis.

Este trabalho não é uma teoria derradeira da ação nos videojogos, mas uma proposta de que estes podem ser considerados e analisados enquanto artefatos baseados em ação. Com isto em consideração, é também um apelo aos designers de jogos, apresentando a ideia de que ao trabalharem com ação em mente estão a trabalhar com conceitos fundamentais sobre os quais os videojogos operam.

Palavras-chave: *Ação, Cronologia, Design, Foco, Framework, Pensamento e Acionamento, Profundidade, Responsividade, Transcodificação, Travessia, Videojogos.*

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Introduction

Our fascination about video games began in early childhood, while playing on what we later discovered to be a clone of the Atari 2600. Compared to other media, toys and games at our disposal, the images (and sounds for that matter) generated by those video games were the most rudimentary of all, based on sharp edges, gross geometry, and undetailed iconography. Nevertheless video games were very different from every other piece of entertainment that we had until then experienced. In fact, in time we grew very fond of those kinds of graphics and sounds, but what really triggered our fascination was their inherent ability to interact with us. They had the means not only to immediately react to our actions, but also to challenge us, establishing what we felt (and still feel) to be a very powerful link of communication between us and the game system, a relationship we describe in this work as being both dialogical and dialectical.

Over the following years, this sense of wonder and curiosity increased dramatically, taking us from a position of gamer, to that of an aficionado, culminating on that of an ever-curious academic and designer. It was this deep sense of allurement and growing desire to understand video games that not only drove us into the development of this work, but also kept us deeply motivated throughout its course. And we are certain that it is what will keep us ever more fascinated and amazed in the future.

In our perspective, the study of video games has always been relevant, but it became even more so since they became such ubiquitous artefacts. Today, video games are not only products of unquestionable commercial success, but also extremely widespread artefacts bearing significant social and cultural relevance. They not only follow the ubiquity of computational media in general, but are also present across various kinds of social and cultural activities and contexts, going beyond the world of entertainment, being used as pedagogical and training tools, as well as being created and appropriated into the realm of the arts.

Research in this field has never had the opportunity to work on a subject with such a wide audience as it does today, since nowadays video games are not only played everywhere and on the most diverse occasions, but also by people of both genres with distinct ages and lifestyles.

Going deeper into this thought, to research video games within the field of Art and Design is most certainly then to increase the scope of actuation of the Arts and Design, embracing the social and cultural contexts in which video games are present.

To study video games within the scope of Art and Design is also a relevant activity as it permits that perspectives and methodologies typical of these fields of study to be introduced into the study of video games. Arts and Design are fertile grounds for the production of novelty, very open to experimentation and heavily inclined to questioning dogmatic standpoints, and with a substantial propensity towards multidisciplinary practices, often combining distinct perspectives of the world to generate new ideas, new perspectives, new understandings. They are then able to pay a major contribution to video game studies, as their vision on the world is also able to depict an unique perspective on the exquisite cultural artefacts that video games are.

Starting Point

During our first encounters with video games, we remember being enthralled not by their graphics or sound but by the fact that the game system was able to respond to our input, challenging us. This was the source of amazement of something that was both new to us and completely distinguishable from other media at our disposal back then. In time, video game systems became increasingly capable of depicting ever so realistic audiovisual environments, being one of the primary sources of players' allurement.

Nonetheless, we believe that it is not graphics nor sound that are at the core of this medium, but *action*. There are several reasons for this and we talk about them in chapter 1, but, for the sake of making a straightforward starting point, let us begin by drawing some considerations about the most recent generation leap in game consoles.[1] In the

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1 A generation leap happens when new and usually more powerful game consoles are introduced to the market. At the time of writing the current generation of home gaming consoles are the Sony PlayStation 4, the Microsoft Xbox One, and the Nintendo Wii U.

past, this effect – the transition from one generation of consoles to the next – was hugely felt by means of a considerable technical evolution of the hardware's audiovisual capabilities. Each generation brought with it some sort of novelty in terms of graphics and sound, and the change was contrastingly perceivable. However, this new generation of game consoles does not heavily distinguish itself from the previous in terms of its audiovisual capabilities as their predecessors did.[2] The contrast, the leap, lies elsewhere.

Playing e.g. *Middle Earth: Shadow of Mordor* (2014) or *Alien: Isolation* (2014) in game systems belonging to the current generation and in those from the previous one[3] are two very dissimilar experiences. At times, it is as if playing two different games altogether.

During a period of transition, it is usual for games to be released for both the current and the previous generations of game consoles, with those that run on older hardware being downgraded to suit the machine's capabilities, with much of that being done in terms of graphics. However, these games didn't just suffer the expected diminishment in graphics, but on their behaviour as well. Due to the limitations in processing power of the older game consoles, the downgraded versions possess a much more simplistic behaviour than their more sophisticated counterparts. This oversimplification of the system's behaviour ended up transforming so much of the game's dynamics that the experience became contrastingly different. Both versions possess the same theme, iconography, and even storyline, but the way they are played is dauntingly different: the downgraded version of *Middle Earth: Shadow of Mordor* has a simplified version of the Nemesis system[4] – where the player is able to interfere with the social network of their enemies –, making the

2 There are considerable improvements in terms of image and sound, however we do not witness the same contrast as in previous generation leaps. We believe this is due to the fact that many of the audiovisual improvements that are now happening are manifested at a scale small enough to be considered details. We are not saying that details are not important, because that very much are, but changes at that level of magnitude are not so contrasting as the previous ones. In sum, it is not a revolution at a larger scale as it was in the past, but rather an evolution at the scale of detail.

As a second note, maybe the differences between the Wii and the Wii U possess more contrast. But that mainly happens because they are/were the most underpowered machines of their respective eras. In fact, the next games we will provide as examples don't run on either the Wii or the Wii U.

3 The current generation of game consoles where these games run are the PlayStation 4 and the Xbox One. The PlayStation 3 and the Xbox 360 are the game consoles of the previous generation where downgraded versions of the games run.

4 We talk more about this game and this particular feature in section 9.3.3.

game's action be much more about a mechanic of a typical *hack and slash*[5] game (which despite being very present in the original game it is not its primary feature); and in *Alien: Isolation* the xenomorph[6] that hunts the player's character is so dumbed down that it becomes much more predictable, removing much of the sense of fright and constant tension that are crucial in its experience.[7]

Of course that we were not aware of these examples when we started this project, since they are somewhat recent, but they serve as confirmation of our initial premise. As highly visual beings, images will always be motif of our fascination, however and despite the increasing investment on graphics, video games are essentially about action.

And this is not something recent. This is not something due to recent efforts in processing capability of computers. No. Video games have always been about action, behaviour, processes, about the cybernetic relationship they establish with the player, and how that not only contributes to but generates diverse play experiences. These two examples help clarify that fact.

Focusing on a complementary subject, in *MDA: A formal approach to game design and research* (Hunicke, LeBlanc, and Zubek 2004) we find a model that depicts the relationship between the designer of a game and its player as being based on three distinct but interrelated stages: *Mechanics*, *Dynamics*, and *Aesthetics*. The mechanics stage is related with the rules of the game, consisting of all the conditions necessary for particular dynamics to emerge. Dynamics are the mechanics in runtime, consisting of their behaviour, of the events that occur in runtime, which are witnessed and heavily influenced by the player. Aesthetics emerge from the dynamics, in the sense that they consist of the emotional responses of the player when experiencing the game's dynamics.

The player and the designer are placed at opposite sides in this model. While the player is set at the aesthetics stage, the designer is placed at the mechanics stage, finding themselves at the stage of dynamics, but none of them are truly capable of fully grasping what

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5 *Hack and slash* is a term designed to name a type of gameplay that highly emphasises hand-to-hand or close quarters combat with weapons.

6 In this context, a xenomorph is the fictional extraterrestrial creature and antagonist in the film *Alien* (Scott 1979), featuring extreme aggressiveness, being of a highly predatory nature.

7 See Zagalo (2015) on AI being a silent revolution on the new generation consoles.

is at each other's side. In other words, neither the player is truly capable of diving deep into the mechanics of the system nor the designer is actually capable of clearly foreseeing what happens at the aesthetics stage. However, in order to master their roles, that is exactly what they try to achieve: the player tries to master all the mechanics of the system in order to succeed, and the designer tries to aim for particular aesthetics, building what he thinks to be the most adequate mechanics.

The player never truly experiences mechanics because, although they can be known, they are not experienceable. The player only experiences the dynamics of the system. In the same way, the designer never truly experiences the aesthetics because they only occur in the player's mind. Both the player and the designer can only make educated guesses about what happens on each other's side.

The starting point of this work is then set by seeing action in video games through the scope of the MDA framework, a perspective deeply focused on the relationship established between the player and the game system.

Purpose

With this in mind, we undertook this work with the purpose of discovering various dimensions present in the action-based relationship between the player and the game system, aided by the premisses of the MDA framework. What are the foundations of the relationship between the player and the game system when seeing video games as an action-based medium? What kind of dimensions of action can we find in this context? And how can the premisses of the MDA framework help in framing those foundations and consequently those dimensions?

Our answer to these questions arose in the form of an action-oriented framework that contemplates the position of player and that of game system to be of equal order and importance, and in which the entity assuming the role of operator of the game system may not even be of human origins. It is a framework that can be used as a model for analysing or conceiving action in video games, and that is primarily focused on the transition that occurs between the mechanics of the system and the aesthetics of the player, something that rises from action itself and culminates into experience.

Strategy

> Many video games ask for a lot in order to be played, so it is not surprising that some people do not play video games. Video games ask for much more than other art forms. They ask for more time and they more concretely require the player to understand the conventions on which they build. (Juul 2010)

Despite what can be perceived or judged by common sense, video games are not necessarily easy to study. There is a big investment to be done. Video games take a lot of time, requiring skilful and cognitive effort from their players.

With this in mind, and in pursuit of our goals, our research was conducted by methods of inquiry primarily pursued in an exploratory fashion and by means of qualitative analysis on video games, constantly aimed at an understanding of the behaviours of the player and of the game system and phenomena surrounding their relationship.

Thereby, in the course of this work we assumed several roles – player, designer, spectator, reader, writer and lecturer –, with each fulfilling specific needs and following distinct requirements, but still working in conjunction, complementing each other's perspectives on the subject matter. This division of labour was then essential to the development of this work in the terms explained next.

Player

Assuming the role of player is an activity very present in our life as gamer, and although we accomplished it rather intuitively, in the course of this work, we always tried to maintain a critical attitude when playing.[8]

Our background as gamers was very useful as we often resorted to memory to pinpoint particular games, or moments within a given game that we considered to be relevant to

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8 To assume the position of player and of designer was an important task to undertake, because they stand at the opposite sides in the MDA framework (Hunicke, LeBlanc, and Zubek 2004), meeting at the dynamics layer – our main interest.

the discussion at hand. Actually, our almost lifelong history as a gamer was of extreme value, as the memories that prevailed were not only indicative of games to revisit, but also a source of particular experiences that could otherwise be hard to acknowledge and sometimes to re-enact – due to the dynamic nature of video games. Hence, in this context, being a gamer granted us an immense experience of playing video games in first-hand, consisting of a direct exposure to the medium itself, which is essential for a phenomenological stance on researching video games.

That being so, the video games we played and analysed were selected regarding the following criteria:

1. *Access*. It was important to have direct access to the video games we wanted to play and use as references. By considering this, we intended to minimise the quantity of references to video games that were not played, which were reserved to those yet unpublished, or with a very narrow distribution, or unique artefacts considered to be essential examples.

2. The variety of supporting *platforms* was important due to the diverse, singular, and sometimes quite peculiar traits each provides, with differences extending from small annotations to great contrasts.

3. *Historical context*. A typical video game in the 1970s is certainly different from those commonly developed today, whether derived from the characteristics of technological media that supports them or due to their social and cultural status in each era.

4. *Historical reference, socio-cultural benchmarking or milestone.* Studying video games that revealed themselves as icons of a certain era is important because they became the reference for many others that followed in the course of time, sometimes even establishing a whole genre, as is the case of e.g. *Pong* (1972).

5. The *references provided by studied authors* not only became important examples of their standpoints but were equally relevant when confronting their theories.

6. Our *empirical knowledge* on the subject was also a criterion, as in frequent occasions video games were invoked by memory alone, by remembering playing them.

Designer

As a designer, we started to plan and conceive diverse video games, but we soon came to the conclusion that our initial strategy would not allow us to the meet our expectations in due time. We had several reasons, from which: a) developing video games (even prototypes) takes a considerable amount of time, and we could not disregard other equally important chores; and b) we were not aiming towards the development of a single game but of many more.

We solved this in the following ways: instead of creating original games – and we had plans for some –, we decided to design variations (in the mechanics) of existing games, mainly classics.[9] This strategy allowed us not only to compare the original games with the new versions (and between these as well), but also to focus solely on the variations themselves, saving much time and keeping focus on the topic at hand.

However, even with this new strategy, we were still confronted with problems relating manpower, since we needed several variations. To solve this we 1) conducted several workshops where participants were instructed to create their own variations on a selected video game, and 2) collaborated with professors and students from the Integrated Masters in Informatics and Computing Engineering from the Faculty of Engineering of the University of Porto, to whom we proposed the same exercise.

This was an exploratory exercise, aiming to push ourselves and the collaborating teams into developing all sorts of variations focused on tampering diverse types of game mechanics to then see what kinds of behaviour we could come up with, and thus start distinguishing the dynamics that emerged and why.

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9 "A core mechanic can be extended and enlarged through the design of variations. Breakout provides a good example of a simple core mechanic that is intrinsically successful, but which has been successfully modified into many variations." (Salen and Zimmerman 2004, 327)

Engaging on the rationales of each team when each variation was being conceived was extremely fruitful. The fact that the teams were designing for variations on already determined mechanics – filtering out everything else – made the task much more focused, which intuitively made us think on how the developed variations influenced the player's actions. What's the focus of the team's idea? How does that idea is considered to be a variation on the original? How will that variation in the mechanics of the game change its dynamics? If we're aiming towards a particular behaviour what modifications need to be done to the original game? How is the new version supposed to be played and how does that compare to the original? It is more or less challenging and why? Does a high number of variations create a new game altogether? And do they point to new genres? And so on…

At the end, it was this focus on the act of designing games itself – and not necessarily on a postmortem assessment of the exercise – that made us achieve a particular mindset that was attentive to the phenomena emergent from the mechanics, to the system's dynamics, to action. This was how we assumed the position of designer, based on a phenomenological approach, such as for the player.

As a final note, interpreting the results was also useful, a task that was accomplished at the beginning of this work by following a more intuitive and exploratory approach.

Spectator

The observation of others playing provided useful leads for us to empirically understand the relationship player-game system, and their respective roles, from an outsider's point of view. So, if assuming the role of player or designer was grounded on a phenomenological stance, then being an observer granted us the necessary distance to take notice of events that while playing we could not witness, contributing to a more complete understanding of the relationship between the player and the game system.

Reader

Reading about the object of study has always been one of the primary sources of information in research, and therefore is automatically a self-justifiable activity. Our readings were mainly about interaction design, game design, game studies, gameplay mechanics, serious games, casual games, art games, interactive and procedural art, media studies, video game history, video game genres and taxonomies, human-computer interaction, psychology, sociology, philosophy, neuroscience, cybernetics, artificial intelligence, and usability, in trying to develop an overview of the current theory on these fields that could be relevant to our project.

Writer and Lecturer

Assuming the roles of writer and lecturer was decisive in our approach to the development of this work. Writing research articles not only gave us much of the required experience but also tested our work, granting that we could communicate our ideas to peers, adequately structure our thoughts and sustain them with proper references, employ adequate terminology, draw conclusions and aim towards future studies. Seeing our work validated by peers and obtaining their feedback in the form of constructive criticism was an invaluable learning experience.

Therefore, as soon as we had sufficient material on a particular subject we proceeded into writing a research article. Following this premise, we ended up authoring 17 works during the development of this thesis, from which: 4 are short papers and 13 are long/full papers; 2 were published on national events, and 15 were published on international events or journals; 16 were conference papers, and 1 a journal article.[10]

Cardoso and Carvalhais (2012c) is a paper that relates to our initial research proposal, which had already been validated by an internal committee within our PhD program, nevertheless we also wanted it to be appreciated by an external party, and to obtain their feedback.

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10 Each article is available in the *digital versions* section.

Eliseu and Cardoso (2012) refers to a prototype we developed in a very initial stage of our work, and where we collaborated as a secondary author. Although its content is not directly present in this work, it depicts the stage where we realised we needed to reformulate the development of prototypes.

Cardoso and Carvalhais (2013e; 2013f) are short papers that consist of reports of the outcomes of the development of variations of classic video games we mentioned when developing the role of designer.

The following papers directly point to the content of PART II of this text, mainly constituted by revised and expanded versions of these papers: (2012d) is dedicated to CHRONOLOGY, the dimension described in chapter 3; (2012b; 2014a) are dedicated to RESPONSIVENESS, found in chapter 4; (2013a) points to chapter 5; (2013c; 2014d) refer to TRANSCODING, present in chapter 6; (2014e) is about FOCUS, chapter 7; (2012a) refers to DEPTH, in chapter 8, as well as Carvalhais and Cardoso (2015), which despite not being entirely dedicated to video games refers to a very particular function in this dimension; and Cardoso and Carvalhais (2013d; 2013b; 2014c) are dedicated to TRAVERSAL, chapter 9.

Finally, in PART III, (2014b) points to one of the directions to pursue in future work.

Significance

Video games have since long been seen at the light of other media, such as cinema, television, literature, etc.. Video games are complex artefacts, having appropriated much of what is found in those other media, something that we believe contributed to that attitude. However, this study sees video games as none of those media, but as media with ergodic roots (Aarseth 1997), evidencing action as their core feature.

Therefore, with this work, we question popular and ad-hoc categories found in video game genres and even used in the practice of game design, categories that are inconsistent and highly unstable, mostly inherited by historical stances. And, since this work avoids seeing video games through a culture of genre – taking into account that a particular genre usually points to an already established and somewhat disorganised group of characteristics –, it promotes a fresh perspective on the subject being opened to new possibilities, to new types of games, to new ways of interaction, to new things.

In continuation, this work, as a study of action that takes into account the dialogical and dialectical properties of the relationship between the player and the game system while being focused on the transitional and ephemeral stage of dynamics, is a step towards the development of a carefully designed procedural rhetoric.[11]

Description and notes on the structure of the thesis

This thesis is divided into three parts. PART I is constituted by two chapters focused on setting-up the grounds and preparing the reader to a particular understanding of the contents present in PART II.

Chapter 1 contextualises this work depicting why action is not only essential but a defining element in video games. We follow some premisses from a previous study developed in a similar context (Cardoso 2008), but not necessarily sticking to all of its conclusions or assumptions.

Chapter 2 depicts the functioning of the framework itself, its mechanics. Starting from its grounding principles, to a description of its components and primary method of operation, followed by a much deeper inspection of its components' attributes, as well of the variations in its methods of operation.

PART II consists of seven chapters, each devoted to the description of a particular dimension of action. These are particular perspectives through which we can analyse the relationship between the player and the game system, following the premisses established in chapter 2.

Chapter 3 is about *chronology*, a dimension focused on the manipulation of objective time – the time the player takes to play – and event time – the time related with the diegesis of the game world.

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11 Procedural rhetoric is a concept that tries to explain how people learn through the procedures they experience and the mental models they construct when engaging in those processes. See Bogost (2007; 2008). See Frasca (2007) on video game rhetoric.

Chapter 4 refers to *responsiveness*, a dimension that looks at the fundamental input and output structure of the player and the game system, recognising their distinct states in order to draw the possible combinations between these.

Chapter 5 concerns a dimension that stands between *thinking and actuation*. It is observant of the player as an entity of biological origins, distinguishing the diverse kinds of action that emerge by varying the balance between conceptualisation and enaction of an action.

Chapter 6 examines *transcoding*, a dimension focused on the relationship between the performance of the player and its proxy in the game world by considering the corresponding events in player space – the space where the player's body is actually situated – and in game space – the space where the game actually occurs.

Chapter 7 is about *focus*, a dimension concerned with how the game system challenges the player's attention span, sometimes by overload and other times by deprival.

Chapter 8 inspects *depth*, a dimension that is attentive to the influence of the player on the game system's behavioural structure while playing.

Chapter 9 describes *traversal*, a dimension related with how the player journeys through the game, by considering diverse relationships between the hardcoded narrative – the narrative that is fixed, predetermined – and the emergent narrative – the one that is fluid and dynamic, arising from the behaviours of the player and of the game system.

Part III consists of two chapters, aiming at wrapping up this thesis. In **chapter 10**, we dissertate on various analysis procedures for using the model developed in this work. **Chapter 11** is focused on enunciating overall considerations and revealing limitations of this work, as well as on appointing future endeavours for a continuation of this research.

Before concluding this section, it is important to state some facts about how the methodology employed during the development of this work ended influencing the structure of this text. Throughout its development we published articles aimed at problematising particular dimensions and their inherent phenomena.[12] Those articles gave rise to

12 For more information about the developed articles consult the *Strategy* section, in this chapter.

diverse parts of this thesis, originating either the chapters or subchapters of this text. Therefore, the modular structure by which this work was developed ended up influencing its current presentation, in which each chapter (of PART II) can be read practically as an independent module, therefore replicating at a smaller scale the overall structure we find in theses with more traditional structures: context and literature review, developments, and concluding thoughts.

With this into consideration, this thesis does not feature the literature review concentrated at its start, because that is done throughout the whole work, chapter by chapter. Nonetheless, the first part of this thesis introduces the context of the work and the reasonings for its direction. A similar situation happens with the conclusions and future work, as each chapter bears a similar section. With this in mind, the conclusions at the end of this document are much more related with the overall work than with the issues present in its parts.

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Part i: Setting-Up

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1. Action: A Defining Trait In Video Games

We have previously defended the stance that action is a determinant element in video games (Cardoso 2008). Since that study ignited this one, in this chapter we expand on this particular subject by revisiting, reviewing, and updating some topics prevailing in its first chapters.

1.1 A Multitude of Perspectives

We start this section with a survey of the genres currently used by 12 well-known websites within the circles of the popular culture of video games: *1up.com, destructoid.com, gamefaqs.com, gamefront.com, gameinformer.com, gamereactor.eu, gamespot.com, gametrailers.com, giantbomb.com, ign.com, indiedb.com,* and *metacritic.com.*[13]

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13 The data from this survey was updated in August 2015. The genres are written exactly as they were in each website, even with misspellings.

Table 1.1: A sample of video game genres in popular culture.

Website	Genres
1up.com	Global: Shooter, Action, RPG, MMO, Sports, Strategy Detailed: 2D, 3D, Action, Adventure, Adventure RPG, Air, Baseball, Basketball, Beat'em Up, Board, Board Sports, Boat, Bowling, Boxing, Car, Card, Combat, Crossword, Cycle, Dating, E3 2005, E3 2006, E3 2007, Economics, Educational, Event, Exploration, Extraordinary Parallel Adventure, Extreme Sports, Falling Tile, Fantasy Sports League, Fighting, First-Person, Fishing, Football, Full-Motion Video, Futuristic, Gamescon, Golf, Hockey
destructoid.com	Action, Indie, Free Games, Fighting, Sports, Shooters, MMO, Music, Platforms, Puzzles, Racing, RPGs, Strategy
gamefaqs.com	Action, Action Adventure, Adventure, Hardware, Miscelaneous, Puzzle, Racing, Role-Playing, Simulation, Sports, Strategy
gamefront.com	Action, Adventure, Arcade, Audio And Video, Card, Card Battle, Combat Sim, Design And Photo, Desktop Enhancements, Developer Tools, Drivers, Driving, Fighting, First Person, Shooter, Free To Play, Internet, Media & Tools, MMO, Other/Personal, Party, Platformer, Puzzle, Racing, Real Time Strategy, Rhythm, Shooter, Simulation, Sports, Strategy, Survival Horror, Third Person Shooter, Turn Based Strategy, Utilities
gameinformer.com	Action, Adventure, Compilation, Fighting, Lifestyle, MMO, Party, Platforming, Puzzle, Racing, Rhythm/Music, Role-Playing, Shooter, Simulation, Sports, Strategy
gamereactor.eu	Action, RPG, Adventure, Strategy, Platform, Racing, MMORPG, Sports, Fighting, Horror, Simulation, Puzzle, MMO, Music, FPS

Website	Genres
gamespot.com	Genre: Action, Adventure, Arcade, Driving/Racing, Fighting, Free-To-Play, MMO, Platformer, Puzzle, Role-Playing, Shooter, Sports, Strategy, 2D, 3D, Baseball, Basketball, Beat'em-Up, Billiards, Bowling, Boxing, Card Game, Compilation, Cricket, Edutainment, First-Person, Fitness, Fixed-Screen, Flight, Football (American), Gambling, Golf, Hidden Object, Hockey, Hunting/Fishing, Light-Gun, Management, Matching/Stacking, Miscellaneous, Moba, Music/Rhythm, On-Rails, Open-World, Party/Minigame, Pinball, Real-Time, Roguelike, Shoot-'Em-Up, Simulation, Skateboarding/Skating, Snowboarding/Skiing, Soccer, Survival, Tactical, Team-Based, Tennis, Text-Based, Third-Person, Trivia/Board Game, Turn-Based, Wakeboarding/Surfing, Wrestling Theme: Crime, Fantasy, Horror, Military, Modern, Sci-Fi, Space, Game Show, Historic, Violent
gametrailers.com	Action, Adventure, First-Person, Fighter, MMO, Party, RPG, Shooter, Sports, Third-Person, 2-D, 3-D, Adult, Arcade, Card-Based, Dance, Educational, Extreme, Family, Fitness, Flight, Graphic Novel, Kids, Movie-Based, Music, Platformer, Puzzle, Racing, Real-Time, Rhythm, Sci-Fi, Side-Scroller, Simulator, Stealth, Strategy, Survival Horror, Trivia, Turn-Based
giantbomb.com	Abstract, Adult, Alternate Historical, Anime, Aquatic, Civil War, Comedy, Comic Book, Crime, Cyberpunk, Dating, Egyptian, Espionage, Fantasy, Game Show, Horror, Management, Martial Arts, Mayan, Medieval, Modern Military, Motorsports, Post-Apocalyptic, Prehistoric, Sci-Fi, Steampunk, Superhero, Vietnam, Western, World War Ii
ign.com	Action, Adventure, Battle, Board, Card, Casino, Compilation, Educational, Fighting, Flight, Hunting, Music, Other, Pinball, Platformer, Party, Productivity, Puzzle, RPG, Racing, Shooter, Simulation, Sports, Strategy, Trivia, Virtual Pet, Wrestling

Website	Genres
indiedb.com	Action: First Person Shooter, Third Person Shooter, Tactical Shooter, Fighting, Arcade, Stealth Adventure: Adventure, Platformer, Point And Click, Visual Novel Driving: Racing, Car Combat RPG: Role Playing, Roguelike, Hack 'N' Slash, Party Based Strategy: Real Time Strategy, Real Time Shooter, Real Time Tactics, Turn Based Strategy, Turn Based Tactics, Tower Defense, Grand Strategy, 4X, MOBA Sport: Baseball, Basketball, Football, Golf, Hockey, Soccer, Wrestling, Alternative Sport Simulation: Combat Sim, Futuristic Sim, Realistic Sim Puzzle: Cinematic, Educational, Family, Party, Rhythm, Virtual Life, Puzzle Compilation
metacritic.com/game	Action, Adventure, Fighting Games, First-Person Shooters, Flight/Flying, Party, Platformer, Puzzle, Racing, Real-Time Strategy, Role-Playing, Simulation, Sports, Strategy, Third-Person Shooter, Turn-Based Strategy, Wargames, Wrestling

Upon a general inspection, we may say that popular culture categorises video games in the most varied ways, and while games inscribed in a given genre seem to possess common traits, there is no central element to regulate their divergencies and commonalities (Järvinen 2008, 309). Also, while some websites use long lists of genres, others are very succinct, and there seems to be no explicit agreement on which genres to use, since they relate to diverse things, from game mechanics, to interface, theme, etc.. The formal arrangement between genres themselves is in an equal state of ambivalence, although sometimes they appear organised in groups.

> (…) in popular discourse the genre criteria are arbitrary and not commensurable. The label of genre A is based on its thematic traits, genre B's name tag refers to traits of the interface used in playing the game, while genre C has a label that describes on a general level what the player(s) do during the game. Still, labels A, B, and C are often presented as belonging to the same hierarchical level. (Järvinen 2008, 309)

However, Jesper Juul claims that genres such as *fantasy* or *science fiction* are not game genres. Agreeing with Greg Costikyan (2005) he states that although game genres are defined by game mechanics, those "specific genres also have affinities to specific fictions" and "with certain interface conventions". (Juul 2010, 135)

> That is, although genres are named after game mechanics, they are also associated with other game elements, and all elements are potentially relevant to how a player understands a game. (Juul 2010, 135-136)

According to Aki Järvinen, "[g]ame genres are found in the junction of game themes, system behaviour, and emotions and moods, where they are articulated both by game developers, marketing, journalists, audiences – and theorist-designers, as in here." (2008) This does not seem to pose a problem to the frugal use of genre in popular culture. However, when studying, analysing or designing video games it may.

> In a growing market, the existence of well-established genres, such as real-time strategy games and first-person shooters, can be seen as both a blessing and a curse (…), because they carry with them a number of content- and business-related expectations that must be tackled by designers and producers alike. (Laramée 2002, 195-196)

According to François Dominic Laramée, working within the boundaries of a given genre can, on one hand: 1) promote faster, easier, and more robust design, mainly because designers and developers don't need to deal with problems already solved in previous games; 2) working with conventions means shorter learning curves for the players and the implementation of predetermined features for developers; 3) working towards a ready-made audience permits taking less risks. And on the other side they: 1) restrict creativity, since straying from conventions will be seen as a risky manoeuvre; 2) increase competition, because many companies aim for the same audiences; and 3) may originate budget bloating, because, according to him, historically the most common way to have commercial success in a highly competitive market saturated with games featuring standardised gameplay is to make upcoming games bigger and more polished, and to invest more on marketing.

Maybe its because of this that the use of genres within the game design discourse seems to be more moderate than in popular discourse. The sample we collected starts with Chris Crawford's *The Art of Computer Game Design* (2011), first published in 1984.[14] Then, we inspect five more references aimed at portraying an overview on this subject along the first decade and a half of the 21st century.[15]

Table 1.2: A sample of video game genres in game design discourse.

Game Design References	Genres
Chris Crawford, 1984 (2011)	Skill-and-Action Games: Combat Games, Maze Games, Sports Games, Paddle Games, Race Games, Miscellaneous Games Strategy Games: Adventures, D&D Games, War Games, Games of Chance, Educational and Children's Games, Interpersonal Games.
François Dominic Laramée (2002)	Action Games, Management Games, Fast Strategy Games, Story-Driven Games, Simulators, Abstract Games, Platform Games, Edutainment, Persistent Game Worlds, Invasive Games, Event-Driven Games
Rollings & Adams (2003)	Action Game Genres (Shooters, Non-shooters), Strategy Games, Role-Playing Games, Sports Games, Vehicle Simulations, Construction and Management Simulations, Adventure Games, Artificial Life, Puzzle Games, and Other Genres, Online Games

14 The kindle version was published on 2011 and possesses author's comments focused on a reflection and review of the original text.

15 There are other references on game design but these were the ones we found to explicitly deal with the subject of genres.

Game Design References	Genres
Phill Co (2006)	Action, Shooter, Brawler, Adventure, Role-playing, Platformer, Strategy, Racing
Tracy Fullerton, Christopher Swain, Steven S. Hoffman (2008)	Action Games, Strategy Games, Role-Playing Games, Sports Games, Racing/Driving Games, Simulations/Building Games, Flight and Other Simulations, Adventure Games, Edutainment, Children's Games, Casual Games
Ernest Adams (2014)	Shooter Games (2D shooters, 3D Shooters), Action and Arcade Games (Platform Games, Fighting Games), Strategy Games, Role-Playing Games, Sports Games, Vehicle Simulations, Construction and Simulations Games, Adventure Games, Puzzle Games

According to this sample, not only game design discourse lists fewer genres than popular discourse, but each author seems to invoke a somewhat similar list of genres. This gives the impression that game design seems to have been stalled, producing the same kinds of games. Actually, in a overall appreciation, we may notice that the genres listed in half of the websites in the survey of video game genres in popular culture are, in general terms, those that have been prevailing throughout the history of game design, as well.

Table 1.3: A sample of video game genres in popular culture, organised by number of references.

Number of References	Genres
12	Action
11	Adventure, Puzzle, Role Playing Game or RPG, Sports, Strategy
9	Racing, Simulation
8	Fighting
7	MMO, Shooter
6	Party, Platformer
4	Arcade, First Person Shooter or FPS, Flight, Music, Wrestling

Number of References	Genres
3	3D, Baseball, Basketball, Card, Compilation, Educational, First-Person, Golf, Hockey, Horror, Real-Time Strategy, Rhythm, Sci-Fi, Third Person Shooter, 2D
2	Adult, Beat'em-Up, Board, Bowling, Boxing, Combat Sim, Crime, Dating, Driving, Family, Fantasy, Fitness, Football, Free To Play, Game Show, Management, Miscelaneous, MOBA, Modern, Music/Rhythm[2], Pinball, Real-Time, Roguelike, Soccer, Stealth, Survival Horror, Third-Person, Turn Based Strategy, Turn-Based
1	4X, Abstract, Action Adventure, Adventure RPG, Air, Alternate Historical, Alternative Sport, Anime, Aquatic, Audio And Video, Battle, Billiards, Board Sports, Boat, Car, Car Combat, Card Battle, Card Game, Card-Based, Casino, Cinematic, Civil War, Combat, Comedy, Comic Book, Cricket, Crossword, Cyberpunk, Cycle, Dance, Design And Photo, Desktop Enhancements, Developer Tools, Drivers, Driving/Racing, E3 2005, E3 2006, E3 2007, Economics, Edutainment, Egyptian, Espionage, Event, Exploration, Extraordinary Parallel Adventure, Extreme, Extreme Sports, Falling Tile, Fantasy Sports League, Fighter, Fighting Games, Fishing, Fixed-Screen, Football (American), Free Games, Full-Motion Video, Futuristic, Futuristic Sim, Gambling, Grand Strategy, Graphic Novel, Hack 'N' Slash, Hardware, Hidden Object, Historic, Hunting, Hunting/Fishing, Indie, Internet, Kids, Lifestyle, Light-Gun, Martial Arts, Matching/Stacking, Mayan, Media & Tools, Medieval, Military, MMORPG, Modern Military, Motorsports, Movie-Based, On-Rails, Open-World, Other, Other/Personal, Party Based, Party/Minigame, Platform, Platforming, Platforms, Point And Click, Post-Apocalyptic, Prehistoric, Productivity, Real Time Shooter, Real Time Tactics, Realistic Sim, Shoot-'Em-Up, Side-Scroller, Skateboarding/Skating, Snowboarding/Skiing, Space, Steampunk, Superhero, Survival, Tactical, Tactical Shooter, Team-Based, Tennis, Text-Based, Tower Defense, Trivia, Trivia/Board Game, Turn Based Tactics, Turn-Based Strategy, Utilities, Vietnam, Violent, Virtual Life, Virtual Pet, Visual Novel, Wakeboarding/Surfing, Wargames, Western, World War II

> It is becoming common to see complaints that the games biz has lost its creativity. Year after year, we see the same game designs re-issued with improved graphics and a new title – but it's still the same old game we got tired of ten years ago. Why can't the games industry come up with something new? (Crawford 2004)

Crawford still argues that this lack of creativity is the result of designers and developers working towards the production of established genres, and of publishers being too afraid of supporting something different (2004). If we take into account how much it costs to make a video game like *Grand Theft Auto V* (2013)[16] or *The Witcher 3: Wild Hunt* (2015),[17] for example, we easily understand why this fear prevails in the industry of video games, usually deciding to hold on to the most successful conventions in order to keep on profiting, for as long as possible.[18]

With this in mind, Arsenault states that video genres evolve akin to biological species and that this fact "is second nature to the discourse of most knowledgeable gamers, gaming press people, industry veterans and game studies academics. Innovation in video game genre is consequently understood as either exploring radically new ground by creating a new genre, or refining current mechanics up one notch and taking an existing genre to a new age (…)." (2009) Taking this into consideration, we may agree with Mark Wolf claiming that "[t]he idea of genre has not been without difficulties, such as defining what exactly constitutes a genre, overlaps between genres, and the fact that genres are al-

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16 Several reports say that *Grand Theft Auto V* (2013) costed about 265 million USD to develop and to market, having however outweighed those costs with extreme success. For more info see http://www.ibtimes.com/gta-5-costs-265-million-develop-market-making-it-most-expensive-video-game-ever-produced-report, http://www.gamesindustry.biz/articles/2013-02-01-gta-v-dev-costs-over-USD137-million-says-analyst, http://www.businessinsider.com/gta-v-cost-more-than-nearly-every-hollywood-blockbuster-2013-9 and http://www.vg247.com/2013/09/09/gta-5-most-expensive-game-in-history-cost-170-million-to-make-market/. And on its success see http://www.gamasutra.com/view/news/200547/GTA_V_hits_800M_in_dayone_sales.php and http://www.forbes.com/sites/davidthier/2014/05/13/grand-theft-auto-5-has-sold-nearly-2-billion-at-retail/.

17 *The Witcher 3: Wild Hunt* (2015) costed 306 million złoty (about 81 million USD, according to gamespot.com) to develop and market. More info at the CD Projekt Group's financial briefing on the first half of 2015 (at https://youtu.be/_MyMiT4OUy4) and at a summarised report of that event at gamespot.com (at http://www.gamespot.com/articles/this-is-how-much-the-witcher-3-cost-to-make/1100-6430409/).

18 However, in a 2012 postscript, Crawford mentions that the indie games movement is in fact doing much of what he called for, breaking free from the shackles of triple-A games' industry, in order to develop different and riskier games with smaller teams and less financial investment.

ways in flux as long as new works are being produced." (2001, 113) Nevertheless, genres in video games consist of preconceived combinations of game mechanics, iconography, theme, etc.. They consist of a disorganised multitude of perspectives on a complex medium, representing established conventions and leaving little room for experimentation. We may then say that video game genres are a reflection of a medium that simultaneously craves and fears newness.

Arsenault's suggestion for innovation is enticing, but to create something new we need a deeper insight on video games themselves. We need to search for their structural elements and act there, avoiding conventions – the pre-established combinations of these elements. We need to search for their core, for what makes them what they are and differentiates them from other media.

"In the ergodic literature, nontrivial effort is required to allow the reader to traverse the text." (Aarseth 1997, 1) In this sense, video games can be seen as ergodic media (Carvalhais 2010), since the player exerts non-trivial effort to play the game, assuming diverse functions and choosing from various possible paths.

> The cybertext reader *is* a player, a gambler; the cybertext *is* a game-world or world-game; it *is* possible to explore, get lost, and discover secret paths in these texts, not metaphorically, but through the topological structures of the textual machinery. This is not a difference between games and literature but rather between games and narratives. (Aarseth 1997, 4-5)

With this in mind, we may see Costikyan's (2005) claim that game genres are tied to game mechanics as a pretty valid starting point. To focus on what the player does while playing seems to be a crucial perspective. "Video game genres study differs markedly from literary or film genre study due to the direct and active participation of the audience in the form of the surrogate player-character, who acts within the game's diegetic world, taking part in the central conflict of the game's narrative." (Wolf 2001, 114)

This is how we get to the concept of *action*.

> The reason so many games seem similar to one another is because they use the same set of actions. Look at the games that are considered "derivative," and you will see that they have the same set of actions as older games. Look at games that people call "innovative," and you will find that they give the players new kinds of actions (…). (Schell 2008, 143)

1.2 Why Action?

> Some media for representing reality are static. A painting or sculpture depicts a snapshot of reality frozen in time. Some media are dynamic; they show change with time. Movies, music, and dance are dynamic in this way. They are able to represent the changing aspect of reality more richly. But the most fascinating thing about reality is not that it is, or even that it changes, but *how* it changes, the intricate webwork of cause and effect by which all things are tied together. The only way to properly represent this webwork is to allow the audience to explore its nooks and crannies to let them generate causes and observe effects. Thus, the highest and most complete form of representation is interactive representation. Games provide this interactive element, and it is a crucial factor in their appeal. (Crawford 2011, loc 207)

The graphical capabilities of early video games mainly consisted of rarefied and geometrical two-dimensional figures with no textures, shadows, nor any other visual effects that contemporary video games so blatantly display. They generated realtime interactive moving images acutely constrained by the technical limitations of the computers of that era. Therefore, there was simply no processing power for visual complexity. And, since those machines were unable to process complex graphics along with the interactive features expected from a video game, the priority was directed to gameplay (Rollings and Adams 2003, 292), to action.

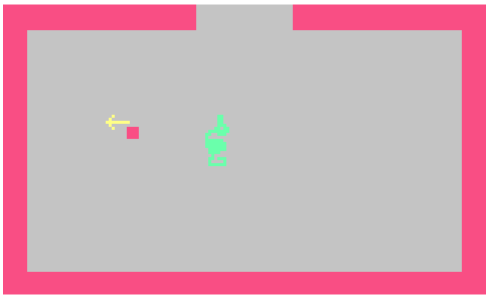

Figure 1.1: *Adventure* (1979).

> Computer graphics of the late 1960s and early 1970s, however, were not sophisticated enough to easily and cheaply produce detailed, representational moving imagery in real time, so simple iconography (dots, squares, rectangles) had to suffice. Detail and complexity were sacrificed for fast, immediate, and interactive action; a player could imagine the details, but action had to be depicted as a visual display. (Wolf 2001, 30)

Even in contemporary video games image is constantly sacrificed in favour of action – despite the increasingly mesmerising graphical capabilities displayed by contemporary game-dedicated hardware –, with all visual resources having to be strictly optimised to favour its performance.[19] It doesn't matter how good a given video game looks if it is not playable. According to Mark Wolf, the player can imagine the visual details, but it is imperative for action to be conveyed. In fast-paced games this is crucial, since the relationship between the game system and the player requires instantaneity, perceivable immediate feedback. And an eventual lack of feedback may be interpreted as a malfunction or result in a frustrating experience.[20] Even in less frantic games action remains as important, because the player still needs to possess the ability to take part in the central conflict of the game's narrative – in Wolf's terms. In other words, the player is required to act within the game world and to influence it in the most various ways.

> Why was *Spacewar!* the "natural" thing to build with [computers]? (…) Its designers identified *action* as the key ingredient, and conceived *Spacewar!* as a game that

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19 In video games, textures and geometry are commonly simplified for performance, resorting to illusions to convey visual details while saving processing resources. Techniques like *normal mapping* – frequently used to simulate wrinkles, dents, and other similar details without adding more polygons to 3D models – are examples here.

20 We talk about this subject in chapter 4 (responsiveness).

> could provide a good balance between thinking and doing for its players. They regarded the computer as a machine naturally suited for representing things that you could see, control, and play with. Its interesting potential lay not simply in its ability to perform calculations, but in its capacity to co-create and represent actions with human participants. (Laurel 2014)

The primacy of *action* in video games is then a fact, but in more recent times it was incredibly evidenced by the trend of motion games. While possessing inferior graphical capabilities than the other competing platforms of the same generation, the Nintendo Wii became widely known for implementing the Wiimote as its game controller, which possessed motion and optic sensors, allowing the player to interact with the machine by performing gestures and aiming.[21] With it, Nintendo propelled this trend into mainstream gaming, followed by Sony and Microsoft.[22] Today, the hype of motion games has cooled down, but it marked a generation of game consoles, where action was a very perceivable prerogative, accentuating the performative ethos of video games.

Notwithstanding, graphics are exceedingly important in video games. From the concept art images published while a given game is still in early development, to previews and announcement videos, to the reviews from the media, right until actual play, the first contact that a player establishes with a given game is mostly of visual order. And, propelled by the inevitable technological advancements, over time video games were able to generate increasingly realistic and naturalistic depictions.

> As the game's visuals developed, games began using different styles of lightning, different points of view, continuity editing, and other techniques from film and television. Games became more character centered. Visually, backgrounds had

21 "No piece of hardware has changed the landscape of console video gaming as dramatically as the Nintendo Wii and its motion-sensitive controller, the Wii Remote (often shortened to Wiimote). (…) The Wii Remote works really well in games that map a player's physical activity directly onto the avatar's activity in the game world, such as action, sports, and driving games. It is less successful with games that traditionally use a mouse, such as role-playing, strategy, and construction and management games. If you want your players to control your game with the Wii Remote (…), you should design the game for the Wii Remote from the beginning." (Adams 2014, 293-294)

22 Later, Sony followed similar steps with the PlayStation Move controller – featuring similar characteristics as the Wii Remote –, and Microsoft with the Kinect – a game controller primarily based on computer vision and speech recognition.

> more scenery and became locations, and there was often more narrative context surrounding the action of the game. By the 1990s, video games had title screens, end credits, cutting between different sequences, multiple points of view, multiple locations, and increasingly detailed storylines. (Wolf 2001, 32)

Strategies and techniques from cinema were adapted to and implemented in video games. Storyline became more present and more complex. Even actors started to be hired to grant more believable expressions to game characters.[23] And as games became more cinematic, graphics assumed an increasing relevant role. Today, graphics are so highly rated that many gamers are intolerant towards games that don't deliver a certain level of graphical awe. And, what two or three years ago was considered to be top-notch graphics, today is already seen as obsolete.[24]

Figures 1.2, 1.3, 1.4, and 1.5: *Far Cry* (2004), *Far Cry 2* (2008), *Far Cry 3* (2012), and *Far Cry 4* (2014).

23 For example, *Beyond: Two Souls* (2013) features well-known actors – Ellen Page and Willem Dafoe –, depicted with recognisable realism.

24 On the other hand, graphics from older games also became a trend. Today, we can find contemporary video games such as *Rogue Legacy* (2013), *Nidhogg* (2014), or *Shovel Knight* (2014), as examples. And in music/sound as well, in the chiptune community.

As games became more cinematic they also started to occasionally transform the player into a spectator.[25] During cinematic interludes e.g. the player is confined to spectate and interpret the narrative that unfolds without her intervention.[26] Nonetheless, cinematic interludes were many times criticised by gamers for being passive moments.[27] Initially composed by static images[28] – sometimes featuring subtitles – cutscenes evolved to pre-rendered animations and full motion video.[29] Today, many cinematic interludes are processed in real time, allowing more flexibility in terms of narrative and being more inclusive of the player's actions, from granting the player the ability to choose from diverse camera angles and perspectives[30], to being able to depict the equipment the player has actually chosen for the playable characters.[31] Although they are not something born on contemporary video games, *quick time events*[32] are also an example here, as they are a hybrid between cinematic interludes and interaction. So, even in one of the most passive moments in video games – the cinematic interludes –, designers recognised the need to include player action, providing players with means to take part of the events in the game world.

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25 "Theoretically, many of the same issues and concepts in films theory can also be applied to video games, and video games are themselves becoming more like film and television, embedding video clips within the games, or like many laserdisc, CD-ROM, and DVD-ROM games, relying on video sequences almost entirely. Many games now use recorded sounds rather than just computer-generated ones, and they have elaborated opening and closing sequences, in an attempt to create a more cinematic experience (including long crawl of end credits)." (Wolf 2001, 2)

26 "Formally speaking, cinematic interludes are a type of grotesque fetishization of the game itself as machine. (…) So, ironically, what one might consider to be the most purely machinic or 'digital' moments in a video game, the discarding of the operator and gameplay to create machinima from the raw machine, are at the end of the day the most nongamic. The necessity of the operator-machine relationship becomes all too apparent. These cinematic interludes are a window into the machine itself, oblivious and self-contained." (Galloway 2006, 11)

27 Games with complex storylines could sometimes possess long cinematic interludes. *Metal Gear Solid 4: Guns of the Patriots* (2008) e.g. possesses one cutscene with the approximate duration of 27 minutes, featured within a very long sequence of cutscenes. At the time of writing this could be seen at https://youtu.be/2e94EVtyj4Q?t=12m10s.

28 See e.g. *Comix Zone* (1995).

29 See e.g. *Final Fantasy VII* (1997), as well as many other video games from the Playstation era.

30 See e.g. *Metal Gear Solid 3: Snake Eater* (2004) and *Metal Gear Solid 4: Guns of the Patriots* (2008).

31 See e.g. Bayonetta (2009). But this is a very common feature nowadays.

32 Quick time events derive from the gameplay style introduced by games like *Dragon's Lair* (1983), in which the player had, at specific or key moments, to press the correct button in order to keep on playing.

In sum, besides the apparent relevance of graphics, a game's primary prerogative is to be playable. Without playability it stops being a game altogether. Without action it becomes passive entertainment. "Action is indeed the primary component of human-computer activity – not environments, interfaces, or objects." (Laurel 1991, 135)

> Though we may refer to film spectatorship as "active", due to the viewer's ongoing attempt to make sense of the film, the video game player is even more active, making sense of the game as well as causing and reacting to the events depicted. (…) Only when a player becomes attuned to the design of the game and the algorithms by which it operates will success be possible; thus a certain manner of thinking and reacting is encouraged. (…) While film or TV may influence behaviour, in the video game, the player is called upon not just to watch but to act; simulation becomes emulation, and sympathy becomes empathy. (Wolf 2001, 3)

With this in mind, we may say that the player is much more active than a traditional spectator, exerting her influence on the game world, actively participating in its events. Therefore, the less decisions are left for the player the more she becomes a spectator and the game becomes cinema. In Wolf's terms, the player assumes a more involved role in the unfolding of the game than the spectator. The spectator zaps, the player acts (Lévy 2000, 84). One only experiences a video game as player when actually playing it. Action is then the means by which the player is able to alter game states (Björk and Holopainen 2005, 20), influencing the system which reacts back at the player, in an endless cybernetic feedback loop (Wiener 1948, 1954).[33] And, "this experience is so strong that most people will involuntarily change bodily position when encountering interactivity, from the lean backward position of narratives to the lean forward position of games." (Juul 2001) It thus is only through action that the role of player is 'born'. Without it there is nothing but spectators. "Without action there would, in fact, be no game at all. From the player's point of view, action is the most important (though not the only) feature of a game." (Lankoski and Heli 2002, 312) We may even risk saying that, in video games, everything subdued to action.

> If photographs are images, and films are moving images, then video games are actions. Let this be word for video game theory. Without action, games remain only

33 In chapter 4 we talk about variations in responsiveness that affect this feedback loop.

> in the pages of an abstract rule book. Without the active participation of the players and machines, video games exist only as a static computer code. Video games come into being when the machine is powered up and the software is executed; they exist when enacted. (Galloway 2006, 2)

1.3 A Brief Survey

In this section we aim at a brief survey of six theories that directly or indirectly incorporate action in the context of games, evidencing which topics influenced our work: Mark Wolf's interactivity genres; Richard Bartle's player types; Staffan Björk and Jussi Holopainen's activity-based framework for describing games; Alexander Galloway's gamic action model; Julian Alvarez, Damien Djaouti et al. game bricks tool for classifying video games; and Jesse Schell's thoughts on operative and resultant actions.

1.3.1 Wolf: Genres and Interactivity

In *The Medium of the Video Game*, Wolf follows the logic that "[i]n some ways, participation is arguably the central determinant in describing and classifying video games – even more so than iconography" (2001, 114) and theme. Therefore, while the latter are more suitable concepts for analysing cinema, interactivity "is an essential part of every game's structure and a more appropriate way of examining and defining video game genres" (114). With this in mind, he presents 42 genres that "regard the nature of interactivity in the game itself rather than ask whether the game is single player, multiple player, or designed to be playable over a network. Due to the different types of action and objectives that can occur in a single game, games can often be cross-listed in two or more genres" (116). Wolf's genres are the following: *Abstract, Adaptation, Adventure, Artificial Life, Board Games, Capturing, Card Games, Catching, Chase, Collecting, Combat, Demo, Diagnostic, Dodging, Driving, Educational, Escape, Fighting, Flying, Gambling, Interactive Movie, Management Simulation, Maze, Obstacle Course, Pencil-and-Paper Games, Pinball, Platform, Programming Games, Puzzle, Quiz, Racing, Role Playing, Rhythm and Dance, Shoot 'Em Up, Simulation, Sports, Strategy, Table-Top Games, Target, Text Adventure, Training Simulation,* and *Utility.*

Taking into consideration the descriptions Wolf provides for each genre, we may state that the problem with his taxonomy is centred in the fact that not all of these genres are related to interactivity. Genres like *Capturing, Collecting, Dodging, Driving, Fighting, Flying, Gambling, Training,* e.g. seem to be more successful,[34] but genres like *Abstract, Utility, Demo, Adaptation, Educational,* etc., are not related to "interactivity" at all: *Abstract* is related with iconography, *Utility* refers to non-games, and *Demo*, *Adaptation,* and *Educational* do not describe any parameter regarding interactivity of a game whatsoever. Also, Wolf's system ends up being pretty similar to popular video game taxonomies, in the sense that some genres are quite identical, such as *Adventure, Interactive Movie, Platform, Shoot 'Em Up, Sports, Strategy,* etc..

As a result, not only his taxonomy is rather confusing but utterly betrays the grounding principles he himself established – it was supposed to be a taxonomy based on *interactivity*. Nevertheless, Wolf takes a step in a direction of our interest, and, in our view, just fails in execution, in representing interactivity.

1.3.2 Bartle: Players and Game World, Action and Interaction

First in *Hearts, Clubs, Diamonds, Spades* (1996) and then in *Designing Virtual Worlds* (2004), Richard Bartle presents a typology of players in Multi-User Dungeons (MUDs). Nonetheless, his model has "been applied successfully over the years to the players of a wide variety of virtual worlds" (139) and even "beyond the confines of virtual worlds into domains such as online community management and tabletop RPGs" (140). His player types "arise from the inter-relationship of two dimensions of playing style: action versus interaction, and world-oriented versus player-oriented" (1996), in four categories: *achievers, socialisers, explorers,* and *killers.*[35]

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34 "Actions are the verbs of the game, and the way in which the player usually thinks about his play: 'I run, I jump, I punch, I buy, I build.' On arcade machines, each input device is usually labelled with a verb: Fire, Boost, and so on. When you define the player's role in the concept stage of game design, you should make a list of some of these verbs." (Adams 2014, 339)

35 Who so desires can take the Bartle test, "an online questionnaire that players of virtual worlds can take to discover what player type are they." (Bartle 2004, 145) "The test is the brainchild of Erwin S. Andreasen and Brandon A Downey, who wrote it in response to my player types paper so as to test the theory." (145) At the time of writing it could be accessed at http://www.gamerdna.com/quizzes/bartle-test-of-gamer-psychology, and was originally published at http://www.andreasen.org/bartle/.

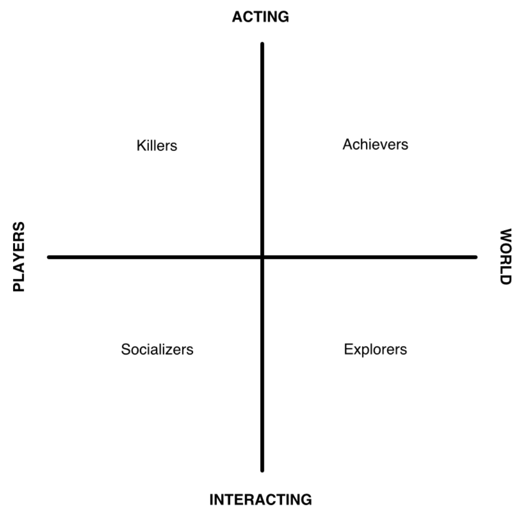


Figure 1.6: Bartle's player interest graph (2004, 131).

Achievers "have fun acting on the virtual world" (2004, 132). They enjoy realising goals defined by the virtual world, ranking up in the game and progressing their characters. *Socializers* "have fun interacting with the other players" (132). They mostly enjoy social interaction with other players, either as themselves or by role-playing. *Explorers* "have fun interacting with the virtual world" (132). They are eager to discover how the virtual world functions, to learn about the game world. "They seek out the new". (130) And, *killers*[36] "have fun acting on other players" (132). They are focused on dominating other players, either by force or through psychologically manipulative behaviour.

The model is deeper than this, specially its dynamics, but it is not our intention to undergo on a full explanation here. Our main interest is that Bartle's model reflects a very interesting notion regarding the relationship players establish between themselves and with the game world, following a distinguishable difference between *acting on* and *interacting with*. Through this model, he tackles a very interesting conflict between *action* and *interaction*.

36 Sometimes also known as *griefers*, according to Bartle (2004, 130).

1.3.3 Björk & Holopainen: Action and Actuation

First in *Describing Games: An interaction-centric structural framework* (2003) and then in *Patterns in Game Design* (2005), Staffan Björk and Jussi Holopainen present a framework that "is based on the assumption that playing a game can be described as making changes in quantitative game states, where each specific state is a collection of all values of all game elements and the relationships between them" (2005, 8). This framework establishes the grounds for the second stage of their work, which consists of a series of game design patterns. It is divided into four components: holistic, boundary, temporal, and structural.

> The holistic components describe how the activity of playing a game is separated from the other activities, the boundary components limit the possible actions of the player within the game, the temporal components describe the flow of the game, and the structural components define the physical and logical elements necessary for containing and manipulating the game state. (8)

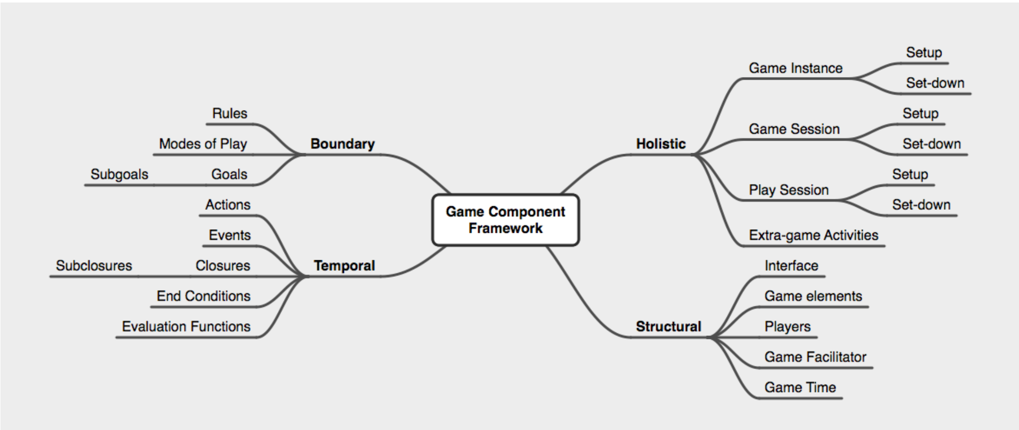


Figure 1.7: Björk and Holopainen's activity-based framework for describing games (2005).

In the scope of our work it does not seem fitting to fully describe the framework here. However, it is important to see how action is defined in this context.

> The action definition used in this framework is for those logical actions that cause changes in the game state. That means the physical movement of a player's finger to press a button is not considered an action but that the change in the game state that

> is initiated through the button press is an action. Actions are thus always associated with the interface through which the players can initiate the game state changes. (2005, 20)

According to the authors, there are two types of actions: those that are *explicitly* available to the player and those that are *implicit* in the game. Explicit actions occur when the player manipulates game controllers and joysticks, pressing either physical buttons or those in the graphical user interface of a game. Implicit actions "are typically found in text-based adventures or graphical point-and-click adventures where finding out which actions are possible is an integral part of the challenge" (20). As is evident, in this model, the actions of the game system and those of the player are not set in equal stances. In this framework, *actions* are only those that are related with the input to the game. The actions of the game system are considered to be *events* instead, being mixed with the actions of other players.

> Events are the game state changes that are perceivable to players. If actions represent the input to the game, events are the output. They inform the player of the consequences of their actions, let them update their goals and tactics, and show the actions of other players. All events do not have to be responses to the player actions as the game can create events based on randomness, time spent playing, or algorithms, depending on the game state. (20)

In conclusion, the fact that the player's physical movement is not considered to be an action, but the alterations in the game's state initiated by those movements are, originates an interesting distinction between the performance of an action and the mensurable activity in the game world that results from it. This framework is then only attentive to activity that can be measured, to actions that succeed in disrupting the game world. In other words, if the player fails in changing the game state, the actions she enacted while trying are ignored by this framework. This represents, in a more or less concealed way, the close relationship between the player and the game system, in the sense that an action is only considered to effectively be an *action* when the player operates the game system and it returns a result.

In our framework we frequently resort to the term *actuation*. We may generally define it as making a machine or device operate or act in particular way. However, in this context, we use the term to refer to the enactment of an action, which can be manifested by physical movement or by other means – that depend on the characteristics of the entity that originates that action in the first place, like sweating e.g. –, and that are manifested with or without self-control. An actuation reflects then the performative component of an action that is able to change game states. However, as we will see throughout this work, neither the player nor the game system are at all times receptive to each other's actuations.

1.3.4 Galloway: Player and Game System, Diegetic and Non-diegetic, Action and Inaction

For Alexander Galloway, "[a] video game is a cultural object, bound by history and materiality, consisting of an electronic computational device and a game simulated in software" (2006, 1). For him, more importantly than being games, is the fact that video games are software, and that that fact "must always remain in the forefront of one's analysis" (6).

In *Gaming,* Galloway avoids the term "interactive", preferring to call video games and computers action-based media. He states that "what used to be the act of reading is now the act of doing, or just *the act*." (3) With this he affirms that in video games the actions of the game system are as important as the actions of the player[37] (5). And those actions may happen in two different spaces: a *diegetic* space – "the game's total world of narrative action" (7) – and a *non-diegetic* space – the space that, by opposition, encloses the "gamic elements that are inside the total gamic apparatus yet outside the portion of the apparatus that constitutes a pretend world of character and story" (7-8).

His definition of *gamic action* is then established according to four categories: the *operator's non-diegetic act,* the *operator's diegetic act,* the *machine's non-diegetic act,* and the *machine's diegetic act.* This is a model that in his words makes "room (…) for the entire medium of the video game", focused on uncovering its formal traits, where "pressing Pause is as significant as shooting a weapon" and "[c]heats are as significant as strategies" (8).

37 He refers to the game system as the *machine* and to the player as the *operator,* in order to reinforce the idea of the cybernetic relationship that exists between them.

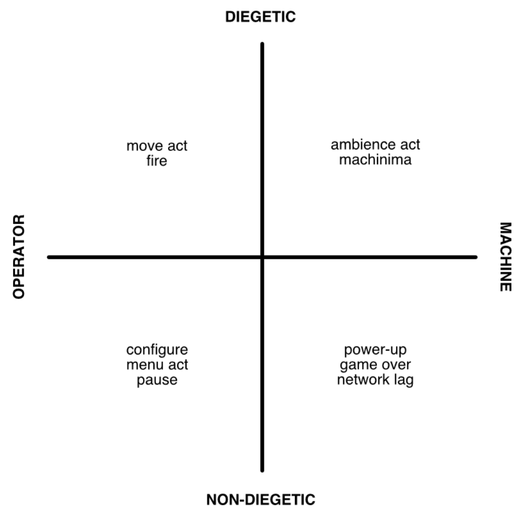


Figure 1.8: Adapted from Galloway's four moments of gamic action (2006, 37).

Galloway characterises the *diegetic machine acts* as moments of *pure process*, where the game is on but the player is absent, where the machine is working but the operator is away. He refers to this as the *ambience act*, the inverse of pressing pause (10), and as *machinima*.[38]

He classifies the *nondiegetic operator acts* as acts of configuration, of setting up, that "are always executed by the operator and received by the machine. They happen on the exterior of the *world* of the game but are still part of the game software and completely integral to the play of the game" (12).

The *diegetic operator acts* "take place within the world of gameplay", being "perpetrated by the game player rather than the game software or any outside force" (22). They appear as *move* or *expressive acts*. Move acts "change the physical position or orientation of the game environment" (22). Expressive acts concern player expression appearing in the form of actions such as: "select, pick, get, rotate, unlock, open, talk, examine, use, fire, attack, cast, apply, type, emote", etc. (24).

38 Machinima can be summarily defined as the creation of cinema by means of real time computer graphics engines, usually game engines.

And finally, the *nondiegetic machine acts* are "actions performed by the machine and integral to the entire experience of the game but not contained within a narrow conception of the world of gameplay" (28). He divides them into two major groups. *Enabling acts* are those fed by "internal forces like power-ups, goals, high-score stats, dynamic difficulty adjustment (DDA), the HUD, and health packs" (28). And *disabling acts* are those actions of "any type of gamic agression or gamic deficiency that arrives from the outside the world of the game and infringes negatively on the game in some way", either "fatal or temporary, necessary or unnecessary" (31), "such as software crashes, low polygon counts, temporary freezes, server downtime, and network lag" (28).

Table 1.4: Galloway's gamic action (2006, 38).

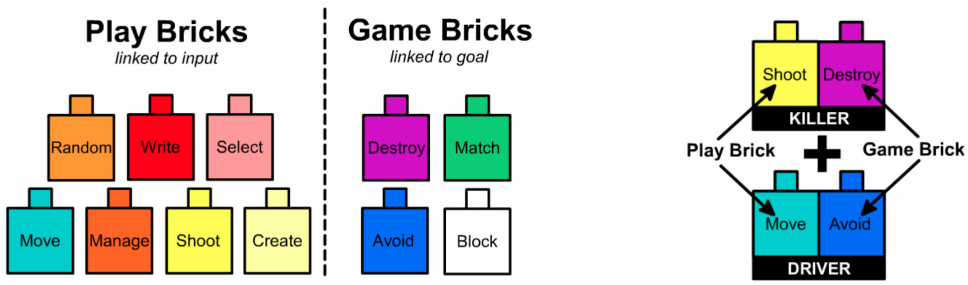
Type of gamic action	Categories	Shape of action	Quality of action	Emblematic games
Diegetic machine acts	Ambience act, machinima	Process	Informatic atmosphere	*Ico, Myst, Shenmue*
Nondiegetic operator acts	Acts of configuration, setup act	Algorithm	Simulation material	*Warcraft III, Flight Simulator, Final Fantasy X*
Diegetic operator acts	Movement act, Expressive act	Play	Rule-based, singular	*Tekken, Metroid, Prime, Half-Life*
Nondiegetic machine acts	Disabling act, enabling act, machinic embodiments	Code	Swarms, patterning, relationality	*Dance Dance Revolution, SOD, State of Emergency*

Galloway refers to his model as incomplete, since, "[t]o be thorough, one should supplement it with a consideration of the relationship between two or more operators in a multiplayer game, for the very concept of diegetic space becomes quite complicated with the addition of multiple players." (2006, 36) Nevertheless, this is a model that portrays action in video games while seeing them as a medium made of software, depicting an extremely strong relationship between the machine and the operator – in Galloway's terms –, between the player and the game system – in ours –, a bond that, in our view, is crucial for a proper understanding of action in video games.

Furthermore, not only Galloway evidences that the actions of the player are as important as the actions of the system, but also that *inaction* is as important and relevant as *action*.

1.3.5 Alvarez, Djaouti, et al.: Modularity and Recursion

Throughout several publications Julian Alvarez, Damien Djaouti, et al. (Alvarez et al. 2004, 2006, Djaouti, Alvarez, Jessel, and Methel 2007, 2007, 2008, 2008) present a model that aims at a classification of video games through a very particular definition of game-play[39] as "the association of 'Game rules', stating a goal to reach, with 'Play rules', defining means and constraints to reach this goal" (2008). In their model they identify fundamental elements, called *gameplay bricks,* that are divided into two groups: *play bricks* – associated with the input to the game – and *game bricks* – linked to the goal of the game. According to the authors, the different combinations when pairing play and game bricks "seem to be able to cover the gameplay of videogames" (2008) – called *metabricks.*



Figures 1.9 and 1.10: Game and play bricks (on the left) and metabricks (on the right), (Djaouti, et al. 2008).

Disregarding a description of every aspect of this model, what is of most interest to us here is that it tries to depict action in games by means of a modular structure – something that ended up being useful use to us.

Another thing is that *gameplay bricks* and *metabricks* can be seen here as two distinct levels of action: two simpler actions that when combined give origin to a more complex one. Following the example in **figure 1.10**: *to shoot + to destroy = to kill;* and *to move + to avoid = to drive.* And, although it doesn't seem to be the authors intention, if we follow

39 This can also be consulted at www.gameclassification.com/EN/about/article.html.

the same logic we may postulate that eventually *to drive + to kill = an even more complex action.*[40] A *recursive structure* of this kind is one of the core features of our own model.

1.3.6 Schell: Emergence

In *The Art of Game Design*, Jesse Schell defines actions of a game as the *verbs* of its mechanics, distinguishing from two types of actions: *operative* and *resultant*. The former are "the base actions a player can take. For example, in checkers a player can perform only three basic operations:" 1) "move a checker forward"; 2) "jump an opponent's checker"; 3) "move a checker backwards (kings only)" (2008, 140). The latter are the actions "that are only meaningful in the larger picture of the game — they have to do with how the player is using operational actions to achieve a goal" (140). He provides the following list of resultant actions in checkers: 1) "protect a checker from being captured by moving another checker behind it"; 2) "force an opponent into making an unwanted jump"; 3) sacrifice a checker to trick his opponent; 4) "build a 'bridge' to protect his back row"; 5) "move a checker into the 'king row' to make it a king"; 6) "…and many others" (141). "The resultant actions often involve subtle interactions within the game, and are often very strategic moves. These actions are mostly not part of the rules, per se, but rather actions and strategies that *emerge*[41] naturally as the game is played." (141)

It is this relationship of emergence that is the focus of our interest here. It is the ability to generate complex activity from simpler elements, in this case complex actions from simpler ones, that interests us. With this in mind, in our view and in the same way that Schell's resultant actions are complex actions that consist of sequences of operative (simpler) ones, so is the articulation of these more complex actions able to constitute even more complex ones – something that ultimately generates very specific behaviours, which heavily contribute to shape the narrative that unfolds and consequently the experience of the player.

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40 *Carmageddon* (1997) could serve as an example here, as these seem to be the game's primary actions. This game is actually classified at the authors' website *gameclassification.com* with the following game bricks: *avoid, match, destroy, move, shoot* – at http://www.gameclassification.com/EN/games/213-Carmageddon/analyses/index.html.

41 Emphasis added.

1.4 Player-System: Two sides of the same relationship

For Ernest Adams the "player experiences a video game through its input and output devices" (2014, 255),[42] which connections are regulated by the game's user interface.[43] In its turn, the user interface mediates the player's relationship with the game's core mechanics,[44] by taking "challenges that are generated by the core mechanics (driving a racing car, for example) and turn[ing] them into graphics on the screen and sound from the speakers. It also turns the player's button presses and movements on the keyboard or controller into actions within the context of the game." (2014, 38)

> The concept of a user interface should be familiar to you from computer software, but in a game the user interface has a more complex role. Most computer programs are tools of some kind: word-processing tools, web-browsing tools, painting tools, and so on. They are designed to be as efficient as possible and to present the user's work clearly. Games are different because the player's actions are not supposed to be as efficient as possible; they are obstructed by the challenges of the game. Most games also hide information from the player, revealing it only as the player advances. A game's user interface is supposed to entertain as well as to facilitate. (Adams 2014, 38)

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42 In the same sentence, Adams goes a bit further by saying that the player may also experience a video game "(possibly) through interactions with other players in the same room." (2014, 255) An interaction between players that are present in the same actual physical space may be achieved without the relay of the game system, since they are able to directly communicate with each other.

43 "The user interface does more than display the outputs and receive the inputs. It also presents the story of the game, if there is any, and creates the sensory embodiment of the game world – all the images and sounds of the world and, if the game has other input devices (such as a vibration feature, as mobile phones usually do), those sensations as well. All the artwork and all the audio of the game are part of its user interface, also known as its presentation layer." (Adams 2014, 38)

44 "One game designer's tasks is to turn the general rules of the game into a symbolic and mathematical model that can be implemented algorithmically. This model is called the core mechanics of the game. The model is more specific than the rules. For example, the general rules might say, 'Caterpillars move faster than snails,' but the core mechanics state exactly how fast each moves in centimetres per minute. (…) The core mechanics are at the heart of every game because they generate the gameplay. They define the challenges that the game can offer and the actions that the player can take to meet those challenges. The core mechanics also determine the effect of the player's actions upon the game world. The mechanics state the conditions for achieving goals of the game and what consequences follow from succeeding or failing to achieve them." (Adams 2014, 37)

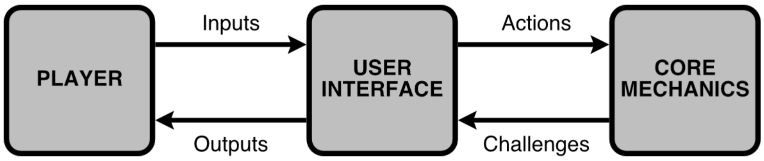

Figure 1.11: Relationships between the player, user interface, and core mechanics (Adams 2014, 38)

We are not going to explore Adams's model in depth, because we reached the focus point of our interest: this dual-sided relationship between the player and the game system, that we may consider as *dialogical* on one side – because it is focused on establishing a communicational feedback loop between the player and the system –, and that on the other side we may classify as *dialectical* – where the player and the system act as opposing forces.

1.4.1 A Dialogical Relationship

Crawford sees *interactivity* as a conversation: "a cyclic process in which two actors alternately listen, think, and speak" (2003, 5), and where "[t]his process of conversation cycles back and forth, as an iterative process in which each participant in turn listens, thinks, and speaks." (5) In fact, he says that "[w]e can generalize this notion of the conversation as an interactive process to any human interaction, although when we do, we must use the terms listen, think, and speak metaphorically. If we want to get academic, I suppose we could replace listen, think, and speak with *input, process,* and *output*[45]". (5)

In *Toys as Culture* (1986), Brian Sutton-Smith presents a model focused on the psychological processes by which digital games are experienced.[46] Inspecting this model, Katie

45 Emphasis added.

46 Sutton-Smith's model lists five elements through which the player experiences a video game: 1) *visual scanning* – related with visual perception of the player towards the game; *auditory discriminations* – associated with the ability of the player to listen to game events and signals; 3) *motor responses* – which relates with the player's physical actions to operate the game's controller(s); 4) *concentration* – associated with player focus; and 5) *perceptual patterns of learning* – related with the ability of the player to understand the structures of the game.

Salen and Eric Zimmerman state that although "Sutton-Smith's five categories do a good job of describing the experience of early single player console games, they are certainly not inclusive to all games" (2004, 315). However, they affirm that his categories are able to be abstracted into a relationship between *inputs, outputs,* and *internal player mechanisms.* "Sutton-Smith offers a relatively succinct list of elements that constitute the experience to play within a digital game. Visual scanning and auditory discrimination represent the sensorial activities of the player, motor responses represent the player's physical actions, and the other two elements (concentration and perceptual patterns of learning) represent cognitive mechanisms internal to the player that link these inputs and outputs." (315) Therefore, "[t]he way that a player perceives a game and takes action in it is always going to be specific to a particular design. But these details are contained within a larger system of experience that always includes some kind of *sensory input, player output,* and *internal player cognition*." (315-316)

Julian Alvarez, Damien Djaouti, et al.[47] also depict a similar relationship. They represent the structural parts of a video game as *input* (player pushes any button), *compute* (the computer is 'thinking'), and *output* (a 'result' is displayed on the screen) – see **figure 1.12**.

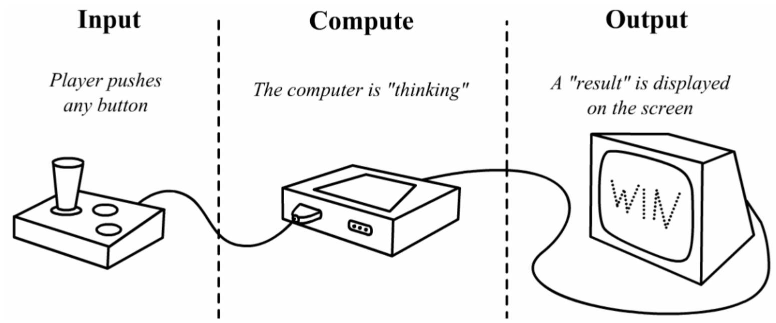

Figure 1.12: The structural parts of a video game according to Djaouti et al. (2008).

In fact, they also follow Crawford's idea of interactivity as a conversation, depicting a cybernetic feedback loop (see **figure 1.13**). The player pushes buttons on the game controller inputting information into the game. The game system computes that information and displays the results, which the player then sees, processes (thinks) that information, and acts based on it, pushing the buttons on the game controller again, closing the loop.

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47 See section 1.3.5.

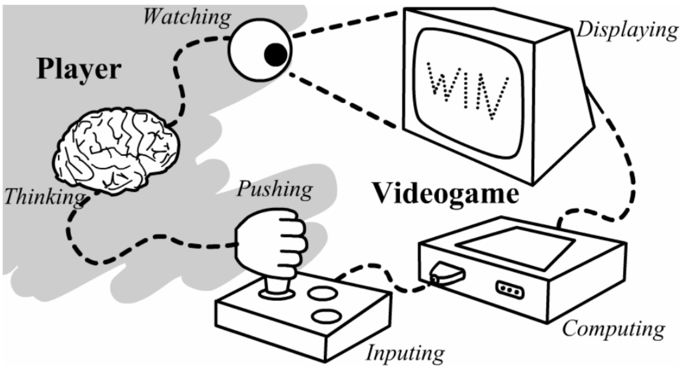

Figure 1.13: A representation of the interactive cycle between a player and a video game (Djaouti et al. 2008).

Up to this point this conversational relationship between the player and the machine seems pretty much an established ground. Video games depend on a cybernetic relationship between the player and the computational system, in which a communicational feedback loop is established, and where every action unfolds the narrative, eventually leading the player to success or to closure. But, in the same way that a conversation possesses multiple dynamics – there are pauses, sometimes only one person talks or several people talk in a more chaotic discussion, other times one person momentarily stops listening, or the one that was talking stops to think for a while, etc. – the relationship between the player and the system is not always in constant flux as well – there are interruptions, malfunctions, there are multiples states through which their conversation assumes distinct states –, which is something that we explore throughout our work.

Since many of those states do not qualify as interactive – in the sense that the flux of the 'conversation' is stopped or interrupted –, when classifying the relationship between the player and the game system, instead of *interaction* we prefer to use the term *action*. With this in mind, we may then see that what is relevant here are not only the interactive states present in the relationship player-game system, but the entirety of possible states in their *dialogical* operations.

1.4.2 A Dialectical Relationship

In this context, we use the term *dialectical* to illustrate the fact that the player and the game system act in opposition to each other.[48] This situation is very evident in older video games where the player is constantly challenged by the presence of enemies that populate the game world and that contribute to a game world topography that is challenging to traverse. For Crawford, "[c]onflict arises naturally from the interaction with the game", where "[t]he player is actively pursuing some goal", but "[o]bstacles prevent him from easily achieving this goal" (2011, loc 280). This relationship of conflict, illustrated by win and loose conditions present in those games (and in many contemporary ones), acutely depict this reasoning. Salen and Zimmerman also argue that "[a]ll games involve a conflict, whether that conflict occurs directly between players or whether players work together against the challenging activity presented by the game system" (2004, 255).

> Conflict can only be avoided by eliminating the active response to the player's actions. Without active response, there can be no interaction. Thus, expunging conflict from a game inevitably destroys the game. (…) Conflict is an intrinsic element to all games. It can be direct or indirect, violent or nonviolent, but it is always present in every game. (Crawford 2011, loc. 285-301)

Notwithstanding, in some contemporary video games this is not so clear, since sometimes there are no win or lose conditions. The focus is on experience, narrative, exploration, and so on. In any way, by providing the player with a plethora of choices, often questioning her moral standpoints or her judgmental capabilities, we may still consider the system as an opposing force to that of the player – even when these situations are implicit. The choices the player makes can dramatically change the unfolding of events and, consequently, her experience. This is a kind of conflict the game system constantly presents to the player, through various means and nuances.

> All drama originates from conflict. Indeed, without conflict, no dramatic tension will ever emerge. In a game, the conflict comes from the *contest* around which the game is built. (LeBlanc 2005, 444)

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48 Part of this section consists of a revised and expanded version of the one related with the same topic on (Cardoso and Carvalhais 2014b).

On the other side, the player also challenges the game system by not only exploring its capabilities but also its limitations, testing it – sometimes even trying to bend the rules –, extracting as much as she can from it in order to understand it.

> (…) knowledge of how [the algorithmic structures controlling the game's events and characters] function is often needed for success in the game. While figuring out these structures, or solving puzzles or challenges posed by the game's author, players try to think like the designer or programmer, which sometimes forces them to momentarily take on the author's way of thinking. (Wolf 2001, 4)

This need of the player to figure out the author's way of thinking in order to succeed in the game, is explicitly depicted in the MDA framework (Hunicke, LeBlanc, and Zubek 2004). This framework portrays the relationship between the designer and the player, along three layers: mechanics, dynamics and aesthetics. *Mechanics* are related with the rules of the system, which can be interpreted as the code of the game. This layer is created by the designer of the system and is commonly inaccessible to the player. The *dynamics* derive from the mechanics. They are what happens when the mechanics are put in motion, being the phenomena that occurs in runtime during the game. The *aesthetics* are created by the player. They consist of the emotional processes that are developed in the player's mind – triggered by the the events in the dynamics layer – and thus inaccessible to the designer.

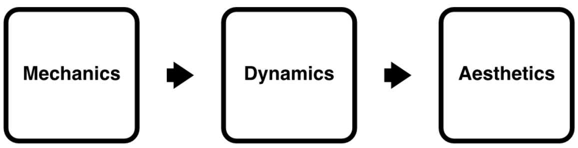

Figure 1.14: The MDA Framework – adapted from (Hunicke, LeBlanc, and Zubek 2004).

> Authorship in electronic media is procedural. Procedural authorship means writing the rules by which the texts appear as well as writing the texts themselves. It means writing the rules for the interactor's involvement, that is, the conditions under which things will happen in response to the participant's actions. It means establishing the properties of the objects and potential of the objects in the virtual world

> and the formulas of how they will relate to one another. The procedural author creates not just a set of scenes but a world of narrative possibilities. (Murray 1997, 152-153)

In this model, the entry point of the player is through the *aesthetics* layer while that of the designer is from the side of the *mechanics* layer. Both have access to the *dynamics* layer. While the player mainly operates at the aesthetics and the dynamics layers, the designer greatly operates at the mechanics layer, inspecting what goes on at the dynamics layer. While the player tries to tame the system by uncovering its mechanics, the designer aims at stimulating or triggering particular aesthetics, specific emotional reactions on the player.[49] But, ultimately both the player and the designer can only make educated guesses on what is happening on their opposite side.

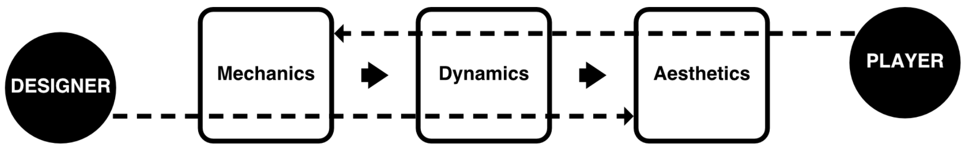

Figure 1.15: The relationship between the designer and the player through MDA Framework – adapted from (Hunicke, LeBlanc, and Zubek 2004).

The game system presents diverse kinds of challenges to the player. We can see these challenges as being explicit and assuming more traditional forms, or simply through the underlying need of the player to understand the functioning of the game world – which sometimes can be a pretty hard achievement – by means of understanding the author's way of thinking in order to progress in the game. With this in mind, video games are bound to this dialectical relationship, a relationship that in distinct ways puts the player and the game system as opposing forces, a relationship that sometimes is not clearly perceived in the ways the player and the game system challenge each other.

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49 According to Jesse Schell, "[t]he designer creates an experience" (2008, 9), "[t]he experience rises out of a game" (23), and "[t]he experience is in the player's mind" (113).

1.5 What then does it mean to act?

We started by inspecting genres in popular culture and game design circles in search for a defining characteristic (or set of characteristics) evidencing that video game genres depict in a disorganised fashion a multitude of perspectives on the medium itself. Some genres loosely follow conventions dictated by established game mechanics, such as *platform, racing, shooter,* etc., trying to somehow depict what the participation of the player is about. This set us on the path of action, which we portrayed as a determinant trait in video games.

We then briefly surveyed six theories that encompass the concept of action, evidencing topics that ended up influencing our work: from genres and interactivity, to players, game world and game system, action, interaction, actuation and inaction, diegetic and non-diegetic, to questions related with modularity and recursion, and emergence.

Lastly, we drafted a two-sided perspective on the action-based relationship between the player and the game system: dialogical and dialectical.

With all of this in mind, how can we describe *action*? What does it mean to act in this particular context of the relationship between the player and the game system?

In accordance to Galloway, we must acknowledge that the actions of the game system are as important as the actions of the player. After this, we must evidence that the game system is a machine and that the game is software. By assuming this standpoint, we are not only able to acknowledge the relationship between the player and the system as cybernetic, but also to comprehend its idiosyncrasies. *To act is then to engage on a cybernetic relationship with the game system.*

Secondly, we must accept the fact that action in this context implies actuation. The actions of the player may only be realised when the game state changes, but they always require some kind of actuation to be enacted, beforehand. This is also valid in the opposite direction, since the game system's actions are able to change the player's affective state, nevertheless they also always need some sort of actuation that the player is able to perceive. Therefore, *to act is to actuate in order to alter either game states or player states.*

Thirdly, when perceived, their actuations are then interpreted as signals, and by emitting signals back and forth they are able to communicate with each other – which stand as the basis for establishing their dialogical relationship. Then, *to act is also to emit signals, and thus to communicate.*

Fourthly, such as any communicational procedure, theirs is not always based on fluid and continuous feedback. There are pauses, glitches, non-interactive moments, etc.. Even inaction must be considered as a state of action, in this case. All of these moments are part of the process, each bearing significative consequences, each being significant signals. And because not all states in this communicational procedure are considered to be interactive, interaction becomes just a part of action, such as inaction, as disruptive as this may be. So, *to act is also not to act.*

Fifthly, actions are built on systems of emergence, in the sense that a sequence of simpler actions give rise to more complex actions. And also of systems of recursion, since sequences of these more complex actions are then able to generate even more complex actions, all the way up to the moment where they are considered to be plans, strategies, and ultimately behaviours. So, if actions alter the states of the game and of the player, then through this recursive system they are also very capable of altering their behaviour. Therefore, *to act also means to influence behaviour.*

Lastly, the player and the game system assume very particular roles in this relationship, and their most basic behaviour is based on the side of their relationship that we called dialectical. By shaping their behaviour, either through smooth nuances or by contrastingly and abrupt shifts, they will consequently shape the course of the game, and ultimately the experience of the player. So, *in the end, to act is to shape the experience of play.*

With this in mind, we embark towards a description of an action-oriented framework, presenting its grounding principles and methods of operation. A framework that rises from the grounds explored in this chapter, and that, in its turn, will serve as basis for the dimensions of action presented in PART II of this thesis.

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2. An Action-Oriented Framework

2.1 Grounding Principles

> Truth is nothing but a chain of translation without resemblance from one actor to the next. To focus only on the end-points is to distort the meaning of truth. (Harman 2009, 76)

The framework we propose and describe along the following sections is based on diverse theories, albeit not in full agreement with all of them, taking advantage of very specific components from various systems of ideas. While doing that, it follows a very particular line of thought that acts as its backbone, a cornerstone that can be summarily described as a multistage transition that goes from action to experience: from *action* stems communication, *communication* originates networking, *networking* creates emergence, *emergence* gives rise to narrative, and *narrative* constitutes *experience.*[50] This chain of procedures when observed from an operational standpoint – which is a perspective that this framework promotes – is in tune with the MDA framework (Hunicke, LeBlanc, and Zubek 2004, LeBlanc 2005), in the sense that when the player interacts with the game-system, the mechanics of the system give rise to diverse dynamics from which its aesthetics emerge. With this in mind, that series of interconnected concepts – from action to experience – consist of our perspective of how the dynamics of a system establishes a

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50 It is important to state here that our perspective on narrative is not focused on storyline. In this context, narrative is constituted by the sequences of events that emerge from the behaviour of the game system and from the player's interactions with it. It is those sequences of events that constitute the narrative that the player then interprets and assimilates as very particular experiences. See sections 2.1.4 and 2.1.5.

link between the mechanics and the aesthetics levels. In other words, that chain of procedures is, in our perspective, an unfolding of the dynamics stage in the MDA framework.

In sum, this is an *action-oriented framework* that from an *operational vantage point* explores *dynamics of (inter)action* in video games, being attentive to how they emerge from the mechanics of this framework and how they develop into potential experiences. Notwithstanding, our study is not necessarily focused on the fruition of those experiences themselves[51] nor on the mechanics per se. Nonetheless, of course that to understand the engendering of particular dynamics we needed to dive into the mechanics level, and to understand how they are received by the player we also needed to swoop into the aesthetics level. In fact, due to the exploratory nature of our study, we often uncovered diverse phenomena in the dynamics level by tampering with the mechanics of a system, and also through the aesthetics level by observation, inquiry, reading, and mainly by playing.

Therefore, assuming the roles that are prevalent on both sides – of player and of designer – was an important decision because, according to MDA framework, the mechanics of a game-system – while in form of code – are often hidden from the player, with a similar situation happening with the aesthetics level, which are essentially developed by the player, being inaccessible by the designer (and to other players and the game-system, for that matter). While interacting both the player and the game-system may try to uncover what is going on the opposite side, sometimes succeeding, but mainly through careful and pondered suppositions and/or well-educated guesses.[52] And, since our interest resides mainly in the dynamics level, perspectives from both points of entry ended up being useful.

As a final note, it is important to say that when we mention mechanics as rules of a system we are not just talking about the rules of a game and the respective gameplay

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51 A study focused on that is one much more related with the aesthetics level as defined by the MDA framework, and thereby that is outside the scope of this work, as we are concerned with dynamics.

52 Sometimes the game system may try to burrow into the player's mind, but never being able to establish a full 'understanding' of everything that is going on. It may be able to guess the player's affective state by means of data obtained through biometric sensors or it may be able to establish an adequate profile by analysing the player's behaviour (see section 9.3.4 Profiling), for example, but it is never truly able to know what is on her mind. And a similar situation may happen in the opposite direction, where the player is not able to fully and with certainty know everything that the machine is doing.

mechanics. We are also talking about the code by which the system operates. It is from that code that diverse processes, procedures and operations emerge, and it is these that constitute the dynamics of the system, being very much present in the relationship between the player and the game-system.

2.1.1 Action – Communication

In video games, the relationship between the player and the game-system can be characterised as based on a communicational feedback loop rooted on a cybernetic relationship "involving both organic and nonorganic actors." (Galloway 2006, 5)[53]

It is through this structure, through this feedback loop, through this cybernetic relationship between the player and the game system that a video game traditionally[54] unfolds, thus developing diverse experiences, usually for the player. Every action taken by either part evolves the narrative, makes it progress, ultimately leading the player to success, failure, or closure. In other words, the game system and the player react to each others' actions, influencing each other's behaviour, thus shaping the outcome of events. In this framework, the player's and the system's actions are acknowledged as the procedures through which they communicate, and it is by those means that they influence each other's behaviours, changing each others' states (Björk and Holopainen 2003; 2005).

> (…) there is no other way to define an actor but through its action, and there is no other way to define an action but by asking what other actors are modified, transformed, perturbed, or created by the character that is the focus of attention. (Latour 1999, 122)

The player and the game system's actions consist of signals that travel between them, where there is a myriad of things with the ability to transform those signals – something that we call *environment.*[55] With this in mind, we can see that the framework we propose also has its grounds on Shannon (1948) and Weaver's (1949) model for communica-

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53 To reinforce that fact, in the same work Galloway even uses the terms operator – instead of player – and machine – in substitution of game system.

54 We use this term to express the fact that – as we will describe in chapter 4 – in video games this feedback loop is not always in constant flux, depending on the responsiveness of the player and of the game system.

55 We will describe the environment to a greater extent in upcoming sections.

tional systems, a model in which the player emits signals that traverse through a given environment and that are ultimately received by the game system, and vice-versa.[56] Our framework adapts their model to fit it within the context of the cybernetic relationship between the player and the game system we previously identified.[57]

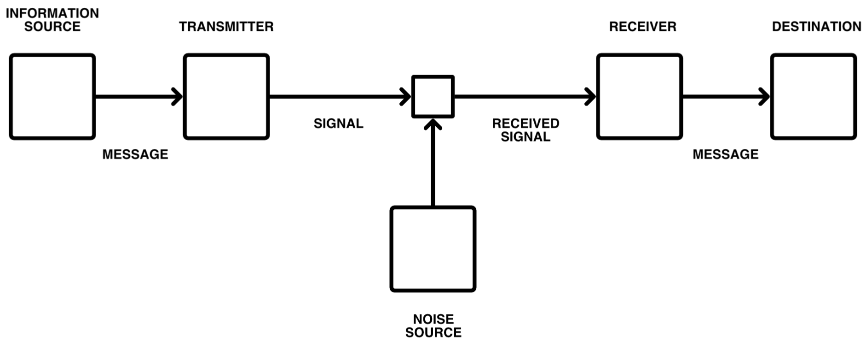

Figure 2.1: Shannon and Weaver's schematic diagram of a general communication systems (Shannon 1948; Weaver 1949).

2.1.2 Communication – Networking

Another set of influences within this framework are Bruno Latour's *actor-network theory* (1987, 1988, 1993, 1999, 2005, 2013), Graham Harman's *object-oriented philosophy* – mainly his perspective on Bruno Latour's work as a contribute to the field of metaphysics (2009) –, and Ian Bogost's *unit operations* and *tiny ontology* (2006, 2012). Their influence resides mainly on the fact that they promote an inspection of the world from the perspective of things, as opposed to a human-centred outlook. "OOO[58] puts things at the center of being. We humans are elements, but not the sole elements, of philosophical interest." (Bogost 2012, loc 164)

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56 We dissertate on how this model is adapted within this framework to a greater extent in the upcoming sections of this chapter.

57 As we will see ahead, this model is not only applicable to the relationship between the player and the game system but also to the relationships of communication that all entities or elements – in this framework are called actors – establish with each other, even including those that constitute the actual player and/or the game system themselves.

58 *Object-Oriented Ontology*.

> Latour's commitment to democracy is not a form of pandering to the spirit of our age, but is an intimate part of his metaphysical position. The universe is nothing but countless actors, who gain in reality through complex negotiations and associations with one another: not as one against a crowd, but as one in the shape of a crowd of allies. (Harman 2009, 88)

Therefore, by considering a decentralised perspective of the overall system[59] but by keeping in mind the ontological diversity of each element[60] – in the context of our framework we call these actors[61] – we were allowed to concentrate on the procedures themselves, on their actions, on the communication phenomena that occur in their midst.

> (…) since Latour grants all [actors][62] an equal right to existence, regardless of size or complexity, all natural and artificial things must count as [actors] as long as they have some sort of effect on other things. (Harman 2009, 17)

When these actors act, they communicate with each other and consequently establish networks. In this framework, the actions of actors are understood as procedures used to communicate with each other, from which and when in considerable numbers may result pretty complex entanglements we may consider as networks[63] – although a network does not need to be complex to be recognised as a network by this framework. And, such as in actor-network theory, in the context of our framework these networks are fluid, dy-

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59 With this term we mean to aim at the system constituted by the player and the game-system.

60 Latour calls actors or actants to these elements, things or entities, a term we adopted for our own framework and that we explain throughly in upcoming sections of this chapter. Nevertheless, we do not necessarily consider an actor to be everything that Latour does, specially events and similar phenomena. Harman uses the term *objects*.

"First, [for Latour] the world is made up of actors or actants (which I will also call 'objects'). Atoms and molecules are actants, as are children, raindrops, bullet trains, politicians, and numerals. All entities are on exactly the same ontological footing. An atom is no more real than Deutsche Bank or the 1976 Winter Olympics, even if one is likely to endure much longer than the others." (Harman 2009, 14)

61 This framework is mainly about actors. Their roles and traits are extensively discussed in the upcoming sections of this chapter.

62 When discussing Latour's actor-network theory, Harman invokes both the terms 'actant' and 'actor'. For the sake of clarity, we substituted the former by the latter in every quote.

63 And adding to the fact that these entities, these things are constituted by yet other entities or things that act, communicating with each other, they become networks in themselves. In section 3.4 we make a deeper analysis of this.

namic, ever-changing. "[A]ctors do not stand still long enough to take a group photo[.] (…) No, alliances are forged not *between* nice and discrete parties but in a disorderly and promiscuous conflict that is horrible to those who worship purity." (Latour 1988, 206) Actors constantly establish links with each other that are frequently interrupted as well or even severed by their own will or by decision of others. Their networks are thus dynamic.

2.1.3 Networking – Emergence

It is from the fluidity of these networks, from their ever-changing nature that behaviour *emerges*. And it is this behaviour that we, as players, mainly witness as the rules of the game in motion, as the algorithms being enacted.[64]

In video games, the behaviours that emerge from these networks are enacted within the boundaries established by the interaction of actors regulated by strict, fixed and usually simple rules. And that when in sufficient numbers may express a collective behaviour of high complexity.[65]

Nonetheless, our framework contemplates both systems where order is the prime matter and those that are developed in disorder and unpredictability, just as the relationships

64 "Thirty years after the two researchers first sketched out their theory on paper, slime mold aggregation is now recognized as a classic case study in bottom-up behaviour. Keller's colleague at MIT Mitch Resnick has even developed a computer simulation of slime mold cells aggregating, allowing students to explore the eerie, invisible hand of self-organisation by altering the number of cells in the environment, and the levels of cyclic AMP distributed. First-time users of Resnick's simulation say that the on-screen images—brilliant clusters of red cells and green pheromone trails—remind them of video games, and in fact the comparison reveals a secret lineage. Some of today's most popular computer games resemble slime mold cells because they are loosely based on the equations that Keller and Segel formulated by hand in the late sixties. We like to talk about life on earth evolving out if the primordial soup. We could just as easily say that the most interesting digital life on our computer screens today evolved out of the slime mold." (Johnson 2001, 16-17)

65 "Emergent systems too are rule-governed systems: their capacity for learning and growth and experimentation derives from their adherence to low-level rules: ants choosing to forage or not, based on patterns in their encounters with other ants; the Alexa software making connections based on patterns in the clickstream. If any of these systems—or, to put it more precisely, the agents that make up these systems suddenly started following their own rules, or doing away with rules altogether, the system would stop working: there'd be no global intelligence, just a teeming anarchy of isolated agents, a swarm without logic. Emergent behaviors, like games, are all about living within the boundaries defined by rules, but also using that space to create something greater than the sum of its parts." (Johnson 2001, 181) between actors that Latour describes as being "disorderly" and "promiscuous". Video games are often portrayed as controlled, closed and self-contained systems, but from our perspective – and despite much effort taken on behalf of many authors, studios, producers, publishers, etc. – they are pretty permeable to that sense of 'disorder' and 'promiscuity'. First, they commonly express unforeseen behaviours, often the result of untested scenarios and overlooked problems in their mechanics, usually consisting of bugs in the code – which usually result in exploits and glitches.

Secondly, they are also constantly exposed to unanticipated behaviours on behalf of their players.[66] Players often find routes, behaviours, resources that were unaccounted for. And also, players often cheat.[67]

Thirdly, the traditional behaviour of the overall system is also influenced or affected by unforeseen actors for the most diversified and pretty much unaccounted reasons. Here, we are talking about hacking activities, mods, or even alterations done by other software, viruses included.

Fourthly, modifications that change behaviours may also be found at the level of hardware that supports the system. The simple fact that computers featuring contrasting hardware components may promote noticeably different experiences in play comes to mind. Just think about the differences and the asymmetries that can be generated if in a play session one player possesses a game controller with the ability to auto-fire while the others don't. Another is, if one machine is very dated, its processing speed may affect the flow of events while running a modern and demanding game. Another example could be easily found in the difference between the arcade and home console versions of diverse video games, specially in the 1990s – just think of racing arcade video games that featured steering wheels and chairs with motorised haptic feedback, in opposition to the same game in a home console.[68]

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66 In chapter 9 we explore this to a greater extent when we talk about *exploiting*.

67 For an in-depth view on cheating and marginal player behaviour see (Consalvo 2012). "How players choose how to play games along with what happens when they can't always play the way they'd like are the beginning points of exploration for this book. Such activities by players challenge the notion that there is one "correct" way to play a game, or that games can have specifiable "effects" on players." (2)

68 Even more extreme examples can be found in the yearly days of video game history where the same game (at least featuring the same title) had to often be heavily customised to run on specific hardware. Many

We don't need to keep these references just about modifications to game system. We may also make mention to the changes that occur on the player side or even to those that happen in the surrounding environment. Behaviour emerges from the many networks of actors that constitute the overall system (player and game system, in this case), with each actor having a potential meaningful effect on the others that are connected to it, consequently affecting how narrative unfolds.

2.1.4 Emergence – Narrative

The sequence of events generated by these behaviours is what constitutes narrative. Bear in mind that we are not necessarily talking about the storyline of the game – although the mechanisms that generate this narrative may influence and even be able to generate it –, but about all the events that result from internal procedures of the game system and from the player's interactions with it that are expressed in runtime during a game. That is what Marc LeBlanc calls the *emergent narrative*[69] (Salen and Zimmerman 2004, 383). Also, in *Extra Lives* (2011), Tom Bissel states that "[g]ames with any kind of narrative structure usually employ two kinds of storytelling": the "framed narrative' and the 'ludonarrative'. The "framed" – as Bissel calls it –, scripted, or hardcoded narrative is fixed, unchangeable, and is imposed to the player. It usually consists of the story of the game, with all its multiple ramifications. The emergent narrative is "unscripted and gamer-determined" (2011). It is a kind of narrative that is a volatile, unstable, dynamic, and sometimes unpredictable, albeit bound by rules, by the algorithms that govern the game world. And by comparing both, one may say that the former is more data intensive, and that the latter is more process intensive (Crawford 1987; Carvalhais 2013; Kwastek 2013).

> Narrative has always been about the mix of invention and repetition; stories seem like stories because they follow rules that we've learned to recognize, but the

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were noticeably transformed. Some even stopped being the same game altogether. More recent examples are *Middle Earth: Shadow of Mordor* (2014) and *Alien: Isolation* (2014) that had their artificial intelligence systems trimmed down in the versions that run on older game consoles (see *Introduction*). Although that may not make them entirely different games, it makes them different enough to develop different dynamics that in their turn will promote experiences that unfold in different directions.

69 According to Salen and Zimmerman in *Rules of Play* (2004, 417), LeBlanc referred these terms at the 1999 Game Developers Conference.

> stories that we most love are ones that surprise us in some way, that break rule in the telling. They are a mix of the familiar and the strange: too much of the former, and they seem stale, formulaic; too much of the latter, and they cease to be stories. (Johnson 2001, 189)

In sum and for the sake of the argument, we are concerned about narrative that emerges from the behaviours of the game-system and those of the player. Thereby it is not fixed, it is dynamic, fluid, and sometimes not exactly re-experienceable, because the conditions that promote the occurrence of a certain event may not be repeated. As such, this is a kind of narrative deeply engrossed in the game's dynamics. Video games may dismiss the fixed narrative, but the one that emerges from their dynamics is unavoidable, as it is that which promotes the sense of agency[70] in the game, but also the feelings of uncertainty that result from the surprises and unexpected twists to its 'plot'.

> Instead of narration and description, we may be better off thinking about games in terms of *narrative action* and *exploration*. Rather than being narrated to, the player herself has to perform actions to move narrative forward—talking to other characters she encounters in the game world, picking up objects, fighting enemies, and so on. If the player does nothing, the narrative stops. From this perspective, movement in the game world is one of the main narrative actions. But this movement also serves the self-sufficient goal of exploration. Exploring the game world, examining its details and enjoying its images, is as important for the success of games such as *Myst* and its followers as progressing through the narrative. Thus, from one point of view, game narratives can be aligned with ancient narratives that are also structured around movement through space, from another perspective they are exact opposites. Movement through space allows the player to progress through the narrative, but it is also valuable in it self. It is a way for the player to explore the environment. (Manovich 2001, 247)

70 "Agency is the satisfying power to take meaningful action and see the results of our decisions and choices." (Murray 1997, 126)

2.1.5 Narrative – Experience

It is this kind of narrative that constitutes an *experience* of the player. In other words, it is these sequences of events that the player interprets and assimilates as experiences. Refuting, one may state that our perspective just aims for a part of the experience of playing. Video games are complex systems that bear diverse kinds of artistic and cultural expressions, with many adopted by other media – including visual arts, cinema, theatre, music and sound, literature, etc.. Thereby, storytelling, theme, iconography, etc., are also dimensions to be attentive to in the study of video games. It is not by chance that many popular genres in video games – and in movies for that fact – consist of differentiation by theme, such as *horror*, *adventure*, etc., or iconography, etc..

Nevertheless, our interest resides elsewhere. The experience we are talking about has nothing to do with iconography or theme.[71] It is an experience dependent on the processes, on procedures, on action. It is related with the sequences of events that unfold while playing the game, enacted through the dynamics of the overall system, and that can be seriously affected by diverse actors – such as the player, the game system itself, and even by foreign or unforeseen entities. This is the subject matter of the experience we consider for this framework. Having said that, other perspectives on experience need to be considered, of course, but through other lenses, through other studies. We believe that a perspective of video games grounded on action – as the one we propose – is one that looks at the intricate specificities of video games as ergodic media as defined by Aarseth (1997).

In conclusion, this framework is heavily focused on procedures, on the actions that are developed while playing video games, both on the side of the player and of the game system. This is its core. This is its heart. And this is what we believe that thrives video games into being the dynamic artefacts that they very much are.

> A game is kind of abstract storytelling that resembles the world of common experience but compresses it in order to heighten interest. Every game, electronic or otherwise, can be experienced as a symbolic drama. Whatever the content of the game itself, whatever our role within it, we are always the protagonists of the symbolic action (…). (Murray 1997, 142)

71 It is important here to not confuse iconography and theme with the audiovisual capabilities of video games.

2.2 Components and Basic Method of Operation

2.2.1 Disambiguation: Actors, actants, agents, and objects

As the player-system relationship is nurtured by *action*, we need to propose a framework grounded on the existence of things able to act. Being of paramount importance to the development of the framework, these things require a name, a term able to transpire their basic, essential, structural attributes. With this in mind and from several hypotheses, we chose the term *actor.*

Objects, instead of humans, are at the centre of object-oriented ontologies and philosophies. We have resorted to these schools of thought to highlight the fact that humans are not necessarily at the centre of this framework[72] but networks of actors. Even so, in a framework such as this – where experience surges from narrative that emerges from networks established by webs of actors that communicate with each other – we require a different kind of term besides *object*, mainly because it not only seems to be more suitable to something static or inert, as it also gives the impression of a somewhat passive thing or entity, of something to which a specified action is directed. Yes… we need a term that encompasses that, but also that can incorporate more active attributes.

Elsewhere (Cardoso and Carvalhais 2012b) we called *agents* to actors. However, we concluded that the term agent would be more adequate to entities that experience the phenomenon that Janet Murray defines as *agency* (1997), something that may or may not be experienced by actors: e.g. the flower power-up in *Super Mario Bros.* is unable to experience agency, but a human player may. Nevertheless, they are both considered to be actors in the game. And, since in this framework the actor that operates the game system may not be the player and may not even be human,[73] agency posed a serious problem.

The term *agent* could also be mistakenly confused with the definition of the same term used in multiagent systems theory in artificial intelligence studies (Wooldridge 2009; Sterling and Taveter 2009; Russel and Norvig 2010) – which is, by the way, only suitable

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72 Although we also pay a lot of attention to the particularities of human players, and some of the dimensions we present in part II are indeed concerned with human players, such as those in chapters 5 (THINKING AND ACTUATING) and 7 (FOCUS).

73 We talk about this in section 2.4.

for particular kinds of actors. Actors also don't need to be autonomous or to act autonomously. Some may only act when operated by other actors. And this may eventually stand against definitions that imply agents to possess, at least, a given dosage of autonomous behaviour (Foner 1993).

We then needed a term that could be inscribed in a conceptual model that is not solely concerned with the awareness that these things (actors) have of their own influence in the system and on each other, but with the communicational procedures they express regarding their mechanics, dynamics and aesthetics – in the sense proposed by the MDA framework (Hunicke, LeBlanc, and Zubek 2004; LeBlanc 2005) – and that could simultaneously reflect the context and phenomena of action we described in previous sections.

We also reflected on the term *actant* as a possibility, but ended up considering that it is also unable to convey the desired meaning in full. Actant can be broadly defined as something that plays an *active role in a narrative*. This summarily definition seemed particularly pertinent to our framework, featuring a more active stance than the term *object*, and seemingly embracing a broad range of entities when compared to the term *agent*. Actually, in the context of actor-network theory Latour uses both *actant* and *actor* to refer to the same elements. However, narrative is not the bedrock nor the foundation of our framework. Action is. In our framework, narrative is a consequential product that emerges from a network seeded on the actions of the elements we ultimately named *actors*. Narrative is of extreme importance in a video game's dynamics, but it is not its quintessential element. Therefore, to avoid confusion we dismissed the term actant.

An actor can be broadly defined as "a participant in an action or process".[74] Its a simple definition, but by clarifying the term actor as such we are able to establish crucial grounds in exhibiting its procedural nature. While defined as a series of actions, the term process stands much closer to the concept of narrative. Actually, the multistage transition of action into experience that we discussed in the previous chapter, is in itself a process, a process where actors bear a definitive role.

This choice was not done because of a mere description in the dictionary though. *Actor* is also the main term used in actor-network theory – which, as stated, is a major influence on the development of this framework.

74 According to the third edition of the Oxford Dictionary of English.

2.2.2 Actors

> Nothing exists but [actors], and all of them are utterly concrete. (Harman 2009, 16)

Actors are entities that have the ability to act in, on, or within the game world. They are entities with the ability to influence the course of events and to alter game states, making the game progress. In sum, everything able to act, independently of their specific role in the game and its world, is considered an actor, whether it is a playable character, an enemy, a power-up, the cursor pointer, an item, the cameras through which the player inspects the game world and that may or may not be controlled by them, even the game controller may be considered an actor, etc.. As long as they act, producing an effect on the game world and on each other, they are actors. In fact, through this perspective the game system and the player are also actors – albeit very complex. With this in mind we can also consider simpler things as actors, such as a given instance of a particular algorithm that is featured somewhere within the game world. In fact, if everything that acts is seen as an actor, we may say that the game is enacted by means of actions through intricate networks of actors – either belonging to the game world or outside of it, and that were or were not preprogrammed, or designed, or even expected at all.

Therefore, actors exist and perform in diverse contexts, from the cybernetic relationship that exists between the player's body and the system's hardware – governed by more direct, physical or tangible regimens of interaction – to the relationship between actors that inhabit the game world itself – following more indirect, virtual, or intangible regimens.

As they are entities through which actions in the game are enacted, actors play a central role in this framework. Without them everything is static, inert, and no information is conveyed, and thus opposed to the essence of video games themselves as dynamic artefacts.

2.2.3 Signal, Environment, Noise

A *signal* consists of a particular manifestation or action of a given actor and that may be sensed by another actor and/or by its originator. The form and modality of the signal is dependent on the capabilities of the actor that emits it. The capability to perceive the signal is also dependent on the modality of the receiving actor's sensors.

In order for a given signal to go from one actor to another it must travel through the *environment*, something that can be described as the medium through which signals travel. The environment is actually nothing more than a web of other actors that stand between the original emitter and the final receiver. Therefore, taking into account the diversity of actors, the environment must not be seen as something sterile, but as something with very specific characteristics that are for that reason able to influence and alter the signals between the original emitter and the final receiver. So, once emitted, the signal travels through various actors before reaching its final destination (if it has one in the first place). Depending on the involved actor's traits and capabilities for sensing, processing information and manifesting new signals,[75] a signal can be significantly transformed during its journey, a transformation that may range from that considered imperceivable to quite radical.

> Latour's concept of the circulation of reference entails his democratic metaphysics of actors, each separated from the other by a gap as wide as that between human and world, each serving as a mediator or translator that leaves no message untransformed. (Harman 2009, 77)

Thus, the environment allows the creation of links of communication between distant[76] actors, but at the cost of generating distortion and altering the signals. Thereby, we testify the occurrence of *noise*, which consists of the modifications that affect a given signal as it travels through the environment.[77]

75 We dissertate about these capabilities in section 2.3.5.

76 We use the term *distant* only to illustrate that the mentioned actors are separated by a large amount of other actors and not necessarily by space itself.

77 "So in my group, what we try to do is reverse engineer how humans control movement. And it sounds like an easy problem. You send a command down, it causes muscles to contract. Your arm or body moves, and you get sensory feedback from vision, from skin, from muscles and so on. The trouble is these signals

Although noise can result from disturbances provoked by specific characteristics of the environment, it can also emerge from the disruptive encounter of two or more signals, that in some way alters their current characteristics, something that may happen even across different modalities. If an actor receives two or more signals simultaneously, it may 'blend' them in diverse and sometimes unexpected ways. By contemplating this, noise may also be the result of a given actor not sensing anything in particular but a bit of every other signal of ongoing peripheral activities, and blending them as a result. So, there seems to be here a latent relationship between *noise* and *dysfunctionality*.[78]

> Noise is any pattern we don't understand. (…) There's really next to nothing in the visible universe that is patternless. If we perceive something as noise, it's most likely a failure in ourselves, not a failure in the universe. (Koster 2005, 24)

are not the beautiful signals you want them to be. So one thing that makes controlling movement difficult is, for example, sensory feedback is extremely noisy. Now by noise, I do not mean sound. We use it in the engineering and neuroscience sense meaning a random noise corrupting a signal. So the old days before digital radio when you were tuning in your radio and you heard "crrcckkk" on the station you wanted to hear, that was the noise. But more generally, this noise is something that corrupts the signal.
So for example, if you put your hand under a table and try to localize it with your other hand, you can be off by several centimeters due to the noise in sensory feedback. Similarly, when you put motor output on movement output, it's extremely noisy. Forget about trying to hit the bull's eye in darts, just aim for the same spot over and over again. You have a huge spread due to movement variability. And more than that, the outside world, or task, is both ambiguous and variable. The teapot could be full, it could be empty. It changes over time. So we work in a whole sensory movement task soup of noise." (Wolpert 2011) At the time of writing, Wolpert's TED talk could be seen at http://www.ted.com/talks/daniel_wolpert_the_real_reason_for_brains/. And its transcript could be read at http://www.ted.com/talks/daniel_wolpert_the_real_reason_for_brains/transcript?language=en#t-299000.

78 A relationship that we explore ahead in this chapter and in part ii in chapter 4 (responsiveness).

2.3 A Deeper Inspection (Part 1): Actor's Attributes

2.3.1 Topology

> There are only [actors]: all [actors] are constructed through numerous trials of strength with others, and all have an intimate integrity that partially resists any effort to disassemble them. (Harman 2009, 63)

This framework is heavily based on the concept of *actors* and their idiosyncrasies, with special attention to how they communicate with each other. With this in mind, we must now evidence that actors are not all the same. Although, we don't need to go as far as Latour stating that actors are utterly concrete and thereby absolutely different from one another, but we do find the need to evidence their differences. A power-up and the player don't have much in common, nonetheless, they are both actors as they participate in actions or processes that make the game progress – regardless of their disparate degrees of relevance to its unfolding.

That being so, they do possess contrasting differences and we find them immediately in the components that *assemble* them. The player is – in a very rough description and just for the sake of the argument – constituted by various organs and organic tissues arranged in very particular structures, plus all the prosthetics that may be in or on her body. The flower power-up in *Super Mario Bros.* (1985) is – in a similar description – constituted by a very particular set of algorithms. Through this perspective and despite being actors, they seem and are indeed very different.

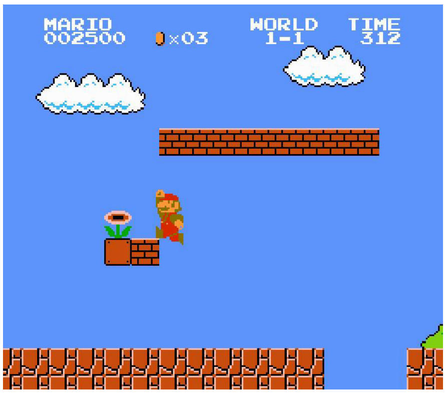

Figure 2.2: The flower power-up in *Super Mario Bros.* (1985).

But by investing a bit more time into this rationale, we can see that their components also act, they also participate in actions or processes which in the whole is what makes the player and/or the power-up to act in the first place. Thereby, they are actors as well. With this in mind, we may state that actors are constituted by particular networks of other actors. Just think of a human player as a collection of actors that act articulately, allowing the player to receive and process information and to act based on that: e.g. just think of human sensory organs such as eyes, ears, the skin, as input devices; think of the brain as a processing unit; and all the sets of muscles, tendons and bones that allow the player to physically express herself as output actuators[79] – not to mention all those that keep her alive, having the ability to influence her affective state.

And if we go a bit deeper we will find that the components of those components are actors as well. Just consider that those organs are constituted by specific tissues that possess diverse types of behaviour, and even these, formed by various cells that also express various ways of acting, still being ontologically very different. The same happens with the flower power up, although expressing a much simpler overall structure. Or even with the game-system itself as its diverse components act in a given network that contributes to the enactment of the game.

With this in mind, to the eyes of this framework all actors are assembled in a similar fashion, an assemblage that is based on a recursive formative structure. To further clarify this, actors are constituted by networks of other actors which in their turn are also constituted by other networks of actors, and so on. And an actor's composition may incorporate a more or less complex networking system while still being able to act as a single entity, component or element.

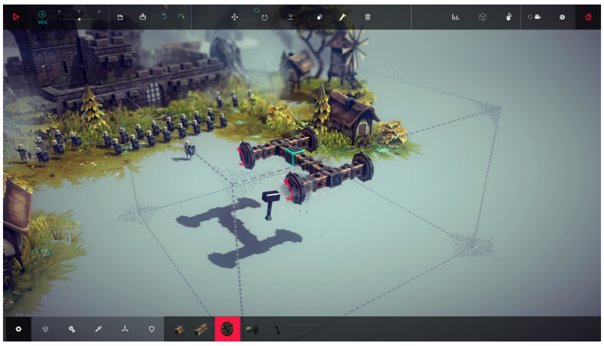

Figure 2.3: ***Besiege*** **(Alpha 2015).**

79 We will talk about the input and output (I/O) structure of actors in section 2.3.5.

An example – simple but quite illustrative – can be found in *Besiege* (Alpha 2015). This is a game where the player engineers diverse machines in order to achieve discrete game objectives. Those machines are assembled by arranging an array of simple modules, in which each expresses a particular behaviour. Depending on the traits of the modules used and their arrangement the machine may express a more or less complex behaviour, sometimes even unpredictable, much of which drives the player to experiment and retrial. *Spore Creature Creator* (2008) may also serve as an illustrative example, where creatures can be created by combining diverse modules each with particular features, that when assembled promotes a wide range of behaviours. *Scribblenauts Remix* (2011) is yet another interesting example, because in the game the player is able to evoke distinct actors by concatenating a series of words, therefore pointing various modules that constitute particular traits and behaviours.

Figure 2.4: *Scribblenauts Remix* (2011).

This recursive formative structure promotes the existence of actors with various degrees of complexity. The deeper we go into that structure the *more specialised* the actors are, focused on performing very specific actions. On the other hand, the higher we go into that structure, the *more versatile* the actors' behaviours can be. Just as happens in *Besiege* where the components by themselves bear relatively simple and focused behaviours when compared to the machine – a network of components, of actors. Continuing with the comparison between the flower power-up and the player, we may consider that the former is set at a lower level than the latter in this structure. While the flower has a very limited set of behaviours and actions at its disposal, the player is much more multifaceted.

The diversity in the actors' behaviour is thus obtained by the variety present in the complexity of their formative structure, their topology. Eventually, actors with higher levels of topological complexity may even be able to experience agency, as defined by Murray (1997), thus being able acknowledge the effects of their actions and those of other actors in the game.

2.3.2 Mereology

But, if actors are recursively constituted by networks of other actors, can we dive deep enough into their structure and reach an end? And what is present at that end? What is there? Is this structure endless – in which inside every actor there are always other actors – or is there an end and is it there that we are able to find the quintessential elements of actors?

> Every actor can be opened to reveal its components, as long as we perform the necessary labour. There is no final infrastructure of reality that reduces the rest to mere ideological superstructure. An actor has no essential inner core separated by a colossal gap from its trivial encrustations, or from its relations with other things. (Harman 2009, 72)

Well, in our perspective when we dive deep into the structures of actors or go extremely far away from our initial standpoint, we reach a point of a *paradigm shift*, that may challenge the limits of our understanding of the subject at hand: e.g. we may reach a point where we are no longer talking about design nor interaction but about computation, biology, chemistry, even physics. When deep enough, algorithms or bodily movement are nothing more than phenomena that emerge from physical and chemical behaviours. And beyond that, we go way astray from our field of knowledge, of study. The same happens when considering a more macro scale, but in either case, both surely fall outside the scope of our work.

Richard Dawkins presents the notion of *middle world* to explain the fact that we, as humans, are bound to perceive the world within a very limited scope. Diverse events or phenomena that occur in our very surroundings constantly escape our perception.

> We live near the centre of a cavernous museum of magnitudes, viewing the world with sense organs and nervous systems that are equipped to perceive and understand only a small middle range of sizes, moving at a middle range of speeds. We are at home with objects ranging in size from a few kilometres (the view from a mountaintop) to about a tenth of a millimetre (the point of a pin). (Dawkins 2006, 363)

The limitations of our own physiology give rise to what Dawkins describes as a narrow window that permits us to only grasp things that stand in a small middle range of all there is. For this reason, he claims that we are under-equipped to cope with things too big or too small, too fast or too slow, further stating that common sense is deceptive because it evolved in this middle world – precisely where everything is neither fast, slow, small nor big – and that we inherited this trait from our ancestors because they didn't need their horizons to be any wider in order to survive.

> (…) the way we see the world, and the reason why we find some things intuitively easy to grasp and others hard, is that our brains are themselves evolved organs: on-board computers, evolved to help us survive in a world – I shall use the name Middle World – where the objects that mattered to our survival were neither very large nor very small; a world where things either stood still or moved slowly compared with the speed of light; and where the very improbable could safely be treated as impossible. Our mental burka window is narrow because it didn't need to be any wider in order to assist our ancestors to survive. (Dawkins 2006, 367-368)

However, entities and events in the *middle world* depend on what happens in the *micro world*.

> There is a sense in which we animals have to survive not just in Middle World but in the micro-world of atoms and electrons too. The very nerve impulses with which we do our thinking and our imagining depend upon activities in Micro World. (Dawkins 2006, 370)

Dawkins's perspective may seem to be of an anthropocentric nature because he regards humans as observers, as perceivers, consequently making the *middle world* the centre of various scales of things. But, in a closer inspection, we may postulate that he intended the opposite: to call to attention the fact that the way we perceive the world is based on very limited resources and thus utterly flawed; and also that what falls outside of the scope of our abilities to perceive and even to interpret the world may deeply influence our own world and our very existence – even without our awareness. It is precisely because of this that Dawkins's theory is relevant to our framework, as it allows us to establish a similar analogy for comprehending the mereology of the framework.

Middle Level

Inspired by Dawkins, we may consider three topological levels in order to understand the mereology of a network: *middle, micro* and *macro.* In the same way that Dawkins's *worlds* are relative to our very own perspective and perception of the world itself, these three levels are relative to our position or to the position of the actors that are the subject of our interest.

Since video games are typically created with the player in mind, therefore being extremely player-centric, it is easier to start by looking at this framework from the player's perspective considering that the current *middle level*[80]. We may consider this to be constituted by the player, the game-system and the environment. And as we have seen, all the actors present in the environment are able to interfere in the communication processes between player and the system, and these may be unexpected, and may distract, obfuscate, and even impede the player to play.

Micro Levels

At the middle level the player operates the game system that provides a given response to which the player responds in her turn, and so on. But, this may not be inspected just at this level. We can go deeper, to see that the player also interacts with diverse actors that constitute the game system, and vice-versa: the game-system may be able to sense the

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80 Nevertheless, this framework is also able to portray cases where the player is absent, missing, or simply not operating the game system. See delegating operations in section 2.4 and responsiveness at chapter 4.

movement of the player's hands,[81] to know where her gaze is by inspecting the movement of her eyes,[82] to measure her heart rate,[83] etc.; and the player usually operates the game controller to manipulate the game character or avatar in order to interact with other actors in the game world.

Taking this in consideration, by establishing contact with those actors, we are immediately descending into diverse *micro levels* in the topology of the game-system. Usually, the influence of the player permeates through diverse layers of the game-system interacting with the actors situated at distinct levels in its topology. And the same is true in the opposite situation – just consider the diverse types and modalities of feedback that machine may produce – visual, aural, haptics – aimed at very different components of the player.

Macro Levels

Following the same logic but looking outwards, we may consider *macro levels* as constituted by clusters of networks formed by players and game systems. This is verifiable in massive multiplayer online (MMO) games, where multiple players are interconnected through a game system located in their own computer that is itself connected to particular networks of servers that may store persistent game worlds.

Structures at this level sometimes make evident asymmetries in the network at the middle level, something we often don't experience in micro and macro levels themselves, because as Dawkins states, those phenomena don't occur at an order of magnitude that we are able to easily to perceive or to acknowledge. As such, the emergence of common

81 Nintendo Wii games can serve as examples here, since most of them use the Wii Remote – the Wii's primary game controller, equipped with accelerometers – which allows the player to interact with the game system through gestures.

82 The PC version of *Assassin's Creed Rogue* (2014) is able to follow the player's gaze in order to adjust the camera.
At the time of writing a video introducing this feature could be seen at https://youtu.be/Bwfc03vm970. More info at http://www.pcgamer.com/steelseries-sentry-impressions-eye-tracking-in-assassins-creed-rogue/.

83 *Nevermind* (Early Access 2015) is an example here. This game uses a biofeedback sensor to monitor the player's stress levels. More info at www.nevermindgame.com.

but not necessarily intentional asymmetries in responsiveness between actors, that ultimately affect gameplay, become more evident to us. For example, in a multiplayer game, if a given player's connection possesses a very high latency that same player may experience lag, a noticeable delay in responsiveness. In practical terms, this means that if in a multiplayer online game all players execute the exact same action at the exact same time, the player that possesses the higher network latency will see the results of her action after all the others see theirs. In fact, that same player will also see the other players' actions at a later time. All this happens because the signal that a player emits takes a higher amount of time to reach the server (also an actor) to which all other actors are connected and that remotely regulates some events. In sum, a player with a lag problem may not even be able to see that she may already have lost the game. This not only originates a delay in responsiveness but also an asymmetry in the experience of the flow of time, in which the same event occurs at different times for disparate players. So, usually, it is commonly desired to establish connections between actors that possess very low latency in order to avoid lag.[84]

There is another way in which lag may occur. When a given actor receives an enormous amount of signals from other actors, noise may be generated as the signals get entangled and the receiving actor may not be able to filter or make sense of them. Some actors are able to arrange those signals in a queue, and thus process them one at a time. However, lag may be experienced if the queue is too long. An example of this is found in *Twitch Plays Pokémon*, which consists of a social experiment on the website *twitch.tv* – a video streaming service –, where *Pokémon* video games are played by a large crowd of users by parsing their commands through the channel's chat room. The bigger the crowd the longer the queue of commands becomes, and the longer the queue of commands is the more lag is experienced. In fact, the queue became so long that a given player was unable to know what would be the action in the game that the command she inputed would give origin to.[85]

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84 In chapter 4, we explore these variations in responsiveness and how they promote diverse experiences for the player.

85 At the time of writing a gameplay video could be seen at https://youtu.be/IPrNqm3F4Go.
Also, variations with very different games, such as *Twitch Plays Metal Gear* and *Twitch Plays Dark Souls*, appeared later.

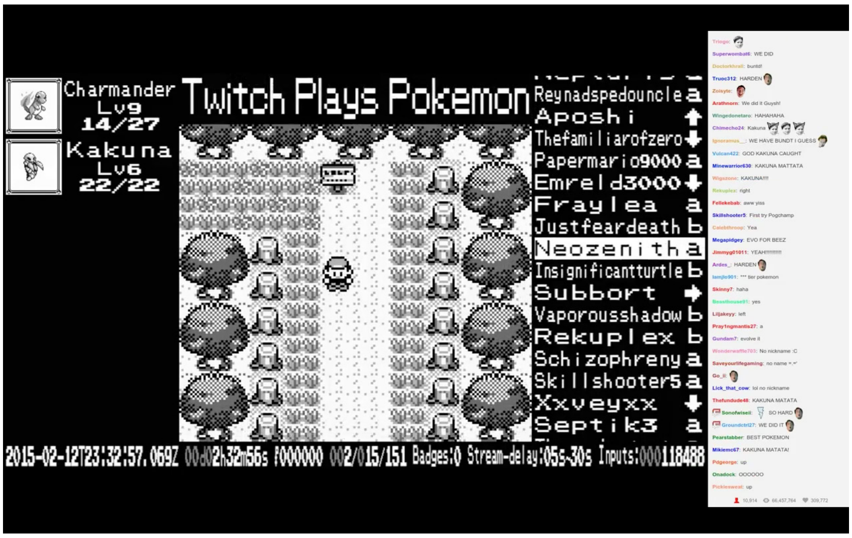

Figure 2.5: Screenshot of *Twitch Plays Pokémon*.

Twitch Plays Pokémon is however a very interesting experiment to consider because, even though participants are only able to momentarily and interchangeably assume the role of the player, introducing one command at a time, overall the crowd of participants acts as one, as a player.

To close this discussion and reinforce what was stated at the beginning of this section, if we move far enough we may eventually reach a level where we are unable to understand how the network functions, meaning that we are at the actual limits of our horizons, of our window – in Dawkins's terms –, to what this study is concerned with. To do that is to loose focus, moving from design to other fields of study each time a paradigm shift occurs.

2.3.3 Access

> While the term 'black box' is not of Latour's own invention, he deserves much of the credit for importing it into philosophy. A black box is any [actor] so firmly established that we are able to take its interior for granted. The internal properties of a black box do not count as long as we are concerned only with its input and output. (Harman 2009, 33)

According to Latour, actors turn into black boxes when they become an accepted dogma within a given community. It is that level of acceptance that makes them somewhat stable[86], often employed without deep or even superficial knowledge about what they enclose. In fact many items we use on a daily basis are 'black-boxed' to us: of the millions of people that use computers, many do it without possessing knowledge beyond that considered necessary for common use, that is to say that they mainly understand their input and output structures and methods – and, often, only the most commonly used. Everyday millions of people, as well, drive automobiles without deep or even basic knowledge of how an internal combustion engine works. This can also be applied to religious beliefs and faiths, and to knowledge, as Latour (1987)[87] and Harman describe.[88]

> By definition, a black box is low-maintenance. It is something we rely on as a given in order to take further steps, never worrying about how it came into being. The reason it can be either so refreshing or so annoying to speak of one's work with outside amateurs is that they lack awareness of the black boxes widely recognized in our respective professions. (Harman 2009, 37-38)

86 For Latour (1987) actors are always involved in trials of strength with each other. A black box is an actor in which its internal components (actors) enjoy from being in a state of stability sufficient enough to make the back box a consistent whole.

87 This happens mostly when "[t]he original discover[ies] (…) become tacit knowledge." For example, "[w]ho refers to Lavoisier's paper when writing the formula H2o for water?" (Latour 1987, 43)

88 According to Latour (1987), we may question the validity of black boxes, but we risk mockery, disrespect and even exclusion from the associated social circles, as he demonstrates with a short tale featuring two fictional characters the "Dissenter" and the "Professor". The Dissenter questions the validity of everything in the Professor's laboratory (which is filled with black boxes), his methods, the tools and the subjects he uses – in other words, how he operates and the actors in which he acts on. Disproving black boxes may create important historical milestones and/or generate opposing factions and disarray within particular social circles. But, in the story, the Dissenter eventually failed to disprove the validity of the Professor's black boxes and leaves the laboratory embarrassed and ashamed. Harman takes the story a bit further: "The Dissenter is now a scientific laughingstock. At future conference presentations, smirks and knowing glances are exchanged among those who bother to attend his papers at all. Some of the Dissenter's grant proposals now mysteriously fail, and his once friendly co-workers seem to turn the other way down the hall as he approaches. Maybe he's just being paranoid? No, he's not. The Dissenter's scientific isolation has permanently increased. His former allies have deserted him in droves, and his career will take years to recover even after an abject letter of apology to the Professor, who ruthlessly circulates the letter with his own sarcastic marginal notes." (Harman 2009, 43)

In the framework we propose there are not black boxes in the full sense that Latour proclaims. Instead, actors present themselves as having either a *closed* or *open topology*. When the micro levels of a given actor – its components – are hidden or inaccessible to other actors, we may say that it possesses a *closed topology*. As a consequence, actors appear to others as *black boxes* whose internal functioning is not visible to others, just being able to recognise or to perceive its input and output interfaces.[89]

Actors with an *open topology* have their components accessible to others. Tampering with those components without possessing an understanding of how they operate and their respective functions in the network bears the risk of retrieving unexpected results or even dysfunctionality – system failures, breaks, crashes, injuries, etc. – depending on how deep in the topology of the overall system we are acting.[90] The more dysfunctional the actor gets, the more *noise* is generated within its network, which may eventually propagate to other actors, to other networks, preventing their functioning.

So, if actors with a *closed topology* impose particular input and output protocols by means of a given interface in order to communicate with other actors – keeping the underlying network (their engines) hidden –, by contrast, actors with an *open topology* are permeable to *direct paths of communication* (input and output) directly into their micro level, which is something that doesn't happen with the actors with closed topologies.

Summing up, actors with open topologies are able to interact independently of their topological level. In fact, it is all a matter of perspective and how deep in this structure that their actions are inspected: e.g. is it the player that is interacting with the game system in order to play, or is it their brain that sends the respective signals to their spinal cord that in its turn emits other signals to their nerves and these to their muscles thus commanding their arms, hands and fingers to press the keys on the keyboard, which in turn sends the respective signals to the computer's processor by means of particular hardware and software procedures? Or is it just a matter of complex mechanical and electro-chemical processes that are happening within their body – not disregarding their own brain activity – and inside the computer itself? It is in fact everything mentioned!

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89 This only happens to actors that are familiar with the communication input/output protocols or modalities that actors with a closed topology employ.

90 This notion of depth is further developed in chapter 8.

> There is not some magic natural stratum of the universe where all accidents and combinations fall aside to reveal pure natural unities known as substances. Any black box can be opened, and inside we will find nothing but more black boxes. (Harman 2009, 66)

On the other side, such as any blackbox can be opened, an actor with a closed topology (actor A) can also be opened, but only if the actor trying to open it (actor B) has the *means* to do it, meaning that actor B needs to understand the functioning of network that keeps actor A closed. For example, lets consider the game system (actor A) as an actor with an open topology constituted by a game console or computational system itself (actor A1), a game controller (actor A2), the TV set (actor A3) and a pair of audio speakers (actor A4). All of these actors constitute what we consider to be this game system and we, as the player (actor B), establish links of communication with each of these components while playing. So, actor A is an actor with an open topology, as its components (actors A1, A2, A3, and A4) are accessible to the player. Nevertheless, actor A is composed of actors with closed topologies, as each of them bears particular input and output interfaces, enclosing everything else in a box – and like this we (actor B) cannot see the network beyond these.

Still regarding this example, if actor B possesses a screwdriver and knows how they are closed she then gathers the *means* to open up actors A1, A2, A3, and A4, exposing their micro levels, and only then be able to tamper with them. Either, when opening them up or when tampering with their micro levels, if actor B does not possess the knowledge of how those networks function she risks disabling or crippling them or even harming herself – in this case electrocution can be an example.

And, if instead of these, the actor with a closed topology was a particular algorithm (considering how deep we need to go to access it, it is now named actor A1624364, for example), we (actor B) needed to possess the knowledge of how to get to it and edit it as well as any other thing that could be considered the means to execute that action, otherwise we could not change it. The means to execute these actions – any action for that fact – is determinant, and they may reside at any topological level, counting down from the one the executing actor stands. In the case of the screwdriver it resided at our middle level; in the case of knowledge it resided at our micro level – deep into the structure of our brain.

Those means are thus related with an actor's surroundings, with its social circles, with its milieu – something that we explore in the next section of the text – and that of the actors that constitute it as well.[91]

> [Harman] suggests that objects do not relate merely through human use but through any use, including all relations between one object and any other. Harman's position also offers an implicit rejoinder against scientific naturalism; things are not just their most basic components be they quarks or neurons. Instead, stuffs enjoy equal being no matter size, scale, or order. (Bogost 2012, loc 164)

To conclude, any understanding on any given action will thus depend on the range of the topological levels that are examined for it to take place. It depends on how deep in the topology a certain action needs to be understood. And the more topological levels are examined, the more complex a given procedure will seem to be.

> Every [actor] can be viewed either as a black box or as a multitudinous network, depending on the situation. [Actors] can be either matter or form in different respects: matter for the larger assemblies that make use of them, form for the tinier components they unite beneath their umbrella. (Harman 2009, 34)

This seemingly chaotic and somewhat permeable topological access is what allows actors and their respective networks to be and to constitute extremely versatile systems of action.[92] And through this perspective, we are able to conceive the notion that actors are not only able to be perceived as acting as a whole but also as multiple parts, considering the activity within their micro levels.[93]

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91 It is important to notice that, in the examples given, when the player tried to transform an actor with a closed topology onto one with an open topology, she stopped fulfilling the role of player and assumed the role of designer. We talk to a greater extent about this in chapter 8 (depth).

92 "An open system has an exchange of some kind with its environment. A closed system is isolated from its environment. (…) Experiential systems can be open or closed systems." (Salen and Zimmerman 2004, 55)

93 This is crucial for understanding the differences between actions that invoked and controlled by conscious thought and those that are executed as part of our own biology by the autonomic nervous system, for example. This is subject is further developed in part ii, chapter 6 (thinking and actuation).

2.3.4 Milieu

> *Socrates*: At the very beginning of our discussion, I praised you for being in my opinion well trained in these matters. So tell me, if you will, what is a microbe?
>
> *Latour*: Certainly, Socrates. What I say is that we do not know a microbe in itself, but only what other actors are modified, transformed, or perturbed by it. (Harman 2009, 93)

An actor is typically connected to other actors, these are connected to yet other actors, and so on, thus forming networks. We may define an actor's connections with other actors – its social grounds or network – as its *milieu*.[94]

There are however some brief considerations that should be addressed before continuing: 1) two actors may possess different milieux, even if they are directly connected and are very similar actors; 2) it is possible for two actors that are not connected to possess the same milieu; and of the utmost importance, 3) an actor's milieu is not necessarily constant or static, changing during the game and evolving as it progresses, establishing new connections while others are severed. Therefore, an actor's milieu is always related with the *current* connections established with other actors, which in their turn may or may not possess the exact same milieu.

> For Latour the world is a field of objects or [actors] locked in trials of strength—some growing stronger through increased associations, others becoming weaker and lonelier as they are cut off from others. (Harman 2009, 16)

According to Latour an actor is as strong as the number of connections it establishes with other actors.[95] "An [actor] is always a strength, and a strength is a central point that gath-

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94 A connection is established when an actor acts, emitting a signal that another actor senses. If, by some reason, the latter is unable to sense the signal of the former the connection is not established. And as we will see in the second part of this thesis – mainly in chapter 4 –, actors possess diverse input and output states, in which in some they are unable to receive or emit signals, something that may occur either because that is a result of their processing stage, or simply because they are just too busy processing data, or even yet because of internal malfunctions.

95 "[Actors] are not stronger or weaker by virtue of some inherent strength or weakness harbored all along in their private essence. Instead, [actors] gain in strength only through their *alliances*." (Harman 2009, 15) ers other [actors] around it." (Harman 2009, 54) In other words, an actor is potentially more influent the more expansive its milieu is. The more actors it is connected to, the higher the chances are for it to exert significant *influence* across a wide range of other actors. Notwithstanding, the opposite may happen as well. The more actors are connected to a single actor, the higher are the possibilities for those actors to exert a heavy influence on it. After all, an actor's milieu is constituted by actors as well.

> The balance of force makes some [actors] stronger than others, but miniature trickster objects turn the tide without warning: a pebble can destroy an empire if the Emperor chokes at dinner. (Harman 2009, 21)

With this in mind, the influence that an actor's milieu exerts on it *determines and constrains* that actor's actions in the first place. Not all actions that an actor is able to realise are constantly available to it. Some are only able to be enacted in certain contexts, in determined situations, moments, or conditions – or in other words, depending on the milieu. Think of contextual actions. Video games are filled with such actions. Games like *Heavy Rain* (2010) are mostly played resorting this kind of actions, in which the player uses the exact same controls and resorts to the exact same operations to enact diverse kinds of actions that only become available in specific moments. These contextual actions are the core of what are called *Quick Time Events* – in which the player traditionally presses particular buttons on the game controller or keyboard in a timely fashion in order to execute particular actions – which today are very common during cinematic sequences or heavily cinematic games, such as *Asura's Wrath* (2012).

Figure 2.6: One of the many quick time events in *Asura's Wrath* (2012).

But we can aim for even more common things: just think that in many occasions the player's body performs the exact same movement – pressing a particular button – in order to realise the most diverse actions within a game – selecting an item in a game menu or shooting, for example. Depending on the current context, that action – pressing the button – originates different results, bearing different meanings. Although this last example is pretty low level, it illustrates how an actor's milieu determines and constrains the actions that are available to it.

Another aspect that we wish to focus on regarding an actor's milieu is *dependency.* The wider an actor's milieu is the more influent it may be in the network, but it may also become more permeable to the influence of those other actors, and their respective milieux, in their turn. Hence, one may think that an actor with a wide milieu may possess a leading role within a given network, or that the network is very dependent on that particular actor. However, the dependency of a given network towards an actor doesn't entirely rely on how influent that actor is. An actor within a particularly meagre milieu may be of extreme importance to the overall network, to the point of being indispensable, which is something that depends on the architecture of the network itself, and the role of that actor within that network. Dependency relies much more on the way a particular network functions, on how its actors are arranged and how *redundant*[96] is the activity of that actor.

2.3.5 I/O Structure

Actors are entities with the ability to generate, convey, and alter signals, influencing the course of events, the state of the game, the game world itself, and altering the state of other actors, by inspecting the environment and processing and exchanging data between each other. With that in mind, we were able to discern three separate activities that actors engage on: 1) *inspection*, a moment of sensing the environment; 2) *signal processing*, a moment in which the data extracted from the signals sensed by the sensors is handled, and in which decisions about how to proceed may or may not be made; and 3) *actuation*, a moment focused on disturbing the environment in order to emit specific signals even-

96 We use the term redundancy here to illustrate the fact that in a given network several actors may develop the same actions and functions, and if some cease to exist, or simply abandon those functions, the remaining may still keep that network ongoing.

tually targeted at other actors. Reckoning these activities, we consider actors to possess a basic structure constituted by three main elements – *sensors*, *processors* or *processing core*, and *actuators* – that depending on their alternative states express different actor's states, promoting diverse behaviours.[97] And with this in mind, we are able to expand a bit our definition of actor to that of an entity that is able to *sense* and/or to *transmit* and always *to process* signals, autonomously or not.[98]

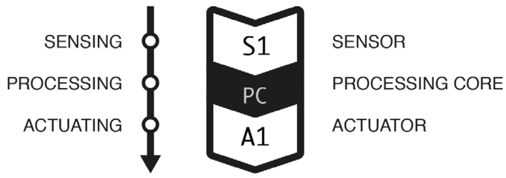

Figure 2.7: A schematic representation of the I/O structure of an actor.

Sensors

The *sensors* are the structural elements of an actor that are sensitive to the environment. They are the entry points of information, allowing the actor to be aware of other actors' outputs and of their own. They sense changes in the environment, transmute them into a form of manageable data, sending that to the processing core.

These sensors are susceptible to very specific manifestations in the environment that engulfs the actors. They are *modally specialised*, in the same way that a video camera is able to capture a specific range of frequencies of the electromagnetic spectrum or that a microphone is able to sense given oscillations in air pressure, which means that if there are changes in the environment that the sensors cannot capture, the actor is not aware of those.

97 See chapter 4.

98 See section 1.4.1 on the dialogical relationship between the player and the game system.

An actor doesn't necessarily possess only one sensor, nor solely sensors of the same kind. It can be endowed with as many sensors and of the many kinds its internal network – its micro level – is able to support.

An actor's sensors have two mutually exclusive states – *off* or *on* –, but they don't need to be all simultaneously with the same state. Depending on its complexity, an actor may be able to listen to a given type of environmental manifestation while choosing to ignore another.[99] Hence, some sensors can be operational while others are not working at all, something that can be due to malfunction or strictly as a result of the processing stage.

Processing Core

The *processing core* is where the data originated by the signals transmuted by the sensors is processed, digested, transformed, and then sent to the actuators. This process can be rather straight forward or pretty convoluted. And, depending on the complexity of the actor itself, this is where decisions can be made. Not all actors have the ability to make decisions though. Many actors constantly process the signals in the same way, obtaining the same or very similar results. On the other hand, others are able to interpret the signals and make various decisions about how to act next. So, whether deliberations are done or not, this stage always consists of processing data, and the outcome is only then communicated to the actuators.

In this framework, an actor's processing core is always considered to be active. If an actor is unable to process information it stops being an actor, as that would sever the link between the sensors and the actuators, the input and the output, rendering that element irrelevant. But, from this framework's perspective, this doesn't mean that its components disappear. Quite the opposite. If the network of actors – its micro levels – that constitutes the processing core breaks, the actor also breaks, becoming a set of actors probably fulfilling dysfunctional communication methods.[100] Simply put, it stops being an actor to become a set of actors that once composed a network, that gave origin to that actor in the first place.

99 In chapter 4 we will discuss matters regarding responsiveness of actors.
100 We will talk more deeply about this subject in chapter 4.

Phenomenologically speaking, the processing core can appear to be non-existent in an actor, although from an ontological perspective it is present and functioning: the processing core can be on hold, occupied processing information and thus not being able to manifest the results to the actuators, which may lead one to think that that actor is not an actor at all but something else. But, what that actor is expressing is just an unresponsive behaviour.[101]

Actuators

The *actuators* are responsible for outputting the results from the processing core to the environment, transmuting that data into very specific signals. Such as the sensors, the actuators are specialised by modality. Thus, depending on the compatibility between sensors and actuators, the signals the latter emits may or may not be sensed by the former.

To sum up, the actuators are the structural elements of the actor that direct and emit signals (output), that derive from the outcome of the processing stage and that will be potentially detected by the sensors of other actors. But the sensors may also capture signals emitted by their own actor's actuators. In some cases, this can result in a disruptive feedback loop, through which the signal gets progressively distorted and the information or data is transformed or even destroyed. But in other scenarios, the outcome may consist of a useful confirmation that the signal is being properly or improperly sent. For example, if we think of our vocal system as the actuator, our brains as the processing core, and our ears as the sensors, when we hear our own voice while we speak we obtain a confirmation that our discourse is ongoing and if the message is or is not flowing as intended.

In the same way of what happens with the sensors, an actor may possess more than one actuator and of diverse kinds. And according to the decisions made at the processing core, the *actuators* may or may not create output. Therefore, they express two divergent states: when they are generating output we consider that they are *actuating*, and when they are not generating output we consider them as *not actuating*.

101 Something that we will also focus on chapter 4.

2.3.6 Behaviour

A game's state changes according to the actions and corresponding behaviours developed by the actors in play, as their activities affect each other, an effect that determines the course of events and shapes the progress of the game. Through the course of the game, actors may autonomously assume diverse behaviours, even when being manipulated by other actors, which can be divided into four distinct classes. Notwithstanding, an actor doesn't have to invariably express just one of these classes of behaviour all the time. Depending on various factors, they may change behaviour in the course of time and ultimately its class as well.

The classes we propose are drawn from Stephen Wolfram's (2002) classes of computational procedures. However, we are not solely focused on computational entities. The classes we present are adaptations that take into consideration the ontological diversity expressed by what we have up to now been defining as actors, taking into consideration some thoughts and deliberations articulated by Rudy Rucker (2005) and Miguel Carvalhais (2010) on the subject.

Class 1: Uniform behaviours

Objects that in the game world typically serve as floor or walls, architecture or e.g. certain parts of the scenery may be considered actors that express a *class 1* behaviour. Although these actors may seem static, inactive and just part of the spatial configuration of the game world, they serve to constrain other actors in a defined space, therefore having an effect on other actors, as their properties interfere with them. According to Alexander Galloway, "non actionable objects are inert scenery." (2006, 24) Here the word "scenery" is meant for objects that do not exert influence on others. But, in a deeper inspection we may say that this is not the case. They do exert influence on other actors as they constrain them into a particular space. In many occasions, they direct the player and other actors into particular areas, and through very specific routes. Because their actions are constant, they seem to be rather passive, and thus we tend to be dismissive of them.

The actions of actors that exhibit class 1 behaviours express an *uniform*, *deterministic* and *predictable behaviour*, which may or may not be *controlled or activated by other actors*. We may also think about power-ups and power-downs as actors with class 1 behaviours, such as the speed boosters found in *Wipeout* (1995) or the mushroom and the flower power-ups in *Super Mario Bros.* (1985). We may also find them as weapons and equipment or as movable, moving, destructive or even destructible (and so on) objects around the set, such as the self-moving asteroids in the eponymous game (1979), the descending blocks in *Tetris* (1984), the destructible blocks in *Arkanoid* (1986), the bombs in *Bomberman* (1983), the giant blocks of stone that the player has to move in *God of War* (2005), etc..

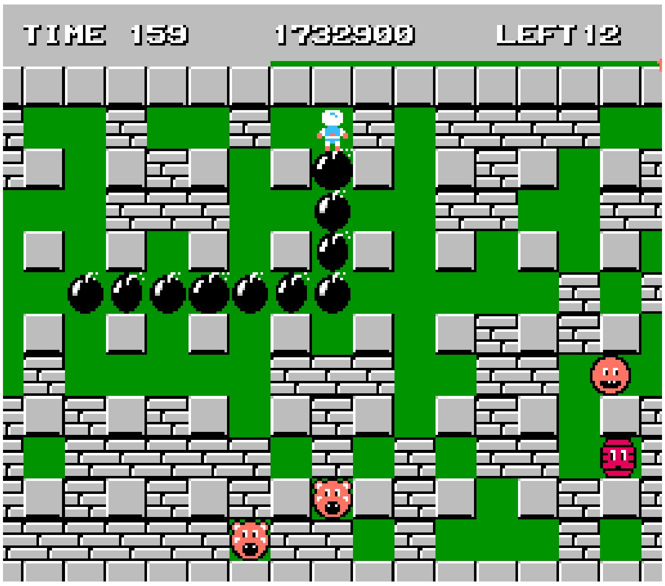

Figure 2.8: *Bomberman* (1983).

Actors exhibiting this class of behaviour may also be combined with other class 1 actors in order to create alternative behaviours, sometimes bounding together into a single more complex actor.[102] One example of this can be found in *Deus Ex: Human Revolution* (2011) where the player can customise weapons, adding extra features by attaching a silencer, or a laser aiming device, etc.. A similar example can be found in *Besiege* (Alpha 2015), such as we described in section 2.3.1 regarding the actor's topology. And yet another one in *Dead Rising 2* (2010), where the player is able to mix diverse items with distinct characteristics, from which emerge various things that may serve as weapons. In *Scribblenauts Remix* (2011) the player is able to invoke particular actors by describing them through text. When doing that, the game system resorts to a vast dictionary and asset database, composing a given actor that takes into account the request of the player, to the best of its capabilities.

102 In fact, in this framework all actors are combined into networks that consist of a more complex actor, and that thus may be able of exhibiting more complex behaviour.

Figure 2.9: In *Dead Rising 2* (2010) workbenches are used to combine weapons.

Class 2: Periodic, nested patterns of behaviour

Actors that exhibit a class 2 behaviour act according to *nested patterns of behaviour* that can be perceivable depending on the time that their cycle takes to restart. Usually the player has to understand these patterns – sometimes by trial and error – in order to interact with them. In *Metal Gear Solid* (1998), in order to traverse several areas of the game unnoticed, the player has to learn the behaviour patterns of patrol guards, surveillance cameras, etc., observing their movements, their courses, their actions. At those moments, these actors express class 2 behaviours, but if the player is discovered the patrol guards' behaviour may change, either by increasing or decreasing in complexity, or to another class altogether.

Figure 2.10: *Metal Gear Solid* (1998).

This class can be frequently found in the behaviour of common enemies in classic games such as *Pac-Man* (1980), *Donkey Kong* (1981), *Manic Miner* (1983), *Super Mario Bros.* (1985), *Alex Kidd in Miracle World* (1986) and *R-Type* (1987), for example, in which many opponents seem to move in a 'mechanical' fashion, mostly in patterns with short-term cycles.[103] In *R-Type*, when a group of opponents appears on screen they even seem to be dancing in synchrony, following a very particular choreography. By understanding and memorising that pattern the player is able to better progress in the game, moving to the best locations and choosing the finest moments to attack and to avoid attacks.

Figure 2.11: *R-Type* (1987).

But this class may be also present in other types of enemies, such as bosses,[104] in games like *Sonic the Hedgehog* (1991), *Streets of Rage* (1991), *Contra III: The Alien Wars* (1992), *Final Fantasy VII* (1997), *Dead Space* (2008), *Metal Gear Rising: Revengeance* (2013), and in many others. Usually these enemies do not necessarily resort to just that kind of short-term mechanical movement or action, but mostly to a predetermined sequenced set of actions that runs in loop. In both cases, the player has to learn and sometimes even memorise their behaviour in order to defeat them. Understanding these actor's patterns of behaviour is the very first step to overcome the challenges they constitute within the game. And although this class of behaviour may sound somewhat deterministic, the behavioural patterns featured in this class may achieve considerable high levels of complexity.

103 One can speculate on how these elements have roots in the other mechanical elements from pinball games, that have been listed as one of the roots of computer games (Kent 2001).

104 Bosses are system-controlled opponents, and are usually more powerful than the opponents the player has previously faced. Boss fights or battles commonly occur at the end of a level or section in game.

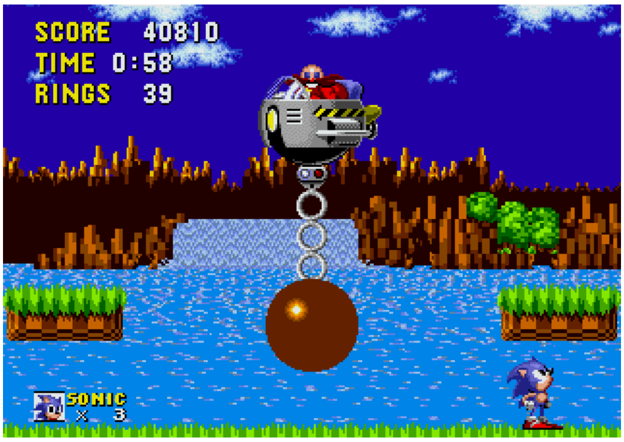

Figure 2.12: Eggman (a.k.a. Dr. Robotnik) in *Sonic the Hedgehog* (1991).

Class 3: Confusing behaviours, random outcomes

The output of actors with class 3 behaviour may present *random or pseudo-random results*. Although their behaviour is somehow *unpredictable,* they are usually accepted by players as one of the characteristics of the game, as being part of the challenge.

As an example, we may find this class in the *mystery blocks* in *Super Mario Kart* (1992) – the ones with the question mark on – that randomly (or seemingly randomly) give the players that hover them one of the available power-ups/items. Another example may be found in the random enemy encounters[105] used in role-playing games such as *Final Fantasy VII* (1997) or *Dragon Quest VIII* (2005), that have roots all the way back to *Dungeons & Dragons* dice-throws to determine the behaviours or skills of opponents or to affect the effectiveness of attack and defence of non-playable and playable characters, which is something that was also adapted to games in this genre.[106]

105 A random encounter is a feature that is used in some role-playing games consisting of encountering enemies at random or at seemingly random rates while traversing perilous areas.
Another question that may arise here is 'can this feature of random enemy encounters be considered an actor at all?' First of all, an actor doesn't need to be visible or in any way perceivable to the player. Secondly, these encounters are regulated by a particular algorithms that act within the game world triggering events when certain conditions are met, therefore influencing the game. Thirdly, it is not the feature itself that is an actor, it's the instances of that feature at runtime that are considered actors. And fourthly, if it is able to act it is an actor.

106 Actually, western role-playing games may have suffered a higher level of influence from *Dungeons & Dragons* games than their Japanese counterparts (JRPGs), such as the previously mentioned games. However, random enemy encounters seem to have been more popular feature in JRPGs than in western ones.

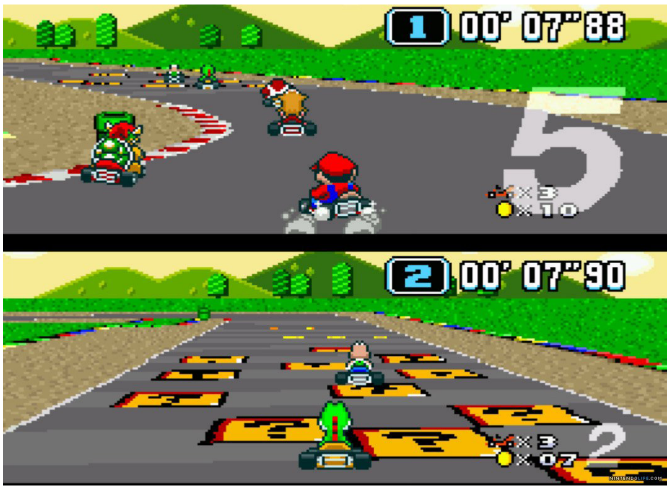

Figure 2.13: ***Super Mario Kart*** **(1992).**

Players cannot base their actions on the behaviours of these actors because they are rather intricate. They can only try to make sense of some patterns that may eventually emerge. In some occasions players may even think to have unraveled relevant patterns in their behaviours that will somehow benefit them or that they can somehow use to their advantage, but often they are just experiencing what Michael Shermer defined as *patternicity* – the ability to find meaningful patterns in meaningless noise (2008, 2010, 2011). In fact, some of these actors' behaviours are largely based on noise, randomness, dysfunctionality, phenomena that promotes unpredictability.

Class 4: Gnarly behaviours

> The original meaning of "gnarl" was simply "a knot in the wood of a tree." In California surfer slang, "gnarly" came to be used to describe complicated, rapidly changing surf conditions. And then, by extension, something gnarly came to be anything with surprisingly intricate detail. (Rucker 2005, 112-113)

This class encompasses all the actors that are able to make a variety of decisions and to plan various strategies to accomplish their objectives. They also have the ability to negotiate, to ponder and to evaluate between several goals. It is important to note that these actors have a structured but not necessarily deterministic behaviour, which may even become somewhat unpredictable due to their complexity. A human player is considered to be an actor with class 4 behaviour, although they may try to express all other three classes. Thereby, this class may also be used to simulate humans, as in the case of the numerous guards found in *F.E.A.R.* (2005) or *Far Cry 2* (2008)[107] that resort to an artificial intelligence engine.[108]

Figure 2.14: *Far Cry 2* (2008).

> In every case, the gnarly zone is to be found at the interface between order and disorder. (Rucker 2005, 116)

Some actors that seem to express a class 4 behaviour may actually be actors with class 1 or class 2 behaviour that are being controlled by human players. Class 4 actors usually manipulate actors of other classes, which then serve as their embodiments in the game,[109] allowing the players to inspect and act within the game world, while benefiting from their abilities.

Actors with class 2 behaviour that are in some way controlled by the player actually bear some resemblances to what is defined by some artificial intelligence studies as agents that act on behalf of a human, in this case, on behalf of the player. And, as actors have the ability to intercalate between behaviours and even between behaviour class, when a certain condition or set of conditions are met the actor that the player controls may act

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107 And, at the time of writing, *Far Cry 2* is already an somewhat old video game. We can easily substitute this with *Far Cry 3* or even *Far Cry 4*, or other similar but more contemporary games.

108 These may not be class 4 actors all the time. As stated, sometimes they express a class 2 behaviour – compare with the example of the guards from *Metal Gear Solid* (1998) we enunciated when describing class 2.

109 These actors are usually called the player's avatar or their playable character. But, in this framework this situation is not exclusive to the player's avatar or playable character. Other actors such as cameras, cursor pointers, or even the blocks in *Tetris* (1984) are controlled by the player, even if for a small amount of time. We prefer to call these actors the player's proxy, as we will dissertate in chapter 6.

on its own, removing the control – totally or partially – from the player and giving it back afterwards. Sometimes, the player may not even be aware of such occurrence. One very common example is present in a feature called auto-aim, which is very common in first-person shooters, and that consists of computerised assistance to the player's aim, by snapping the cursor to a particular point of interest situated in the proximities of its original location.[110]

2.4 A Deeper Inspection (Part 2): Methods of Operation

2.4.1 Mediated Operations

As we have seen, in this framework every interaction between actors is considered to be *mediated*. A signal that a given actor emits towards others needs to travel through the environment, which is constituted by yet other actors that are able to sense that signal, to process it, and to finally emit other signals that, in their turn, are sensed by yet other actors that proceed in the same way, a procedure that recursively occurs until the original signal dissipates, reaches its intended end or diverts from the intended path.

> Nothing is pure calculation, nothing follows directly from anything else, nothing is a transparent intermediary. Everything is a mediator, demanding its share of reality as we pass through it toward our goal. Every medium must be negotiated, just as air and water strike back at the vehicles that traverse them. (Harman 2009, 18)

The signals emitted by the actors that belong to the environment may be similar or distinct from the signal that was sensed by them in the first place, therefore potentially transforming the original signal, a phenomenon that we may refer to as *adding noise*. That is to say that the more actors are in-between the original emitter and the intended receiver(s) the more probable is that the original signal gets distorted, sometimes transformed radically, to the point of being utterly corrupted, or at least considered unreadable.[111]

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110 This practice is more common in players that play with a game controller than those that play with keyboard and mouse, due to the lack of precision in aiming of the former in this kind of game.

111 This is not the only factor, of course. We have considered other sources of noise in section 2.2.3.

One simple and typical example can be found when the player uses a common game controller to play a game. Lets consider the following actors: the player, the game controller[112], and the player's character. The player manipulates the game controller in order to control the playable character. The signals that the player sends to the game controller are very different from the signals that the game controller relays to the game system and consequently to the playable character. Nonetheless, most of the times their actions are coordinated successfully, in a way that the actions of the player are conveyed by means of the game controller to the playable character, through which are then manifested in the game world. Through this perspective, the game controller can be considered an actor that serves as a transcoder between the player and her playable character, hence changing the nature of the player's signals in order for those to be understood by other actors.[113]

Now, lets consider that the game controller is constituted by a video camera and that the game system possesses computer vision capabilities able to track the player's movements and use that as means to control the playable character. Everything that the camera of that device is able to sense, that stands in its field of vision and between it and the player's physical body has the potential to interfere with the communication pathway between the player and the game system. Neither the player nor the game system are actors acting in a vacuum. Surrounding them is an environment, and as such, between them there are other actors that may modify the signals, many of which are not part of the original or intended setup or were simply not foreseen by the designers and developers of the game. In sum, they consist of things that may stand in the way, but are also the things that allow communication to take place, constituting the environment that engulfs the player and the game system, and therefore mediating their operations.

A situation in which a mediated operation is much more evident can be found in the practice of tool-assisted speedruns[114] (TAS). In the context of video games, a *speedrun*

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112 We may consider the game controller as an actor with an uniform behaviour (class 1), which is directly manipulated by the player. In the simplest case, the player presses its buttons emitting particular signals aimed, in this case, at the playable character.

113 For Latour "[e]verything is a mediator, (…) [as] it is impossible to derive one thing instantly from another without the needed labour. In other words, the link between actors always requires *translation*." (Harman 2009, 18) See section 2.2.3.
We also further develop this notion of transcoding in chapter 6.

114 At the time of writing, a good resource for TAS videos can be found at http://tasvideos.org.

consists of a play-through in which the player tries to achieve the game's closure or particular objectives in the speediest way possible. Some of these are performed with the use of tools beyond the original setup or configuration of the game. In other words, TAS are speedruns in which the player usually resorts to tools that were not originally designed for the game[115]. Some of these consist of software that augments the player's capabilities for finding the quickest or the most effective way to beat the game, including exploration of errors and glitches that can otherwise be pretty hard to encounter.[116]

Figure 2.15: Screenshot of a TAS video of *Super Mario 64 DS* (2004), where the player uses glitches to reach the end as fast as possible.

These situations demonstrate that every operation is considered to be mediated, nevertheless while some of the resulting interferences – noise – are perceptible, many are unnoticeable and subtle enough to be unobtrusive, and that is when we consider a method of operation to be *direct*.

115 Many are found in emulators of the system that runs the game.

116 At the time of writing, a good example could be found at http://tasvideos.org/2791M.html, where the player concludes *Super Mario 64 DS* (2004) in just 08:58.41 minutes (figure 2.14). At the time of writing the video can also be seen at https://youtu.be/OGtBhtK5t7U.
Much more similar examples can be seen at *tasvideos.org* – where one can browse through the category "Heavy glitch abuse".

2.4.2 Direct Operations

We call *direct* to operations where the effects of mediation are considered to be irrelevant, in other words, when a very low amount of noise is generated. As we've seen, low noise may be achieved by avoiding transcoding the original signal and/or by steering clear of 'overpopulated' environments. If those conditions are met, actors are able to establish what we may consider a direct pathway of communication.

But, if actors are constituted by networks of other actors then within a given actor there are multiple internal environments that bear diverse levels of influence across the multiple existent relationships between the actors that compose that more complex actor in the first place. This is the same as saying that noise is also generated internally, within actors. Think of our own movements when we are trying to execute a given action: e.g. our intent is to aim and shoot at an particular enemy, but our body trembles, pulsates, it moves erroneously seeming to be automatically disobeying our very own mental commands. However, in order to improve, we may train ourselves to control or eradicate the erroneous movements until they are not so troublesome. That is to say that we optimise a part of our internal network.[117]

With this in mind, an operation is always mediated and noise is always present. It is only when that noise is considered meaningless that we also consider an operation to be direct. Actually, along the years huge efforts have been made towards eliminating noise in various types of media – computational included –, progressively acquiring higher levels of fidelity across diverse modalities of perception. Today, we have media able to acquire, store, and emit information with more resolution that we had ten years ago, and this will surely increase in the time of the upcoming ten years.

On the other hand, despite this apparent increase in fidelity, today, information is more mediated than ever. This paradoxical stance is supported by the fact that we use more and more computational artefacts that act on our behalf, automatically editing the infor-

117 We talk about actions that can be mastered by rote in chapter 5 (THINKING AND ACTUATION), noticing that eventually some actions that initially required high cognitive effort will require less and less labour with proper training.

mation we input – such are the cases of auto-filters present in many photo cameras, or the simple auto-aim feature in first-person shooters in the case of video games. And this takes us to what we call *delegated operations*.

2.4.3 Delegated Operations

A *delegated operation* occurs when an actor acts in representation of another. This actor may be delegated by the actor that it will represent or by another one. In the first scenario, this method consists of at least two moments: in phase 1 actor A interacts with actor B in order to deputise it, setting it up, instructing it; in phase 2 actor B assumes the role of actor A, acting on its behalf, while actor A monitors it and/or embraces other tasks, either related or unrelated with the game. Regarding scenario two, in phase 1, actor A should be substituted by actor C.

In many occasions, the player orders actors to fulfil certain tasks within the game. In strategy games, such as *Pikmin 3* (2013), this is very evident, as the player is in command of a considerable number of actors at the same time (characters named 'pikmin'), delegating certain tasks to certain actors or groups of actors that act on their own, an activity that the player may eventually interrupt.

But this situation is more interesting when it is more extreme: e.g. when the player delegates her role as operator of the game system[118] to another actor. Good examples of this can be found when players use software bots to play on their behalf, sometimes with the intention to bypass repetitious and time-consuming tasks, such as those that are based on grinding or farming[119]. By implementing those resources, those actors in play, players are also removing the effort it takes to achieve particular results, allowing those mechanisms – that range from simple to pretty complex – to automatically improve their status in the game or simply to make it progress.

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118 We use here the term of operator in the sense that Galloway sees the player. See (Galloway 2006).

119 Grinding and farming are very common phenomena in role-playing games, consisting of repetitious tasks that need to be performed in order to e.g. level-up characters or to obtain items in a game.

> More recent third-party programs for online games have proliferated and include programs that enable players to play a game in Windowed mode (if the game does not usually allow it), and more easily level and farm individual characters. One such program is the WoW Glider, designed for players of World of Warcraft who wish to automate certain aspects of gameplay. (Consalvo 2012, 122)

In *The Maximum Score in Super Don Quix-ote* Paul Keir (2015) presents software that although is not able to play *Super Don Quix-ote* (1984) is capable of pinpointing hidden valid inputs in the game's quick time events (QTE), allowing the player to achieve the actual maximum score.

> A selection of QTEs in SDQ [Super Don Quix-ote] allow responses distinct from those invited by the on-screen prompts. (…) For example, the game's penultimate QTE prompt is shown bottom-right (…). An arrow invites a leftward movement of the joystick. Such a gesture is of course permitted; yet so is a button press. These 14 QTEs are sprinkled throughout the game, and each valid QTE alternate response provides the player an additional score bonus of 10,000. This project identifies all such QTE alternatives using custom software which exhaustively tries all possible responses to the 156 QTEs in SDQ. With this information, the game is subsequently completed by the author to obtain the maximum possible score in SDQ of 776500. (Keir 2015)

Learnfun & Playfun, software that plays Nintendo Entertainment System (NES) games, is another example. In *The First Level of Super Mario Bros. is Easy with Lexicographic Orderings and Time Travel . . . after that it gets a little tricky* (2013) Tom Murphy VII shows us how this software is able to learn to play *Super Mario Bros.* (1985), although failing after the first level. He also shows us how it is able to play other NES games, namely platformers,[120] but it utterly fails at *Tetris* (1984) – it even pauses the game indefinitely as an action of last resort in order to not loose the game altogether.[121]

120 In video games the genre *platformer* or *platform game* is characterised by a type of mechanics where the player controls a game character which is usually required to jump or climb onto diverse platforms along the game world.

121 The author states that his work is real, although works presented at SIGBOVIK conference – as his was – are not necessarily real (it is an April Fool's conference that normally publishes fictitious works). For more info, see the project's page at http://www.cs.cmu.edu/~tom7/mario/, and the author's presentation video at https://youtu.be/xOCurBYI_gY.

MarI/O is software that is able to play *Super Mario World* (1990). Some video reports were made public on *youtube.com*[122] and the code was also published publicly online at *pastebin.com*[123]. It was not published on academic grounds and the creator himself claims this to be nothing necessarily new, being based on *Evolving Neural Networks through Augmenting Topologies* a work by Kenneth O. Stanley and Risto Miikkulainen (2002) that aims at machine learning, evolving across generations in a way akin to the way biological species have done and still do.

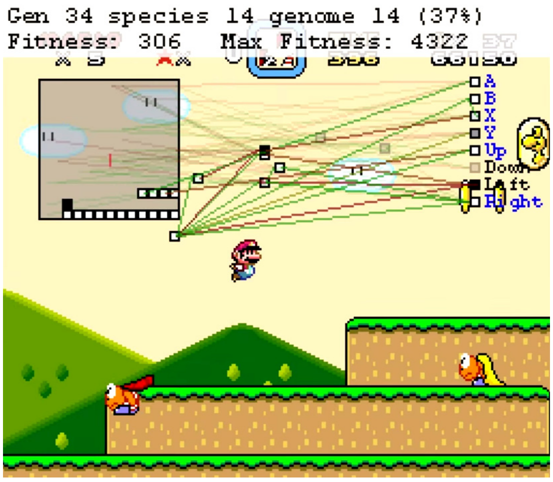

Figure 2.16: Screenshot of *MarI/O*.

Mario AI is yet another example of software that learns to play *Super Mario World* (1990). It was created by Stephan Ehrenfeld, Fabian Schrodt, and Martin V. Butz from Cognitive Modelling, Department of Computer Science, Faculty of Science, University of Tübingen and was the winner of the ninth Association for the Advancement of Artificial Intelligence (AAAI) Video Competition People's Choice Award.[124] The video named *Mario Lives! An Adaptive Learning AI Approach for Generating a Living and Conversing Mario*

122 At the time of writing, the video *MarI/O - Machine Learning for Video Games* can be found at https://youtu.be/qv6UVOQ0F44; *MarI/O Followup: Super Mario Bros, Donut Plains 4, and Yoshi's Island 1* at https://youtu.be/iakFfOmanJU; and *Super MarI/O Kart Commentary/Stream Highlights* at https://youtu.be/S9Y_I9vY8Qw. These videos were all claimed to have been uploaded by the creator of the that particular software.
123 At http://pastebin.com/ZZmSNaHX.
124 "The goal of the competition is to show the world how much fun AI is by documenting exciting artificial intelligence advances in research, education, and application." Cited from the event's homepage at http://www.aaaivideos.org.

Agent[125] shows us software that is able to make Mario to play the game by being aware of its environment – considering particular limitations – and by verbal instruction, which it can do by conversing with the player.[126]

Figure 2.17: Screenshot of *Mario AI*.

However, software is not the only resource players may use while developing this method of operation. On January 18 2015, on *reddit.com* the user *yavin427* created a post with the following title: *For those with no time to spare for alternate characters, I present the slowest, laziest way to level up to 20 without having to lift a finger. I'm equal parts proud, and ashamed.*[127] In this post he shared a simple mechanism claimed to have been created by him and that was able to play *Destiny* (2014) for him: a simple robot that periodically pressed the shoulder button[128] on the game controller. Due to the automated activity of that robot, the player's character attacks and eliminates a couple of enemies, and dies, only to respawn[129] doing it all over again, endlessly, automatically levelling-up.

125 At the time of writing this video could be seen at https://youtu.be/AplG6KnOr2Q and at http://www.aaaivideos.org/2015/14_mario_lives/.

126 We use here the term *player* in the sense that despite the fact that she delegated the task to operate the system to a software actor, we consider that it is she that is still playing the game as she is able to operate the software that is operating the game system.

127 At the time of writing the post could be consulted at https://www.reddit.com/r/DestinyTheGame/comments/2svsok/for_those_with_no_time_to_spare_for_alternate/, and the video at https://youtu.be/s8v87S8AroE.

This was also featured on some press sites at http://www.kotaku.com.au/2015/01/genius-destiny-player-builds-robot-to-grind-for-him/, http://www.vg247.com/2015/01/20/one-destiny-player-has-built-a-robot-to-do-all-the-grinding-for-him/, and at http://www.eurogamer.net/articles/2015-01-20-mans-basic-invention-levels-destiny-character-while-he-sleeps.

128 The shoulder buttons are buttons located on the upper edge of a game controller.

129 To respawn means to be recreated after being destroyed. In this case, the game character was killed by enemies and reappeared moments afterwards.

Figures 2.18 and 2.19: Screenshots from the videos where the reddit user *yavin427* shows his bot in action. The image on the right depicts a later and more complex version.

On April 15th 2014 on *wired.co.uk,* there was a post entitled *Lego robot plays freemium iPad games while creator sleeps* that stated that a man had produced a robot, resorting to Lego Technics and an Arduino board,[130] to play[131] *Jurassic Park: Builder* (2012) on his iPad while he slept. As an actor with a class 1 behaviour, this robot operates the game always in the same manner, it moves left and right in particularly discreet increments and taps the screen. With that in mind, the player carefully placed every item (in this case, dinosaurs) equidistantly and arranged in a line so that the robot could move to their locations and tap on them to earn in-game currency.[132]

Figure 2.20: Screenshot from a video that shows the bot operating *Jurassic Park: Builder* (2012) on an iPad.

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130 Arduino is a company that designs and produces open source microcontroller-based kits aimed at the assembly of computational artefacts able to sense and act in the physical world, much used within the do-it-yourself community, as well as by artists and designers.

131 At the end of this section of the text, we propose *to operate* as a more suitable term.

132 At the time of writing this information could be found at http://www.wired.co.uk/news/archive/2014-04/15/lego-jurassic-park-robot-ipad. A video displaying the robot functioning could also be found at https://youtu.be/SnUH6f_Mv8o.

Despite their simplicity, from the standpoint of the framework we propose, these mechanisms, these physical mechanical artefacts are considered actors too. The fact that they constantly and uninterruptedly perform the same action or set of actions certainly is no deterrent to this statement, for as long as they influence the game they are actors. The behaviour of these actors is rather simple – mainly class 1 –, but more complex mechanisms may eventually be able to express complex behaviours.

A different example can be found in *Fish Plays Pokémon,* which is a sort of a homage to *Twitch Plays Pokémon*.[133] It functions in a similar fashion but delegates the role of operator of the game system to a fish swimming in a fish bowl. The image from the video feed of the fish is super imposed to another image where the commands for the game are displayed. If the fish swims through the areas where a given command is placed the respective trigger is activated, as if one was holding the corresponding button, or key. For example, if the fish swims to the location where the command to go left is the player's character moves to the left, for example, or whatever is being controlled at that moment moves left or does the corresponding action, as if one pressed that button on a game controller.[134] And as before, to the eyes of the framework we propose, these biological entities are considered actors too, as their actions influence the game.

Figure 2.21: Screenshot of *Fish Plays Pokémon*.

133 See *Macro Levels* section 2.3.2.

134 Despite the pretty inconsistent play that emerged from this setup, *Fish Plays Pokémon* became widely know throughout the Internet. The channel at *twitch.tv* could be accessed at http://www.twitch.tv/fishplayspokemon.

By summing up, we become aware that the employment of this method of operation raises some questions related with experience. If we place actors in play that are not aware of their role in the game can we consider play to be a voluntary activity?[135] Or even a conscious activity? Are these actors (the AI, the bots, the fish…) playing, in first place?

We believe it is easy for people to say things like 'the fish is playing a Pokémon game' or that 'a robot is playing this or that game'. But, if we inspect things a little bit deeper we come to doubt those statements. The robots we presented certainly don't play. Animals play, but in the case of *Fish plays Pokémon*, for example, the fish is not playing video games from the Pokémon series nor any other video game at all, as it is not even aware that its actions are influencing the game system. From all the above, the software with artificial intelligence is the only one that we could eventually consider the hypothesis of it being able to play, but we prefer not to take that risk yet. Therefore, we prefer to say instead that these actors are not players but *operators* of the game-system. The player is the one that employed them, that delegated them the role of operator of the game system. Which means that the player stops fulfilling her role as operator of the game system, entrusting it to another actor – at least partially.

But, this also raises other questions. Is the player, of all the actors, playing at all? By delegating their activities in the game to another actor – an actor that may not be conscious of what it is doing in the game and that may even be an automaton – is the player really playing the game? And if the player is not playing and the actor delegated by her is not playing too, what happens to play? Is anyone or anything playing at all? And thus, do video games require play at all, or are they just a matter of interaction and/or operation? Or can play be considered the moments of setting up these mechanisms to only later see them play out? With this into consideration and increasing the intensity of the problems these questions raise, we ask: what about zero-player games? This kind of game also tackles some of these questions by removing from the player the ability to operate the game.[136]

135 "[P]lay is a voluntary activity or occupation executed within certain fixed limits of time and place, according to rules freely accepted but absolutely binding, having its aim in itself and accompanied by a feeling of tension, joy and the consciousness that it is 'different' from 'ordinary life'. Thus defined, the concept seemed capable of embracing everything we call 'play' in animals, children and grown-ups: games of strength and skill, inventing games, guessing games, games of chance, exhibitions and performances of all kinds. We ventured to call the category 'play' one of the most fundamental in life." (Huizinga 1949, 28)

136 We talk about the role of zero-player games in chapter 4 (responsiveness).

2.5 Summary

In this chapter, we described an action-oriented design framework aimed at conception and critical analysis of video games in the scope of art and design, with use within the realm of game and interaction design, and design, game and media studies. It is focused on dynamics of action, that were translated into a multistage transition that goes from action to experience (action – communication – networking – emergence – narrative – experience) and that constitute its grounding principles, and that from its point of view also correspond to an unfolding of the dynamics stage in the MDA framework. With its grounding principles laying on the foundations of the MDA framework, this framework appropriates and adapts Shannon and Weaver's model for communicational systems while taking much of the basic rationale found in actor-network theory, object-oriented ontology and philosophy. From their articulation, questions of emergence and narrative emerge – namely the emergent narrative mentioned by Marc LeBlanc and Tom Bissel –, and only then concluding in experience.

We then presented actors as the quintessential elements of this framework and described its basic method of operation. Later, we performed a deeper inspection on actors explaining how their topology relies on a recursive formative structure, the fact that they are networks of actors in themselves; how their mereological relationships are ruled by their middle, micro and macro levels; how actors access each other by means of open and closed topologies, elucidating the fact that interaction between actors situated in diverse topological levels is feasible; how actors' influence is determined and constrained by their milieu and how they are also influenced by the same social network; how actors process signals through a basic I/O structure grounded on the articulation of sensors, processing core and actuators; and that actors are able to express four classes of behaviour, from simple and uniform all the way to very complex and gnarly.

After that, we also performed a deeper inspection on the methods of operation, exploring three distinct methods: mediated operations – which are the basis of all operations in the framework –, direct operations – that happen when the effects of mediation are considered irrelevant –, and delegated operations – that occur when an actor acts in representation of another.

To conclude, it is important to state that this framework is born out of design studies, where communication and interaction design play a leading role, but also applicable to the scope of game design. This is then not a study focused on technology in itself or about aiming at technological advancement per se. Instead, it aims at an analysis of video games as design artefacts, which leads us to an awareness of how they develop or unfold by means of action, which in its turn promotes the shaping of methods and tools aimed at conceiving high level concepts of video games regarding their mechanics and dynamics with a steady view on the experience that from there emerges.[137]

With this in mind, we proceed to PART II of this thesis where we present and discuss seven dimensions of action that rise when this framework is put to action, and that can be used to shape those previously mentioned methods and tools.

137 Applying this to other computational artefacts is also a possibility but a proper study needs to be accurately done.

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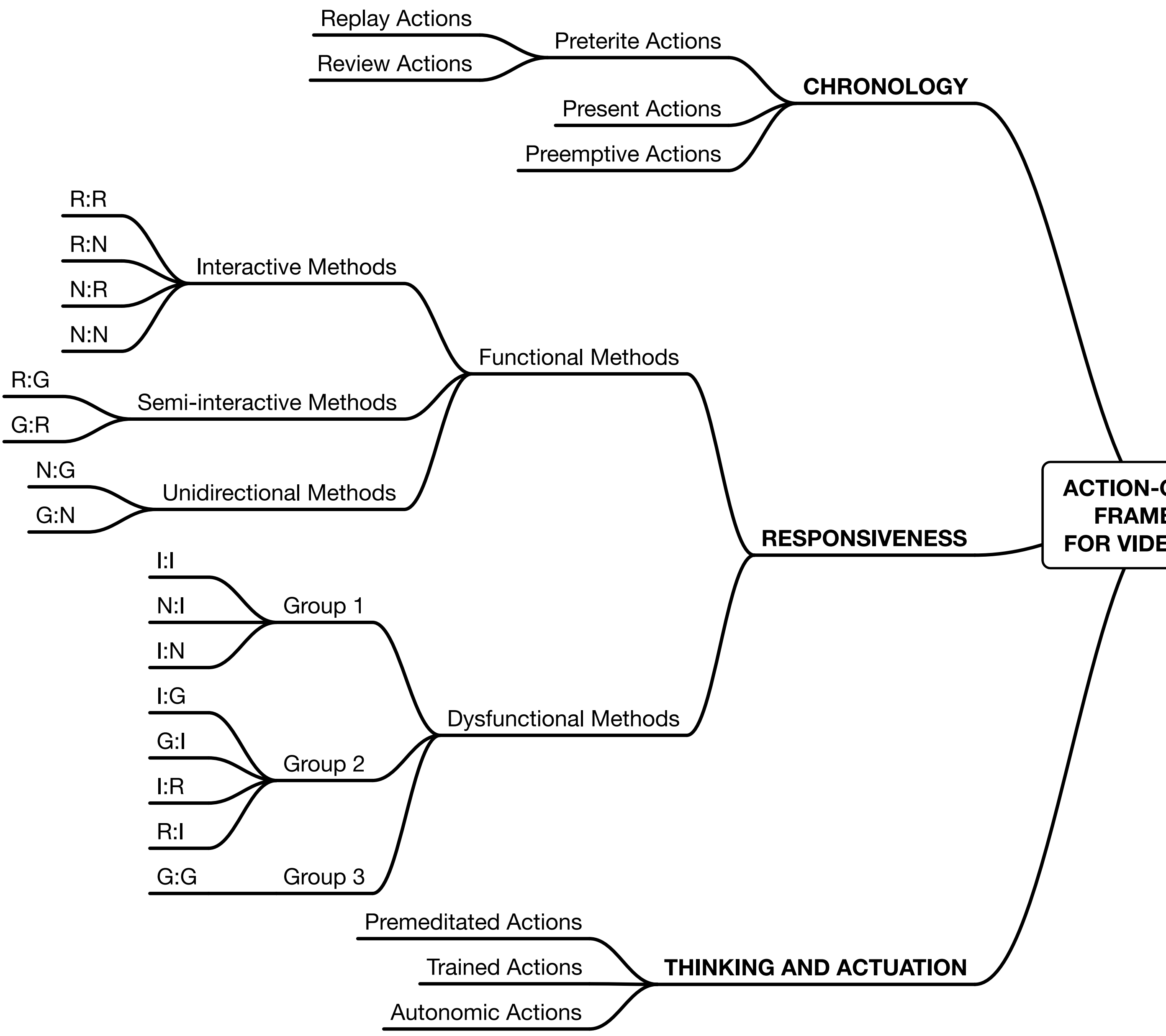
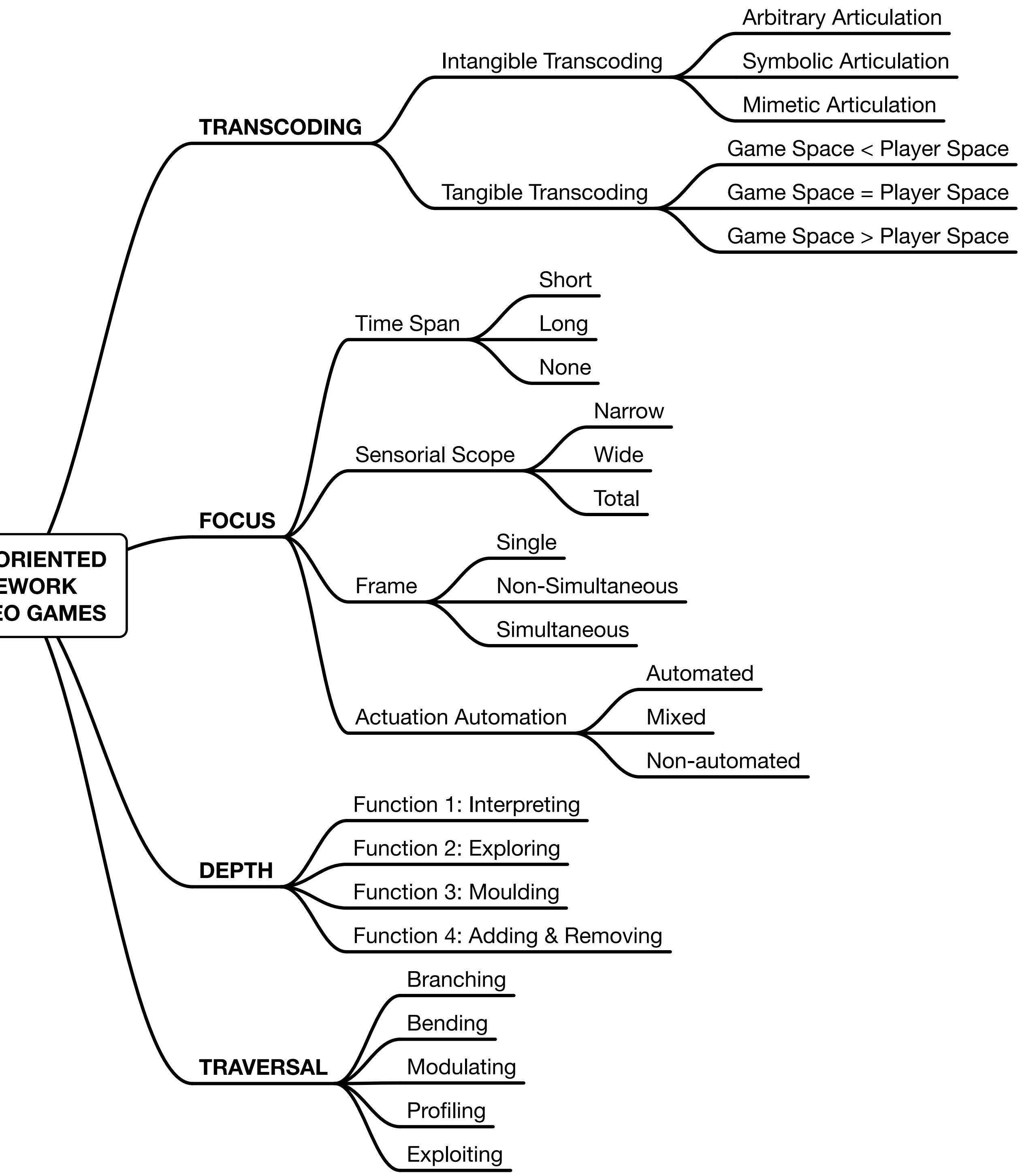
Part ii: Playing in 7D

To understand video games, then, one needs to understand how action exists in gameplay, with special attention to its many variations and intensities. (Galloway 2006, 3)



ACTION-C
FRAME
FOR VIDE
CHRONOLOGY
Preterite Actions
Replay Actions
Review Actions
Present Actions
Preemptive Actions
RESPONSIVENESS
Functional Methods
Interactive Methods
R:R
R:N
N:R
N:N
Semi-interactive Methods
R:G
G:R
Unidirectional Methods
N:G
G:N
Dysfunctional Methods
Group 1
I:I
N:I
I:N
Group 2
I:G
G:I
I:R
R:I
Group 3
G:G
THINKING AND ACTUATION
Premeditated Actions
Trained Actions
Autonomic Actions


ORIENTED
EWORK
EO GAMES
TRANSCODING
Intangible Transcoding
Arbitrary Articulation
Symbolic Articulation
Mimetic Articulation
Tangible Transcoding
Game Space < Player Space
Game Space = Player Space
Game Space > Player Space
FOCUS
Time Span
Short
Long
None
Sensorial Scope
Narrow
Wide
Total
Frame
Single
Non-Simultaneous
Simultaneous
Actuation Automation
Automated
Mixed
Non-automated
DEPTH
Function 1: Interpreting
Function 2: Exploring
Function 3: Moulding
Function 4: Adding & Removing
TRAVERSAL
Branching
Bending
Modulating
Profiling
Exploiting

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3. Chronology

Video games rely on a chronological dimension that should not be overlooked in their study. They require the player and the computational system to proceed on various analyses of the past and of the present in order to project due consequences onto the future, to invoke sequences of preprocessed events or to alternatively generate procedural outcomes. With focus on the player-system relationship, this chapter demonstrates three types of action that are enacted during gameplay, shaping the personal narrative experience. In this context, we propose definitions for those actions that may allow actors to 1) revisit the past; 2) focus on very short-term scenarios in current time, or 3) project perceivable consequences onto the future.[138]

3.1 Introduction

Time is an essential dimension to take into consideration when studying action. In fact, in the case of video games, one can say that *game time* is based on the time that the players take to play, and the time that is specific to that game world (Juul 2004). The underlying principles of this concept of game time are based on the relationship between these two timelines, from which results the player's temporal experience, either by exploring eventual convergences or divergences.

> The pacing of a video game, then, becomes a combination of the preset pacing of the computer-controlled events and characters in the game, along with the pacing determined by the player, where the player is given that option. Often these two paces come into conflict; if the player is not quick enough, the player-character can

138 This chapter consists of a revised version of *A perspective on action and chronology on interactive narratives and videogames* (Cardoso and Carvalhais 2012d).

> get killed. The temporal experience of the game can be a mixture of prerecorded sequences or animated clips taking a certain amount of time, computer controlled characters and events whose speeds can be varied by the game, and the speed of the player's own decisions, reactions, and movement through the game's world. The balance of these factors differs from one type of game to the next, and sometimes even between different playings of the same game. (Wolf 2001, 86)

For the purposes of this chapter, we are not interested in time itself nor in measuring these two times. We invoke them in order to call to attention and further understand the temporal dimension that constitutes the focus of our concern: *chronology*, or *game chronology*, to be more accurate.

Chronology is the science of organising events by the order they occurred in time. It can also be described as an experience of time constituted by sequences of events. Taking this into account, our focus lies in scrutinising the actions between the player and the game system that are enacted in order to manipulate or influence the sequences of events that are able to be experienced by the player. Influencing the narrative by projecting hypothetical futures, examining past and current events – and even increasing the chance to experience epiphanies (Aarseth 1997) – are player's actions that dynamically reshape what otherwise would be a linear chronology.

With this in mind, we present three types of action that express the described behaviour: 1) actions focused on past events; 2) actions concerned with the present time; and 3) actions that aim at events that are yet to come but may be predicted.

3.2 Establishing Game Chronology

As we have mentioned, in this context there are two dimensions of time that are relevant to the subject of our work: the time the player takes to play – *play time* or *objective time* – and the time that flows in the diegesis of the game world – *event time* (Juul 2004). Playing a video game is an activity that engagingly explores the relationship between these two dimensions of time.

In fact, these are commonly experienced when reading or watching a movie… And actually, they express no necessary newness, either. In ancient Greece, the words *Chronos* and *Kairos* were used to convey similar concerns. The word *chronology* derives from the first term and is related to a more quantitive nature of time, such as objective time. The latter refers to a time of a particular or special moment without the concern of determining its position in a given timeline, expressing qualitative characteristics of time.[139] Spectators of more traditional audiovisual media may experience events regarding the past, present and future, and as they cannot influence the narrative, those events can be experienced in any order, or even simultaneously, without the worry of altering the narrative's temporal logic. Those events are static, their unfolding is predetermined, and consequently so is the timeline – sequences of events – that the spectator experiences.[140] This is an experience primarily related to what Juul describes as *event time*.

As mentioned, the player assumes a more involved role in the unfolding of the narrative than the spectator (Wolf 2001). The game system produces feedback regarding the player's actions (Juul 2001), actions that alter game states and that significantly influence the narrative (Björk and Holopainen 2005, 20). Due to this relationship the player is granted a more active role, being able to influence the course of events, either by invoking preprocessed sequences or by generating procedural outcomes (Aarseth 1997). The player cannot alter or influence events that already happened, as it is also impossible to alter events in the future, simply because they didn't happen yet. Though, action may be taken to shape a potential future, but access to future events is not granted until they are manifested in the present time. So, as the player is traditionally invited to act upon the game world[141], *objective time* is fundamental to the experience of play.

> The theory primarily describes the relation between the linear, objective time of the player and the event time of the game world constructed by graphics and other cues. An obvious objection to this would be that because the playing of a game is

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139 Καιρός (kairos) also means "weather", which also relatively illustrates its qualitative nature.

140 Although the interpretation of the narrative may, in fact, vary as the events are not displayed as they actually occurred. This may result in a more confusing or cryptic style of narrative. We could consider as examples David Lynch's *Lost Highway* (1997), *Mulholland Drive* (2001), or even Quentin Tarantino's *Pulp Fiction* (1994), just to name some cinematic narratives that seem to deal with chronology.

141 This is something that is not necessarily true in other types of narrative artefacts that bear more passive approaches or even in zero-player games.

> a subjective experience, objective time is of minor importance. But this is a faulty assumption since the experience of time is strongly affected by the objective time of the game: game design and game rules work with objective time in order to create the player's subjective experiences. So examining objective time in games is, paradoxically, a way of understanding how the formal structure of a game feeds the more elusive player experience. The aesthetic problems surrounding "save games" are a prime example of this. (Juul 2004)

Superhot (2013) is a good example of a game that explores the tension between *event time* and *objective time*.[142] In *Superhot,* the advancement of event time is directly dependent on the movement of the player, in other words, time only advances if the player moves the playable character.[143] This grants the player time to think and to elaborate strategies to overcome the propose challenges, creating a direct dependency between the timelines of event and objective times.

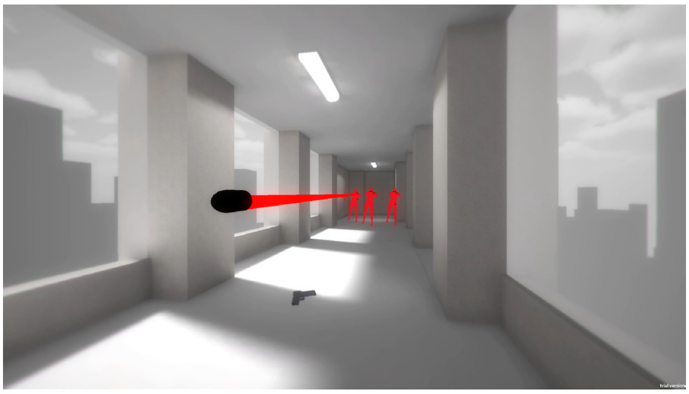

Figure 3.1: *Superhot* (2013).

Notwithstanding, as a result of this relationship there are narrative problems that tend to emerge. Narrative techniques such as flashbacks and especially flash-forwards are difficult to execute in a video game structure due their unpredictability.

> Regardless of inspirations from cinema, time in games is almost always chronological, and there are several reasons for this. Flash-forwards are highly problematic, since describing events-to-come means that the player's actions do not really mat-

142 Here, we are referring to the prototype that was developed during a 7 Day FPS gamejam at 2014. At the time of writing it can be played at the project's webpage at https://superhotgame.com/play-prototype/.
143 The player's proxy in the game world. See section 6.2.

> ter. Using cut-scenes or in-game artifacts, it is possible to describe events that lead to the current event time, but doing an interactive flashback leads to the classical time machine problem: the player's actions in the past may suddenly render the present impossible, and what then? So time in games is almost always chronological. (Juul 2001)

Implementing such possibilities may result in breaking the logical sequence of events, which in turn may originate a time paradox.[144] On the other hand, some of these features have already been long implemented. Lets elaborate on the following scenario: The player revisits the past, changing the course of events within the game world, and, consequently, everything that the player did between the moment she went back and all the moments onward vanish. This is a typical time travel action that occurs when reloading a saved game, perhaps to explore an alternate – and eventually more satisfying – unfolding of events. If the events remain exactly the same, even if the player behaves differently, it can only mean that her actions don't have consequences. Removing this ability to influence the narrative, lowers the sense of agency and meaningfulness, and withdraws the playability of the game. The experience becomes static and predictable – something similar to what Crawford refers to when comparing puzzles and games (2011).

So, in video games, the player is called to act upon the game world (Cardoso 2008; Galloway 2006; Laurel 1991), and that is something that is only possible in the present time. The player acts in the present time echoing consequences to the future, whether closer or farther from the present position in the chronology. This renders video games *natively chronological*.

> It is clear that the events represented cannot be past or prior, since we as players can influence them. By pressing the CTRL key, we fire the current weapon, which influences the game world. In this way, the game constructs the story time as synchronous with narrative time and reading/ viewing time: the story time is now. Now, not just in the sense that the viewer witnesses events now, but in the sense that the events are happening now, and that what comes next is not yet determined. (Juul 2001)

144 A time paradox consists in a self-contradiction in the logic of the sequence of events, due to time travel. For example, if we travel to the past and do something that would prevent us from traveling in time, would it be possible to have done that action that prevented the time travel?

The next sections are dedicated to describe three main types of action that although always executed in the present time, are focused on influencing each of the three mentioned dimensions: the past, the present, and the future.

3.3 Chronology-based Actions

3.3.1 Preterite Actions

A *preterite action* is committed to access past events. It is an action that looks into the history of the player's gameplay. It is an action that accesses the memory of the computational system that supports the game in order to invoke stored data. These events or moments in the chronology are reconstituted, allowing the player to consult, review or even replay what was in the past, and as the capabilities for storing and accessing data in computational systems increase, these actions become potentially more influential and diverse.[145]

We were able to distinguish two sub-types of preterite actions – *replay* and *review* actions –, with each reflecting an alternative approach to dealing with recorded data.

Replay Actions

The *replay action* allows the player to return to a certain already experienced moment in the chronology, normally to change its outcome, usually to a more favourable one. Although perceivable in others, this action is most evident in trial-and-error video games. This is an action that occurs – sometimes automatically – when the player looses and is forced to return to the last checkpoint or save point,[146] to the beginning of a given level, or in more radical situations, all the way to the beginning of the game, in order to retry.

145 See Zagalo (2014) regarding the preservation of memories in video games, for example.
146 Save points are the locations or occasions where the player can store the information of her progress in order to prevent losing it. This saved information can be reloaded later. Checkpoints serve the same principle but that information is only temporarily stored.

> Learning the patterns of behaviour and working around them is usually itself part of the game, allowing a player to advance to higher levels once the pattern is recognized and mastered. Cycled action builds player expectation and anticipation, and knowledge of a pattern is often crucial to the timing of the player-character's actions, such as the dodging of bullets, pursuers, or falling objects, or in running, jumping, using elevators, escalators, swinging doors, and so forth. Often a game's levels will be almost impossible to complete the first time through, since they may require a player to know in advance an exact series of actions that will get him or her through a level. Repetition, then, becomes a form of training, and each time through the level becomes a slightly (or even substantially) different experience for the player. (Wolf 2001, 81)

This is very common in classic video games such as *Lunar Lander* (1973), *Pac-Man* (1980), *Pitfall!* (1982), *Manic Miner* (1983), *Ghost 'n Goblins* (1985), *Super Mario Bros.* (1985), *Alex Kidd in Miracle World* (1986), *Sonic the Hedgehog* (1991), *Contra III: The Alien Wars* (1992), etc.. And it continues to be explored in more contemporary games such as *Super Meat Boy* (2010), *VVVVVV* (2010), *Donkey Kong Country: Tropical Freeze* (2014), etc.. Also, similar patterns can be found in contemporary free and freemium games[147], such as *Bejeweled* (2001), *Plants vs. Zombies* (2009), *Angry Birds* (2009), *Flappy Bird* (2013), or *Daddy Long Legs* (2014), for example.

These games usually feature actors with class 1 or 2 behaviours[148] so that the player is able to test and perceive their behavioural patterns by this process of trial-and-error. Nonetheless, *The Unfair Platformer* (2008) is an interesting example precisely because – within the platform genre – it questions some of the conventions of trial-and-error based-games, by lying and constantly misleading the player into loosing. The player will be tricked very frequently, and will loose the game accordingly. In order to overcome these challenges, the player needs to memorise all failures only to be probably tricked in some unforeseen way, and thus forced to replay.

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147 Freemium games are provided for free, but they charge for particular features and goods. Thus the implementation of trail-and-error gameplay strategies.

148 Consult section 2.3.6.

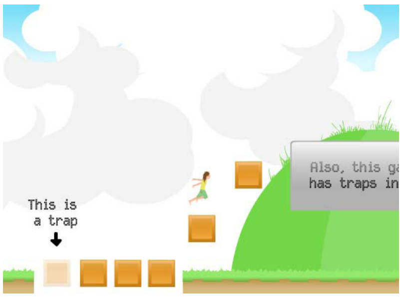

Figure 3.2: *The Unfair Platformer* (2008).

Other games, as *Braid* (2008), deal with replay actions by actually rewinding time – the event time. *Braid* is a game that grants the player the ability to recede and advance along the timeline, through the immediately unfolded events. The player uses this ability to correct eventual mistakes, to observe sequences of events 'un-unfolding', to learn the system, and to prevent death/loosing, retrying or replaying those events again and again until eventual success.

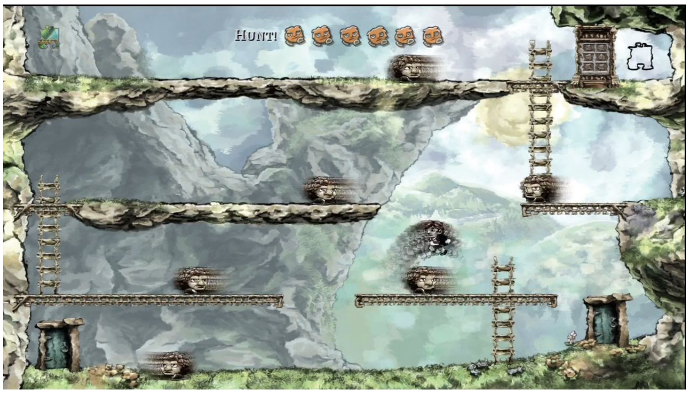

Figure 3.3: Rewinding in *Braid* (2008).

Besides that, many of the game's puzzles are only solved by precisely managing the chronologies of event and objective times. The game features actors that are not affected by the player's manipulation of the event time. So, rewinding the event time may not reposition everything as it previously was, creating interesting distortions or bridges between these two timelines.

Similarly, in *Blades of Time* (2012) the player is able to rewind time. But in doing so, the system creates a clone that replicates the last actions of the player's character. This ability is a central feature of the game, one that the player will use to overcome strong foes or a large amount of enemies and to solve puzzles, since she can momentarily increase her presence in the game world.

Focused on exploring the intricacies of its storyline, *Life is Strange* (2015) is an interesting example. In this game, the player takes the role of Max Caulfield, an 18-year-old woman with the ability to rewind time, something that allows the player to explore multiple and divergent interactions with other characters, including dialogues or conversations. This game is heavily focused on exploring the storyline with each path chosen reflecting consequences to the future. The player is however capable of rewinding time – with some limitations – and thus explore the available choices for a more fitting decision.

Figure 3.4: Rewinding in *Life is Strange* (2015).

Another way to inspect possible and alternative narrative paths, in order to determine how to proceed in a way that best suits the player's interests is by doing it *manually*, by reloading save states when the player sees that there may be no turning back from a given decision.[149] This is something that may also happen in games that heavily promote exploration such as *Fallout 3* (2008), *Grand Theft Auto IV* (2008), *Borderlands* (2009), *inFamous* (2009), *The Elder Scrolls V: Skyrim* (2011), *Far Cry 3* (2012) or *Middle Earth: Shadow of Mordor* (2014), for example.

Replay actions are, however, less common in multiplayer games such as *Counter Strike* (1999) or *World of Warcraft* (2004), or in the multiplayer mode of games such as in *Wipeout HD* (2008) or *Grand Theft Auto V* (2013), for example. In these games, event time is transversal to all players, rendering individual replay actions impossible. In these cases, as time flows uninterruptedly, replay is substituted by the act of respawning,[150] sometimes at a certain cost.

149 Something that we call *branching* in chapter 9.

150 To respawn means to recreate a certain entity after it is destroyed.

Review Actions

The *review action* grants the player access to certain past events, without the ability to alter them, or to influence their outcome. This is an action that is focused on consulting history. The player makes use of this kind of action in order to revisit and evaluate their performance, usually with the intention to improve it.

Wipeout Pulse (2007) is racing game, featuring futuristic anti-gravity race ships that fly at high speed throughout diverse race tracks. As in many other racing games, *Wipeout Pulse* features a mode of play that consists in traversing race tracks in the least amount of time possible. This requires practice that is achieved through frequent replay. But improvement may also be achieved by reviewing or observing other performances. In this game the player is able to race against a 'ghost' of their previous performance, being engaged in competing against their previous-self in realtime. Although, this is an act based on observation, this approach exerts a meaningful influence on the course of events and their outcome.

Figure 3.5: Time trial race in *Wipeout Pulse* (2007) – the ghost ship is on the left.

Something similar happens in *Super Mario 3D World* (2013). This game has a feature called 'ghost Mii', that enables the presence of up to three other simultaneous recordings of other players' performances – downloaded from the Internet – along the game level that the player is currently playing. These recordings may aid the player in traversing the level and in finding hidden locations, valuable items, etc..

Another example is found in *Demon's Souls* (2009), a game that was infamous for its above-average difficulty.[151] This game requires much dedication from the player to overcome its challenges, demanding attention, caution, a keen capability to mentally simulate multiple outcomes, and to anticipate eventual consequences of her actions. Learning by trial-and-error is one of the central activities in this game, but another learning experience was also implemented, a feature that heavily promotes collaboration between players. By means of online-play, players may leave replay data – in form of blood stains – demonstrating how their character perished while traversing the game world – either when facing a given foe or overcoming an obstacle – and text messages for future players, often aiding them in their quests.[152] This action promotes the success of the player on the receiving end, warning them of lurking dangers and informing of eventual successful and unsuccessful strategies, and also instigating vigilance and alertness when it is vital.

Figure 3.6: *Demon's Souls* (2009).

Although in all these examples these actions are taken with the intent to influence the course of events, to shape their outcome, and a potential future, they are different. In the example of *Wipeout 3*, the player is reviewing their own history and actions. The player analyses their own performance, usually with the intention to improve. In the other two examples, we may say that the player is consulting other players' historiographies, examining the events in the timelines of other players.

151 It is actually one of its main characteristics and was promoted as such.

152 It is also relevant to note that the opposite may also occur. Players may also try to misguide others.

3.3.2 Present Actions

Present time consists of a very short time span that occurs at the moment, currently. The past and the future always refer to bigger time spans than that of the present time. Everything from an eventual beginning of time up until now is considered the past, and all that potentially lays ahead is seen as the future. Actually, dependent on the flow of time, the present is always in motion. Never aiming at a single specific moment, but to something that is always skipping ahead. The present time is, in this context and to our understanding, something that can be defined as the short time span that is able to be perceived as a single moment that happens in current time, or in other words, right *now*.

> In short, periodicity appears only in phenomena on our temporal scale. It disappears when the rhythms become more rapid than 16 to 20 per second (as in the movies or in “musical” sounds), precisely at the moment where, for technological and historical reasons, the exact science see it appear. We know that the essence of the moving picture for us is continuity, not the periodicity which concerns only the engineer or technician. The phenomenological approach here opposes the scientific approach a priori, for it suggests to us the concept of the length of the present — the perceptual threshold of duration. (Moles 1958, 67-68)

Present actions are the actions that are only concentrated in the current time, in the now. They are actions that are concerned in providing immediate continuity in the game. The majority of these actions may be characterised as reactions. In other words, they are actions that are immediately enacted in response to activities that occur in the game.

Due to their automaticity the consequences of these actions may not be consciously taken into account. Mostly, they are executed without concern for a long or even medium-term future, but for the immediate present or a very short-term scenario instead. We may even sometimes consider this type of action as an akratic activity in the sense that these actions aren’t always in agreement with one’s better judgement.[153]

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153 “As a person is walking, the sensory inputs from the visual and auditory systems go to the thalamus, a type of relay station. Then the impulses are sent to the processing areas in the cortex and then relayed to the frontal cortex. There they are integrated with other higher mental processes and perhaps the information makes it into the stream of consciousness, which is when a person becomes consciously aware of the information (there is a snake!). In the case of the rattler, memory then kicks in the information that rattlesnakes are poisonous and what the consequences of a rattlesnake are, and I make a decision (I don’t want it to bite

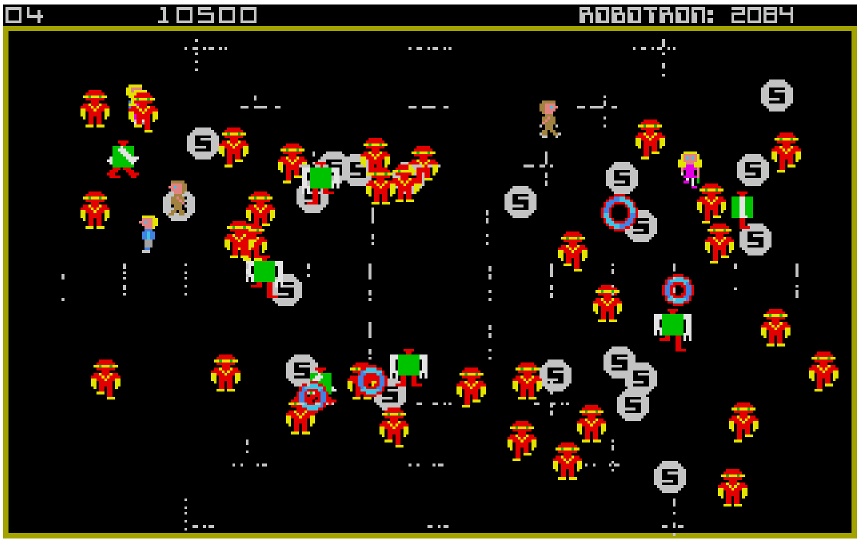

Figure 3.7: *Robotron: 2084* (1982).

However, these fast actions, or reactions, are not necessarily as poor as they may seem at a glance. In fact, they are essential to the success of the player. This is specially evident in fast-paced games where the player has to eliminate enemies almost without having time to think.[154] The player may establish some strategy for the game, but it is inevitable to act reactively – or simply to react. "Fast and automatic is the ticket for success. Conscious processes are expensive: They require not only a lot of time, but also a lot of memory. Unconscious processes, on the other hand, are fast and rule driven." (Gazzaniga 2011, 1235) This allows the player to be able to act in due time, almost automatically. So, the less the time the player has to think about her actions and project them onto the future – estimating their consequences and thus determining a reasonable strategy – the more she has to resort to this type of action. Otherwise, she risks failure. "Conscious takes time, but arrives after the work is done!" (2011, 2040)

Robotron: 2084 (1982), *Unreal Tournament* (1999), *Geometry Wars: Galaxies* (2007), *Bayonetta* (2009), *Vanquish* (2010), *Sonic Lost World* (2013) are just some examples.

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me), quickly calculate how close I am to the snake and its striking distance, and answer a question: Do I need to change my current direction, and speed? Yes, I should move back. A command is sent to out the muscles into gear and then do it. All this processing takes a long time, up to a second or two, and I could have been bitten while I was still in the midst of it. Luckily, however, all that doesn't have to occur. The brain takes a nonconscious shortcut through the amygdala (...). I automatically jump back before I realize why. I did not make a conscious decision to jump, it happened without my conscious consent." (Gazzaniga 2011, loc 1213)

154 *Robotron: 2048* (1982), *Wipeout* (1995), *Unreal Tournament* (1999), *God of War* (2005), *Geometry Wars: Galaxies* (2007), *Sonic Lost World* (2013) are a few examples.

3.3.3 Preemptive Actions

A *preemptive action* is an action (or set of actions) that consists in the interactant's preparation for a determined foreseen or anticipated situation, potentially improving their chances for success. This situation may never occur as it is always hypothetical. However, it is a supposition that is based on the experience of the interactant.

> Repetition, cycled images, consistent and repeating behaviours, revisited narrative branches, and the replayability of many of the games themselves create a sense of expectation, anticipation, and familiarity for the player. They encourage the player to find underlying patterns which allow him or her to take control of the situations encountered, and this assumed orderliness may well be an important factor in the allure that video games have for many people. On the other hand, complete predictability can hurt the replayability of a game. This balance of predictability with randomness, of theme and variation, is necessary to most video games, just as the games must be enough to play so as not to be discouraging, yet challenging enough to invite more playing. (Wolf 2001, 82)

This type of actions rely on the predictability and determinability of the actors' behaviour in the game. This behaviour is determinable when the interactant loses a round and has to play it all over again; the player gains the advantage to know the sequence of events before they happen when playing that round again. This means that the player can now balance choices based on that information, consequently adapting her strategies of play according to the challenges ahead, in order to succeed, as for example, hiding or placing in certain locations determined items for later use or, simply to shift the investment on certain skills to other perks…

Resident Evil 2 (1998) has two playable characters: Claire Redfield and Leon S. Kennedy. The game has a feature called the *Zapping System* that provides slightly different scenarios for each of these two playable characters. Only after finishing the game with Claire in scenario A, the player is granted access to scenario B, in which the events are presented from the perspective of Leon. Conversely, to access Claire's scenario B, the player first needs to finish Leon's scenario A. This sums up a total of four scenarios, and, as the actions taken in the first scenario affect the experience of the second, the player may act preemptively in order to e.g. make available certain items at certain locations. This is in fact a favoured strategy in the game, because the player has already passed through most of the locations with one of the characters and eventually remembers the challenges she had to face. Thus, throughout the rest of the game, a constant sense of expectation lies.

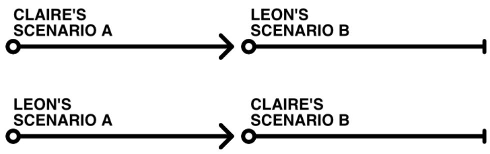

Figure 3.8: A representation of the two sequences of the four scenarios in *Resident Evil 2* (1998).

In reversing the sequence of events in *Braid* (2008) the player can prevent the character's death. We may say that it is a function that prevents defeat and promotes trial-and-error gameplay dynamics, and that by allowing the player to travel to the past, it also allows her to know the future, because she has experienced it already. Thus, by traveling to the past, she may anticipate the future (that has happened once) and act preemptively, in order to change it.

If the actors' behaviour is not necessarily determinable, as the player progresses in the game, she will be sufficiently acquainted with the rules of the system to the point of being able to foresee, guess, or anticipate certain situations and outcomes (Genvo 2009). And, although she may not know exactly what to expect, it is possible to estimate, to some extent, the unfolding of some events, building anticipation to whether those "simulations will be proven correct or if, on the contrary, expectations will not be confirmed." (Carvalhais 2011a)

In *Metal Gear Solid 3: Snake Eater* (2004) there is a boss fight with a sniper called 'The End'. There are several techniques for winning this challenge, but there is one that is particularly relevant in this context: he can be killed in an earlier stage of the game. As the player progresses in the narrative of the game, and gets acquainted with it and with the game system, she can develop presumptions in which certain characters may become key obstacles[155] due to the depth of the characters' personality traits, for example. This is

155 This becomes more evident if the player has already played the previous games of the series, because that grants him a deeper knowledge of the style of narrative and the game in general. We explore this ahead.

similar to what happens in the formation of the perceptive images that António Damásio speaks of, that constitute the memory of a possible future (1994). Such is the case of 'The End', and the player may choose to end him sooner than later.[156]

Figure 3.9: 'The End' in *Metal Gear Solid 3: Snake Eater* (2004).

As the determinability (Aarseth 1997) of the actors decreases, the player has less data on which to base her actions. But, other 'foresight abilities' are not necessarily related with the familiarity with a determined system but with the acquaintance with a group of other systems that share similar characteristics. Many games of the same genre share traits that condition player expectations.[157] An example in platform games is to defeat enemies by jumping on top of their heads – a manoeuvre known as *hop and bop*. Such are the cases of *Super Mario Bros.* (1985), *Sonic the Hedgehog* (1991), *Donkey Kong Country* (1994), etc.. This becomes even more evident when we explore series of video games that develop specific traits between iterations, since it is expected for games in the same series to function in similar ways.[158]

156 At the time of writing this event could be seen at http://youtu.be/wj4Wq0jF3ek.

157 We can connect this to the idea of *interface idioms* proposed by Jennifer Tidwell in *Designing Interfaces* (2005) – after the idea proposed by Scott McCloud in *Understanding Comics* (1993). "[Interface idioms] are interface types or styles that have become familiar to some user populations. They include text editors, forms, games, command lines, and spreadsheets. They're useful because they let you start a design with a set of familiar conventions; you don't have to start from first principles. And once a first-time user recognizes the idiom being used, she has a head start on understanding the interface." (Tidwell 2005, 22)

158 This doesn't always happens. The *Super Mario Bros.* series can serve as an example here since *Super Mario Bros.* (1985) and *Super Mario Bros. 2* (1987) don't function exactly the same way. In the former, the player defeats enemies by hop and bop, while in the latter the player must pick up and throw objects at them or pick them up and throw them away. This is one of several contrasting differences when comparing these games. However, in *Super Mario Bros. 3* (1988) the hop and bop technique returned, enduring until today, along with several other features.

3.4 Conclusions and Future Work

We demonstrated that video games and interactive narratives are natively chronological. Due to that nature, actions based on the manipulation of game chronology are an important contribute to gameplay activities. They are at the core of the dynamics of gameplay activities from which narrative experiences emerge.

Future work is still necessary in identifying sub-types of these three chronological actions. The preterite action already has two subtypes (replay and review actions), but more are needed, mainly in the other two types. In discovering them we may become more prepared to define more direct relationships between these types of action and gameplay phenomena.

The relationships between time, quantity of data, processing capabilities, and memory management play an important role in these types of dynamics. They also need to be more profoundly dissected in order to determine more specific subtypes of these chronological actions.

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4. Responsiveness

We already established that video games depend on a cybernetic relationship between the player and the computational system.[159] However, this relationship isn't based on constant feedback, or on a continuous response from all involved parties. Both action and inaction – of the player and of the system – contribute to the development of multiple methods of communication, that, in turn, translate into various meaningful strategies to produce diverse narrative and aesthetic experiences.

This chapter explores the balance of action and inaction within the relationship between the player and the game system, focusing on the exploration of their responsiveness.[160]

4.1 Introduction

The communicational feedback loop established between the player and the game system consist of a dialogical process that allows events to unfold, developing a narrative toward very specific closures. In other words, the machine (game system) and the operator (player) react to each others' actions, influencing each other's behaviour, shaping the outcome of events.

In this context, the player and the game system express themselves through a variety of means, from pushing buttons and rotating knobs to more gestural and facial expressions monitored by the computer vision, from the momentary activation of servomotors

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159 See chapter 1 and 2.

160 This chapter consists of a revised version of *In/action: an exploratory approach to responsiveness in interactive narratives and videogames* (Cardoso and Carvalhais 2012b) and of *In/action: An exploratory approach to dysfunctional responsiveness in interactive narratives and video games* (2014a).

found on contemporary standard game controllers to the display of images on screen, respectively, and just to mention a few. And depending on that exquisite variety of machinery, the player and the game system express their intentions by inputting and outputting information, communicating with each other, either through the most complex ways or by the simplest means. According to Crawford, the input/output (I/O) structure "is the funnel through which we must squeeze the avalanche of thoughts, ideas, and feelings that we seek to share with our fellow human beings."(2011, loc 1163) It establishes the flow of information that travels between these two, or more, entities (actors).

In the case of video games, the relationship between the game controller and the player is so deep that the latter conveys lots of emotional tension and stress to the former. Some players even smash and destroy the controllers they're using when they become frustrated by some aspects of the game, they are *controller breakers.*[161]

> The input structure is the player's tactile contact with the game; people attach deep significance to touch, so touch must be a rewarding experience for them. Have you ever noticed the tremendous importance programmers attach to the feel of a keyboard? Remember that players will do the same thing with your game. (Crawford 2011)

Until now, contact-based controllers have been privileged in mainstream video game industry. Other devices have been used along the years, such as light guns[162] or the Eye Toy,[163] for example. In the last few years, less contact-based approaches and more motion-based experiences have found the way to mainstream video games, resorting to the Nintendo's Wiimote,[164] Sony's PlayStation Move,[165] and Microsoft's Kinect.[166]

161 For some personal statements about controller breakers please consult the gamespot forum thread "Are you a controller breaker?" at http://www.gamespot.com/forums/topic/25835483/are-you-a-controller-breaker.

162 Light guns are pointing and control devices used in computer games.

163 The Eye Toy was a digital camera for the PlayStation 2 that resorted to computer vision, similar to Microsoft's Kinect, but less technologically advanced.

164 The Wiimote, or the Wii Remote, is the Nintendo Wii's main game controller, one that based on motion sensing technology.

165 The PlayStation Move is a controller for the PlayStation 3 based on motion sensing and computer vision technologies.

166 The Microsoft's Kinect is a motion sensing controller based on computer vision, and voice command device based on computer speech recognition.

The I/O dimension of the model we propose, however, is transversal and not dependent on the particularities of hardware, since it is more concerned with the input and output methods employed in the process of communication instead. As a result, in this chapter we explore I/O methods that shape the way the player and the game system communicate and that therefore condition their behaviour.

4.2 Actor I/O States

By combining the different states of the actor's sensors (*on* or *off*) and those of the actuators (*actuating* or *not actuating*), we are able to obtain four alternative actor I/O states: (R) *Responsive*, (N) *Non-responsive*, (G) *Generative*, and (I) *Inactive*. These are states that, depending on the game, may or may not be permanent. And as so, it is important to notice that all of these states may eventually be expressed by the same actor in the course of a given video game.

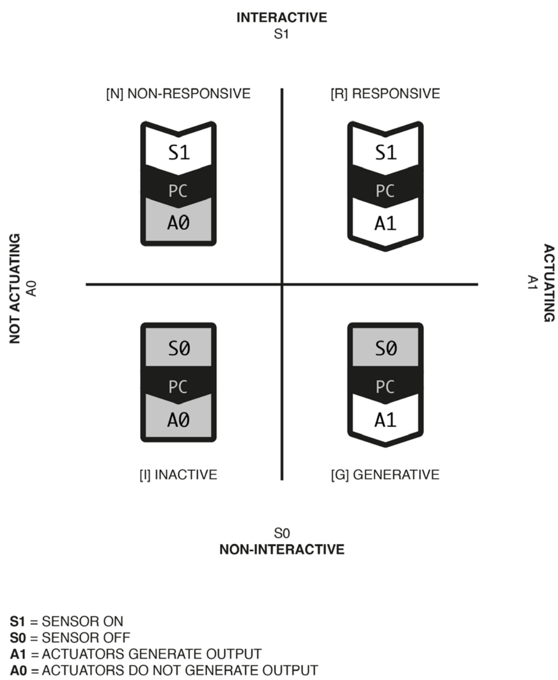

Figure 4.1: Actor I/O states.

As each of these states is intimately linked to the states of their actor's sensors and actuators we are able to map their relationship in a two-dimensional graph (**figure 4.1**). These four I/O states are then represented across four quadrants governed by two axes, each related to the respective states of the sensors and of the actuators: interactive and non-interactive, actuating and not actuating .

The duality between potentially interactive and non-interactive states constitutes the first axis of this model. This is built on the foundations of interaction and communication, in which to act means to influence the outcome of events (Björk and Holopainen 2005, 20), while establishing a dialogical relationship between the player and the computational system (actors) and other actors. So, in order for actors to communicate they need to have their sensors active. For them to absorb, interpret and transform information they have to, in the first place, be receptive to it. With this taken into consideration, because actors in states N and R have their sensors on, we may consider them to be potentially interactive. On the other hand, actors in states I and G are considered non-interactive. As their sensors are off, they are not capable of being aware of the changes in the environment that other actors originate. This prevents interaction, renders it impossible for the dialogical feedback between two or more actors to occur.

The other axis is related to the output generated by the actuators. We may consider that the states R and G are states that generate output – actuating. And the states N and I are states that do not generate output – not actuating.

4.2.1 Responsive

An actor is considered *responsive* when its sensors are *on* and its actuators are *actuating*. In this case, a given signal is captured by the actor's sensors and converted into data. This data is processed at the processing core where a certain course of action is determined, instructing the actuators to generate the respective output, converting data into the form of a signal.

Here the actor is considered responsive because it is able to react to the stimuli provoked by the signals that travel through the environment that its sensors are able to capture.

4.2.2 Non-responsive

An actor is considered *non-responsive* when its sensors are *on* but their actuators *do not create outputs*. Two kind of situations may be considered here. The first results as a consequence of malfunctions on behalf of the actuators, thus unable to actuate. The second portrays that behaviour as choice, a decision to perform inaction: a given signal is captured by the sensors, transformed into data that is processed at the processing core where a decision to not actuate is made.

4.2.3 Generative

An actor is considered *generative* when its sensors are *off* but its actuators are *actuating*. In this case, their output is the sole result of an internal processing of data, as a self-contained generative system. The output is then solely the product of the processing of data in an internal algorithmic feedback loop. This doesn't mean that its output is constant or following a very specific pattern, as it may be pretty unpredictable. It means though that the actions of that actor are not influenced by the output of other actors.

4.2.4 Inactive

An actor is considered *inactive* when its sensors are *off* and its actuators are *not actuating*. In this case, the processing core is processing data and transmitting the decision to the actuators to not actuate.

One example is found when a system crashes, trapped in a infinite cycle of data processing, for example. But it may also be found when in a state of intense data processing, that depending on the balance between its processing capabilities, employed algorithms and the amount of data to process may last for a brief moment to an indefinite period of time, preventing it to send immediate output. Loading activities are an example of this kind of state.

4.3 I/O Methods

In systems that feature two actors and, by taking into consideration all possible combinations regarding the previously enunciated four actor I/O states, we obtained 10 unique types of what we called I/O methods. However, by considering which one is the player and which one is the game system we obtained 16 methods.

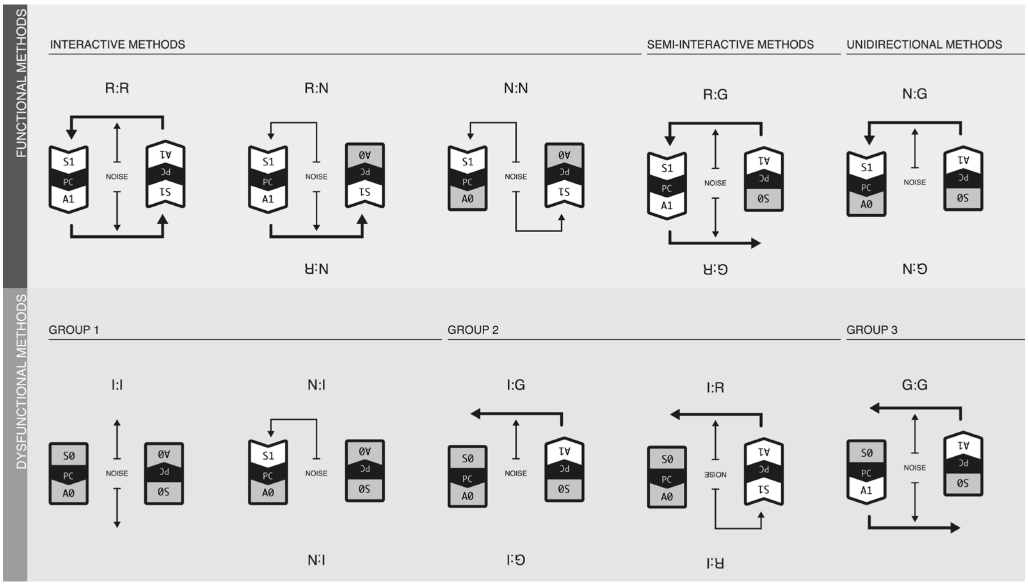

Figure 4.2: I/O methods.

These methods express diverse communication processes between two actors, where some promote an effective communication while others, on the other hand, manifest damaged and broken communication pathways. Consequently, we grouped them into two major categories: the functional and the dysfunctional methods. Their relationship is represented in the graphic below.

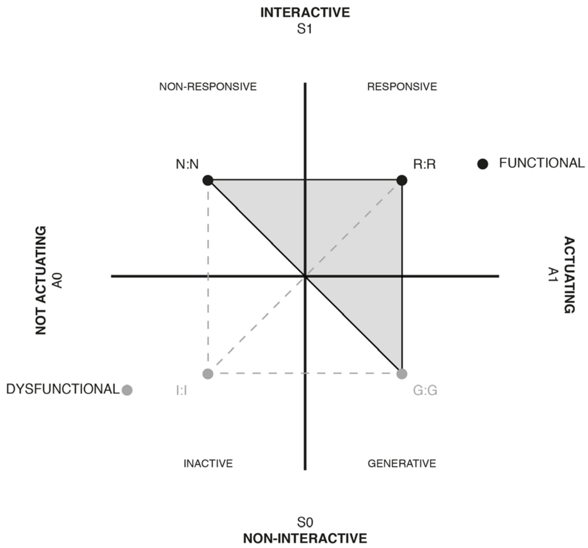

Figure 4.3: I/O methods relationship: the functional methods are at the upper right half and the dysfunctional methods are present in the lower left half.

4.3.1 Functional Methods

We may consider that within this model a system bears a *functional* I/O method when at least one of the actors is receptive to the other's output, meaning that its *sensors must be on*. In the functional systems we found states that consist of unidirectional methods, semi-interactive methods, and interactive methods.

4.3.1.1 Interactive Methods

This group features methods that can be easily pictured as potentially interactive, and thus present themselves as closer to gameplay action, something that is not necessarily true. As we've been stating and as this chapter will demonstrate, gameplay action isn't always constituted by continuous actuation or feedback.

This group consists of I/O methods where the both actors are able to sense each other, where the player is receptive to the system's output, and vice-versa. It also represents pretty well playing as an agreement between the player and the system, in which the player is able to understand the rules and to accept them.

This group consists then of four types of potentially interactive methods that represent different relationships between the player and the game system.

R:R

When the *system and the player are both responsive* (R:R) the communicational process flows continuously. The information that each of them receives is processed and output is generated, transmitted and then again sensed and absorbed by the other. The process is defined by a feedback loop that constitutes a seamless dialogue between the player and the game system.

Figure 4.4: *Geometry Wars 3: Dimensions* (2014).

This is a method essential to be developed in fast-paced situations, usually present in fast-action games. In many of these, the player needs a fast response when shooting, jumping through diverse platforms, or driving a vehicle at high speed, for example. *Super Street Fighter II* (1992), *Wipeout* (1995), *MDK* (1997), *Half-life 2* (2004), *Geometry Wars 3: Dimensions* (2014) are just a few of the many examples.

R:N

If the *player is responsive* and the *system is non-responsive* (R:N), we may be talking about a moment of *configuration* of data. The system is processing data but it's not sending output, because the consequences of those configurations will only take place after they are completed and not during that same stage. All the data that was inputted through the sensors is being processed in order to invoke different combinations of algorithms that will change the actors' behaviour. The enactment of these algorithms will only happen after those configurative actions have already taken place (Cardoso 2008). This also is the moment where the player chooses or creates the 'units' in order to change the text (Aarseth 1997). But the text is only changed afterwards.

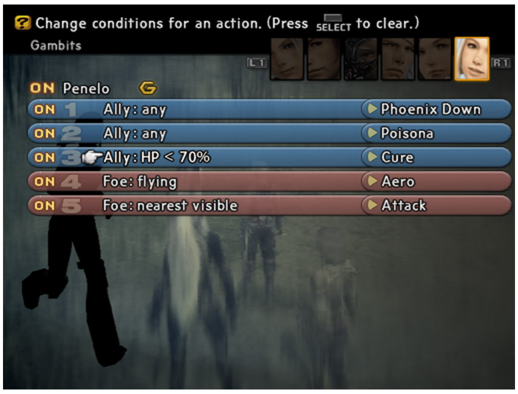

Figure 4.5: The gambit system in *Final Fantasy XII* (2006).

In *Final Fantasy XII* (2006), the playable characters' configuration system allows the player to automatise their actions. This system (called the *gambit system*) allows the player to create a series of battle dynamics adequate for the most various situations.[167] Then, the playable characters' actions are automatised when they enter battle mode (although the player may alter them to adjust her battle strategy).

167 The *gambit system* allows the player to program the actions of the playable characters in battle, so that they are able to respond in very particular ways to distinct conditions. A *gambit* consists of three components: an action – where the player specifies the kind of action to be enacted by the playable character; a target – where the player designates the target and the condition for that action to occur; and the priority – where the player sets which gambits to execute if multiple are called-for. Although, playable characters' actions are then automatised, players have the ability to issue commands manually for each character, and these possess the highest priority.

Another example is found in *The Elder Scrolls V: Skyrim* (2011) and in *Fallout 3* (2008). Besides configuring the race and determined physical and visual attributes of the playable character, the player can customise spells, equipment and weapons that are used by it in the course of the game. All of these modifications exert an influence in the gameplay and consequently in the game world.

N:R

If the *player is non-responsive* and the *system is responsive* (N:R), we may be close to Galloway's 'ambience act', where "the machine is still on (...), but the operator is away. (…) The ambience act is the machine's act. The user is on hold, but the machine keeps on working." (2006, 10) When Galloway relates the ambience act with the cinematic interludes in video games, he considers it the most 'nongamic' moment of the game.

> Formally speaking, cinematic interludes are a type of grotesque fetishization of the game itself as machine. (...) So, ironically, what one might consider to be the most purely machinic or "digital" moments in a video game, the discarding of the operator and gameplay to create machinima from the raw machine, are at the end of the day the most nongamic. The necessity of the operator-machine relationship becomes all too apparent. These cinematic interludes are a window into the machine itself, oblivious and self-contained. (Galloway 2006, 11)

In our model, the difference between the ambience act and this method (N:R) is that the player[168] is not paused. The player is non-responsive but senses the output of the system and is thus aware of it. Instead of being forced into a paused state, the player perceives the output of the system, processes that information, and *chooses* not to act. Not to act is then a choice. In other words, it is the product of data processing done in the processing core. In this case, *not to act is a choice*, not an incapacity.

So, in contrast with the ambience act, as the player is not absent but chooses not to act instead, inaction is validated as a conscious choice and eventually as something that the system may act upon. If we think of this inaction as a valid choice, we come to see that

168 Galloway (2006) refers to the player as the operator.

it originates consequences as any other action. And, for that reason, it is a choice equal to any other. The game continues although the player's activities are suspended. If the player is absent the narrative may not progress, but here she is not.

Figure 4.6: *The Graveyard* (2008).

The Graveyard (2008) is a video game that explores the visit to the graveyard by an old lady, controlled by the player. She cannot jump, attack, or even walk normally, only very slowly. After reaching the bench at the end of the path she may seat. If the player does nothing, a narrative develops for as long as the interactant maintains that state.[169] Upon interruption, she can go out and the game ends.[170]

Heavy Rain (2010) "highlights how action (or acting) isn't the only driving force or motivator for gameplay. In other words, it creates agency from inaction or non-action. Heavy Rain features moments when inaction or passivity, perhaps the anti-thesis of gameplay, is not only a valid choice, but may even be the preferred one." (Zagal 2011, 59) During the game, the player is called upon to take action usually by onscreen prompts. But there are moments when the player may choose to ignore those prompts, letting the moment slip by. The examples that José Zagal and Ian Bogost (2010) describe are a perfect fitting to illustrate this method. For example, in the prologue of the game, when Ethan (one of the playable characters) is playing in the yard with his son with the toy swords, the player may choose to attend to the onscreen prompts, thus wining the 'fight'; or the player may

169 During these moments, the relationship player-game system configures itself in order give predominance to interpretative functions, instead of configurative or exploratory ones. (Aarseth 1997) We explore this a bit deeper in chapter 8 (DEPTH).

170 This is regarding the free version of the game. The paid version adds a feature: the old lady may die. For more information consult the game's website at http://tale-of-tales.com/TheGraveyard/.

choose to ignore those prompts and let the son win. This demonstrates how "[i]naction in Heavy Rain shifts the player's responsibility from simply choosing the right action from a pre-determined set to one in which the player must additionally contemplate whether or not the set of actions makes sense." (Zagal 2011, 60)

Figure 4.7: *Amnesia: The Dark Descent* (2011).

In the beginning of the game *Amnesia: The Dark Descent* (2011) the following message is displayed: "Amnesia should not be played to win. Instead, focus on immersing yourself in the game's world and story." During the game, the player wanders in a hostile environment along dark and eerie corridors and rooms in a sinister castle. Her attack and defence capabilities are seriously diminished, making her pretty vulnerable, which makes her resort frequently to hiding strategies. The player has to blend with the environment while observing the monsters that are passing by. Movement or noise can make her noticeable to those monsters. So, she has to sit still, inert, and this inaction constitutes a moment of great emotional tension, where the player observes the behaviour of her opponents without being detected.

N:N

If the *player and the system are both unresponsive* (N:N) we have a method that consists in listening to the environment. In other words, neither actors produce output, but their sensors are active. This is a moment of *suspension*. A moment where both player and game system are in a listening state and processing that 'listened' information. Neither produce output.

As enunciated in chapter 3, the boss 'The End' in *Metal Gear Solid 3: Snake Eater* (2004) can be beat in various ways, and one of those is of particular interest here. It consists in the player waiting for a week or so[171] until the sniper dies of old age.[172] In this last case, the player and the game system are not inactive, but in a suspension state. Although they are not actuating, they are sensing the changes in the environment and processing that information. In this example, time contributes significantly to these changes[173] that affect both actors' behaviour, whose actions affect game states, that consequently contribute to unfold the game and the narrative.

We could also talk about the moment of pause. When a player pauses the game the system is not inactive, it becomes suspended. It is on hold. We may say that it is waiting for input. This example is similar to the configurative method, but with the difference that the player is not actuating. When pausing, the player is not inputing data. She pauses so that she doesn't have to actuate and neither has the system. She wants suspension, maybe to have more time to think in order to evaluate a determined situation. When the player leaves, this moment is something else,[174] because the interactant is not present, and thus is not listening, and the only actor left is the game system.

4.3.1.2 Unidirectional Methods

The *unidirectional* I/O methods, emerge from the relationship between the *non-responsive* and the *generative* actors. This group consists of I/O methods where one actor is just emitting signals and the other is only sensing them, in which the former may not even be aware of the presence of the latter.

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171 It is possible to quit the game and reload it after a week. Although, if the player does that, another method is enacted: I:I.

172 At the time of writing this event could be seen at http://youtu.be/oKakc1mWwQM.

173 Here, time is regulated by the clock on the PlayStation 2's firmware that is outside of the system that is the game.

174 In this case, if the player leaves the I/O method changes from N:N to I:N, which is discussed further ahead in this chapter.

N:G

This I/O method resembles the one commonly employed by traditional media. If the *player* is *non-responsive* and the system is *generative* (N:G), we may eventually notice that we are describing a kind of relationship that we find in traditional television or in radio, for example. The TV set is not aware of our presence, though it endlessly transmits messages/signals. It creates output independently of us. As spectators, we observe and interpret the information, but we do not act. This is the moment in which the system 'reproduces' data.

There is a type of video game that somewhat fits this description, called 'zero-player games'. These games are characterised by developing their narrative disregarding the player. An interesting example is *Dreeps* (2015). At the time of writing, this game is being announced as a game "[f]or you who don't have the time to play RPG anymore". In this game the player only has to setup an alarm before going to sleep. By doing this the main character in the game will also go to sleep. When the alarm is triggered, that character will automatically proceed in its adventures without requiring further player input. The player may at any time see what is happening in the game, being able to share some screenshots.

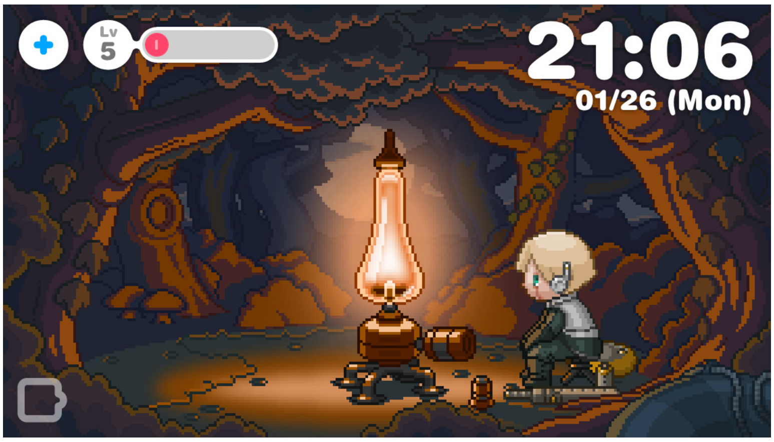

Figure 4.8: *Dreeps* (2015).

Another although hybrid example may be found in *Mountain* (2014), where after the initial input – in which there seems to be no apparent relation of causality to what happens next – the player is only able to observe the mountain, play sounds by pressing keys on the keyboard, and moving around some objects, but also without discernible consequences.

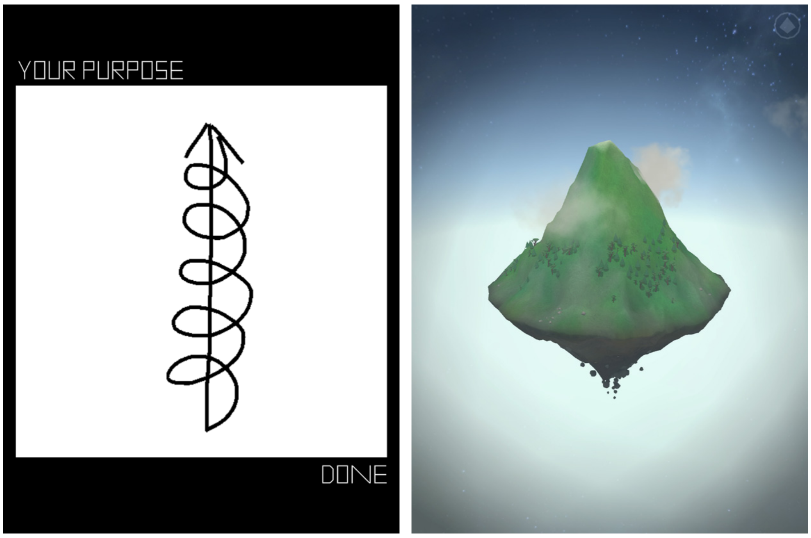

Figure 4.9 and 4.10: Two screenshots of *Mountain* (2014). The game's initial input is on the left.

Notwithstanding the previous examples, not all zero-player games can be considered to belong to this method. According to Björk and Juul (2012), zero-player games is a category that also encompasses games that are played without human players – or sentient players, if we want a more extensive concept. So, from that perspective, games that are played solely by artificial intelligence are also considered zero-player games. In contrast and as we demonstrated in chapter 2, in our framework those are not necessarily games without a player because the role of the player may eventually circumscribe both humans and non-humans players alike, including machines and software, in a compound actor.[175]

G:N

If the *player* is in a *generative state* and the *system is non-responsive* (G:N), we may be looking at the moment in which the system is 'recording' data. It may be done with a computer but also with a piece of paper, or other media. The player acts but the system produces no output, only records it. In fact, the player is not interested in the output (their sensors are off). The player is only focused on inputing information to the game system.

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175 See section 2.4.

4.3.1.3 Semi-interactive Methods

The other remaining I/O method is the semi-interactive method (responsive and generative actors). In these methods actor A senses the signals of actor B, processes them and generates output, but actor B does not sense actor A. As a result the output of actor A may be interpreted as misdirected or broadcasted beyond the scope of this system, as some kind of amplifier, transcoder or relay, for example.

R:G

The first thing that comes to mind in a situation where the *player is in a responsive state* and the *system is in generative one* (R:G) is when the former tries to interact with the game system, but it does not respond to the her input and stays in Galloway's ambience act.[176] This is may indeed be a moment of frustration for the player, a moment of disconnection. The game system may have stopped sensing the player's input, but the player still tries to communicate with it. The origins of this situation may be due to malfunctions in the code, in the hardware, or simply the result of bad design – where the player was not indicated that this is not an interactive moment.

Figure 4.11: Preparing for the first round in *Tekken 3* (1997).

This situation may also happen when the player is trying to interact with the system, eager for the interactive part of the game to recommence. For example, when fighting games like *Mortal Kombat* (1992) or *Tekken 3* (1997) eager players commonly start

176 See section 1.3.2 and Galloway (2006).

pressing the game controller's buttons even before the match has started. The same thing happens in *Super Mario Kart* (1992) since pressing the acceleration button at the right time when departing gives players a speed boost. However, eager players start pressing the gamepad's buttons much before the game system is listening.

G:R

If the player is in a generative state and the game system is in a responsive one (G:R) we may be referring to a player as an automaton that generates output without the ability to receive input. Let's imagine a player that constantly and uninterruptedly performs the same action or set of actions. A good example of this situation can be found in players that make certain actors play for them, allowing those more or less simple mechanisms to 'artificially' and automatically improve their status in the game. In these cases, delegated operations are an example.[177]

4.3.2 Dysfunctional Methods

A system is considered to bear a I/O dysfunctional method when at least one of the actors is inactive or both are in a generative state, being therefore incapable of establishing a direct pathway of communication, and unable to be directly responsive to each other's actions.

Considering the fact that from a phenomenological perspective some methods are unable to be distinguished, we were able to divide them into three groups. Each group expresses very specific dynamics in terms of responsiveness: the actors in systems that belong to *group 1* do not actuate; in the systems in *group 2* only one actor actuates; and in the system in *group 3* both actors blindly actuate. Some of these groups even relate to specific functional methods, diverging in simple ways but in a sufficient manner to create dysfunction within the overall system.

177 See section 2.4.3 Delegated Operations.

4.3.2.1 Group 1 — I:I, N:I / I:N

In this group the actuators of *both actors do not generate output*. In the system I:I the sensors are also off, but in the system N:I one is on.

These methods are somewhat similar to the N:N method – that we considered functional –, but in these cases one of the actors is inactive, something that renders them dysfunctional, as that actor is isolated, oblivious to any potential attempt to communicate. In the N:N method both actors are listening, they are attentive to the environment, monitoring their surroundings. The obtained information is processed, and as a result they choose not to act. In the N:I and I:N methods only one of the actors is listening (non-responsive).

So, if the *player is inactive* and the *system is non-responsive* (I:N) we are facing a moment where the game system is listening to the environment but choosing not to act, and the player is away. We may postulate that the decision of the system of not to act may be the result of an absent player, an inactive actor. We may raise the same hypothesis if the *player is non-responsive* and the *system is inactive* (N:I), where the former listens but chooses not to act because the latter is inactive. In these cases a waiting process may be depicted or at least a process that implies waiting or pause, a moment of cogitation.

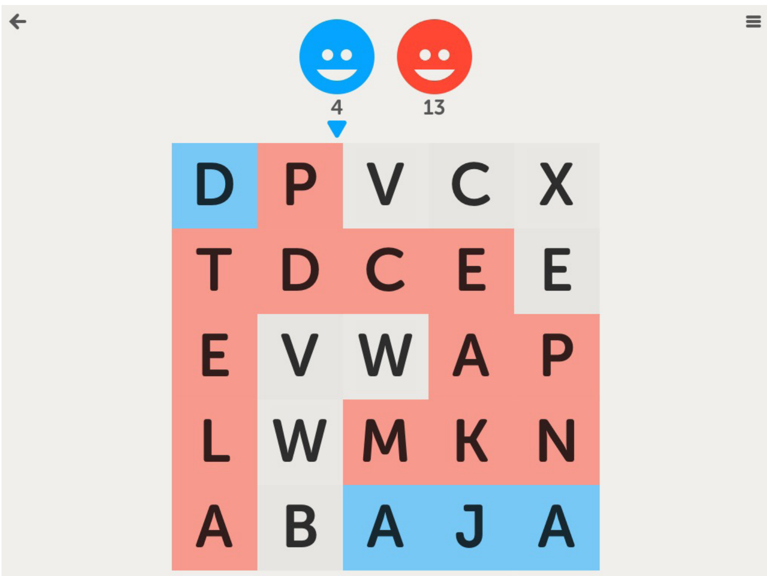


Figure 4.12: *Letterpress* (2012).

This is something that may happen during turn-based games that are played along several days or even weeks, such is the case of *Letterpress* (2012) where each player's turn can take as long as they need. A player can play her turn, abandon the game and return after a few minutes, hours or even days to play again, in response to the turn of the other player, or only to find out that it is still not her turn after all. Despite the fact that this example may feature a system with three actors (both players and the game system), it also summarily depicts how this method can be used in the context of gameplay.

4.3.2.2 Group 2 — I:G / G:I, I:R / R:I

In these methods one of the actors is ignoring the other that is busy emitting signals to the environment. In the R:I and I:R methods part of that signal may be absorbed back by the actor that sent it in the first place. In the I:G and G:I methods that actor is not receptive to its own or any other signals. In both cases, those signals may be sensed by actors from other systems.

These methods are similar to the N:R method that we characterised as being close to Galloway's *ambience act* (2006). We concluded that in the N:R method the player is not paused nor away. The player is able to sense information emitted by the game system but choses not to act.

But, here the player is actually 'away', oblivious and unable to witness what is going on in the game. If the *player is inactive* and the *system is responsive* (I:R) we are actually before the ambience act, where the game is ongoing but the player is away. Phenomenological speaking, the same can be true if the *player is inactive* and the *system is generative* (I:G), with the exception that the system is not receptive to eventual input.

When considering the potential for interaction between systems, we may postulate that these methods promote a kind of passive interaction, where the player is away and the system interacts with another system without her immediate knowledge. One example can be found in the Nintendo 3DS StreetPass feature that allows automatic passive communication between 3DS gaming systems upon close proximity and without requiring user input, being able to exchange data, or to initiate certain events. In *Super Street*

Fighter IV: 3D Edition (2011), the *StreetPass* function allows players to exchange in-game figurines and to trigger battles with those figurines. While playing *Bravely Default* (2012) the player can accumulate sleep points[178] – in-game currency to perform special attacks – by putting the console system in sleep mode for a certain amount of time.

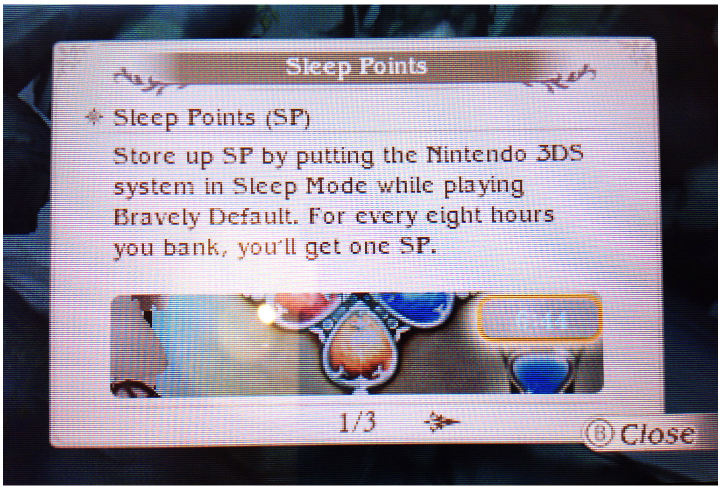
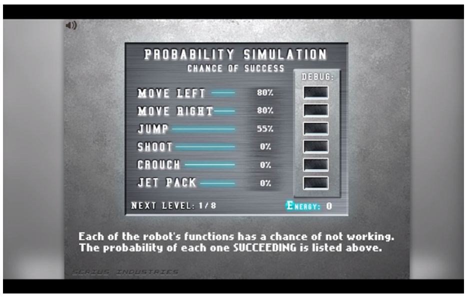


Figure 4.13: Sleep points in *Bravely Default* (2012).

The R:I and the G:I methods occur when the player is in a responsive or in a generative state and the system is inactive, respectively. These methods are somewhat similar to the R:N method, where the player is sending information to the system but the latter chooses not to respond. It may be seen as a moment where the player explores diverse configurations of the available and found algorithms within the system and in which their enactment only takes place afterwards.

But the cases of the R:I and the G:I methods are different: the system is considered inactive. An interesting case is featured in *Randobot* (2012), where the player's avatar (a damaged robot) randomly refuses to execute certain actions instructed by the player herself, such as move, jump, or fire, while traversing the game world.[179]

178 Sleep points are in-game currency to perform particular attacks during battles, that break the traditional turn-based combat mechanics stopping time for the player to execute attacks. Sleep points can be acquired by putting the game in sleep mode and waiting about eight hours for one unit. Or they can be bought.
179 At the time of writing a gameplay video of *Randobot* (2012) could be seen at https://youtu.be/Klc-6Z5PRpZo.



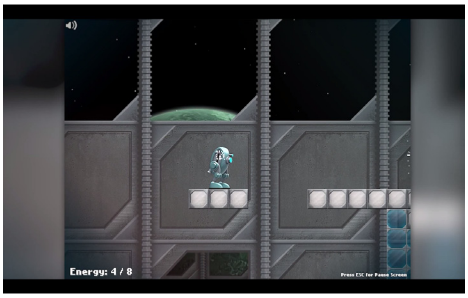


Figure 4.14 and 4.15: Two screenshots of *Randobot* (2012).

Another example is that when the player is before an eventual system crash, or a similar experience. The system may be busy processing an enormous volume of data, a task that will therefore consume a considerable amount time, becoming unresponsive and, from a phenomenological point of view, inactive; or it may be trapped in an internal feedback loop, endlessly processing the same data or executing the same procedure, until the eventual occurrence of a crash.

In these methods one of the actors is actually not listening and doesn't express any kind of activity. And as so, we may think about an eventual disconnection between the system and the player, which is a pretty common incident when playing online video games, such as *World of Warcraft* (2004) or the online mode of *Grand Theft Auto V* (2013). This interruption may be either momentary or permanent, and in the case of the former it can experienced as something that happens occasionally or with more frequency, providing an experience of interleaved functional and dysfunctional methods.

Processing problems are not the only cause. Latency may also play a role here. If the actors take to long to respond, the system may be experienced as a constant alternation between two dysfunctional methods. Let's consider a signal that has to travel a long distance or travels at very low speed. In the time it takes to reach the sensors of another actor and for this to process that data and emit another signal, that has to travel back all the way to the first actor, this first actor may momentarily experience dysfunctional responsiveness.

The structural difference between the R:I and the G:I methods relies on the player, that in the former method is able to sense incoming data, and in the latter method is not aware of its surroundings, blindly emitting information to the environment.

4.3.2.3 Group 3 — G:G

The G:G method is the only one present in this group, as it is the only dysfunctional method that doesn't feature an inactive actor. It is characterised as dysfunctional due to the fact that its actors are unable to sense each other's signals, or any other for that matter. This method creates moments of blind generation of signals, where both actors generate information disregarding every incoming signal. As a consequence, that information is sent to the environment and may be sensed by actors outside of this system.

These signals may not be necessarily targeted at any actor, and as a consequence this method may contribute to a certain creation and dissemination of noise. It is in this context, that, despite its internal dysfunction, this method can play an utilitarian role. As noise can be generated by the disruptions caused by the encounter of several signals that travel through the environment, modifying their original characteristics, one of this method's purposes may be the scrambling of signals. A system performing with this method is able to saturate the environment by constantly emitting signals without targets, creating enough noise either to disturb incoming signals, to scramble outgoing ones, and/or to hide the ongoing activity within a certain area or group of systems. It may serve as a barrier, a protection from external access.

When performing this method, the actors are so disconnected from each other that they may break apart, becoming part of no system, no group in particular, becoming somewhat errant.

4.4 Conclusions and Future Work

We have asserted that communication through the I/O funnel is essential in the relationship between actors, player and the game system, and that together they unfold the narrative. These diverse I/O methods concerning the dynamic relationship established between the player and the system promote the emergence of various aesthetic manifestations, rendering different play experiences.

We demonstrated that this model reckons the dispensability of constant and continuous responsiveness between actors, and that, in this context and as video games are not interactive all the time, dysfunction in communication plays a major role in the expression of diverse dynamics that are rooted in nature of computational systems that are video games. Consequently we also demonstrated that inaction is a valid option in gaming. And thus, paradoxically, not to act becomes an act of play.

We have also demonstrated that different mechanics may portray similar dynamic expressions, as is evident in the methods of group 1, in which, from a phenomenological point of view, no clear distinctions could be made.

Another conclusion is that dysfunction is not synonym of uselessness. There may be purpose in the creation of dysfunctional I/O methods. Activities such as protecting information from specific actors are an example of this, as can be the case of group 3.

Also, when the relationship between actors of the same system becomes dysfunctional, an eventual relationship between actors of different systems gains further potential to establish itself. So, the dismantlement of a given system may originate the assembling of another, revealing that the end of a given regimen in responsiveness may give birth to another. So we may postulate that dysfunction in a system is responsible for creating certain *unbalance* within its external relationships that may result in the creation or transformation of other systems, by aggregating new actors into their midst.

Thus, this study not only revealed the necessity of future research regarding more complex systems – with three actors, for example –, but also on their behaviour regarding the dynamics that emerge from the assembling and the dismantlement of these methods.

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5. Thinking and Actuation

Action involves *thinking* and *actuating*, processes that respectively rely on cognitive and physical effort. When playing a video game, these processes – that may be seen as two stages of player action – do not need to be strictly ordered (thinking–actuating) and they may not even be, in fact, interdependent. This chapter examines three types of player action that result from exploring the interdependences of thinking and actuating: from actions that are the consequence of a thought-out plan, to actions that are the result of embodied or mechanised reflexes, and to actions that are visceral responses of the body to external stimuli and internal mental activities or thoughts.

The relationship that the player and the game system establish is mediated through these actions, undertaken in response to the challenges that the player needs to overcome, through what we may call a *learning process*.

This chapter pinpoints a new and still underdeveloped approach to game design that aims at recognising the player as a biological entity, and consequently at identifying the need for the game system to interpret and transcode her biological traits.[180]

5.1 Introduction

In this chapter we focus on the actions of the player and not on those of the system. In other words, we are concentrating on the actions through which the player operates within the game world. Therefore, this chapter explores alternate modulations between the interdependences of *conceptualising* a determinate action and its corresponding *ac-*

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180 This chapter consists of a revised version of *Between Thinking and Actuation in Video Games* (Cardoso and Carvalhais 2013a).

tuation. These two moments in player action correspond to stages of *preparation* and of *enactment*, respectively. We may say that conceptualisation consists in the mental effort involved into ideating or conceiving a determinate action. On the other hand, actuation consists in the effort employed by the player when trying to instantiate a certain action. We may say that the first moment consists in the effort that is employed by the player when she forms the model that her actuations will instantiate in the second moment, which is a physical operation capable of sending information to the game system.

In *The Art of Computer Game Design* (2011) Crawford presents a taxonomy of computer games organised in two major categories: "skill-and-action ('S&A') games (emphasising perceptual and motor skills) and strategy games (emphasising cognitive effort)." Our approach is based on a different perspective on this subject. We believe these two categories are somehow still visible in contemporary computer games, although positioned in different subcategories. Nevertheless, we think that computer games have been disregarding the fact that human players are biological beings, with specific biological functions and operations. And a category that may encompass this fact is in order.

So, player's actions can be the result of a conscious choice, of an unconscious reflex, conditioned or trained behaviour, or even emerge from the biological functions and operations of her own body. And each of the previously enunciated types is obtained through different modulations between the conceptualisation and actuation phases. In this chapter we describe three types of action that are based in these premises.

The work presented here is related with the work of Donald Norman in *Emotional Design*, in which he presents three levels of cognitive processes, requiring different styles of design.

> The three levels in part reflect the biological origins of the brain starting with primitive one-celled organisms and slowly evolving to more complex animals, to the vertebrate, the mammals, and finally, apes and humans. (Norman 2004, 21)

Norman defines the visceral level as prewired, preconscious, pre-thought, focused on the present time; the behavioural level as not conscious, concerned with use, experience and performance focused on well-trained routine operations; and the reflective level as slow, conscious, contemplative, vulnerable to variability through education and culture, and focused on long-term relations. But where Norman is interested on usability and the relationship we establish with everyday objects, we converge our attention to the phenomena of action in the context of video games.

5.2 Premeditated Actions

We may call *premeditated* those actions that require the player to invest conscious mental effort conceptualising them. They result from the player's conscious thought and may be planned thoroughly. In other words, the player is aware of what she is going to do, independently of how complex of her plan might be or how long it will take.

These are *deliberate, intentional, controlled*, and *voluntary* actions. The player takes her time to consciously process information in order to deliberate the preferred course of action.

> At the highest evolutionary level of development, the human brain can think about its own operations. This is the home of reflection, of conscious thought, of the learning of new concepts and generalizations about the world. (Norman 2004, 23)

The player resorts to these actions when she has to deal with complex or heavy loads of information. Therefore, they are usually slow, because she has to analyse a given situation, deliberate her course of action, and only then actuate. And the more time is available to her, the further she premeditates her actions. She may even premeditate complete sets of actions instead of one at a time.

It is pretty common for strategy-based games to resort to this type of action due to their orientation on heavy planning. In their case, play may be divided into turns, in which players act alternately. In some of them, turns do not even have a temporal limit in which their actions need to be enacted, rendering real time irrelevant in the overall gameplay. Thus elevating the importance of planning, of the effort in making conscious and rational decisions. *Utopia* (1981), *Worms* (1995), *Sid Meier's Civilization* (1991) are good examples of strategy games played in turns.

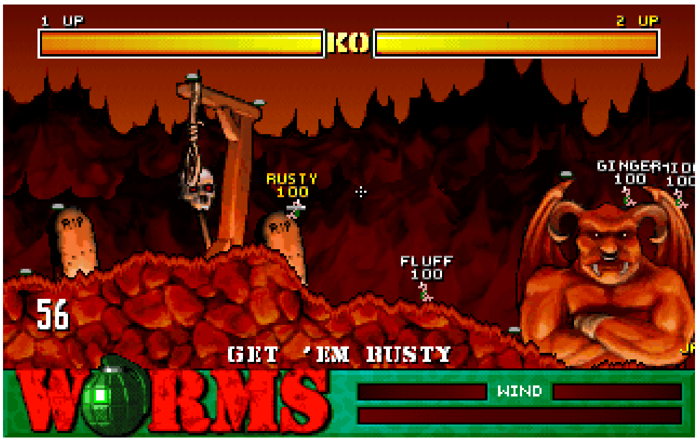

Figure 5.1: ***Worms*** **(1995).**

Real-time strategy games maintain the overall characteristics of traditional strategy games, but they use time as a gameplay element, providing immediate feedback, pressuring the player into making decisions faster and coordinating several elements (almost) simultaneously. Games like *Populous* (1989), *Warcraft: Orcs & Humans* (1994), *Age of Empires* (1997), *Black & White* (2001), *Supreme Commander* (2007), *Starcraft II: Wings of Liberty* (2010) help illustrate this.

Figure 5.2: ***Black & White*** **(2001).**

This kind of action doesn't need to always be related with strategy games. In many other games, the player has to plan her actions no matter how brief that moment is. Even action games require planning at some point, or some kind of premeditation. But the emphasis on this type of action that is evident in strategy games makes them good examples.

Besides games that have planning at their core, the player may also resort to these actions when in other games she is confronted with an entirely new situation. The fact that she is not familiar with a certain set of circumstances is enough to ignite an analysis process, simply because that is the cautious decision.

Yet another situation that invokes premeditated actions occurs when the player's actions do not produce an expected outcome, as when she is constantly defeated at the same location or by the same opponent, or when she simply fails to achieve her objectives. At that point she may recognise the need to implement a new and better strategy (no matter how simple or complex the plan may become).[181]

On the other hand, when the player is confronted with familiar situations, she may employ already tested or tried actions to produce expected and preferred outcomes. And because a plan has already been outlined, the ideation stage is bypassed, resulting in speedier response: her actions will be faster. When this process becomes fast enough, resulting in unconscious processes, we discover another type of action.

5.3 Trained Actions

We may call *trained* to the player's unconscious actions that were learned through instruction and practice. They are automated and sometimes choreographed acts. As António Damásio notes, not all the actions commanded by a brain are deliberated. We can assume that most of the actions happening at a given moment in time are not deliberated at all, and that they constitute simple answers, from which reflex movements are an example: a stimulus transmitted by a neuron that leads another neuron to act.[182] (1994, 128)

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181 Here, replay gives origin to premeditated actions.

182 Freely translated from Portuguese.

For example, an experienced typist doesn't usually think about how her fingers hit the correct keys on the keyboard when typing. Conversely, that usually happens to an individual that has less experience, although with practice she may improve to a point where typing does not require the attention and effort that it previously did. That's what we usually call *experience*. So, the player may refine her actuation, getting better and faster with practice. And as her experience increases, so do the chances of her actions' effectiveness. And as her actions become more and more embodied they require less and less mental effort, becoming *unconscious, conditioned* and *automated* processes.

> If I asked you to describe how you got to work in the morning in some detail, you'd list off getting up, stumbling to the bathroom, taking a shower, getting dressed, eating breakfast, leaving the house, and driving to your place of employment. That seems like a good list, until I ask you to walk through exactly how you perform just one of these steps. (...)
>
> Odds are good that you could come to an answer if you thought about it. This is called a morning *routine* because it is routine. You rely on doing these things on autopilot. This whole routine has been "chunked" in your brain, which is why you have to work to recall the individual steps. It's basically a recipe that is burned into your neurons, and you don't "think" about it anymore. (Koster 2005, 20)

These actions may be *voluntarily ignited and terminated* by the player, but they are *not consciously controlled or performed* by her. We may rather say that they are invoked, performed in correspondence to some sort of training the player has undergone.

> The behaviour level in human beings is especially valuable for well-learned, routine operations. This is where the skilled performer excels. (Norman 2004, 23)

They can be automated performances as when an experienced driver steers a car. It seems that she does it without thinking, intuitively. They can also be conditioned performances, as when we respond to perilous situations, such as the presence of a dangerous animal or other physical threat.

> Your body reacted in an attenuated replica of a reaction to the real thing, and the emotional response and physical recoil were part of the interpretation of the event.

> As cognitive scientists have emphasized in recent years, cognition is embodied; you think with your body, not only with your brain. (Kahneman 2011, 51)

Therefore, games where the player must excel through speed or must somehow develop some dexterity, often deal with this kind of action. They usually present increasingly harder challenges, training the player into embodying several combinations of keys, movements, etc.. Games as *Super Mario Bros.* (1985), *Sonic the Hedgehog* (1991), *Super Street Fighter II* (1992), *Tekken* (1994), *Wipeout* (1995) are just some of the many examples that explicitly use these actions.

Figure 5.3: ***Super Street Fighter II*** **(1992).**

5.4 Autonomic Actions

We may call *autonomic* to actions that are the result of *automatic, mechanical* or *organic responses* enacted by the player's body, and that occur without her direct control or will. The player's conscious thought is not directly entangled with this kind of actions; they are a direct result of the player's body biology and mechanical and chemical operations, regarding its activities and behaviours.

> When you stick your finger in the fire, you snatch it back before your brain has time to think about it (seriously, it's been measured).

> Calling this "muscle memory" is a lie. Muscles don't really have memory. They're just big ol' springs that coil and uncoil when you run electrical current through them. It's really all about nerves. There's a very large part of your body that works based on the autonomic nervous system, which is a fancy way of saying that it makes its own decisions. Some of it is stuff you can learn to bring under more conscious control, like your heart rate. Some of it is reflexes, like snatching your fingers out of the fire. And some of it is stuff you train your body to do. (Koster 2005, 28)

These actions may be triggered by actions of the same kind, but also by conscious thought. For example, it is possible that the player's heart rate goes up and her legs may start to shake when reminded of a traumatic event endured in the past. These actions may also be heavily influenced by the mood or emotional state that player may be under. For example, if player is feeling stressed, her heart rate may be higher than normal, or she may be sweating, etc.. As Damásio states, emotion is a collection of changes in the state of the body, that are induced in several organs through the endings of nerve cells under the control of a dedicated cerebral system, that responds to the content of thoughts related with a certain entity or event. Although some of these alterations may only be sensed by the person in whom they are occurring, many can effectively be perceived by others.[183] (1994, 189)

Here the player's body acts by itself, without their direct control, although some behaviours may be shaped through proper training. "Animals such as lizards operate primarily at the visceral level. This is the level of fixed routines, where the brain analyses the world and responds." (Norman 2004, 23)

PainStation (2001) is an interesting example of this type of action. This is a variation of *Pong* (1972) in which the player that looses points is physically punished through electro-shocks, whippings and extreme heat applied to the left hand which, if removed from the game panel, leads the player to loosing the game altogether. Thus, this game tries to measure the player's resistance to pain, and its rules force her to endure punishment in order to continue playing. Here, the reflex of avoiding pain and the conscious decision to continue playing the game are confronted and in constant turmoil.[184]

183 Freely translated and adapted from Portuguese.

184 For more information consult the project's website at http://www.painstation.de/.

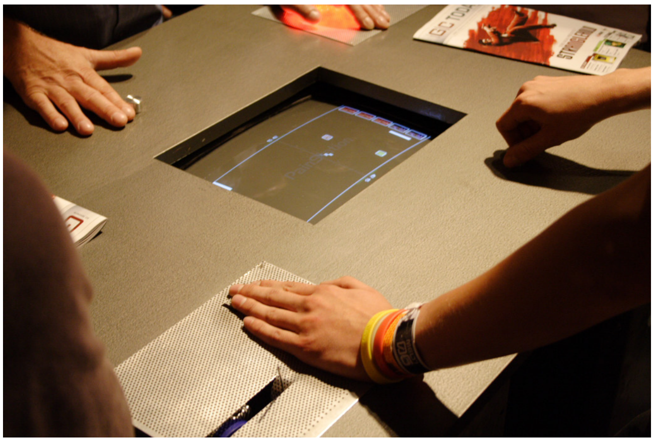
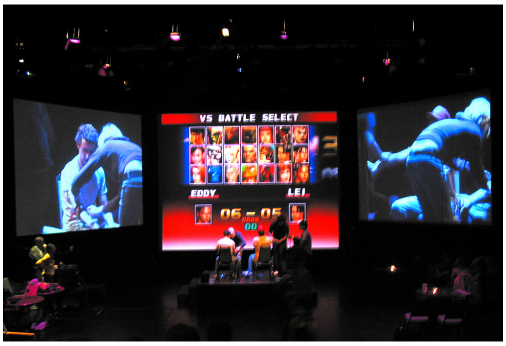


Figure 5.4: *PainStation* (2001).[185]

A similar example is *Tekken Torture Tournament* (2001) where the players play a hacked version of *Tekken* 3 (1997) – a fighting game – and receive non-lethal electroshocks as their onscreen avatars (their proxies) are injured, by means of a custom/dedicated arm strap.[186]



Figures 5.5 and 5.6: Playing *Tekken Torture Tournament* (2001).[187]

Another example can be found in *Nevermind* (Early Access 2015), a game that resorts to a biofeedback sensor to monitor the player's stress levels. According to the authors, the more stressed the player is the harder the game gets.[188]

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185 Image from Wikimedia Commons at https://commons.wikimedia.org/wiki/File:Painstation.jpg.

186 For more information consult the authors' website at http://eddostern.com/works/tekken-torture-tournament/.

187 Images from Eddo Stern's website at http://eddostern.com/works/tekken-torture-tournament/.

188 More info at www.nevermindgame.com.

5.5 Conclusions and Future Work

Looking back into the history of video games we may notice how extensively they have explored premeditated and trained actions. Since the early days, computer games were divided into two major categories that seem to be close to the two types of action. Video games have also excelled at manipulating the player into transforming premeditated actions into trained ones.

Games force players into optimising their performance, usually by presenting them with challenges that grow increasingly more complex and harder to solve, requiring them to master their current abilities. Overcoming these challenges unlocks new abilities, restarting the cycle. In most cases, this happens when players succeed in embodying basic essential actions, freeing mental resources, thus allowing them to solve new and usually more complex situations. In other words, throughout the game the player is trained into increasing her skills, either physical or mental.

This increasing difficulty that is usually presented in video games is a good example of how game systems teach their players something that is not necessarily related with narrative or storytelling.

> Games seem on the face of it to be very different from the stories and to offer opposing satisfactions. Stories do not require us to do anything except to pay attention as they are told. Games always involve some kind of activity and are often focused on the mastery of skills, whether the skill involves chess strategy or joystick twitching. Games generally use language only instrumentally ("checkmate", "ball four") rather than to convey subtleties of description or to communicate complex emotions. They offer a schematized and purposely reductive vision of the world. Most of all, games are goal directed and structured around turn taking and keeping score. All of this would seem to have nothing to do with stories. (Murray 1997, 40)

Instead, they teach something intrinsic to their dynamics. And for players to progress in the game they have to keep on learning, and in many games this happens until closure.

> Moreover, the potential uses of video games extend far beyond the playing of games. They could be excellent teaching devices. In playing a game, you have to learn an amazing variety of skills and knowledge. You attend deeply and seriously for hours, weeks, even months. You read books and study the game thoroughly, doing active problem solving and working with other people. These are precisely the activities of an effective learner, so what marvelous learning could be experienced if only we could use this same intensity when interacting with meaningful topics. Thus, game machines have huge potential for everyone, but it has not been systematically addressed. (Norman 2004, 44)

We can even state that this process has been a favoured form of learning that players have endured in video games up until now. Perhaps it is because of this learning process – that is very advantageous to games when it comes to their replay potential – that games have been heavily focused on premeditated and trained actions. While the player is capable of transforming the first type of action into the second, we don't think it is possible to transform either of the previous into autonomic actions. We know that unconscious and conscious thought influence them, but there seems to be no direct correlation between the first two and the third. At least, not in the way that we are used to experience between premeditated and trained actions.

Another aspect that has come to our notice is the fact that nowadays few games explore autonomic actions. There is a huge gap here. It is very unusual for the player to be able to influence the game system through autonomic actions. Traditional hardware in which video games run is simply not equipped with the adequate sensors or even software that is able to sense and interpret most of these actions. And although the player keeps emitting information that derives from them (because it is in her nature), the game system is not capable of receiving and interpret it. It literally goes to waste.

Another aspect that may have contributed to this is the fact that the player is not able to consciously act on the game through these actions because she is not able to directly control them. It is precisely because of that that this unlocks a new approach to game design, an approach that can be closely linked with affective computing, psychology, neurosciences, and biology. An approach that should perhaps start by asking: How can a game be played if the player does not exert direct control over her actions? If the player is a biological entity, how can a game system interpret and transcode her biological traits transforming the outcomes into actions of play? And how can they influence the game system?

Some experiments with brain-computer interface (BCI) devices seem to be focusing on finding alternate ways for the player to send information to the system. Through these devices the system is able to monitor player's autonomic actions related with her brain activity. *Brainball* (2001) is an experimental game that aims at inverting conventional approaches to competitive games. Here, the winner is the player that is able to achieve the most relaxed mental state, the most passive and calm. Both players wear on their heads a strap that contains biosensors that measure the electrical activity of their brains. Depending on their brains' activity a ball that sits on the table moves back and forward until it reaches one of the player's sides.[189]

Figure 5.7: *Brainball* (2011).[190]

On an opposite side is *BrainBattle* (2011), an experiment in which players play a version of *Pong* (1972), *Space Invaders* (1978) and *Pac-Man* (1980) resorting exclusively to BCI devices. Here players are forced into a higher level of concentration just to move the characters they are controlling with their mind and in most cases success in controlling those characters is hardly guaranteed.[191]

189 At the time of writing a gameplay video of this game could be seen at https://youtu.be/oBeGv_x4Tbs. Also, more info at https://www.tii.se/projects/brainball and http://90.146.8.18/en/archives/prix_archive/prix_projekt.asp?iProjectID=11057#. The commercial version was renamed *Mindball* (www.mindball.se.).

190 Image from https://www.tii.se/projects/brainball.

191 At the time of writing a video demonstrating the gameplay of this game could be seen at https://youtu.be/P3au9eLwmvo.

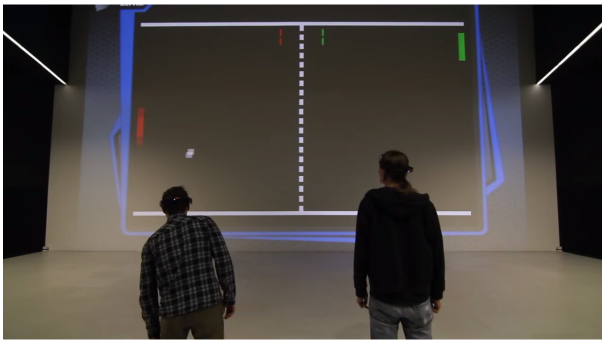

Figure 5.8: ***BrainBattle*** **(2011).**

But BCI is not the only way to introduce autonomic actions into games. The spectrum of means through which humans communicate is very wide and diverse. The human body, particularly the face, is highly expressive, and computer vision (CV) devices, for example, can be powerful tools to monitor those expressions. But, most of contemporary video games primarily use CV for motion tracking, granting the player direct control over certain game elements – like the Microsoft Kinect that visually traces the movement of the player's body. *Kinect Star Wars* (2012) can serve as an example here.

Augmented reality has been another focus in CV based games, but, in this context, it just seems to be another variation of the previous. *LevelHead* (2008) or *Invizimals* (2009) are examples of this.

Video games will be able to include players' autonomic actions into the gameplay when they are capable of sensing and interpreting the modulations of their various states: anxious, excited, relaxed, disoriented, aroused, for example, through bodily responses such as heart rate, skin galvanic response, pupil dilation, facial and body expressions, etc..

We believe that multidisciplinary studies in affective computing, psychology, neurosciences, biology, and game design are needed in order to raise a better understanding on how these can affect gameplay, a yet under-explored path that will expand our knowledge on how our own biology interacts with computational systems and ultimately will allow the development of innovative video games.

With this mind, wearable technologies, such as smartwatches e.g., pose now a recent and very interesting technological development that may contribute to raise interest in this kind of action as well.

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6. Transcoding

While playing a video game, the player-machine interaction is not solely characterised by constraints determined by which sensors and actuators are embedded in both parties, but also by how their actions are transcoded. This chapter is focused on that transcoding, on understanding the nuances found in the articulation between the player's and the system's actions, that enable a communication feedback loop to be established through acts of gameplay, a process that is established with actions of the player aimed at the system, and with actions of the system aimed at the player. We propose six modes of transcoding that portray how the player becomes increasingly embodied in the system, contemplating the moment where the player's representation in the system is substituted by her own actual body.

This chapter aims at an understanding of the relationship between the player and the system's operations, raising the awareness on how the former's organic body and the latter's hardware are entangled in a communication process that allows the system as a whole to develop. This cybernetic relationship shapes our interactions and its relevance goes beyond the scope of video games, being found in all sorts of interactive media.[192]

6.1 Introduction

When playing a video game, the player and the game system's actions are constrained by the supported hardware and the implemented interfaces. Push buttons, knobs, analog controllers, digital cameras, accelerometers, infrared emitters and sensors, global posi-

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192 This chapter consists of a revised version of *Transcoding Action: A perspective on the articulation between the player's and system's actions in video games* (Cardoso and Carvalhais 2013c) and of *Transcoding Action: Embodying the game* (2014d).

tioning systems, digital compasses, touch sensitive surfaces, etc. are just some examples of hardware components that have been explored and combined in various forms across the history of video games, developing new interaction devices.

By combining these and other components, several and diverse artefacts emerged, promoting different modes of interaction between the player and the game system. Some became obsolete or out of fashion, others prevailed and even became ubiquitous. While operating those devices and depending on their particular characteristics, the player performs specific actuations that may vary in terms of amplitude, speed, rhythm, etc.. These may include more than gestures, such as sounds or speech, and even actions that are less controllable or perceptible such as those that derive from the autonomic nervous system.[193] But disregarding their kind, we may say that, while operating an input device, the player manifests her actions through her body and those manifestations compose a sort of performance. And it is this performance that is monitored and interpreted by the game system, registering very specific data that is subordinated to the diverse kinds of input devices that are in current use.

6.2 Performance: Player & Proxy

The player interacts with the game world by operating input devices. In some games, for the player to act in the game world she needs to control an actor that serves as her *proxy*. This proxy is her representation in the game world but not necessarily her representation in the story of the game. The player's proxy is the actor she directly controls, and with which she puts her actions into effect. It is her surrogate.

> (…) cinema offered a window and positioned the spectator within the world it depicted; the video game goes further, allowing the spectator to explore that world through the surrogate of the player-character and take an active role in its events. (Wolf 2001, 75)

With this in mind, her proxy can be her avatar, the playable character she tries to incorporate, assuming its role in the narrative and in the game world itself. But it may also be the arrow cursor that she manipulates by pointing and clicking, putting various functions in motion and even instructing her playable character or playable characters.

193 See chapter 5 (thinking and actuation).

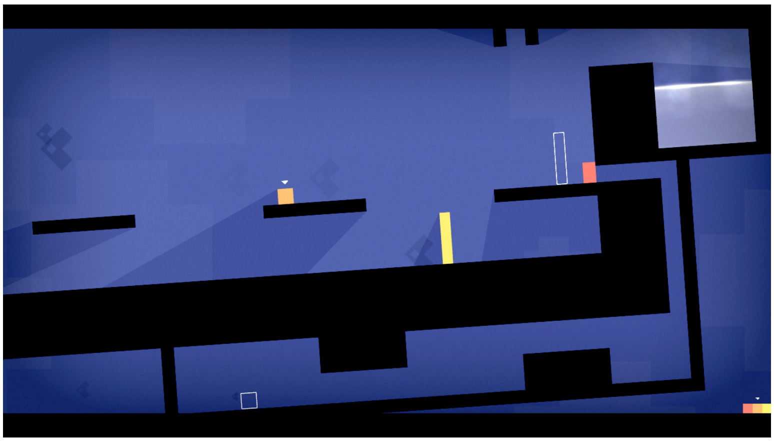

Figure 6.1: *Thomas Was Alone* (2012).

The player may also not necessarily be fixed to a single proxy. Some games allow the player to alternate between controlling various playable characters/actors, as in *Thomas Was Alone* (2012), or even control them simultaneously, as in *Brothers: A Tale of Two Sons* (2013). But by being more attentive, we may notice that it is also very common for the player to be able to exchange the control between playable characters and other elements on screen during play, such as cursors, arrows and other gameplay elements usually featuring graphical representations. So, in the end, we may say that the relationship between the player and her proxy is more accurately characterised in the plural sense: *the player and her proxies.*[194]

This chapter focuses on the articulation between the performance of the player and that of the entities that serve as her proxies in the game world. In other words, it is about understanding how the player's actuations relate to the expressions of those that represent her in the space of the game, but it is also about comprehending when the game space incorporates the player's actual body, dismissing those proxies.

To conclude, it is important to stress that what is explored here is not only the relationship between the player and her playable character in the game world, but also between her proxies in game space.

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194 In *Super Mario Galaxy* (2007) the player can control two proxies simultaneously, the star that is used as pointer – controlled by the pointing the Wiimote to the screen – and Mario – which is controlled by pressing buttons and tilting the analog stick in the Nunchuck.

6.3 Space: Player & Game

In *A Casual Revolution* Jesper Juul differentiates between 3D space, screen space and player space (2010). *3D space* corresponds to the world space of a three-dimensional game. *Screen space* is the two-dimensional surface of the screen itself. *Player space* corresponds to the physical space where the player is situated. Juul identifies these diverse spaces in casual games, stating that “video games started out as two-dimensional games on screen space, became windows to three-dimensional spaces, and now with casual games we see many games returning to both the two-dimensional screen space and to the concrete, real-world player space of the players.” (2010)

Taking these categories into consideration, we discerned two kinds of space that the game system and the player are involved in while playing: player space and game space. *Player space* is, as Juul defines it, the physical space where the player resides. The player’s physical body can never leave this space, as it is intrinsic to its very own existence. Player space also envelops the hardware necessary for the player to play, whether they are input or output devices, such as game controllers and screens. It may also enfold other players’ actual bodies, which may eventually interact with each other while playing, but out of the scope of the game’s game space. For example, in local multiplayer games, such as *Super Mario Kart* (1992) communication is also established in player space, and outside of the realm of game world itself. Players talk, yell, laugh, etc., and even come in direct contact with each other. With this in mind, player space not only is where players actuate but also where they may eventually interact with each other outside of the game world.

Game space is where the actual game world is. Whether it is one-, two- or three-dimensional; whether it is viewed through large or small screens, or even virtual reality goggles; whether it is portable or not; whether it is listened through headphones, loudspeakers, or simply doesn’t feature sound at all, the game space is where the player engages in play, it is the space she is driven to inspect while playing, discovering its residents, characters, objects, locations, events, etc.. In sum, game space is where the game actually happens.

Game space is commonly represented in audiovisual terms, but other and diverse modalities are often combined with the intent of immersing the player into the game world. This necessity for immersing the player in game space has been increasingly noticeable over the years. Game technology commonly favours some modalities, such as the visual, in detriment of others, such as audio or haptics – something that is discernible by the increasingly investment in graphics over the past decade. Notwithstanding this asymmetry in the development of game technology, game space may incorporate many elements of the physical world, as we will see ahead.

6.4 Transcoding Modes

Transcoding can be clarified as the conversion process from one coded form of representation to another. In video games the information that is transmitted results from the sensorial, interpretative and performative capabilities of actors. The term transcoding is thus used in this context to illustrate how the actual physical performance of the player realised in player space is represented in the game space.

The proposed modes of transcoding are divided in two major groups: *intangible* – exploring diverse modes of articulation between the player and her proxy in game space – and *tangible* – inspecting diverse relationships between the now merged player and game spaces.

It is important to notice that these modes of transcoding are transversal to diverse kinds of representation, whether the game is based on simulation or not.

6.4.1 Intangible

Intangible transcoding occurs when player space and game space are separate. In this case, the player needs at least one proxy in game space in order to act in the game. The player actuates in player space and, by means of the most diverse forms of input, the game system registers and transcodes her actuations to her proxy, which, on her behalf, acts in game space. So, as the relationship between player space and game space is *intangible*, so is of the same nature the relationship between the player and her proxy.

We propose three modes of articulation between the player and her proxy that feature an intangible transcoding. These are regulated by principles of *similarity or similitude*, from arbitrariness, to symbolism, all the way to mimicry.

Arbitrary Articulation

An *arbitrary articulation* between the player and her proxy occurs when there is no direct correlation between their actions. And due to that arbitrariness, the player is usually subjected to instruction, learning even the simplest procedures in order to play the game. Even trivial routines such as moving, walking or running may require the player to be instructed, or to learn by trial and error, on how they are performed.

In this kind of articulation the pressing of a button may correspond to potentially anything. Thus the player cannot play properly, or at least as intended, until she learns what every button, knob or other input device does.

> You are a console gamer, for better or for worse, even though you are aware of the generally higher quality PC games. Anyone who claims allegiance to the recognizably inferior is in dire need of a compelling argument. Here is yours: The keyboard has one supreme purpose, and that is to create words. Swapping out keys for aspects of a game control (J for "jump", < for "switch weapon") strikes you as frustrating and unwieldy, and almost every PC game does this or something like it. PC gamers themselves, meanwhile, have always seemed to you an unlikable fusion of tech geek and cult member—a kind of mad Scientologist. (Bissel 2011)

This kind of articulation is usually established according to norms and conventions – many of them seeded by classic gameplay mechanics – that are imposed by the game system.

> We've evolved exquisite sensitivity to visceral challenges. A survey of games featuring jumping found that the games with the "best controls" all shared an important characteristic: when you hit the jump button, the character on screen spent almost exactly the same amount of time in the air. Games with "bad controls" violated this unspoken assumption. I'm pretty sure that if we went looking, we'd find that good jumping games have been unscientifically adhering to this unspoken rule for a couple of decades, without ever noticing its existence. (Koster 2005)

In fact, we may say that the shape or form of contemporary game console controllers is the result of years iterating hardware with the intent to improve the articulation between the actuations of the player and her proxy in game space – although some tried to break with the then current trend, such as the Wiimote.

So, in games like *Super Mario Bros.* (1985) the player doesn't need to actually jump to make Mario (the playable character) jump. The same happens in *Tekken 3* (1997) where the player doesn't need to actually perform a kick for her playable character to kick. The player only needs to press the corresponding button on the game controller. It is this divergence in the actuation of the player and that of her playable character – her proxy – that reveals the nature of this kind of transcoding; a relationship that, in this case, we classify as arbitrary.

We may find an interesting example in *Pong* (1972) – in which the graphic elements are of a more abstract nature –, where the player rotates a knob in order to move a paddle up or down. Rotating a knob bears no resemblance whatsoever to the movement of the paddle, a movement that consists of translating up and down along the screen – the game space. They are apparently unrelated as the nature of the player's actuations and that of the actions of paddle diverge. But, if the movement of the paddles consisted of rotation instead of translation, the articulation between them would be different, as the actuations of both the player and the paddles would be more similar, more related. But in this case, their articulation is forced.

Despite this arbitrariness, the game system doesn't need to expose and instruct the player on all input procedures. The fact that they are hidden may drive players into exploration, and their discovery may grant status, bragging rights and even prolong the longevity of the game. At the end of each fight in *Mortal Kombat* (1992) the winning player is granted a very brief opportunity to gorily kill the loosing player's playable character with a special move called 'fatality'. The execution of this move is not necessarily easy, as the player needs to press a very specific combination of buttons/keys in a very strict and timely fashion (called a 'combo'). Each character possesses its own fatality move, and each move is enacted by a different combo. These combos are not taught by the system, nor they are made very evident or intuitive. And much of this information mainly circulated outside of the game itself, in magazines and through word-of-mouth.

Figure 6.2: 'Fatality' in *Mortal Kombat* (1992).

So, their counter-intuitiveness, somewhat complex performance, difficult memorisation, and limited time span and opportunities in which the players could perform them contribute to their inaccessibility. And it is this hiddenness that often elevates their desirability.

In sum, an arbitrary articulation can be accomplished either by *revealing* the input procedures and *instructing* the player; or by doing the opposite, *hiding* input procedures and instigating the player to *explore*, in a process of discovery by trial-and-error.

Symbolic Articulation

> Through the use of simple gestures like quarter turns or moving to the left or the right with the analog stick, the game creates a deeper connection between the character's in-game actions and the real-world actions of the player playing the game. Although the player's motions are still abstractions of the in-game actions they invoke, the deeper connection formed between them is surprisingly powerful. (Miller 2010)

A *symbolic articulation* occurs when there is a partial correlation between the player's performance and that of her proxy in game space. Although their performances are not exactly the same, they are similar, they are analogous, they bear some resemblance, or at least suggestiveness, or even complementarity.

We can find an interesting example in *Super Street Fighter II* (1992). For the player to execute the *hadouken*[195] (a surge of energy that is shot towards the direction the playable character that invoked it is facing) she has to perform the following combo: move the joystick or the D-pad a quarter of a circle, starting from down and followed by the 'punch' key (↓, ↘, →, punch), in a single swift move. Although occurring at very different scales, this movement is similar to the movement that is performed by the player's proxy, where first it crouches a bit and then thrusts forward with its arms shooting the energy ball.

Figure 6.3: The hadouken in *Super Street Fighter II* (1992).

In the same game, jumping is attained by pressing the 'up' key, crouching is done by pressing the 'down' key, and moving sideways by pressing the 'left' or the 'right' keys, respectively. The arrangement of these keys on the gamepad and some keyboards is done respecting this spatial logic, where the 'up' key is placed at the top, the 'down' key at the bottom, and the 'left' and 'right' keys are placed at the left and at the right, respectively. There is also a symbolic articulation regarding the arrangement of these keys and their functions in the game world, and, consequently, also with the implicit movements of the player when executing those actions, either by moving the joystick or the d-pad up or down, to the right or to the left.

195 For a summarily but still insightful story about the hadouken see *Hadoken: The story behind Street Fighter's most iconic move* at http://www.gamesradar.com/hadoken-story-behind-street-fighters-most-iconic-move/.

Figures 6.4 and 6.5: Two screenshots of *Metroid: Other M* (2010).

In *Metroid: Other M* (2010), the player has a third person perspective side view of the game space, while holding the game controller sideways. But when she rotates the controller pointing it at the screen the perspective of the game space changes to first person, allowing her to closely inspect the surrounding environment. This not only creates a symbolic articulation between the player and one of her proxies – the camera – but also changes some dynamics of play as she is forced to hold the controller in two different manners.

Figure 6.6: Fighting tutorial in *Beyond: Two Souls* (2013).

Fahrenheit (2005), *Heavy Rain* (2010), *Beyond: Two Souls* (2013) and *Asura's Wrath* (2012) often prompt the player for specific input that symbolically relates to the actions being performed on screen. Whether for punching, evading or other countless actions the player is instructed to follow the movement of her playable character with the analog sticks or even with the entire game controller, in a timely fashion. After the tutorial levels in *Beyond: Two Souls*, occasionally, the game doesn't even present non-diegetic information to inform the player what to do in order to succeed, or even that her input is required, e.g. take into consideration the fighting sequences where the player needs to follow the movements of Jodie (a playable character) with the game controller's analog sticks to attack or to avoid opponents.

Mimetic Articulation

When the player's proxy imitates the player's performance, when their actuations are homologous their articulation is *mimetic*. The player's actuations are mapped and reproduced by her proxy in the game space, with diverse degrees of fidelity that depend on the diversity and granularity of the sensors used to monitor the player. As mimetic articulation regards the movement of the player's body, computer vision, accelerometers and similar resources are commonly used.

In *The Legend of Zelda: Skyward Sword* (2011) when the player raises her arm holding the game controller, her playable character raises its sword. When the player swings her arm, that character swings its sword. Due to the mimetic articulation established in this game, fighting is a very physical activity and consequently may get tiresome after a couple of hours playing the game.[196] Games like *Wii Sports* (2006), *Dragon Quest Swords: The Masked Queen and the Tower of Mirrors* (2007), *Heavy Rain: Move Edition* (2010), *Red Steel 2* (2010), *Kinect Star Wars* (2012), *Puppeteer* (2013) are also good examples.

Figure 6.7: *The Legend of Zelda: Skyward Sword* (2011).

196 Video games in *The Legend of Zelda* series require the player to invest considerable amounts of time.

At a smaller scale, in *Tearaway* (2013) the player is able to touch the rear touch-sensitive panel of the PlayStation Vita – the supporting portable game console – to give the impression that her fingers are emerging from the ground in the game world, interacting with the characters and the environment. Here the representations of the player's fingers on screen directly[197] map her own actual fingers' movement.[198]

> (…) performative games (…) emphasize a physical response that requires the cybernetic integration of the games' challenges into the players' cognitive, kinaesthetic, and perceptual functions. (Apperley 2006)

This also happens when playing *Pong* (1972) using a trackpad as a game controller. The players slide their fingers up and down in order to move the paddles also up and down in game space. In this manner, we may also consider that the movement of the players fingers is being mapped and reproduced in the motion of the paddles.

Juul enunciates that "[m]imetic games move the action to player space" (2010). In our model, mimetic games possess a intangible articulation, due to the fact that the player still acts by proxy in the game world, whether that proxy is a character or a simple arrow cursor. But these games are, in fact, on the threshold of tangibility.

6.4.2 Tangible

Tangible transcoding occurs when the player space and the game space are the same. This means that the player's body is fully or partially embedded in the game space. As a consequence the player's proxy in game space is dismissed, as the player's own body now acts within game space.

Where intangible transcoding is regulated by principles of similitude, tangible transcoding is not. Here a paradigm shift occurs. Because the player's proxy is dismissed there is no need to articulate its actions with those of the player, thus veering the focus of transcoding from similitude to spatiality and physicality, exploring not only the gestural

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197 To a certain degree of fidelity.

198 At the time of writing the Gamescom 2012 announce trailer of this game could be seen at https://youtu.be/NK6_QvdxyXQ – it demonstrates this feature and others.

amplitude of the player's actuation in relation to the scale of the game space, but also the involvement of her physical body in that same space.

This not only permits the player to act within game space, but occasionally also allows the game space to act on the player herself. This questions the feeling of safety (Crawford 2011) sensed by the players within the "magic circle" (Huizinga 1950) of the game. Where once the game was make-believe, it is now *half-real*. Not in the sense that Juul defines it as being caught *between real rules and fictional worlds* (2005), but as being situated *between fictional rules and real worlds*. Meaning that, because the game space and the player space are the same, real dangers and challenges of the actual physical world apply. Things that may have not initially been contemplated in the game itself, and that may go from encountering unfriendly people or animals, to trespassing private property, to diverse physical injuries when risking reaching unsafe locations, or performing diverse or unnatural body movements or poses.

The system itself may also injure the player. One example is the *Painstation* (2001).[199] The *Painstation* website even featured an image gallery called the "hall of pain", presenting images of the players' injured hands.[200] A similar example is *Tekken Torture Tournament* (2001), although with a distinct apparatus.[201]

Another example may be found in *Metal Gear Solid* (1998). Already deep into the game, there is a moment where *Snake* (the playable character) is caught by the enemy and tortured. To resist torture and to avoid the character's life bar energy from draining to death, the player has to quickly press a specific button on the game controller for increasingly longer periods of time. The player may also submit to the enemy at any time by pressing another specified button. This is a decisive moment, in which resistance and submission bear significance to the final outcome of the game, and failure means game over[202]. So, after a while the player gets a bit exhausted with a minor sore arm due to the stress of continuous and rapidly pressing that button. In-between torture sessions, *Snake* is taken to a holding room. There, *Naomi* – another game character – communicates with him by means of a hidden device. *Snake* then tells her that his arm hurts, to which she answers

199 See section 5.4 Autonomic Actions.

200 See the project's website at http://www.painstation.de/.

201 See section 5.4 Autonomic Actions.

202 At the time of writing, this torture scene in *Metal Gear Solid* (1998) could be viewed at http://youtu.be/oHUi1TNNGD8.

by instructing him to place the game controller on his arm. The game 'breaks the fourth wall' here,[203] as *Naomi* is actually talking to the player and not to the game character. And as the player follows those instructions, the game controller starts to vibrate, massaging and relaxing her actual physical arm.[204]

Figure 6.8: Naomi and Snake talking in *Metal Gear Solid* (1998).

In essence, the following examples explore a relationship between game space and player space focused on the involvement of the player's body in the game: from smaller and finer movements that require a partial involvement of the player's body, to ampler ones that demand a full body involvement, all the way to the indispensable need for the player to travel, as that involvement becomes geographic.

Game Space < Player Space

Games that resort to natural user interfaces become evident here, where the player establishes direct contact with the game world and its residents, exerting influence upon them. In *Fruit Ninja* (2010) the player slides her fingers across the screen, cutting fruit thrown into the framing of the screen. Here, the player touches the visual representations of the fruit, cutting it. *Angry Birds* (2009) is another, although simpler, example, where the player pushes and aims the birds on the slingshot by also touching their representations on screen.

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203 To *break the fourth wall* in this context means to shatter the imaginary wall that separates the non-diegetic and actual world of the player and the diegetic imaginary world of the game, by means of recognising her existence as the player directly from within the diegetic world of the game.

204 At the time of writing, the in-game screening of this event could be viewed at http://youtu.be/cyOt-FqvK-_U?t=30s.

Figure 6.9: Cutting fruit in *Fruit Ninja* (2010).

The game space in these examples is closer to what Juul describes as *screen space*, where the game happens in the actual two-dimensional space that is the screen itself. And although the two-dimensional plane of the screen (game space) is situated in the same space as the player space, what is important here is not its two-dimensionality, or even that both of these examples use touch sensitive technology, but that they only require a partial involvement of the player's body when playing. The player only uses her hands, manoeuvres her arms at most, to play these games, as the game space is much smaller than the player herself. In these cases, the game space is restricted to the size of the screen.

Figures 6.10 and 6.11: *Fingle* (2012).[205]

But there is more to this kind of articulation. A tangible articulation means that players may actually touch each other, which may actually be an important component of the experience of play itself. While playing *Fingle* (2012) the players need to follow the movement of several shapes that are represented on the screen, touching them and consequently intertwining each other's fingers, an experience that is of a rather physical and of a somewhat sensual nature. So, here touching the other player is essential to the ex-

205 Images taken from the game's presentation video at http://fingle.gameovenstudios.com.

perience, as certain types of movements and the resulting friction between both players' fingers and hands is the focus of the game. It thus raises the awareness that players are actually situated in game space, physically interacting with each other, through a game intended to promote a somewhat sensual experience.

> The input structure is the player's tactile contact with the game; people attach deep significance to touch, so touch must be a rewarding experience for them. Have you ever noticed the tremendous importance programmers attach to the feel of a keyboard? Remember that players will do the same thing with your game. (Crawford 2011)

In *Finger Tied* (2012), instead of following several elements represented on screen as in the previous mentioned game, the player needs to guide similar ones by dragging them with her fingers. It is usual for this game to force the player into making harsh physical movements, stressing the articulations of her hands and fingers. Here the experience is more aimed at dexterity, pliability, and adroitness in solving the presented challenges, but nonetheless a felt physical experience.

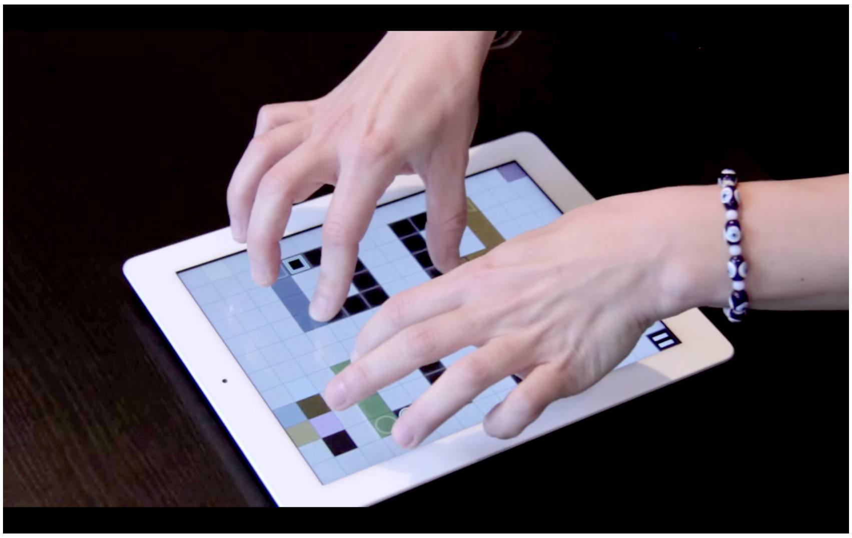

Figure 6.12: *Finger Tied* (2012).[206]

206 Image from the game's official trailer at https://youtu.be/7be7gYJ35vo.

Game Space = Player Space

In the context of tangible transcoding and when the game space and the player space possess an equivalent size, actions that involve the whole body of the player become possible. In other words, if before we were focused on actuations contained to a portion of the body and that featured a finer degree of movement, here we are looking at actuations that are ampler and to gestures that express the *involvement of the whole body*.

Dance Dance Revolution (1998) is a dance/rhythm game in which the game controller consists of a platform with the coloured arrows laid out in a cross. In order to play, the player needs to step onto that platform and to hit the corresponding arrows with her feet, following the visual cues on screen that are accompanied by music. This kind of actuation involves the whole body of the player. As Juul states, *Dance Dance Revolution* "does feature a display, but most of the game's spectacle is in player space". (2010)

Figure 6.13: *Dance Dance Revolution* (1998) arcade machine.[207]

207 Image from Wikimedia Commons at https://commons.wikimedia.org/wiki/File:Dance_Dance_Revolution_North_American_arcade_machine_3.jpg.

One may say that if the player only needs to place her feet at the correct arrow in a timely fashion, the action is still focused on a part of her body – her feet, or her legs at most. That may be true, but and in response, moving her feet or legs like that is an action that involves the body as a whole, finding balance while establishing rhythm, becoming a full body engaging experience, such as is dancing or even walking.

But with that discussion in mind we may find another and more straightforward example in *Johann Sebastian Joust* (2010). This is a game with no video feedback, but with music. Each player holds a game controller with motion sensing capabilities, which they have to avoid registering sudden movements. When the music plays at a slower pace, player's have to remain still, since at this moment the game registers any sudden movement. When the music fastens its pace, they can move more freely as the tolerance threshold to register movement is less strict. At any time players' may try to jostle other players' game controllers to make them loose the game. The last player standing wins.[208]

Figure 6.14: People playing *Johann Sebastian Joust* (2010).[209]

Here, players have to move around, attacking and avoiding attacks from other players, while keeping balance in order to not making harsh movements. In this game, game space involves the players' whole body.

208 More info at the game's website at www.jsjoust.com. A video at https://youtu.be/c2Ei9fgFAOs and https://vimeo.com/31946199.

209 Photo taken from the game's press kit at http://www.jsjoust.com/presskit/ – by Brent Knepper.

Game Space > Player Space

Location-based games are games that depend on knowing the location of the player and tracking them along with other game elements. These games usually force the player to travel in order to play. So, here game space not only envelops the player's body, but the geographic space she inhabits as well. As a consequence, these games need to be fairly mobile, usually relying on GPS technology in order to track players' locations and on augmented reality features to provide information of the surrounding environment.

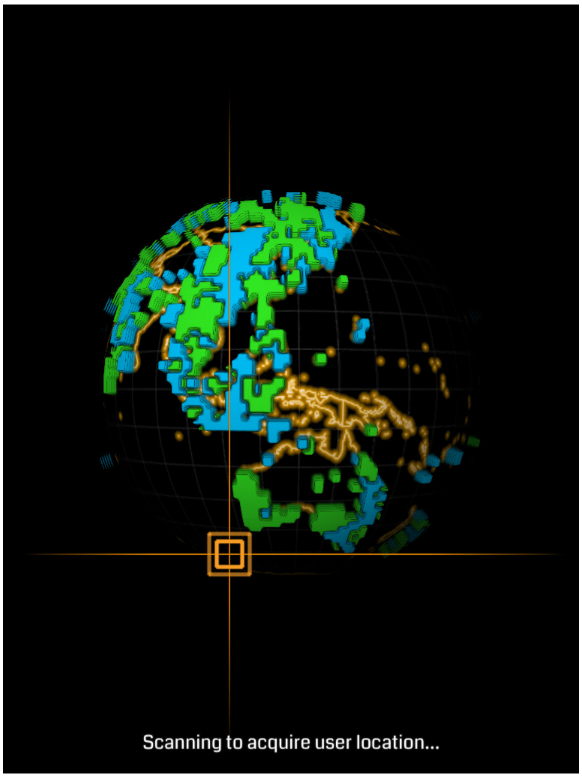

Figure 6.15: *Ingress* (2013).

Ingress (2013) is a location-based massive multiplayer game in which players choose to belong to one of two factions: *The Enlightened* or *The Resistance*. Their goal is to claim portals that either belong to the opposing team or are unclaimed. These portals are spread across the planet, and, in order to find them, players have to travel to their geographic locations. In *Ingress*, we may say that the dimension of the game space is potentially as big as the planet Earth itself. As it features such a massive scale, the player is forced to travel. The focus of this game is not to monitor the players' movements *per se*, but their geographic locations. That is what makes the game progress.

Coderunner (2012) is another example where the player, acting as a spy, has to travel to specific locations in order to play the game. Here the player has to leave and retrieve intelligence files without meeting anyone, something known as a *dead drop*. To create a dead drop the player has to choose a location, mark it on the map, protect it with a password, and point to or plant a clue in the environment so that other players can access it. So accessing a dead drop not only means that the player has to travel to its location, but also to unveil what is behind the clues inspecting the actual surrounding physical environment. In fact, at its official website it is said that "[t]he REAL WORLD is the game map!". That statement clearly demonstrates the fusion that exists between player space and game space.[210]

6.5 Conclusions and Future Work

This chapter was focused on a study that aims at an understanding of the relationship between the player and the game system from an operative and performative point of view in which action is at the centre of this problematic, raising the awareness on how the player's body is as much embed in the video game's activities as the game system's hardware. (Gee 2008) So, mapping existing relationships between several types of hardware and these modes of transcoding may point us towards a better understanding of which devices may or may not promote the use of a given transcoding mode, or vice versa.

We are aware that a single video game may put to use several of these modes of transcoding across diverse moments of gameplay. We cannot thus make the claim of being able to make a mutually exclusive classification. But we can, however, state that we are able to discern them in specific gameplay moments, and that some video games assume one of these modes a predominant type of transcoding throughout the game.

Thus, by distilling them we become more aware on how to effectively use them, and start questioning how these modes function together. We believe that will be useful for figuring out what kind of dynamics these modes promote and how they affect the experience of play. Something that we believe to be crucial in subsequent research studies on this matter.

210 For more information consult the game's website at www.coderunnergame.com.

Also, exploring asymmetric gameplay using different types of transcoding in multiplayer games may also reveal relevant data, probing the relationship between similarity, disparity and complementarity, affecting the dynamics of play and eventually its relevance to the unfolding narrative.

We are also considering subsets for each of these types of transcoding. Finding, exploring and understanding variations featured in the diverse examples that represent each of these modes may also contribute to a better understanding of the dynamics of play and player experience.

Further research should also aim at an understanding of when is the use of each mode more adequate and when it is not, being focused on comprehending how the deployment of these modes may strengthen, weaken or simply alter the experience of the player.

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7. Focus

A video game player manages her attention according to the strategies developed and the challenges unveiled by the game system. The player does this to the best of her capabilities, developing different activities and performing alternative actions that may or may not be suggested or even imposed by the system.

This chapter proposes four dimensions concerning player attention – time span, sensorial scope, frame, and actuation automation –, each being capable of expressing three alternative states – focused, defocused, unfocused –, and through which the game system manipulates the player's affective state.

The variations that can be obtained by calculating all possible combinations, regarding these dimensions and their states, not only influence the affective states of the player, but also specify alternative characteristics regarding the nature of human interaction with the system, transpiring different gameplay dynamics.[211]

7.1 Introduction

In this chapter we are focused on exploring four dimensions that affect the player's attention span. It is important to state that we are not interested in a quantitative analysis, but in discerning between alternative states that the player manages while playing.

With this in mind, we propose the existence of three main states – *focused, defocused,* and *unfocused* – which are generalised expressions of the player's affective states. The player's attention is affected by her current affective state, which is often manipulated by

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211 This chapter consists of a revised version of *Un-De-Focused: Variations of attention in player action in video games* (Cardoso and Carvalhais 2014e).

the game system in order to propose very specific challenges and meaningful gameplay experiences. The player exhibits a *negative affective state* when stressed and anxious. This make her focused on repetitive operations and on developing similar ideas. 'Tunnel vision' is an expression of this phenomena.

> "Fire", yells someone in the theater. Immediately everyone stampedes toward the exits. What they do at the exit door? Push. If the door doesn't open, they push harder. But why if the door opens inward and must be pulled, not pushed? Highly anxious, highly focused people are very unlikely to think of pulling. (Norman 2004, 28)

However, a *positive affective state* is attained when the player is relaxed, which makes her receptive to novel ideas, much more capable of improvisation and adaptation, aware of the overall scenario.

These affective states can be manipulated by the system, in order to contribute to an expressive and meaningful gameplay experience.

7.2 Dimensions of Focus

In the next sections we propose the existence of four dimensions of player focus – time span, sensorial scope, frame, and actuation automation – that are able to express all three mentioned states – focused, defocused, unfocused.

7.2.1 Time Span

Players' actions and actuations are developed throughout specific temporal durations, the limits of which are often imposed by the game system, either to determine player's successes and failures or simply to enforce a given gameplay speed or rhythm. These limits also stress the player, testing their ability to keep on playing the game. This dimension is related with the time span granted to the player to perform either single actions consisting of the simplest actuations or sets of actions involving deep and complex reasonings.

We propose the existence of three classes of time spans focused on promoting alternative player focus states: *short*, *long*, and *none*. As it can be inferred by the terminology in use, these do not consist of absolute measurements, as they are relative to the temporal demands of the activities that the player develops.

Short (focused)

Short time spans enforce the player to act in the immediate moment, without a careful thought-out plan. They instigate fast-paced action, quick decision-making, reaction. They are very present in a response to stimuli.

As the player is not left much time to ponder, the options presented to her are usually very limited and/or summarily described. The shorter the time span and the wider the options, the more stressed the player will feel, as she becomes unable to ponder on all the choices, to 'read' them, or even be aware of them all.

Quick time events are a very common trait in contemporary video games, usually featured during cinematic interludes or cutscenes, events that would otherwise be of mere cinematic contemplation, calling the player to action. During these, players are prompted to press specific combinations of buttons on the game controller within a very limited amount of time. From the classic *Shenmue* (1999), to the button-mashing action of *God of War* (2005) and *Metal Gear Rising: Revengeance* (2013), to the tense scenarios populated by zombies in *Resident Evil 4* (2005), and to more cinematic narratives of *Fahrenheit* (2005), *Heavy Rain* (2010), *Asura's Wrath* (2012), and *Beyond: Two Souls* (2013), these events promote a sort of hybridisation between cinema and gaming.

In *The Walking Dead* (2012) the player is constantly prompted to make choices within very limited time spans. By delaying those choices the player risks the system choosing on her behalf. And to make a fitting decision the player not only has to read and interpret all available choices, but also to mentally simulate their outcomes.[212] Thus the game persistently challenges the player into making moral choices and much quicker than they would otherwise like to, raising a sense of urgency that proliferates throughout the game.

212 See Carvalhais and Cardoso (2015) on virtuosic interpretation.

Figure 7.1: *The Walking Dead* (2012).

In *Octagon: A Minimal Arcade Game with Maximum Challenge* (2013) the player's proxy advances automatically through the game world, and the player is responsible for avoiding gaps and other hazards that appear along the way, only by moving it to the left or to the right. These options are indeed very limited, but when we take into account the short time spans that are granted to the player to act they seem very fitting to a focused performance.

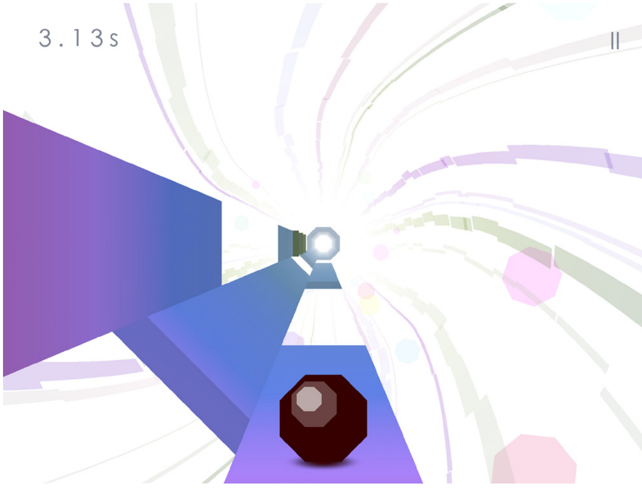

Figure 7.2: *Octagon: A Minimal Arcade Game with Maximum Challenge* (2013).

The same is true for *Super Hexagon* (2012). The player controls a triangle that is only able to rotate – clockwise or anticlockwise – around hexagon-like shapes centred in the screen. A seemingly unending series of hexagon-like shapes are also displayed centred in the screen, progressively shrinking towards the centre, entrapping the player's proxy. These shapes are missing at least one side, leaving them incomplete and open. As the player's proxy cannot touch them – otherwise looses the game—, the player is forced to very quickly escape through those openings. In fact, the game quickly became known for its extreme difficulty. Each turn can last mere seconds.[213]

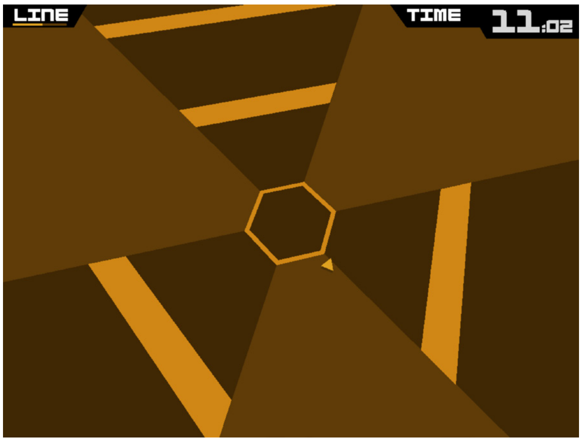

Figure 7.3: *Super Hexagon* (2012).

We can see something similar in *Tetris* (1984) where the player has a limited amount of time to stack the bricks that descend automatically. From this perspective, this game further stresses the player when she is short on vertical space, as vertical space equals available play time.

Long (defocused)

When the player is granted a *long time span* to act, not only she has time to actuate carefully but also to plan her actions. She has time to explore the game world, although a limited time. This careful exploration consists in the realisation of a plan the player puts in motion in order to achieve her objectives.

The main objective in *Worms* (1995) is to obliterate the enemies troops. To do so, each player has about one minute to plan and take action against the enemy. In that time, they have to plan their next move (or conclude their plan for their next move), choose which worm (soldier) to use, pick a weapon from a wide variety and execute the attack, or opt for a more defensive course of action.

213 See Aziz (2012), Rigney (2012), Rose (2012), Smith (2012) and Totilo (2012) for opinions on this game in the context of gaming popular culture.

In *Pikmin 3* (2013), while in the single player campaign, the player has about fifteen minutes per turn, at the end of which she mandatorily has to retreat to their spaceships with as many 'pikmin[214]' under her command as possible. Due to this, the player is encouraged to plan her turn in order to collect fruit (an item that she needs for daily consumption, in other words, for every turn) and to progress in the game, exploring its world.

Figure 7.4: *Pikmin 3* (2013).

Max Payne (2001), a third-person shooter, became famous for the bullet time mode, that consisted in slowing down time without affecting the player's aim, increasing the chances of hitting more targets and more accurately. This illustrates pretty well how a short time span may be stretched to a long time span, offering the player enough time to plan her actions.

Figure 7.5: *Max Payne* (2001).

214 Creatures that follow the player's instructions, having specific and diverse traits, and through which she acts and transforms the game world.

In *Super Mario Bros.* (1985) there is a time limit that the player has to abide by, otherwise Mario – the playable character – immediately 'dies', restarting the level or even the game altogether. But the time span feels long enough to provide a careful exploration of the game world. When the counter reaches the last hundred seconds the 'hurry up' theme plays indicating the urgency to reach the end of the level. At this time, what could be once classified as a long time span becomes a short time span – depending on the location of Mario and if the player is familiar with the level, of course.

None (unfocused)

When the player's actions are *not constrained by any time span*, she is free to relaxedly explore the game world. Even if in the game's storyline the world is close to an end, the player still has all the time she wants to engage in whatever captures her interest. This is one of the main traits of open-world games, promoting exploration in richly detailed and diverse game worlds.

In *The Elder Scrolls V: Skyrim* (2011) the player is able to explore the game world as she sees fit. The game even permits the player to undertake quests and to face foes of uneven resilience and strength, considering the current status of her playable character. It is up to the player, it is her choice. As a consequence, the experience of *Skyrim* results in a fragmented and non-linear narrative, essentially based on the exploration of its game world. The player may spend much time exploring optional content, and may even never witness the conclusion of that main storyline, abandoning the game after spending hundreds of hours exploring the game world.

Figure 7.6: *The Elder Scrolls V: Skyrim* (2011).

Such may also be the case of the *Grand Theft Auto* series that have been progressively offering a wider variety of activities that the player may engage in. And it is also true in more experimental games such as *The Endless Forest* (2005) where "[t]here are no goals to achieve or rules to follow." The player just needs to explore "the forest and see what happens."[215]

Figure 7.7: *The Endless Forest* (2005).

In *Mass Effect* (2007), *Fallout 3* (2008) and *Deus Ex: Human Revolution* (2011), for example, the player doesn't have a limiting time span in which she has to make choices during conversations with other characters. Not only the player is able to ponder on the direction that the conversation is taking, as she may also explore the some ramifications of the script,[216] in opposition to the quick decision making previously described in *The Walking Dead*. And, in *Superhot* (2013) time only advances when the player moves, so that every action can be the result of careful ponderation.

7.2.2 Frame

We refer to *frames* to define the windows through which the player witnesses the game world and the events that it encloses. Frames can be *fixed* – increasing a sense of entrapment or confinement – or *scrollable* – allowing the player to travel to a currently hidden part of the world, immediately hiding another, promoting exploration.

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215 From the webpage of the game, from the official Tale of Tales website, at http://tale-of-tales.com/TheEndlessForest/. Accessed on 2014-01-19.

216 Not all ramifications in the script of these games are able to be explored like this due to branching and the mutually exclusive choices it features. We'll talk specifically about 'branching' on chapter 9 (TRAVERSAL).

Although it is easier to describe this in visual terms – and we use some in the following descriptions –, this dimension may also regard non-visual phenomena – such as haptics and audio – but, so far, in the context of video games, they don't seem have been so widely explored.

Single (focused)

When a video game features a single frame, the player's visual attention is undivided and focused on it. She may be wondering what is happening in the unobservable parts of game world, but they shouldn't affect gameplay as these 'areas' are not part of the play field.

There are many video games that can serve as an example here, some are *Pong* (1972), *Asteroids* (1979), or *Super Mario Bros.* (1985).

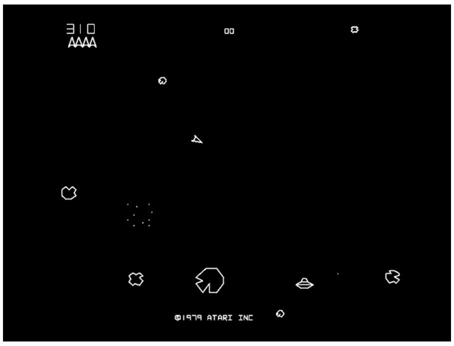

Figure 7.8: ***Asteroids*** **(1979).**

Non-simultaneous (defocused)

In this case, the player is able to inspect the game world through multiple frames, but these can only be displayed alternately, one at a time. Actors in undisplayed frames may get their activities suspended, may be waiting for instructions, or may be engaged in automated actions. The player is thus in a state of permanent concern about what is currently happening in undisplayed parts of the game world. Thus, the player is not entirely focused on the task at hand, as she has to constantly keep in mind all the other ongoing activities that she is not actually witnessing.

In *Beyond: Two Souls* (2013) the player may alternately control two characters. When she is controlling Aiden (a sort of spirit/ghost), Jodie (the other playable character) is sometimes set in a sort of suspension, as if in a state of deep concentration. The same happens in *The Legend of Zelda: The Wind Waker* (2002), when the player uses a *Hyoi Pear* (an item that, when used, attracts seagulls) she gives up the control of Link (the main playable character) to control a seagull – useful to scouting and reach otherwise inaccessible locations. While this happens, Link seems to be set in a state of deep concentration – to control the seagull – vulnerable to enemy attacks.

Figure 7.9: Link places a Hyoi Pear on top of his head in *The Legend of Zelda: The Wind Waker* (2002).

In *Pikmin 3* (2013) the player controls three teams of variable sizes, being able to interchange between them while they are performing diverse tasks. While one team is engaged in one sort of activity the others are accomplishing other tasks in real time. And in *Thomas Was Alone* (2012) the player may, at any time, interchange control between several 'geometric' characters that possess specific traits that the player must take advantage of in order to successfully traverse the game world.

Simultaneous (unfocused)

Here, all frames are simultaneously displayed. The player is thus able to witness several events that may occur in different parts of the game world at the same time, or the same events from alternative perspectives. The player is free from the cognitive strain of simulating undisplayed events, but her attention is seriously divided as all of those activities are simultaneously displayed for her to witness.

Games like *The Legend of Zelda: Phantom Hourglass* (2007) or *The Legend of Zelda: Spirit Tracks* (2009) for the Nintendo DS, and *Assassin's Creed III* (2012) and *The Legend of Zelda: The Wind Waker HD* (2013) for the Wii U take advantage of systems that use two screens.[217] In these games the screens display alternative information: one exhibits the diegetic part of the game world, while the other usually shows non-diegetic components of the game (Galloway 2006), such as maps or menus for configuring the game and/or the characters.

Figure 7.10: *The Legend of Zelda: Phantom Hourglass* (2007).

But this is also possible without physical screens, with different frames in the same screen accomplishing the same goal. In *Fahrenheit* (2005), Lucas (one of the playable characters) had just woken up in a café's bathroom covered in blood, on top of a corpse, with a knife on his hand, and without an exact recollection of what happened. While

217 The DS is a portable video game console that has two embedded screens. The Wii U is a home video game console – that needs to be connected to a TV screen – that features a remote controller with one embedded screen.

leaving the café, the screen is split in two: one side displays the actions of a police officer located inside the café, an event that culminates with him discovering the body in the bathroom; the other shows Lucas controlled by the player, that has to find a way to abandon the area and escape.[218]

Figure 7.11: *Fahrenheit* (2005).

In the course of the game, plenty of moments like this happen. For example, shortly after, as a result of recently fleeing a murder scene, Lucas's home gets filled with incriminating evidence. The police appears and knocks on his door. This is a rather tense moment, as within a limited time span the player tries to cover all the evidence before answering, in order to not raise any suspicions, while constantly monitoring the police officer's behaviour.[219]

Siren: Blood Curse (2008) is a horror game that possesses a very interesting and stressful feature: when escaping or hiding from foes the player is able to simultaneously see from their perspective and from the traditional third-person view. This has serious capabilities of dividing the player's attention, as she is then not only trying to find her way and to hide, but also to constantly check or confirm is she is not being seen or falling into the frame of her foe.

'Screencheat' is something that happens in competitive multiplayer when players take a peek at the opposing player's frame. In *Screencheat* (2014) screencheating is an imposed strategy. It is a first person shooter (FPS) multiplayer game, in which, as in many other

218 At the time of writing this event could be seen at http://youtu.be/Tzz5VY1p-3o?t=7m37s.
219 At the time of writing this event could be seen at http://youtu.be/BhoA1htU_sA?t=7m13s.

FPS, one of the objectives is for players to eliminate each other. The difference consists of the following: the player's characters are invisible to one another and the screen is divided according to the players in play. So, in this game the player is constantly forced to divide her attention between the frame corresponding to her character's location and those of her competitors.

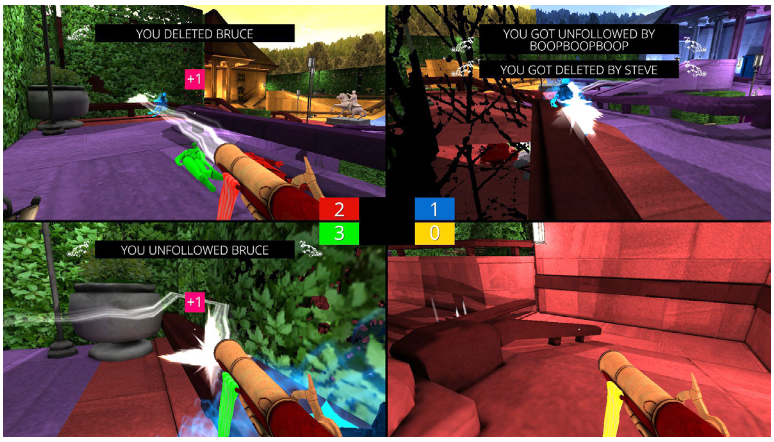

Figure 7.12: ***Screencheat*** **(2014).**

But we may go even further. The attention that is given to specific elements in the Heads-Up Display (HUD) may accomplish the same feat. For example, in *Metal Gear Solid* (1998) in the top right corner of the screen there is a map that displays enemies' positions, their field of view and the terrain. As a result the player often has to distribute her attention between the map and the 3D world to be able to traverse the terrain successfully, unnoticed by enemies.[220]

Simpler elements of the HUD may also play an important role here. Let us just consider the attention that the player needs give to the health bar in fighting games like *Street Fighter* (1987) or *Tekken* (1994).

7.2.3 Sensorial Scope

This dimension is related to how much of the game world the player can perceive in the same *frame* – to keep to the terminology. Able to cross diverse modalities of perception and communication, we propose this dimension to feature three types of sensorial scope: narrow, wide and total.

220 See figure 2.10, at chapter 2.

Visual feedback is an essential component in most video games. It is mostly through images that players inspect the game world, and advancements in technical capabilities of digital systems regarding visual representation are in constant development. So, in this particular modality, this dimension relates to how much of the game world the player is able to see in the same image, a frame that restricts the amount of visual events she may witness. What is within the field of view is potentially perceivable by the player and all that lays outside is hidden – a sort of backstage area where game's actors are spawned, respawned, and dismissed as they become irrelevant to the current event in the game. For example, in *Super Mario Bros.* (1985) the player cannot backtrack, so all that lays behind becomes inaccessible.

In some video games the sensorial scope changes along the traversal. This ability may be granted to the player or automatically managed by the system, or even both, enforcing, supporting or changing the current play strategy.

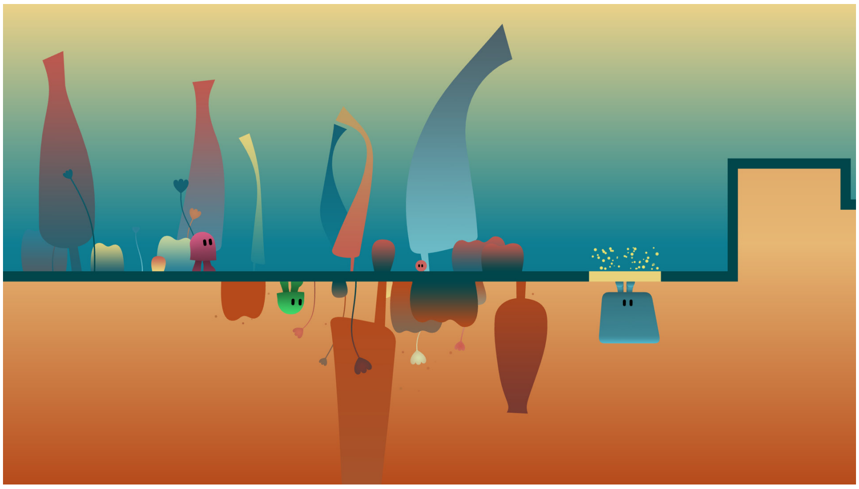

Figure 7.13: *Ibb & Obb* (2013).

In *Ibb & Obb* (2013) and in *Brothers: A Tale of Two Sons* (2013) the player is able to moderately control the field of view of the game world by moving apart both playable characters within a given limit. In *Locoroco* (2006), *Limbo* (2010), and *Badland* (2013) the game system regulates the field of view automatically as the player traverses the game world, allowing her to be more or less aware of her surroundings, promoting an increased focus on the vicinity of her playable characters or on more distant locations.

In *Captain Toad: Treasure Tracker* (2014) the player is able to choose between two types of camera: one through which she is able to see the whole scenario or set[221] – which is a puzzle –, and one that only depicts the current playable character and its immediate surroundings, thus promoting a closer inspection of her proxy's vicinity. Similarly, in *The Elder Scrolls V: Skyrim* (2011) the player is able to choose between playing in third-person view or in first-person view. Something that changes the awareness of the player, while the first is more aware on the surrounding space, the latter is more able to inspect closed spaces and details in the environment – without mentioning matters regarding player immersion in the game. The same is true for racing games, such as *Wipeout* (1995), *Gran Turismo* (1998), etc., or even in *Grand Theft Auto V* (2013), for example, where the player is able to choose between diverse camera views.

Figure 7.14: *Captain Toad: Treasure Tracker* (2014).

In the first level of *The Unfinished Swan* (2012) the player is confronted with a completely white world, unable to see her surroundings. The player is able to move around the world even without seeing. But, to effectively be able to travel through the environment she has to shoot black paint balls at the set, painting it with splashes of black colour. This is a very interesting feature that creates a very strong sense of deprival in the player, while explicitly asking her to expand her sensorial scope. The player may just want to shoot

221 However, in bigger, harder and/or more complex levels – that appear later in the game – this camera is not able to depict the whole level, but a portion. This change is actually, in our view, a good indicator that the difficulty in the game has levelled up, not only because the player is visually confronted with a bigger level but also because she has been denied the ability to analyse that game level by observing its entirety.

enough paint to find her way, traveling through a somewhat obscured path. However, if the player wants to see everything in the set, it may be a daunting effort, as every detail has to be painted, and with too much paint everything turns to solid black – which ends up concealing every shape in a similar fashion as the white colour does.

Figure 7.15: *The Unfinished Swan* (2012).

Notwithstanding the focus on visuality, as audiovisual artefacts, video games convey information to players through image and sound. So, in a similar way that the player is able to observe the game world, she may also be capable of inspecting it through sound. And, depending on the hardware, haptic feedback may also play a role here.[222] If the player is not able to see a given actor but to hear it instead, it is because that actor is manifesting itself by means of a given modality of perception – something that influences the focus of the player. The same may happen to touch or haptic feedback. An example of this is featured also in *Captain Toad: Treasure Tracker* (2014): the levels of this game are often completed when the player's character reaches a certain location, which is marked by a golden star. Along the way, the player collects various items – diamonds, golden coins, mushrooms, etc., common in the *Super Mario* franchise. Only after concluding a given level is the player confronted with a secondary objective, which she may or may not have accomplished in the last play-through. At the level 1-12 *Briny Bowl Swimming Hole*, as a secondary objective, the player is asked to find the 'gold mushroom'. That particular item is nowhere to be seen. However, the player is able to find it if she is attentive to the haptic

222 We aim to further develop this with focus on haptics, sound and other sensorial capabilities in future studies.

feedback emitted by the game console's controller. When the player passes through the location of that particular item the controller slightly vibrates. The somewhat faint visual feedback that occurs when the playable character is at the hidden mushroom's location can be easily dismissed, specially if other objects get in the way, but haptic feedback is surely felt. Then, only at that particular location the valuable item is captured with the simple press of a push button.[223]

Ultimately, if the player's proxy and/or avatar falls outside of the player's sensorial scope, it is the same as having disappeared – which does not mean that it is gone, absent or even inexistent. On the contrary: it may be there. And it may mean one of two things: 1) it is the player that is simply not capable of perceiving it, or 2) it is the actor that is not communicating in a way that allows itself to be perceived – by the player, in this case.

Narrow (focused)

A *narrow sensorial scope* focuses the player on fewer game elements. It forces the player to be attentive to the events that occur in the immediate surroundings of her proxy or the actors she manipulates; to focus on the immediate present time, promoting quick reaction to external stimuli, as it conditions the amount of time available between the perception of an eventual threat, for example, and the time that threat will actually get concretised. *Dead Space* (2008) is practically experienced like this due to its poorly lightened environments through which the player fearfully traverses. Actually, many survival-horror games are experienced like this, such as *Resident Evil* (1996), *Silent Hill* (1999), *P.T.*[224] (2014), etc..[225]

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223 At the time of writing a commented (not our comments) play session of this level could be seen at https://youtu.be/et_V4XnS7IQ.

224 *P.T.* is actually the acronym for the 'Playable Teaser' of *Silent Hills* (Cancelled), which was released in the PlayStation Store during Gamescom 2014. Recently, *Silent Hills* was cancelled by Konami – the publisher – and consequently *P.T.* was removed from the PlayStation Store, leaving users that had previously downloaded it without the ability to re-download it.

225 On there other hand, these games may feature wider sensorial scopes when it comes to audio. This comes to no surprise as a narrow sensorial scope on one end and a wider sensorial one the other may unease the player. Hearing more actors and events than we are able to see, may create an unbalance in perception that may lead to anxious and stressful states of mind.

Figure 7.16: *Dead Space* (2008).

Wide (defocused)

A *wide sensorial scope* allows the player to see beyond their immediate surroundings. By being able to witness more events, the player may be capable of anticipating behaviours, increasing her capabilities to take action based on those simulations. While on a narrow sensorial scope the player is forced to react almost instinctively, with a wide sensorial scope she is granted some leeway between planning/thinking and actuating.[226] Games like *The Sims* (2000) and *Starcraft II: Wings of Liberty* (2010) are good examples.

Figure 7.17: *Starcraft II: Wings of Liberty* (2010).

226 For more information on THINKING AND ACTUATION see chapter 5.

Total (unfocused)

A *total sensorial scope* may be described as a fixed self-contained window that displays the whole playable game world or field of play. There are no hidden playable sites or areas. Some actors may inhabit or be spawned or respawned outside that frame, but that is not a part of the play field, and thus is dismissed. *Pong* (1972), *Asteroids* (1979), *Tetris* (1984) may serve as examples here.

Figure 7.18: *Columns* (1990).

7.2.4 Actuation Automation

Controls can be shared between actors, allowing the player to move two actors or entire hordes of actors in one move or actuation, managing them as one big collective element, and insuring that the actors are not lost or in jeopardy. Games like *Locoroco* (2006), *Badland* (2013), *Duet Game* (2013), *Super Mario 3D World*[227] (2013), *The Swapper* (2013) and *The Wonderful 101* (2013) are good examples where the player controls multiple actors in this manner.

Dedicated controls allow the player to manipulate each actor individually. As a consequence, the player may experience some difficulty in controlling several actors simultaneously with dedicated controls, as she tries to divide her attention to the best of her capabilities between all the relevant events in which those actors are involved in.

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227 This is happens when the player uses the 'double cherry' item, that creates a clone of the player's avatar.

Figures 7.19 and 7.20: *Badland* (2013) on the left and *The Wonderful 101* (2013) on the right.

In *Brothers: A Tale of Two Sons* (2013) the player controls two characters through the game world, solving puzzles that often require their cooperation. The controls for each character are mapped at opposite sides of the game controller, forcing the player to use one hand to control one character and the other to control the remaining one.

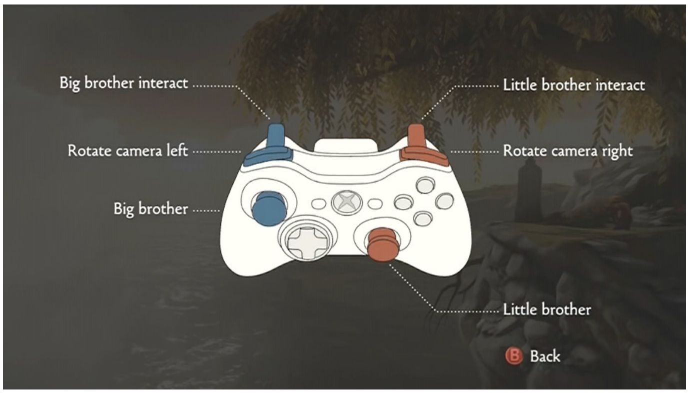

Figure 7.21: The control mapping in *Brothers: A Tale of Two Sons* (2013).

Ibb & Obb (2013) follows the same premise, but unlike *Brothers: A Tale of Two Sons* it is aimed at two players. Although the methods for controlling the characters are very simple – using the analog sticks on the game controller to run and jump –, it is very difficult to synchronise their different actuations when playing alone, although improvement is possible with practice.

The main difference between these two video games is that *Brothers: A Tale of Two Sons* is only tailored for one player and that means that the limits of the player's attention span were carefully pondered. Sometimes the player just needs to control each character alternately – as when they are climbing a wall with a rope that is attached to both. But, it is when she is forced to control both simultaneously that the different states we propose for this dimension become more evident.

Automated (focused)

Here the player is involved in repetitive actions, whose actuations can be trained, incorporated, patterned and thus transformed into automated processes. After that, the player is focused on excelling at their execution, grasping their patterns and optimising their performance.[228] "The ultimate goal is to turn it into a routine. Frankly, my impression is that the brain doesn't particularly want to deal with it again" (Koster 2005, 32) so that she can focus on something else while keeping that operation ongoing.

An example in *Brothers: A Tale of Two Sons* occurs when both characters are pulling levers at the same time, using the same or similar control schemes.

Figure 7.22: *Brothers: A Tale of Two Sons* (2013).

Mixed (defocused)

In many of the cooperative gameplay strategies involving simultaneous control of both characters in *Brothers: A Tale of Two Sons*, the player usually executes two very different types of actuation: one is an automated actuation – which is learned, incorporated and whose procedures are automated; and the other is a non-automated actuation – which will be explained next. What is of importance here is that the player's focus is divided between these two types of actuation. Something that is rendered possible because an automated actuation can be kept ongoing without being constantly monitored, which leaves room for the player to focus on the remaining character as well.

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228 See section 5.3 Trained Actions. Also, there is a relationship between these two types of action, a consideration that we mention at section 11.3 Future Work.

Another example can be found in *Brothers: A Tale of Two Sons* when one of the characters is continuously manipulating a sort of lever – in a patterned actuation – while the other has to move through the set, being attentive to whatever lurks in its path.

Figure 7.23: *Brothers: A Tale of Two Sons* (2013).

Non-automated (unfocused)

> In many games, you are asked to find "secrets" or to explore an area completely. This teaches many interesting things, such as considering a problem from all angles, making sure that you should make sure you have all the information before you make a decision, and thoroughness is often better than speed. Not to denigrate training by rote and reflex, but this is a much better and interesting set of skills to teach, and one that is more widely applicable to the modern world. (Koster 2005, 76)

In opposition to automated actuations, non-automated ones involve the player in constant improvisation and adaptation to the events in progress. Here actions are not repetitive, nor their actuations can be necessarily trained. They consist of a different stage of learning: the moment of surprise, of discovery. They are born of the necessity of exploring the game world. And this unpredictability requires the player to constantly monitor the events they are involved in.

Continuing with *Brothers: A Tale of Two Sons*, when both characters are traveling through the game world, the player is engaged in two simultaneous non-automated actuations, as she needs to be attentive not only to the directions they both take but also to the lurking dangers in their way. This seems a very simple task when controlling one character, but when multiplied by two it can sometimes become pretty daunting. This is precisely one of the reasons that makes playing *Ibb & Obb* alone so difficult.

Figure 7.24: *Brothers: A Tale of Two Sons* (2013).

7.3 Un-De-Focused

Considering the mentioned dimensions, we were able formulate three general states regarding player focus: focused, defocused, and unfocused. These states are, as mentioned, generalised concepts, but their serve as a starting point to explore the multiple possibilities that are obtained by combining all of the presented dimensions in all of these three states: 81 in total.

7.3.1 Focused

A player is *focused* when engaged in activities that require attention to the immediate and present time, to the displayed and perceptible game world, developing single-minded activities and patterned actuations and actions. The focused player is stressed into actuating in short time spans and within a narrow sensorial scope, perceiving the game world through a single frame.

A focused player is driven into monotasking, focusing on one task or activity at a time, and on repetitive and patterned actions. A player that is focused is a player that is fully concentrated on the event at hand, ignoring all that may surround her.

> In essence, we know how vividly we see some aspects of our world, but we are completely unaware of those aspects of our world that fall outside of that current focus of attention. Our vivid visual experience masks a striking mental blindness – we assume that visually distinctive or unusual objects will draw our attention, but in reality they often go completely unnoticed. (Chabris and Simons 2010)

7.3.2 Defocused

A *defocused* player is engaged in activities that require both attention to the immediate time and to the near future, planning and putting those plans into practice.

A player that is defocused is granted enough time to plan her actions, possesses a wide sensorial scope, inspects the game world through multiple frames but focusing on one at a time, and is engaged in realising non-automated actuations while keeping a part of her attention span dedicated to the realisation of certain automated actuations.

A defocused player always has her attention span divided between what is happening and what is to happen, between what is seen and unseen, between performing and planning; and is always tracking some side activities. The defocused player suffers the cognitive strain of multitasking, but witnesses only one event at a time.

7.3.3 Unfocused

> [A] mind adrift lets our creative juices flow. While our minds wander we become better at anything that depends on a flash of insight, from coming up with imaginative wordplay to inventions and original thinking. (Goleman 2013)

An unfocused player is engaged in activities that don't have a temporal limit to be met. Is a player that is not stressed, with a sensorial scope that engulfs the totality of the playable game world, accessing multiple frames simultaneously, witnessing multiple ongoing events at different places. The unfocused player is engaged in realising non-automated actuations, involved in improvisation and adaptation in order to keep on playing while developing this state.

An unfocused player suffers the cognitive strain of multitasking, constantly distracted by the persistent and simultaneous calls to attention of the multiple tasks and ongoing events and activities on the game world. But on the other hand and as previously said, she has all the time she wants to realise her actions.

> (…) the experience of cognitive strain, whatever its source, (…) [shifts] people's approach to problems from a casual intuitive mode to a more engaged and analytic mode. (Kahneman 2011, 65)

7.4 Conclusions and Future Work

In the future we will focus on exploring all the variations that can be obtained by combining these dimensions regarding their different states, in a total of 81 types. Their exploration will allow us not only to map different gameplay styles, but may also permit the discovery of new and untested ones. Considering this, the necessity for the production of prototypes seems now even more evident.

Furthermore, we believe we will be able to obtain even more variations if we take into consideration the specificities between the different human modalities of perception. Sight has been a favoured sense in the context of video games – something that has been definitively suggested by the increasing investment in graphics in the development of game engines. Nevertheless, when it comes to the experience of the player, sound and haptics may also play a very relevant role. So, all of the variations previously described can be dramatically increased if we discriminate different senses that contribute to the experience.

Other dimensions may eventually emerge through the course of time, further increasing all variations, but these 81 will already greatly grant us enough material to focus on.

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8. Depth

> (…) the experience of play is not something that a game designer directly creates. Instead, play is an emergent property that arises from the game as a player engages with the system. The game designer creates a set of rules, which players inhabit, explore, and manipulate. It is through inhabiting, exploring, and manipulating the game's formal structure that players experience play. (Salen and Zimmerman 2004, 316)

In video games, human interactants and computational systems may act and interact at different depths of the game system's structure, influencing its behaviour through the generation of new structures or the reconfiguration of previously existing ones. Focusing on the exploration of the player's abilities to induce changes within the game system, in this chapter we depict how the player increasingly embraces activities from the designer's realm when progressively diving deep into the game system's structure, by paying close attention to the recursive structure of actors, to the relationship of emergence present in the MDA framework (Hunicke, LeBlanc, and Zubek 2004), and by adapting the works of Marie-Laure Ryan (2011a, b) and Espen Aarseth (1997).[229]

8.1 Introduction

For Raph Koster games are based on recursion, as they "can be seen as nested events. A given game is part of a meta-challenge, or includes challenges within it self"(2004). He presents *Moon Patrol* (1982) as an example: "the game is about getting the highest score

229 This chapter consists of a revised version of *Explorations on Action Depth in Video Games* (Cardoso and Carvalhais 2012a). *Beyond Vicarious Interactions: From theory of mind to theories of systems in ergodic artefacts* (Carvalhais and Cardoso 2015) is a paper also related with this dimension although not exclusively focused on video games.

possible", *within which* "the game is about making it to the other side of each level", *within which* "the game is about defeating a given enemy", *within which* "the game is about timing a button press" (2004).[230] This recursive structure bears some resemblance to that of the actors' topology in our framework.[231] Therefore, taking into consideration the fact that in our framework actors are not events, and while for Koster *depth* is literally the depth of recursion, for us it is not only a matter of how deep within the topology of the game system the player is granted access to[232] but also about how their actions alter the network of actors at those levels. In other words, *depth* is as much a matter of the scope of the player's actions as of their capability to effectuate alterations within that range, influencing the way a given actor operates.

Figure 8.1: ***Moon Patrol*** **(1982).**

In the course of the game, the player – as well as other actors – acts within the game world influencing the course of events. With this in mind and when granted the possibility to act at deep levels of the game system's structure, the player may even alter the initial possibilities presented by the game itself. By doing this, the player will assume diverse functions, from acting at the surface of the system to changing core features within it, hence gradually assuming a role of designer.[233]

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230 In continuation, he affirms that "[a]ll games have at least one level of recursion" and that the last of those levels is the magic circle (Koster 2004).

231 A recursive formative structure in which actors are constituted by networks of other actors. See section 2.3.1.

232 See section 2.3.3, regarding actors with an open topology.

233 As we will see, we do not mean that the player will be the designer of the game itself, but the designer of new behaviours, operations and actions instead.

8.2 Player Functions

In *Cybertext* (1997) Aarseth defines the mechanical characteristics of a text by presenting concepts as *scriptons* (sequences of signs as they appear to the reader), *textons* (sequences of signs as they exist in the text), and the *traversal functions* (the mechanisms through which *scriptons* and *textons* are presented to the user). The way these elements behave and are structured in a text originate different types of cybertext. Aarseth presents seven dimensions in his analytical model, of which the *user functions* are of our interest. In the omnipresent *interpretative* function the user is only concerned with the meaning of the text; in the *explorative* function the user decides which paths to take along the traversal; in the *configurative* function the user chooses or creates *scriptons*; while in the *textonic* function the user permanently adds *textons* and *traversal functions* to the text.[234]

Table 8.1: Summary of Aarseth's user functions.

Interpretative	The user is only concerned with the meaning of the text.
Explorative	The user decides which paths to take along the traversal.
Configurative	The user chooses or creates the scriptons.
Textonic	The user permanently adds textons and traversal functions to the text.

On the other hand, in a theory more devoted to narrative in the context of stories and storytelling, we have also found that Ryan's *layers of user participation in digital narrative texts* (2011a, b) reflect close considerations on the subject at hand. She presents five layers regarding the way the user influences the narrative. She defines the first level as *peripheral interactivity,* where "the story is framed by an interactive interface, but this interactivity affects neither the story itself, nor the order of its presentation." (2011a, 37)

The second level is defined as *interactivity affecting narrative discourse and the presentation of the story*: "On this level, the materials that constitute the story are still fully predetermined, but thanks to the text's interactive mechanisms, their presentation to the user is highly variable." (40)

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234 Although "textonic" is a term adequate to textual artefacts, we prefer the term *structural* (Carvalhais 2010, 2011b), which points to the manipulations provided by this function in an artefact that is not solely constituted by text but rather by a variety of media.

She defines the third layer as *interactivity creating variations in a partly pre-defined story*. She affirms that this type of interactivity is typical of computer games (although we believe that it is not the only type). Here, the interactant is granted "some freedom of action, but the purpose of the user's agency is to progress along a fixed storyline, and the system remains in firm control of the narrative trajectory" (44).

The fourth concerns *real-time story generation*, where "stories are not pre-determined, but rather, generated on the fly out of data that comes in part from the system, and in part from the user" (48).

And the fifth level is designated as *meta-interactivity*. Here, the user introduces new objects and behaviours into the system, expanding the initial field of possibilities of the story world. Examples can be found when "designing a new level for a computer game, creating new costumes for the avatar" (59). Nevertheless, for Ryan, in order for this to "constitute a genuinely 'meta' interactivity, [these activities] must be done by writing code and patching up the source, rather than using tools internal to the game" (59). At this level Ryan talks about a fundamental shift of role, from user to designer:[235] "It is on this level that the idea of the user as coauthor becomes more than a hyperbolic cliché, but the two roles do not merge, since users cannot simultaneously immerse themselves in a story world and write the code that brings this world to life." (59)

Table 8.2: Summary of Marie-Laure Ryan's layers of user participation in digital narrative texts.

Level 1: Peripheral Interactivity	The user's actions affect neither the story itself, nor the order of its presentation.
Level 2: Interactivity affecting narrative discourse and the presentation of the story	The story is predetermined, but interactive mechanisms make its presentation to the user highly variable.

235 She never uses the term *designer* per se, implying the term *author* instead. Nevertheless, we think *designer* to be a term most suitable to our train of thought.

Level 3: Interactivity creating variations in a partly pre-defined story	The user is granted some freedom of action, but progresses along a fixed storyline.
Level 4: Real-time story generation	The story is generated in runtime out of data that comes from the system and the user.
Level 5: Meta-interactivity	The user introduces new objects and new behaviours, expanding the initial field of possibilities.

Another way to understand depth is through the MDA framework (Hunicke, LeBlanc, and Zubek 2004), which portrays the relationship between the player and the designer, depicting how the game system's mechanics give origin to the game's dynamics that are experienced by the player and processed as emotional content at the aesthetics level.[236] It is this logic of emergence that allows us to discern between three distinct stages at which the game may be influenced.

Table 8.3: Summary of the three stages of the MDA framework.

Aesthetics	"The emotional content of the game. The kinds of fun we have when we play. The emotional message we hope to impart as game designers." (LeBlanc 2005, 458)
Dynamics	"The way a game behaves when it is played. The strategies, events and behaviours that emerge from the mechanics of the game." (458)
Mechanics	"The complete description of the game system; the rules and components we need to play the game." (458)

There is some sort of kinship or conceptual proximity between Ryan's layers of interactivity or user participation and Aarseth's user functions. Even without the possibility of establishing a direct correlation, placing them side to side makes semblances more noticeable, and the MDA framework makes the transition from player to designer more evident. With this in mind, we are aware that the following comparison does not depict perfect matches, nonetheless it helps to pinpoint some overlapping concepts.

236 See chapters 1 and 2.

Table 8.4: Possible relationships between Marie-Laure Ryan's layers of user participation, Espen Aarseth's user functions, and the MDA framework.

Layers of User Participation	User Functions	MDA
—	Interpretative	Aesthetics
Level 1: Peripheral interactivity	Explorative	Dynamics
Level 2: Interactivity affecting narrative discourse and the presentation of the story	Explorative	Dynamics
Level 3: Interactivity creating variations in a partly predefined story	Configurative	Dynamics
Level 4: Real-time story generation	Configurative	Dynamics
Level 5: Meta-interactivity	Textonic	Mechanics

Despite the fact that Ryan's layers of user participation are focused on how the user affects the storyline and Aarseth's user functions are more concerned with the topology and mechanisms of the text itself, both seem to bear one thing in common: they aim at portraying several stages in which the user is granted an increasing ability to exert influence on the how the system operates. Starting from Aarseth's interpretative function – that bears influence on the player instead of the system; followed by the explorative function and Ryan's levels 1 and 2 – where the user navigates the text without being able to influence the system's operations; succeeded by the configurative function and levels 3 and 4 – where the user traverses the text by influencing the system's behaviour within predefined boundaries that consist of its interface, or, in Aarseth's terms, that consist of scriptons (the sequences of signs as presented to the user/reader); all the way to the textonic function and level 5 – where the user is able to add new objects and behaviours, new textons and traversal functions to the system, deeply influencing its functioning, even to the point of promoting erratic and/or unpredictable behaviours.

Considering this allows us to adapt their work into the formulation of a theory focused on establishing parameters for acknowledging how the player may be able to modify the topology of a system. As a result, the four following parameters – that we called player functions – aim at four direct correspondent levels that describe how deep into the game system's structure the player goes in order to modify it.

Table 8.5: Player functions and respective summarised descriptions.

Player Functions	Description
Function 1: Interpreting	The player does not interact with the game system, but observes its behaviour, being concerned with its meaning instead. This function is grounded on an internal processing of the signals emitted by the system. *The player interprets the network of actors.*
Function 2: Exploring	The player interacts with the game system without changing the underlying structure of its behaviour, interacting within the boundaries of fixed and unmodifiable rules. *The player explores the network of actors.*
Function 3: Moulding	The player interacts with the game system by reconfiguring its behaviour, but always within boundaries of predeterminate parameters and values. *The player rearranges the network of actors.*
Function 4: Adding and removing	The player adds new actors and/or permanently removes existing ones from the game, something that may promote unforeseen, and occasionally out of control behaviours. *The player adds new actors to and/or removes existing ones from the network of actors.*

8.2.1 Function 1: Interpreting

While developing function 1, the player is only concerned with watching, listening, sensing, and interpreting the game. This function is essential for the player to generate meanings based on the system's behaviour. It is also developed when vicariously learning about the game world. It is based on the meanings generated while developing this function that the player will actuate afterwards.

Nevertheless, while developing this function the player's operations are not restricted to observation and pure interpretation, as the player is also able to deduce the unfolding of new events and the surge of new behaviours based on the ones already observed. This means that the player not only tries to make sense of the signals emitted by the game system, but also creates mental analogues of its functioning by developing internal simulations, whose outcomes may dictate their actions while developing other functions. Therefore, actors developing this function are not mere observers as this function is also about introspection, internal processing. As we mentioned in *Beyond Vicarious Interactions: From Theory of Mind to Theories of Systems in Ergodic Artefacts* (Carvalhais and Cardoso 2015), by observing the system, the player[237] is able to create mental analogues of its functioning based on previous experiences and simulating processes whose outcomes will be either confirmed or contradicted by posterior observations or actual interactions with the system.

With this in mind, it is crucial for the player to constantly develop this function, for it is essential that they try to make sense of the system's behaviours in order to meaningfully act within the game, otherwise their behaviour and effort can be misapplied, as if acting blindly. Nonetheless, there are actors, other than the player, that do not develop this function at all. In video games, we may commonly find them as simple enemies developing a class 1 behaviour.[238] And more rarely, we may find them in simple actors delegated by the player to operate the game system on her behalf.[239]

In sum, this function is about making sense of the game world, and it is solely related with what happens on the side of the player, just as the aesthetics layer in the MDA framework is. Consequently, it does not aim at affecting the functioning of game system

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237 In the article we use the term *reader*, but in this context is more adequate to use *player* instead.

238 See section 2.3.6 Behaviour.

239 Such as the examples mentioned in section 2.4.3, namely *Fish Plays Pokémon* and the physical mechanical robots. The software bots are excluded from this reasoning because they may actually develop this function, since they inspect and evaluate the game environment, sometimes developing internal simulations. If we think about our discussion on responsiveness in chapter 5, we may acknowledge that, in this case, those mechanical robots express a generative I/O state while the referred software bots don't – because they have to sense the environment in order to ponder their actions. And the fish, although not in a generative state as well, is not sensing any information coming from the game system, either because the signal is lost in the environment or, most probably, because it is not able to interpret the signals. Therefore, the fish actually establishes a *semi-interactive method* with the game system (G:R).

whatsoever. Instead, it is focused on the internal processes of the player that are set in motion to interpret the game system's behaviour. From the point of view of the player, it is a function based on introspection.

8.2.2 Function 2: Exploring

A player developing function 2 is able to communicate with the game system. However, through this function, the player's actions are heavily dictated by the game system,[240] without being able to change the underlying structure of its behaviour, interacting within the boundaries of fixed and unmodifiable rules. It is as saying that the player is free to choose the system's behaviours from a predetermined list of options. This is a very contained form of interaction, where every ramification can be anticipated and fully authored by the designer.[241] Therefore, without granting the possibility of effectuating alterations to the underlying network of the system, any shift in the system's behaviour consists of a predetermined arrangement.

With this into consideration, the implementation of this function is a common ground for many video games where the designer wants to take control over the player's experience, such as in *Super Mario Bros.* (1985) or in *The Last of Us* (2013), for example.

Figure 8.2: *The Last of Us* (2013).

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240 See section 2.3.4 Milieu.

241 Although no one can grant complete control over a player's experience, many video games resort to this function as it is a mildly secure way for designers to try to achieve that control.

8.2.3 Function 3: Moulding

The actions of a player developing function 3 penetrate a bit deeper into the structure of the game system's behaviour, being granted the possibility to reconfigure it but always within the boundaries of predeterminate parameters and values. At a more superficial level, one simple example can be found in *Lemmings* (1991) when the player makes a lemming drill the ground to redirect the others. A similar one, in *From Dust* (2011) when the player induces geographic and physical changes in the game world trying to tame water, lava, or sand, in order to save a nomadic tribe. In these, the player reconfigures the spatial arrangement of the game world in order to get nearby actors to behave in particular ways or achieve certain goals.

At a deeper level, the player may be granted the ability to generate actors from within a predetermined set of constitutive elements – which is the only way that the player has for creating novelty within the game while developing this function. Therefore, depending on the complexity and variety of that set, the player may generate new and previously unforeseen actors featuring also unforeseen and sometimes unpredictable behaviours, as we may find in *Spore* (2008), *Scribblenauts Remix* (2011) or *Besiege* (Alpha 2015).[242] Eventually, she may also be able to eliminate actors by disassembling them into a series of their constitutive elements.

Figure 8.3: *Besiege* (Alpha 2015).

Super Mario Maker (2015) is a more stark example. The game consists of creating levels based on the *Super Mario* series, which can be shared and played with others. In this game the player alternately assumes two functions: function 2 when exploring the level,

242 See section 2.3.1.

and function 3 when creating it. We may say that the player may assume the role of designer of that particular game level but not of the elements that constitute it.[243] *Minecraft* (2011) is a similar example, and many other video games based on a logic of building and crafting.

Figure 8.4: *Super Mario Maker* (2015).

Outside games belonging to that particular genre, this logic of building and crafting is something also very present in role-playing games (RPG). The player is not only granted the ability to customise playable characters, but also to craft their equipment, weapons, and other items. Besides that, the playable characters also evolve during the game, taking into account the actions and choices of the player.[244] This is also an example of this function being developed, undeterred by the fact that the actions that may lead to this may occur in the background or as secondary activities while playing the game.

For these reasons, while performing this function, the player stands much closer to the realm of the designer, in the sense of the MDA framework. The player is still the player nonetheless, but the operations she is engaged in are very similar to those the designer develops. It is here that questions of co-authorship start to arise,[245] as the player is able to create actors in the game, but novelty is only achievable through the reconfiguration of what already exists within the game world.

243 To do that, the player has to dive even deeper into the system.

244 In fact, in the course of the last years, character progression has been a feature seen in an increasing amount of video games, being in some cases utterly unnecessary, in our opinion.

245 See Murray (1997).

8.2.4 Function 4: Adding & Removing

A player developing function 4 is able to change the rules by adding truly new actors and behaviours to the game. While developing this function the player dives deep into the structure of the game system in order to change its core, its mechanics. We believe that this is the moment where there is a fundamental paradigm shift, where the player stops acting as a traditional player[246] to start acting as a designer (in Hunicke's terms), altering the very essence of the game, defining truly new and initially 'unprogrammed' behaviours. Instead of merely acting within the constraints defined by the original set of rules, the player expands or breaks the initial field of possibilities, altering their mechanics by adding new actors to the game and/or permanently removing existing ones.

We may say that the making of a mod[247] is an activity that consists of this function, such as creating a game from scratch. However, these are not activities of a player per se, but solely of a designer.[248] Notwithstanding, that is not the only way to develop this function. *Hack 'n' Slash* (2014) is a game in which the player resorts to reverse engineering tools to play, hacking the code that runs the actual game. In more a superficial level, the player has the ability to alter the parameters (the values of variables) of certain actors within the game world – enemies, objects, the playable character, etc. –, with the intent to alter their behaviour in order to progress (an activity that is function 3 related). But later into the game, the player is able to introduce profound changes on the behaviour of diverse actors by altering the algorithms that instantiate them, and with that also comes the possibility to break the game altogether.[249] By achieving certain objectives the player is granted *in-game books* which are items that represent the actual code files on which the game runs, each related with particular aspects or actors in the game. More importantly, the player is able to alter them, and with that also able to introduce truly new behaviours and thus adding truly new actors into the game.

246 We use the term *traditional player* in order to convey the idea of a player whose actions are always executed within the scope of the rules of the game.

247 A mod consists of a modification made to a video game in order to either create new content for it or to create a new game altogether. Mods usually require the original release in order to run.

248 Of course that a designer must play the game in order to test it, but that is not the approach we are aiming for.

249 The game possesses a fail-safe mechanism giving the player the possibility to restore a backup version of the game's code, useful in the case of a system breakdown or of severe malfunctions.

Figure 8.5: ***Hack 'n' Slash*** **(2014).**

In sum, players developing this function don't fiddle with the specified parameters of the game. They actually tamper with the mechanics of the game system. And, at this level, players are granted the ability to either destroy or create new actors and to design new behaviours, reverberating the due consequences to the game system's behaviour, its dynamics.

With this in mind, one may say that this is usually the realm of the designer, their entry point, which stands on the opposite side to that of the player, according to the MDA framework. According to Ryan, the roles of user and designer cannot merge, since the user cannot be immersed in the story world while simultaneously creating it. However, her perspective is focused on the subject of stories and storytelling. Ours is not. In the context of video games merging the roles of player and designer can be in fact a feasible thing, simply because games are not fundamentally about stories or storytelling, but about actions.[250]

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250 "By and large, people don't play games because of the stories. The stories that wrap the games are usually side dishes for the brain. For one thing, it's damn rare to see a game story written by an actual writer. As a result, they are around the high-school level of literary sophistication at best.
For another, since the games are generally about power, control, and those other primitive things, the stories tend to be so as well. This means they tend to be power fantasies. That's generally considered to be a pretty juvenile sort of story." (Koster 2005, 86)
And also: "Games seem on the face of it to be very different from the stories and to offer opposing satisfactions. Stories do not require us to do anything except to pay attention as they are told. Games always involve some kind of activity and are often focused on the mastery of skills, whether the skill involves chess strategy or joystick twitching. Games generally use language only instrumentally ('checkmate', 'ball four') rather than to convey subtleties of description or to communicate complex emotions. They offer a schematized and purposely reductive vision of the world. Most of all, games are goal directed and structured around turn taking and keeping score. All of this would seem to have nothing to do with stories." (Murray 1997, 140)

> Games are not stories. It is interesting to make the comparison, though:
>
> • Games tend to be experiential teaching. Stories teach vicariously.
>
> • Games are good at objectification. Stories are good at empathy.
>
> • Games tend to quantize, reduce, and classify. Stories tend to blur, deepen, and make subtle distinctions.
>
> • Games are external—they are about people's actions. Stories (good ones, anyway) are internal—they are about people's emotions and thoughts.
>
> In both cases, when they are good, you can come back to them repeatedly and keep learning something new. But we never speak of fully mastering a good story.[251] (Koster 2005, 88)

And from this perspective, merging the roles of player and designer is feasible because the player may need to resort to this function in order to traverse the game. The case of *Hack 'n' Slash* demonstrates how this is actually contemplated in its mechanics and design of the game.

8.3 Conclusions and Future Work

In this chapter, we described depth as consisting of the influence that an actor exerts on another actor's behaviour. With focus on the relationship between the player and the game system, we defined that the scope of influence of an actor's actions is dependent on the recursive structure of these, presenting four distinct functions that an actor develops at different depths of their topological structure.

We have also seen that, in order to develop function 4, the player doesn't have to abandon play altogether. The player doesn't have to stop being the player to assume a role of designer, as she is able to access the mechanics of the system as an act of play. Granting that level of access to the player, permits them to truly transform its mechanics, even if sometimes that means to break the game, or crash the system.

251 Although we agree that games are not stories but rather include or generate them, gamers may actually choose to play particular games for their stories. Stories and games may work together since the former "may be used for telling the player what to do or as rewards for playing" (Juul 2001).

Another question unveiled by this study comprises the possibility of a similar one in order to uncover the game system's functions. The designer aims at creating particular aesthetics, something that only happens within the player's mind. Therefore, she conceptualises particular behaviours and events (dynamics), writing all the conditions she thinks of that are necessary for those to take place (mechanics) into the game system. Hence, the relationship between the designer and the player is mediated by the game system, because it is the game system itself that possesses the game's mechanics and executes them into the form of various dynamics that are ultimately experienced by the player.

With this into consideration and if we understand the MDA framework as a model depicting a particular perspective on how the system communicates with the player – in the sense that the game system's particular mechanics originate its own dynamics, a behaviour that is witnessed by the player and that in consequence generates in her mind particular experiences (aesthetics), we may postulate – since both the player and the system are considered to be actors in our framework – that the player also responds to the system in the same way. In this sense, the player replies by means of their own mechanics, generating the corresponding dynamics, a behaviour that the system may be able to interpret in a layer analogous to that of the player's aesthetics. By considering this hypothesis, it not only seems relevant to unveil what kind of functions are viable for the game system in this context, as – in the same way the designer aims at creating an aesthetics of the player – it appears to be of major importance to raise the question of how to design for an aesthetics of the system. With the increasing developments and general implementation of artificial intelligence systems in video games, it becomes correspondently important to start thinking about how the outcomes of the process of interpretation of the player's behaviour influence the game system's own functioning – in a analogous way to what happens with the player when interpreting the game system's behaviour.

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9. Traversal

In video games the player's personal experience is shaped by the relationship she establishes with the game system. This experience consists of a journey that is in constant transformation, supported by a narrative that emerges from that relationship. This chapter explores how the player traverses the ergodic landscape of video games, examining different kinds of tension between the emergent and the hardcoded narratives.

We propose five types of traversal in video games: 1) that in which the player is able to choose from mutually exclusive paths; 2) that in which the player is able to engage in optional activities, expanding the narrative; 3) that in which the traversal is determined by the disposition of the actors within the game world towards the player and towards each other; 4) that in which the game system's actions are based on an analysis of the player's behaviour and on the interpretation of the patterns that from there emerge, consisting of a reflection of the player's behaviour; and 5) that in which the player resorts to a hidden side of the algorithm, exploiting glitches, errors, flaws in the game system, journeying through a world of unpredictable behaviours and events, that may ultimately break the game altogether.[252]

9.1 Traversal: Ergodic or Non-ergodic

Along their history, video games have embedded many elements from the discourse of cinema. Nowadays, we may talk about cut-scenes or cinematic interludes in which the player is invited to watch the narrative unfold without the possibility of interaction – as

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252 This chapter consists of a revised version of *Traversing the Emerging Narrative in Interactive Narratives and Video Games* (Cardoso and Carvalhais 2013d), of *Breaking the Game: The traversal of the emergent narrative in video games* (2013b), and of *Profiling: A traversal between the player and the game system* (2014c).

in traditional cinema. In fact, when interactive movies were first developed they were expected to be a sort of "remediation[253] of cinema through video games. Interactive movies were fantasized to be video games that could still, somehow, succeed at being good movies." (Lessard 2009, 202) But, in spite of their apparent proximity, they bear exquisite differences.

While journeying through a game, the player's personal experience emerges from her interactions with the game system. It is this relationship that determines the course of events, that makes the game progress and narrative emerge, shaping the player's personal experience.

This relationship is extremely dynamic, ranging from A) moments where the player assumes the role of spectator, as are the cases of cinematic interludes or cutscenes and of what Galloway calls the *ambience act* (2006) – where the game goes on but the player is away, or in other words, where the player does not provide input; and B) to moments where the player develops a non-trivial effort (Aarseth 1997) in order to be able to respond to the game system.

Traversal may be defined as traveling through something. In this particular context, it is related with how the player crosses the ergodic landscape of a video game. It is focused on how the player travels through the game world's topology,[254] something that is able to be altered in diverse ways depending on the actions of the player and of the game system.

> As players we have become incredibly adept at recognizing the kinds of choices we make in games and the impact we expect these to have on our overall experience. (Zagal 2011)

The traversal may be ergodic or non-ergodic. A non-ergodic traversal results from a system defined by static features, which produce a non-modifiable, non-editable, and fixed narrative. In fact, here we cannot talk of an interactant but rather of a reader or spectator.

253 See Bolter and Grusin (1999).

254 It is important to mention here that by topology we are not necessarily referring to the spatial topology of the game world, but mainly to the topology of the game system instead – in the same sense as the text topology that Aarseth speaks of (1997).

On the opposite side, in ergodic traversals the player is potentially more active, an interactant, able to participate in the unfolding of events, being required to make a nontrivial effort in order to traverse the narrative (Aarseth 1997, 1). The system is receptive to the player's input, which influences its own output, providing her with an experience that becomes, to a certain degree, unique, personalised, variable, dependent on her choices in conjunction with the rules which govern the game system.

One singular aspect of ergodic traversals is that they may not be easily re-experienceable. If we think about it, we can watch a movie in about two hours, for example. If we would like to review it we can immediately make a rerun and spend another two hours. Of course, we will be paying attention to other subjects or new details, we will be expecting certain events to occur at determinate times, but the overall experience and the narrative that is presented will not change. They cannot be altered, we have no means to influence them, and neither do they change on their own. The same happens with a book. In the case of video games the exact same experience may never be truly re-experienced, because the system's output is variable, dependent on the player's input and the rules through which it functions. We may say that the fidelity of reproduction of a given event or experience must not be taken to a degree of exactness but rather one of approximation. Besides that, games can take "dozens of hours to complete and [have] a limited number of save slots, much of it accessible only by playing it through again, the game itself structurally obligated to fight [us] every inch of the way. (…) Say you want to check on something that happens about halfway through some older game. Not only do you have to find it, you will, once again, have to play it. Probably for hours. Possibly for days." (Bissel 2011)

As players, we expect our decisions and our actions to have an unquestionable influence in the game, although their results are not always immediately, or almost immediately, perceived.

> As players, we know that not all choices matter in the same way. (…) We understand how some choices may affect gameplay, some may affect a game's narrative, and also how the choices we might make now, imply a different set of choices available later on. Thanks in part to how gameplay is segmented, we even understand which things can be "undone" and which cannot. When we can go back and redo, and when we can't. (Zagal 2011)

9.2 Narrative: Hardcoded or Emergent

Not so long ago, in the mainstream video games' industry, there was a boom of games that explored a feature known as 'open-world'. These games usually were mission- or quest-oriented, where the player could decide which missions to complete in a modular fashion, while exploring a massive virtual world. Open-world games are known for allowing the player to explore their worlds and to avoid following the (main) storyline that eventually leads to their resolution. Such games as *Far Cry*, *Borderlands*, *Grand Theft Auto*, *The Elder Scrolls*, *Infamous*, etc. constitute good examples that help to illustrate this fact. Actually, in *Infamous* (2009) after concluding the story, the game permits the player to continue exploring its world.

By playing these games we notice that there is a conflict between two elements: the storyline and the gameplay. When the player is freely exploring the world, or pursuing side-quests, the main storyline does not progress; it becomes stationary, stays on hold. Actually many of the joys in the *Grand Theft Auto* series consist in neglecting the main storyline and in exploring the virtual world, pursuing optional content. By doing this, a long time may pass before the player decides to follow the storyline again.

But, even when the storyline is 'on hold' another narrative structure remains active. Video games are artefacts that live by developing two kinds of narrative: one that is fixed, recognisable, that makes sense, whose dramatic arc is carefully calculated – the hardcoded narrative –, and one that is fluid, dynamic, devoid of a previously defined structure, strange and even abstract sometimes – the emergent narrative. Traditionally, the first consists in the storyline that can be experienced through the cinematic interludes, cut scenes, dialogues, etc., and the latter is dynamic and unscripted.[255]

Yet, despite their divergences, they are bound to work together, and the ratio between hardcoded and emergent narratives in a video game is what determines how much of the game is static, predetermined, and bound to scripted events, and how much of it is volatile and run by procedural occurrences. It is this that determines when it is necessary for the player to follow a specific narrative path and when she is free to go astray.

255 See section 2.1.4 on matters regarding the emergent narrative.

> The differences between the framed narrative and the ludonarrative are what make story in games so unmanageable: One is fixed, the other is fluid, and yet they are intended, however notionally, to work together. Their historical inability to do so may be best described as congressional. (Bissel 2011)

This journey is what we call *traversal*. And the types of traversal proposed in this chapter explore different forms of tension between emergent and hardcoded narratives.

9.3 Types of Ergodic Traversal

9.3.1 Branching

Branching is one of simplest types of traversal in video games, occurring when the player is *asked to choose between mutually exclusive paths*. It resides at the core of video games, and of ergodic works in general, as the player is "constantly reminded of inaccessible strategies and paths not taken, voices not heard. Each decision will make some parts of the text more, and others less, accessible, and you may never know the exact result of your choices; that is, exactly what you missed." (Aarseth 1997, 3)

Branching is something that can be more or less self-evident. Lets consider *Super Mario Bros.* (1985) as an example: Right at the beginning of the game, during the first level, the player has the opportunity to progress by constantly traveling to the right reaching the end in a matter of seconds or of a few minutes; but along that path she is presented with some pipes where Mario can enter, a path that if the player chooses to take, will lead her to an optional room with several coins.[256] The next pipe will lead Mario back to the upper part of the level, to an area a little bit ahead from the one entered in before. Since the player is prevented from traveling backwards, the choice between these two paths becomes evident. This initial stage teaches the player that she will probably have to make more choices like this in the future.

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256 Coins are collectable items in the game, that if enough are collected the player is rewarded with one extra life, a chance to play again.

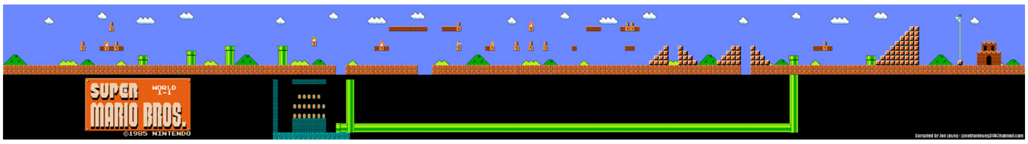

Figure 9.1: Full map of level 1:1 of *Super Mario Bros.* (1985).[257]

We may find another example in *Heavy Rain* (2010), a game that may be described as constituted by an enormous network of branches, organised in micro and macro structures that encapsulate the events that may (or may not) be experienced by the player.

> Heavy Rain's premise is that all choices matter because they affect how the narrative develops and unfolds. (…) [A]nd as a player, I found myself continually second-guessing myself, wondering if I had missed something important or if a seemingly innocuous decision would have far-reaching effects. (Zagal 2011)

Heavy Rain frequently forces the player to make decisions based on morality, such as when Ethan (one of the playable characters) is extorted to kill a person, or to cut his own finger in order to collect the next missing piece of the puzzle that may or may not help him to find his kidnapped son. We may notice the same kind of situation in *Bioshock* (2007), where the player either opts a) to kill the *Little Sisters* and collect the ADAM they possess (a valuable substance in the game that is used to power up a variety of superhuman skills); or b) to help them, amassing much less ADAM, resulting in less resources (although some other 'gifts' become available in the course of time due to this act).

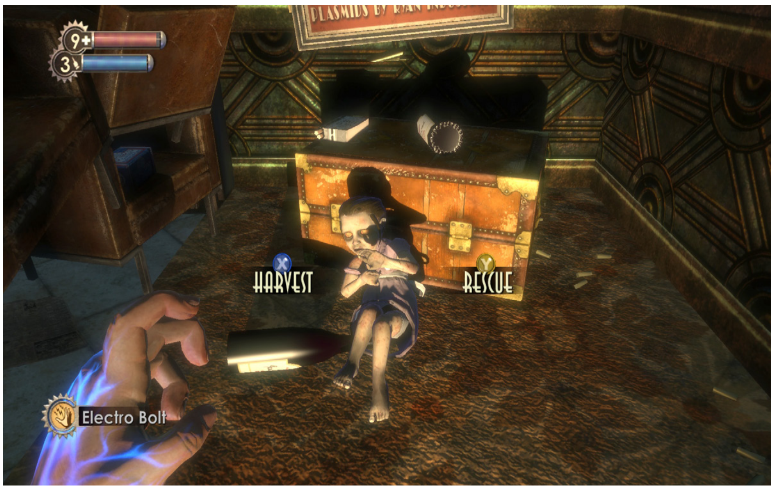

Figure 9.2: Help or destroy the little sister in *Bioshock* (2007).

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257 Picture found at http://www.mariomayhem.com/downloads/mario_game_maps/super_mario_bros_maps/SuperMarioBros-World1-Area1.png.

In *Infamous* (2009) the player is constantly reminded and even explicitly asked to make mutually exclusive choices. She must choose between evolving her character's super powers either by becoming a sort of paladin or hero – helping the population, ensuring order and applying justice – or a villain – oppressing the population, and taking inconsiderate, thoughtless, self-centred and egotistical actions. This is an outcome that depends on the kind of quests the player undertakes and on the player's actions taken in-between them. If she completes those that promote the hero side, the corresponding missions that promote the villain side are blocked, and vice-versa. Depending on these choices the character evolves disparately, with unique sets of skills and abilities, conditioning the overall experience of the game and its world. These player's actions are taken into account, determining in which side she is currently on, as that not only is depicted in the heads-up display, but also reflected on the visuals of the character itself.[258] Also, she is constantly being granted determined abilities that change according to her balance and evolve corresponding to her proficiency.

Figure 9.3: *Infamous* (2009).

Fallout 3 (2008) also presents us with a huge range of choices, especially in its early stages (Bissel 2011). It bears an interesting system for defining the perks and characteristics of the player's character. Everything begins with its birth, the player names it, learns to move in the game world as a young child, experiences events such as the character's birthday, school, etc.. In all of these events the player is led to make choices, and these

258 This is also very noticeable in *Fable* (2004), for example.

define the type of playable character that will eventually be developed. Some are more evident, others are more covert. But they all serve the same purpose and once done the player cannot go back.[259]

Silent Hill (1999) has several possible endings, which the players may access depending on the course of events along their traversal. Actually, multiple endings are so common in video games that players already assume that they may exist, even when that may not be true. One of the main playable characters in *Final Fantasy VII* (1997), Aeris,[260] dies several hours into the game. This constitutes a huge loss for the player, mainly due to the time she may have already invested on that character. Aeris's death had such an impact that fans of the game became interested in finding a way for her not to perish. They intensively searched for an alternative course of events, and thus a different ending, although to date they still haven't found a way to prevent her from dying.[261]

Figure 9.4: The moment of Aeris's death in *Final Fantasy VII* (1997).

259 Actually the player is granted one opportunity to reformulate her complete set of choices regarding the her playable character's initial setup and abilities: right before escaping the vault, which can be considered the tutorial level of the game. At this time she can in fact make her choices without the story to justify them or simply for the sake of immersing the player in the diegesis, navigating through a non-diegetic landscape of menus.

260 In the japanese version, Aeris is called Aerith.

261 In fact, some players may resort to glitches to bring her back and be able to play with Aeris after her own death (see *Getting Aeris back without hacks, add-ons, etc, etc.* at http://steamcommunity.com/app/39140/discussions/0/540732596654445281/). And as a side note, according to an article at *kotaku.com*, players want an alternate route where Aeris lives in the upcoming remake of *Final Fantasy VII* (see http://kotaku.com/poll-what-japanese-gamers-want-in-the-final-fantasy-vi-1724510473).
At the time of writing a video of the moment where Aeris dies could be seen at https://youtu.be/9qnyxd7Vq0Q.

9.3.2 Bending

> Rather than use traditional, linear or branching storytelling methodologies in Indigo Prophecy, Cage invented a branching storytelling system that allows the player to "bend the story" through acquiring or failing to acquire optional information concerning the game's narrative. (Miller 2010)

Bending is a type of ergodic traversal that occurs when the player accesses optional non-mutually exclusive events (Miller 2010), lengthening the game (Bogost 2010), either to increase her knowledge of the game world or to experience parallel narratives.[262]

Ian Bogost (2010) affirms that if the verb that defines cinema is *to edit*, then video games should do the opposite: *to prolong, to lengthen*. Bending is consistent with this. Bending reveals optional and sometimes hidden elements of the game, such as areas of play, objects, characters, actions or abilities, etc.. Games like *Super Mario World* (1990), *The Legend of Zelda: A Link to the Past* (1991), *Final Fantasy VII* (1997), *Mass Effect* (2007), *Grand Theft Auto IV* (2008), *Borderlands* (2009), *Heavy Rain* (2010), *The Elder Scrolls V: Skyrim* (2011) are just a few examples that implement bending to engage the player in exploration and expand their game worlds. In these games the player may not follow the main quest or storyline – which would lead to closure – but may instead wish to explore the world that the game offers.

Figure 9.5: Part of the world map in *The Elder Scrolls V: Skyrim* (2011), with the icons pointing to known locations – much of those are optional to visit.

262 We borrow the term *bending* from Miller (2010).

Open-world games fit very well into this category, as the player is able to explore them, sometimes spending much more time in side activities than on the ones that guide the game to closure. Nonetheless, not all games that implement bending are considered open-world games, as we can see from the given examples.

> Stories are about time passing and narrative progression. Games are about challenge, which frustrates the passing of time and impedes narrative progression. (Bissel 2011)

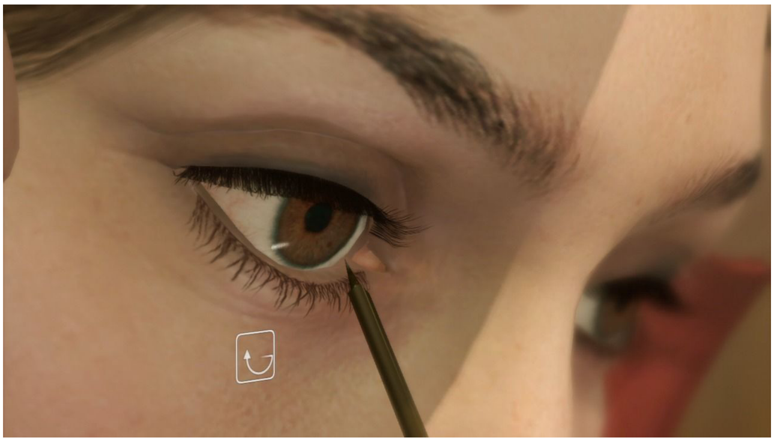

Figure 9.6: Applying make-up in *Heavy Rain* (2010).

Heavy Rain is not an open-world game, but still fits this category as it allows the player to engage in side-activities, some of them consisting of mundane chores (Bogost 2010).

> Games, on the other hand, contain more than most gamers can ever hope to see, and the person deciding where to point the camera is, in many cases, you—and you might never even see the "best part." (…) Teeming with secrets, hidden areas, and surprises that many pounce only on the second or third (or fourth) play-through (…) video games favor a form of storytelling that is, in many ways, completely unprecedented. (Bissel 2011)

In *Fahrenheit*[263] (2005), depending on the choices made during a given dialogue event, the player may obtain more or less detailed information related to what the conversation is about. "Moreover, there are often a number of contextual actions the player can take in various environments that are non-essential to story progression." (Miller 2010)

263 In North America, this game was named *Indigo Prophecy*.

When the player is bending the narrative she is undertaking optional research, exploring the game world (and everything in it), in a way that puts on hold the progression of the framed/hardcoded narrative. Thus, bending extends the experience of the game, providing optional content that can be immensely fun and appealing to explore and to discover.

Nonetheless, if these side activities do not contribute in some way to the game (and we are not referring to its closure), they risk becoming dull, pointless, unappealing and even painful to undertake. At that moment they become *fillers* – features that do not meaningfully contribute to the overall experience. *Grand Theft Auto: San Andreas* (2004) features one example of this. The playable character may get fat by eating fast food, and become slim when engaging in physical activity. None of these features seem to be meaningful to the game's main objectives, however they may pay a relevant contribution in the development of its emergent narrative.

> [*Grand Theft Auto: San Andreas* (2004)] also added dozens of diversions, the most needless of which was the ability of your controlled character, a young man named C.J., to get fat from eating health-restoring pizza and burgers—fat that could be burned off only by hauling C.J.'s porky ass down to the gym to ride a stationary bike and lift weights. This resulted in a lot of soul-scouring questions as to why (a) it even mattered to me that C.J. was fat and why (b) C.J. was getting more physical exercise than I was. Because I could not answer either question satisfactorily, I stopped playing. (Bissel 2011)

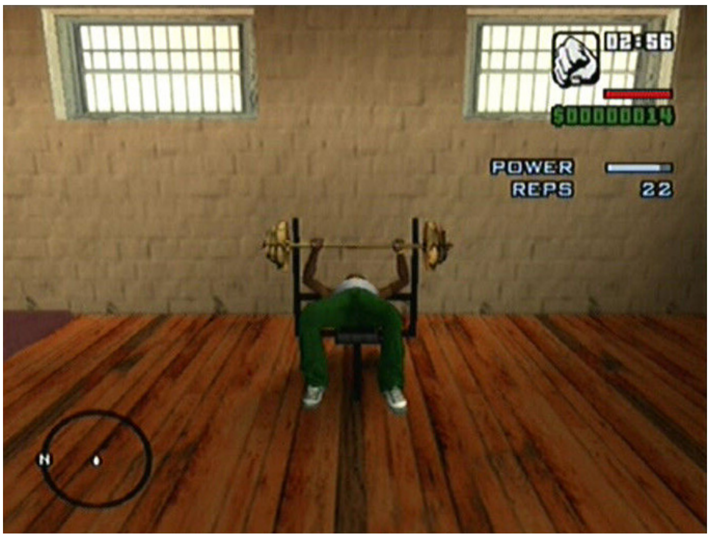

Figure 9.7: C.J. at the gym in *Grand Theft Auto: San Andreas* (2004).

Bending prolongs or even explores the emergent narrative. The player is usually rewarded for her effort into finding extra content, by means of acquiring (special) items, special abilities, or even by obtaining new or more powerful means to explore the world. The fact is that these rewards may have the ability to influence or alter the experience of play, and thus to modify the narrative that emerges from the interaction between the player and the rules of the game world: the emergent narrative.

9.3.3 Modulating

While traversing the game world the player engages with many other actors – either objects, characters, etc.. These usually have a determined affinity towards the player and each other, sometimes expressing themselves in the simplest of terms: friend or foe. When the player is able to regulate the disposition of those actors towards her – or her proxies in the game world – and/or towards each other, she performs what we call a *modulating traversal*. This type of traversal consists of moulding the social fabric established between these elements.

To sum up, this concept of modulation describes a mode of traversing the game by *crafting relationships*, and *regulating the disposition* of the game's actors. Here, the choices that the player makes regulate (or modulate) the values that constitute the 'personality' traits of other characters – or, in more abstract terms, the constitutive traits of the game's actors. Thus, we may say that the player, through her actions, directly or indirectly influences other actors' behaviour, modulating the parameters that constitute their behavioural framework. Games that support this kind of traversal feature a social network that can be moulded as the player acts within the game world. And, according to that framework, what may be honourable and righteous to a certain character or actor may be nefarious to another.

The 'Karma system' in *Fallout 3* (2008) is an interesting example because it works in a way so that the actions of the player affect the disposition of non-playable characters towards her. Helping or hurting them not only directly affects their affinity towards the player but also the attitude of the ones in their social network, also towards her.

> [In *Fallout 3*, the Karma system] works so that every action you take to help or hurt others will subsequently affect their disposition and actions toward you. More importantly perhaps, it will also affect the attitude of that character's "social network" and thus the attitude toward you that characters you may not have even seen before will take. In this way, if you affect a character in a positive way, their friends may also have a positive disposition toward you, and be willing to help you later, or if you hurt the character, they might do the same to you. (Games 2011)

In other words, the player acts on the game world exploring the plasticity of its social network, which allows the narrative to emerge and the game to unfold, with her decisions usually reverberating favourable and dire consequences. *The Elder Scrolls IV: Oblivion* (2006) makes this even more evident as the player has to perform several actions to make determinate characters to befriend her.

Figure 9.8: The persuasion wheel in *The Elder Scrolls IV: Oblivion* (2006), a moment where the player tries to influence the disposition of a non-playable character.

The games in the *Grand Theft Auto* series are also interesting examples. When the player steals a car, or undertakes a certain task that will benefit a gang, either the victim of carjacking or the rival gang will most certainly see her as an enemy. And, although they may not be present in the moment that the player first made and enacted her choices, they may surprise her later in the game, and engage her if she travels through their territories. Therefore, it becomes a kind of a game of chance, where probability plays a major role in the traversal.

> Discovering who panics and who decides to stop and duke it out with you when you try to steal a car is one of the GTA games' endless fascinations. When a Liberty City guy in a suit unexpectedly pulls out a Glock and starts firing it at you, you are no longer playing a game but interacting with a tiny node of living unpredictability. The owner of one of the first vehicles I jacked in Liberty City tried to pull me out of the car, but I accelerated before she succeeded. (Bissel 2011)

Action thus becomes meaningful through the consequences that emerge from it (Games 2011), and that becomes rather evident in this kind of traversal. As the social fabric of the game changes, it shapes the narrative, influencing the player's progression.

Middle Earth: Shadow of Mordor (2014) is an excellent example of modulating traversal. In this game the player plays as *Talion*, a ranger that was killed – along with his family – and returned from death sharing his body with a being from another dimension – a wraith. During the game if Talion dies he is spawned back to life, although not immediately and only in very specific types of places. This feature plays a central role in the game.

The enemies that the player faces in combat will remember him after those encounters. If Talion is killed not only its enemies stats increase but they may also be promoted within the ranks of their army. This is where the *Nemesis system* presents itself as a core feature. In this game and through this system, the player is able to influence the social network of their foes' army. Each captain and other characters feature diverse characteristics,[264] some that empower them, others that do the opposite, and some that are more related to the affinity they have towards other members of their army – either respect, loyalty, fear, hatred, etc.. In fact, if one of them has the opportunity to be promoted – which seems to be one of their main goals – they may take it, even if that means to kill its commanding officer, an event that is more recurrent when the latter is in a weaker state – something that may have been caused by the player. So, if the player eliminates a given captain, another will take its place later on. If the player weakens one of them, another may eliminate it and also take its place. If the player is 'killed' by one of them, its stats will increase and on the next confrontation it may fight with more ferocity or confidence than before. And the same may also happen if the player injures them and then evades.

264 Both the characters and their characteristics are procedurally generated.

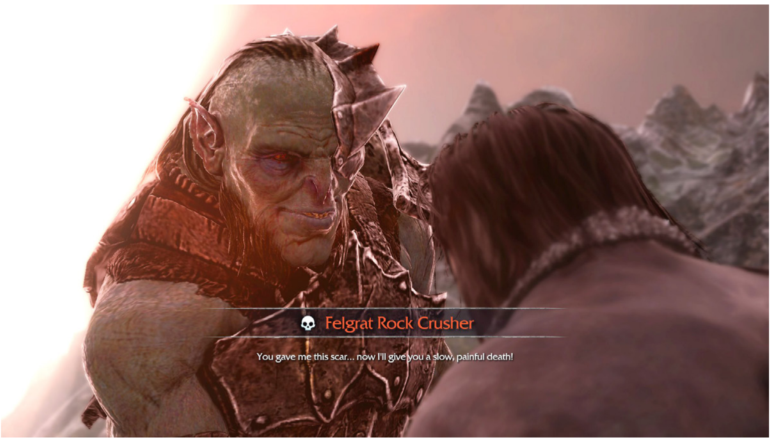

Figure 9.9: A moment when the player reencounters a foe (which remembers him) in *Middle Earth: Shadow of Mordor* (2014): "You gave me this scar… now I'll give a slow, painful death!"

There are several ways for the player to collect intelligence about her enemies, from scouting and questioning soldiers, to simply finding information that is scattered around. What is important here is that the collection of intelligence is a central activity to consider in order to figure out ways to face foes. For example, the player may be informed that a specific enemy is afraid of fire or of a particular kind of wildlife. With that information she may devise a plan that is focused on setting on fire her enemies' stronghold or lead that particular kind of wild life to their encounter, an event that would potentially attract many soldiers to the same place and would set their captain on the run or at least afar from those occurrences – a plan that would raise the player's chances for success.

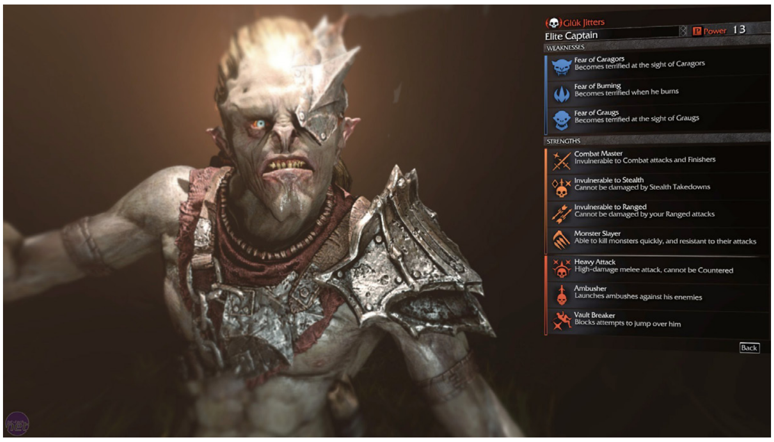

Figure 9.10: The characteristics of a foe in *Middle Earth: Shadow of Mordor* (2014).

This system gets more complex and interesting later in the game when the player acquires the ability to manipulate soldiers on the opposing side. This not only grants the player the ability to make them fight for her but also the opportunity to infiltrate their ranks. So, by these means the player may be helped in accomplishing her objectives and also being able to further reach the higher ranks of her enemies' army.

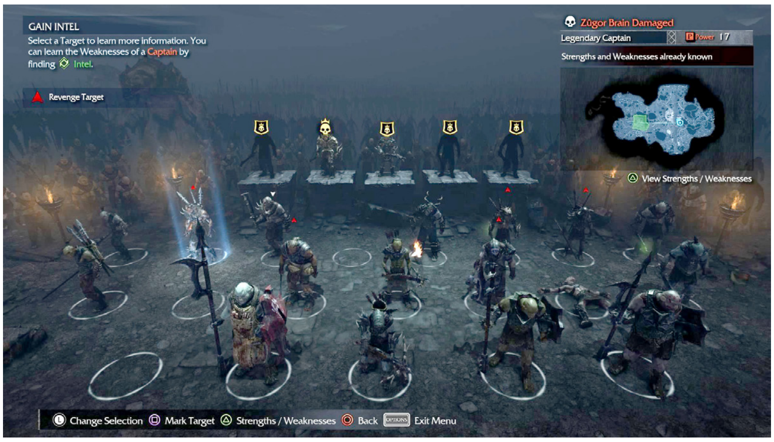

Figure 9.11: The enemy's ranks in the Nemesis system in *Middle Earth: Shadow of Mordor* (2014).

Other games such as *The Sims* (2000), *Façade* (2005), *Prom Week* (2012) fit very well in this category, since, in all, the player is focused on moulding the social network established by the game's characters.

There seems to be a revolving interest in this kind of traversal on behalf of game developers more dedicated to mainstream gaming with interest in narrative, e.g. at the Game AI Conference 2014, Stéphane Bura presented the *storybricks engine demo* (2014)[265] – which is a system for dynamic storytelling –, and, in a keynote at Game Developers Conference 2014, Ken Levine presented his ideas for a modular narrative system (2014).[266] Their ideas are focused on how storyline can be emergent, through the manipulation of the social relationships of the game's characters, revealing ways in which the emergent narrative can take a more relevant role in the storyline of a game. As Bura says towards the end of his keynote: "Characters are stories trying to tell themselves".

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265 At the time of writing this keynote could be seen at https://youtu.be/id-3sUo_DFU.

266 At the time of writing this keynote could be seen at http://www.gdcvault.com/play/1020434/Narrative or at https://youtu.be/58FWUkA8y2Q.

Some games may appear to express this type of traversal while, in fact, they are based on another. While *The Walking Dead* (2012) is heavily based on branching, the game also forces the player to make choices that have meaningful consequences on the relationships that other characters have towards hers, such as who lives and who dies, who eats and who has to wait, etc.. Consequently, some actions will please some and displease others. The game even informs us if a certain character became aware, memorised or took into consideration certain actions and statements the player chose to do or make. What is interesting about this game is that from the player's perspective it may sometimes seem like a modulating traversal, despite the fact that mechanically it is based on branching. A fact that on a second play-through becomes more evident due to the repetitiveness and lack of emergent behaviour, of emergent narrative.[267]

One of the main differences between branching and modulating can be expressed and summarised considering the following situation: in a given game, the player is granted the choice to kill or to help a given game character: 1) by killing it its friends become the player's enemy; 2) by helping it its friends become the player's friends. There is a considerable difference if this situation is experienced by means of a branching traversal opposing to a modulating traversal. In branching the consequences (antagonising or befriending the group) are static, are written in the *hardcoded narrative*. In a modulating traversal those consequences are dynamic, they are an expression of the *emergent narrative*. Although both seem similar, their expressions differ significantly and their experience as well. In a branching traversal the player is submitted to the hardcoded narrative, unable to dynamically change it, experiencing it only by choosing between predetermined events, static, fixed. In a modulating traversal the described situation is emergent, dynamic, and in alternative play-throughs the outcomes may eventually be subject to change, from minor alterations to more radical ones.

9.3.4 Profiling

Profiling essentially aims at the discovery of patterns in data in order to identify or represent something or someone, be them individuals or groups. While *profiling*, the system

267 See Stéphane Bura's keynote at Game AI Conference 2014 (2014) at https://youtu.be/id-3sUo_DFU?t=1m58s. Right at the beginning, he explains the difference between branching present in *The Walking Dead* (2012) and the narrative that is generated by the *Storybricks engine*.

analyses a player's behaviour and interprets the emerging patterns in order to establish a course of action. Profiling is not just about activating or collecting particular objects, or accomplishing quests. It features a much deeper and complex design. It is about what collecting that object or accomplishing that quest *means*. It is about understanding what it means to undertake tasks, about understanding *how* the player plays the game, *how* she accomplishes a certain goal or *how* she acts in a given situation, throughout a specific section or even for the duration of the entire game. It is about interpreting behaviour, analysing sets of actions and understanding even the most subliminal behavioural patterns, and acting based on that.

Silent Hill 2 (2001) features an interesting, although rarefied approach to this type of traversal. As its predecessor and many video games, it features several possible endings. What is new here is how the player accesses each ending.

Figure 9.12: *Silent Hill 2* (2001).

Silent Hill 2 is a horror game that tells the story of James, right after receiving a letter from his recently deceased wife, Mary, telling him that she is waiting at their special place – which James interprets as being Silent Hill. Summarising, James is traumatised for euthanising his wife (something that he is not aware of at the start of the game) and the city of Silent Hill where he meets Maria – a woman with extreme physiognomic resemblance to his wife – becomes a manifestation of his inner struggle between selfless love and selfish passion, making the player reflect on the reasons behind his actions: did he kill Mary because he loved her and wanted to end her suffering, or because he wanted his life back and to end his own suffering?

This not only sets the mood of the game but also seeds the mechanics for accessing one of multiple endings. There are three main endings that can be accessed depending on the player's behaviour, which the game system monitors in order to evaluate which one is more in tune with her actions. The player can access one ending if she meets specific requirements, consisting of sets of actions that she must or must not execute along the game. Some relate to specific one-time events and others to recurring patterns of behaviour. Meeting one of those requirements increases the chances of accessing the ending that corresponds to the group in which that particular requirement is included. Each of the three groups of requirements configures itself as a specific psychological profile within the context of the game, a profile that is associated with a given ending.

Lets briefly examine each of the three main endings. The ending entitled *Leave* consists of James accepting Mary's death, and finding inner peace. For accessing this particular ending, the player must meet most the following requirements:[268]

1. Listen to the entire hallway conversation;
2. Occasionally examine Mary's picture and letter;
3. Heal immediately after being hurt;
4. Exceed maximum health limit;
5. Do not try to return to the apartment;
6. Do not stay close to Maria.

268 The following three lists are mainly based on the following walkthrough: Matt Clark. 2006. *Silent Hill Ending FAQ: Ending FAQ / Guide to Silent Hill 2*. Gamefaqs.com (version 1.4). Accessed 2014/09/21. At http://www.gamefaqs.com/ps2/437029-silent-hill-2/faqs/23368.
Other walkthroughs provide similar information, see: Evil-Chicken. 2002. *Silent Hill 2: Restless Dreams-Endings FAQ (Spoiler-Free)*. Gamefaqs.com. Accessed 2014/09/24. At http://www.gamefaqs.com/pc/561577-silent-hill-2/faqs/16417; AIex. 2005. *Silent Hill 2: FAQ/Walkthrough*. Gamefaqs.com. Accessed 2014/09/24. At http://www.gamefaqs.com/pc/561577-silent-hill-2/faqs/34677; and Conquerer. 2002. *Silent Hill 2: FAQ/Walkthrough*. Gamefaqs.com. Accessed 2014/09/24. At http://www.gamefaqs.com/ps3/632692-silent-hill-hd-collection/faqs/22833.
A few adaptations were required in the text, mostly to correct misspellings.

One may say that in the context of this game, these requirements point to a profile that is characterised by expressing love or at least fondness for Mary (points 1[269] and 2), having self-esteem or at least a regular sense of self-preservation (points 3 and 4), and not expressing affection towards Maria, a character that antagonises the memory of Mary (points 5 and 6).

The ending named *Maria* consists of James reliving is passion for Mary, now in the form of Maria, that at the end starts to cough, which can be understood as presage. One may say that Maria represents all that James wanted his wife to be, but that she was not. She represents his inner, most selfish desires, his idealised mate, the passion without commitment, compromise, dedication, selflessness and ultimately sacrifice. All of the requirements needed to access this ending either aim at protecting Maria or ignoring the memory of Mary.

1. Try to return to Maria's jail cell after James finds her dead;
2. Stay close to Maria;
3. Revisit Maria's hospital room when she lays down;
4. Make sure Maria receives very little damage;
5. Do not attempt to return to Nathan Avenue after the bowling ally;
6. Do not examine Mary's picture and letter;
7. Do not stay far away from Maria;
8. Do not bump into Maria often.

The ending labelled *In Water* is where James is unable to make peace with himself and commits suicide, being that the only way he conceived for him and Maria to be together again. These requirements all point to depression, and negligence in self-preservation or self-care:

1. Examine Angela's knife often;
2. Read the diary on the hospital roof;
3. Stay at low health throughout the game;
4. Listen to the entire hallway conversation;

269 The hallway conversation features the voice of Mary in her sickbed, in an advanced stage of her illness. This happens right before the final boss of the game.

5. Listen to the headphones in the reading room after watching the tape;
6. Read the second message to James in Neely's Bar;
7. Do not heal right after taking damage.

As previously mentioned, we identified two types of requirements. *Type A* requirements consist of actions to be realised in one-time events, such as "Listen to the entire hallway conversation". And *type B* requirements that comprise behaviours that need to be incorporated by the player along the game, such as "Heal immediately after being hurt", "Occasionally examine Mary's picture and letter" or even "Do not stay close to Maria". In opposition to *type A* requirements – that are defined by hardcoded narrative events – these are strictly expressed by the posture and attitude of the player towards the game itself. For example, by immediately healing after being hurt the player has to always have healing items with him, and to not be constantly hurt, she has to ponder her decisions carefully and avoid unnecessary risks. This, in turn, may also mean that she cares about her character, her representation in the game world, thus expressing self-care, and eventually self-esteem. Consequently, the behaviour of the player within the game may become an expression of the player's own personality or, at least, of her current state of mind.

And to conclude, what is even more important here is that it is not a single action or requirement that aims at a specific profile. It is the entire set. So, taking this into consideration, if the conditions for attaining a specific ending, such as *Leave*, would only be to "Listen to the entire hallway conversation", we would be witnessing a branching traversal: either the player does that or she doesn't. If we add another *type A* requirement, such as "Do not try to return to the apartment", we are witnessing a slightly more complex branching traversal. Although, adding more requirements could eventually translate into forms of profiling. But, by simply adding a *type B* requirement, such as "Heal immediately after being hurt", profiling would emerge. So, as long as the player's behaviour possesses a meaning in the game, capable of meaningfully alter the game's state, a profiling traversal is present.

The endings in *Silent Hill 2* try to reflect the player's profile, behaviour, and decisions. This fosters a hidden potential towards a deeper intertwinement between the hardcoded and the emergent narratives, based on the player's behaviour. For example, if the player acts in a perfidious way throughout the entire game, at the end she won't be able to select 'the good ending' just because she wanted. Instead, the ending would have to reflect her choices, her behaviour, her actions.[270] Here, both play and narrative are deeply connected and interdependent, establishing a set of narrative possibilities based on their tension. And although *Silent Hill 2* is a somewhat simple example, this type of traversal is capable of setting a web of possibilities that may easily become unfathomable.

Explicit & Implicit

This type of traversal differs from the previous in a fundamental aspect: it features an indispensable need to *collect and interpret data*. This is something that may be more or less evident to the player. Data may be collected by various means and methods, and even while performing other modes of traversal. For example, the system may be collecting data based on the specific choices the player makes while performing a branching traversal. From that data, the system may understand that, when confronted, the player often opts to go with the choices that imply least conflict, for instance. And this is data that may be useful in the future.

The same may occur with bending: imagine that the system uncovers that the player is usually interested in pursuing optional content that is related with a specific character, but not with others. And also to modulating: where the system may figure out that the player is more interested in befriending characters with specific alignments, sets of beliefs, levels of wealth, occupations, gender, race, equipment, etc.; or the opposite, where the player usually modulates her character in a way that consistently antagonises that particular set of non-playable characters. With this in mind, we may state that profiling is pervasive, as it has the ability to occur along with other types of traversal.

Contributing to its potential pervasiveness is the fact that collecting data may be a pretty *implicit* process to the player. She may not be aware of it at all. Especially when the system collects data from more mundane acts. In *The Elder Scrolls IV: Oblivion* (2006), *acrobatics* is a skill that influences the ability of the player's character to jump and determines its resilience when falling. The higher the acrobatics skill level the farther and higher that

270 "No more could players play like a renegade for the entire story and then select the good ending just because they wanted one. This could open the potential for the player to actively become a story component as much as its main characters, which is an exciting idea." See *DSB: Silent Hill 2 Has the Best Ending in Gaming History*, in Kotaku: Talk Among Yourselves, at http://tay.kinja.com/dsb-silent-hill-2-has-the-best-ending-in-gaming-histor-1443614830.

character is able to jump or perform other abilities. And the more the player's character jumps, the higher the acrobatics stats get. This is not easily noticeable. However, when the player becomes aware of this process, she is able to take advantage of it – e.g. by jumping more often than they normally would in order to increase the acrobatics stats more rapidly. Their behaviour may even drastically change to the point that they alter the type of traversal altogether, e.g. *exploiting*[271] the game: finding places where their characters get stuck performing continuous jumps automatically.[272]

There are other situations where data is collected implicitly. Where the player may not be fully aware of the consequences of her behaviour, where she is unaware of being monitored, or at least, of what is monitored. *Silent Hill 2* (2001) is again a good example, as the game itself doesn't provide clues on how to achieve all of the possible endings. The system silently collects data and only at the end manifests the due consequences.

What is considered implicit or explicit monitoring not only depends on the disclosure on behalf of the game system or the game itself, but also on the perceptiveness of the player. Some actions are of course more explicit than others, and some are more controllable than others: consider e.g. differences between voluntary and autonomic actions[273] (Damásio 1994, Koster 2005). Ultimately, if the player perceives it and how it works, profiling becomes explicit; which is something that may or may not be intentional.

To Balance & To Unbalance

Interpreting the collected data may consist of a straightforward process or of a very convoluted procedure of a high algorithmic complexity. Let us imagine a game in which the player usually looses when fighting a specific type of non-playable character (NPC). This is a pretty simple case where the player is unprepared for a given challenge and looses the game. Upon verifying this fact, the game system may try to help the player to overcome that particular challenge, either by lowering the level of difficulty or by instructing her in how to overcome the NPC.

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271 In this chapter, *exploiting* is the last and the next type of traversal to be discussed.

272 For more information consult: http://elderscrolls.wikia.com/wiki/Acrobatics_(Oblivion).

273 For further reading on this matter consult chapter 5 (THINKING AND ACTUATION).

Lets develop this example a bit further, conjuring that the player usually looses not to a single type of NPC but to several others. By comparing their traits, the system may conclude that the player usually looses to NPCs that share a specific set of characteristics. With that information the system may better regulate the balance of the current state of the game, either by lowering their presence across the game or by providing means to promote their defeat: abilities or items, things that can be either found, fought for or even purchased.

This kind of behaviour is perceivable in some games and is known as *dynamic game difficulty balancing*, implemented with the goal of avoiding player frustration due to high difficulty, or boredom due to the opposite situation. By unbalancing the game, the system may create novelty, surprise, suspense, break the flow (Csíkszentmihályi 2009), set new paces, establish new challenges, present the necessity for alternate styles of play, etc..

Figure 9.13: ***Left 4 Dead*** **(2008).**

Left 4 Dead (2008) is a game that cannot be overcome by memorising the locations of the enemies in an attempt to anticipate their moves, because the game system dynamically adjusts their presence according to the performance of the player. In this context, the player experiences "a series of found narratives" (Bissel 2011), that ensures that she is not always attacked in the same place and by the same number of enemies. This is an element of surprise that creates a certain unease and novelty upon each play-through, thus unbalancing the game. In summary, profiling may be expressed by balancing or unbalancing the common and the uncommon, the known and the unknown, the much and the least, now and then, the here and there, thus contributing to an emergent narrative.

Shallow & Deep

Another expression of profiling emerges from the *player's play history*. In *Super Mario 3D World* (2013), if the player looses five times in a row in a level that has not been completed, she is granted a special power-up, known as the *invincibility leaf*, from the sixth try onwards. This power-up grants the playable character special abilities – such as partial invincibility and momentary hovering[274] – that ease the difficulty of the game and consequently the effort of the player while traversing that game level.

This is also an example of *dynamic game difficulty balancing* as well as an expression of profiling. But, now we are interested in another thing: the player's play history. Independently of how useful this particular feature is for maintaining enthusiasm and retaining players in the game, losing five times in a row in a level of *Super Mario 3D World* consists of a short play history – as each common level in this game is usually concluded in less than 300 seconds, which is their time limit. In this example, the actions are simple and the consequences are straightforwardly implemented: if the player looses five times in a row in a level that has not been completed, offer her a special power-up to ease the game. This is *shallow profiling*, focused on a short play history.

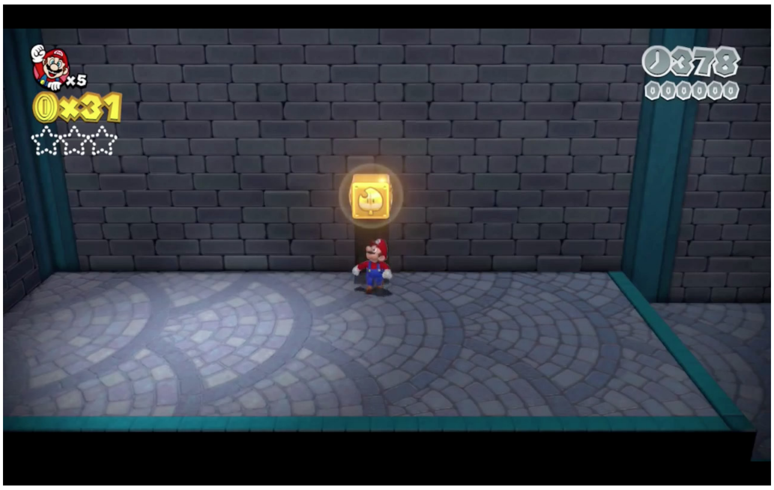

Figure 9.14: The invincibility leaf in *Super Mario 3D World* (2013).

274 At the time of writing more information could be found at http://www.mariowiki.com/Invincibility_Leaf and at http://www.mariowiki.com/White_Tanooki_Mario.

As profiling heavily consists in collecting data, the longer the player's play history is, the higher the volume of data collected may eventually be. And a high volume of data allows deeper and more profound analyses, that in turn may return more accurate results or at least more complex outcomes. On the other hand, a high amount of data may take longer to analyse – leading to delay in responsiveness[275] or, at least, to the implementation of the due consequences in farther futures. This is *deep profiling*, focused on long play histories.

The demonstration of *Metal Gear Solid V: The Phantom Pain* (2015) at Gamescom[276] 2014 revealed a particular feature that is of interest to this discussion. This presentation consisted of exhibiting a subsequent play-through of the mission that was firstly displayed at their E3[277] 2014 demo. So, while infiltrating the same military base, the player discovered some differences from the first play-through. Two of them are of our interest: 1) there were many more guards patrolling the area; and 2) many of them were wearing helmets. The reason for this, as explained in the video, is that in the previous play session the player performed several head-shots with a tranquilliser gun. The system acknowledged that as a recurrent behaviour and reacted in this round, by placing helmets on the heads of the next batch of enemy soldiers and by increasing their numbers.[278]

Figure 9.15: *Metal Gear Solid V: The Phantom Pain* (2015).

275 For more information on *responsiveness* consult chapter 4.

276 Gamescom is a video games trade fair that has been realised on a annual basis in Cologne, Germany.

277 E3 is the diminutive for Electronic Entertainment Expo, which a video games and computer industries trade fair realised annually at Los Angeles, USA.

278 For more info consult http://www.eurogamer.net/articles/2014-08-13-watch-17-minutes-of-mgs5-the-phantom-pain. Also, at the time of writing, a video of this presentation could be seen at the previous web address as well as at https://youtu.be/ik7AUiFOO5Y.

As a side note: this game was published in September 2015 – very close to the conclusion of this thesis – which is why our analysis is based on the referred presentation and not on playing the game itself.

So, ultimately, profiling is not just about measuring the player's successes or failures. It is also about understanding her competencies, either to ease or to difficult, to propose new challenges, or to dynamically shift or adapt the narrative. *Shallow profiling* usually results from monitoring simple actions in very specific situations, something possible in a short play history, such as loosing five times in a row. On the other hand, the outcomes of *deep profiling* stem from more algorithmic complexity, interrelating the obtained data in order to analyse the behaviour of the player and to identify patterns, which is something that may require a longer play history.

Prefiling vs Profiling

It has been a very common strategy in western role-playing video games – but not exclusive to these – to provide, usually at their beginning, a set of options for the player to parametrically customise her character.[279] This is noticeable in games such as *Mass Effect* (2007), *Fallout 3* (2008), *Dragon Age: Origins* (2009), *The Elder Scrolls V: Skyrim* (2011), *Kingdoms of Amalur: Reckoning* (2012), just to mention a few relatively recent games. In these, the player builds up her character by assigning specific values for parameters such as gender, age, race, social or historic background, physical and mental attributes, occupation, vocation or craftsmanship, among others… Each divergence potentially generates alternative playable characters, which will affect the way the player will play the game. These choices will help in determining which actions will be available or not to the player, thus encouraging alternative play styles. For example, if the playable character is incompetent in face-to-face combat but is an expert at sneaking and breaking and entering, that certainly promotes a style of play more based on furtive activities than on all out action. This shapes how the player devises her strategies, as the chances to succeed increase if she plays in accordance to the previously created profile.

Although in these cases the player creates a determined profile for her character(s), this is not profiling in terms of ergodic traversal as we have previously defined it. In some of these cases the profile is created before play, beforehand, by the player. In these cases, no data is collected by the system during actual play, as it only asks the player what kind of profile she desires. With all the risks that are usually appended to the introduction of

279 Probably, a trait inherited from Dungeons & Dragons table-top role-playing games that heavily influenced western RPGs in video games.

new terminology, instead of profiling we call this phenomenon *prefiling*, as the creation of the playable character's profile is done before playing the game itself; being forced upon the player, imposing the specific play styles that emerge from that. Opposing to profiling, *prefiling* is thus and fundamentaly an action of the player, where she essentially establishes a determined profile with the intention to promote certain behaviours and particular play styles. While prefiling the player acts based on the her expectations about the game world – expectations that are seeded on her current knowledge of the game and on her own personal experience –, creating a profile that she believes to best meet her needs and desires.

In *profiling* the system interprets and analyses the player's actions, the player's behaviour. In *prefiling* we may say that it is the player that analyses herself, that looks into her own history, makes choices based on her expectations, aiming towards a particular experience that she idealises as favoured. So, within this framework, prefiling doesn't constitute an experience of traversal any different from that of *branching*, *bending* or *modulating* – depending on the complexity of the system.

In *modulating* the player regulates the values of a series of parameters in order to influence the actors' social network. While *prefiling*, the player accomplishes the same. She preemptively makes a series of choices, regulating the disposition of other elements of the game towards her or the character she controls. This even happens in games that allow the player to constantly optimise or modify the playable characters' profile, which is a pretty common feature in many video games, such as *Borderlands* (2009), *Final Fantasy XIII* (2009), or *Dishonored* (2012); but also in *Super Mario Bros.* (1985), *R-Type* (1987), or *Contra III: The Alien Wars* (1992), if we think of the power ups as enablers or disablers of particular abilities that in turn reflect changes in play style, even if their effect is momentary. This is not profiling in the context of traversal as we have stipulated. From the player's perspective, her experience, her *journey*, her traversal is nothing more than what we have defined as modulating, where she regulates the disposition of the game elements.

We have also realised that in certain situations *prefiling* is also attainable by *branching* – in which the player is asked to choose from mutually exclusive paths. This is what happens in some games that feature pre-established profiles. In other words, the characters and their specific traits are already created, and, just as in a branching traversal, the player is only requested to mutually choose from the available options. In this case, one may say that if *customisation* is a job for *modulation*, *pre-customisation* is a task for *branching*.

Figure 9.16: *Contra III: The Alien Wars* (1992).

Many examples can be found for this particular situation, from *Street Fighter* (1987), *Streets of Rage* (1991) or *Tekken* (1994) to more recent games such as *Dungeon Siege III* (2011), *Super Mario 3D World* (2013) or *Hyrule Warriors* (2014), where the player chooses from various characters with dedicated special actions. But a more interesting example comes to mind. At the beginning of *Tales of Xillia* (2011), the player is forced to choose one of two possible main characters: Jude Mathis (a medical student proficient at martial arts) and Milla Maxwell (a being from another dimension). This choice will not only determine which parts of the story the player will witness, but will also condition the player into a certain the style of play as each character supports a particular set of abilities – at least during its beginning, as they join forces not much later in the game.

Figure 9.17: Character selection menu in *Hyrule Warriors* (2014).

Another example in which a single action, a single choice, affects all or a great number of elements in a game occurs in the difficulty level options screen. Choosing between easy or hard modes is also branching prefiling, as that alters the profiles of the involved various game actors.

Fantasy Life (2012) features the same basic example, but substitutes branching for *bending*. In this game the player is able to choose and at any moment alternate from 12 occupations (called *lives* in the game), each with unique abilities: angler, alchemist, blacksmith, carpenter, cook, hunter, magician, mercenary, miner, paladin, tailor, and woodcutter. Each occupation offers alternative ways of playing and consequently of experiencing the game. The implementation of a job system is not something new in video games, neither is that kind of newness of interest here. What is in fact of our particular interest is the fact that the player is able to alternate between each occupation and to retain the learned skills when doing so. By being able to change occupation, the player is able to access parallel or optional content, expanding her knowledge of the game world – a defining characteristic of bending traversal – customising her playable characters at the same time.

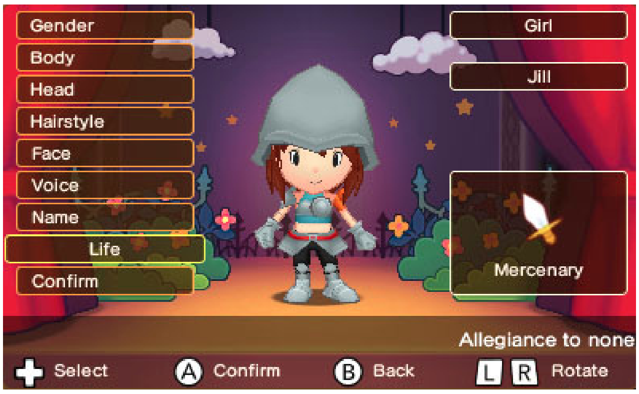

Figure 9.18: *Fantasy Life* (2012).

In conclusion, while profiling the system adapts to the player, basing its actions on her behaviour. On the other hand, while prefiling it is the player that adapts to the system, explicitly choosing from the available options. *Profiling* is essentially an act of the system based on its knowledge of the player. *Prefiling* is essentially an act of the player based on her knowledge of the game and its system.

9.3.5 Exploiting

Although the previous types of traversal are quite different between themselves, they bear one thing in common: they operate in a part of the system that was planned, that was meant to be, that was designed. As soon as we acknowledged this fact, we searched for an alternative type of traversal, unbound (or not exclusively bound) to the side of the system that was intentionally designed, but to the side that is dysfunctional and untested.

> Exploits (…) are "found" actions or items that accelerate or improve a player's skills, actions, or abilities in some way that the designer did not originally intend, yet in a manner that does not actively change code or involve deceiving others. (Consalvo 2012, 114)

When players traverse a game exploring manifestations of specific malfunctions in the game system, we may say that they are *exploiting* it. Glitches and bugs are manifestations of specific malfunctions within the system. They result from unforeseen and unresolved problems, and are something that was not supposed to be. While some glitches may open a door to a new and unpredictable set of possibilities for the player to experience, others may actually prevent the player from progressing – originating frustration and disapproval – and since they were not supposed to exist in the first place, developers tend to eradicate them over time. In fact, contemporary video games often support online updating, allowing developers to patch the system as a means to erase errors in the code and to prevent system malfunctioning. On the other hand, some errors come to be adopted by developers, as is the case of the 'double cherry' power-up in *Super Mario 3D World* (2013), that creates another instance of the playable character with both being controlled simultaneously. But, of course, once it became an actual official feature of the game, it also became part of the designed algorithm.[280]

280 The double cherry power-up resulted from an error in the code while the game was in development, which was then adapted into an official feature. For more info see *Why double Mario forced Nintendo to change Super Mario 3D World* at http://www.gamesradar.com/double-mario-forced-nintendo-change-super-mario-3d-world/.

Figure 9.19: The double cherry power up in *Super Mario 3D World* (2013).

But considering actual malfunctions, in the beginning of *Final Fantasy IV* (1991), thanks to a glitch, the player is able to skip a major section of the game. When following the story of the game she is forced to visit 'Mist', the hometown of an important character. But by skipping it, a crucial sequence in the hardcoded narrative never occurs, and as those events never take place the game breaks altogether.

> At the beginning of Final Fantasy IV, your heroes Cecil the Dark Knight and Kain the Dragoon are sent to deliver a package to the sleepy town of Mist. Once you get there, the package detonates and sets fire to the town. You meet a little girl named Rydia, whose mom you've just killed. She summons a monster to get revenge. Then Cecil blacks out. He wakes up in a field on the other side of the mountains. Kain is gone. Rydia is lying nearby, unconscious. Cecil picks up the girl and heads out into the desert.
>
> By skipping Mist [Rydia's hometown], we skip that entire sequence. The package never explodes. Rydia's mom never dies. Kain never leaves. And the whole game is broken as a result. (Schreier 2013)

In the earlier *Final Fantasy* games the player's abilities to explore the world map increase as the game and its narrative progress. The player usually starts by traveling across the world map on foot, acquiring, later in the game, other means of travel such as ground and water vehicles, or by riding a sort of fictional birds called 'chocobos'. Traditionally, much later into the game, the player is able to get the means to travel by air – usually through an airship – that give her the possibility to journey to places that were once unreachable.

Thanks to a glitch, in *Final Fantasy VI* (1994), the player is able to acquire an airship way too early. This enables the player not only to further explore the game world, but also to experience narrative sequences out of order and witness other strange events.

> But there's a hell of a lot you can do when you have the airship this early in the game. You can do story events out of order, break sequences, and glitch out Final Fantasy VI in all sorts of ways. (Schreier 2012)

As at that time the player was supposed to be constrained to a given location, the events in other parts of the game world could not, in principle, have been triggered. But when the player suddenly appears in parts of the world where she was not supposed to be in, the system assumes (sometimes) that the game that should lie behind was already experienced and tries to keep developing the narrative, although it could not make a more wrongful assumption. And therefore, the game sometimes breaks.

In *Tomb Raider* (1996), the player can usually only progress in the game if she finds a given key-item that opens doors, gates or something similar that blocks her path. Finding that item may be the motivation for the player to explore the game world and to undertake the sub-challenges that are eventually encountered. But sometimes the player may manage to go through those blocked doors without using a key. The player just has to execute a couple of moves with her playable character in order to be transported to the next room. By doing so, enemies may already have been spawned in that specific room, but since the door itself hasn't been opened, they are not active and remain static, inert. This is an interesting glitch that illustrates how the game system was still not aware of the player's presence. It is as if the player has vanished from the game's radar.

Some glitches can be found almost anywhere, but some are bound to specific locations or events. In *Tomb Raider 3* (1998), there is a bug in the code that allows the player's avatar to move from the floor straight to the roof. Players normally use this to further explore the game, to reach inaccessible areas, or at least not so easily accessible.

In *The First Level of Super Mario Bros. is Easy with Lexicographic Orderings and Time Travel... after that it gets a little tricky* (2013) Tom Murphy VII reports the work he underwent in creating a software program – *Learnfun & Playfun* – that plays *Super Mario*

Bros. (1985). He also published a video showing the program learning how to play the game. At a given moment, his program finds a way to kill Goombas[281] jumping from below. For a moment, he thought that was an isolated incident, but the program started to use it recurrently as a gameplay method. In other words, in a move that would surely kill Mario (the game's playable character), the glitch allows him to not only survive but also to kill his enemy.

> Mario bounces off one Goomba up into the feet of another. Not only doesn't he have enough velocity to reach the platform, but he's about to hit that Goomba from below. Believe it or not, this ends well: Playfun is happy to exploit bugs in the game; in this case, that whenever Mario is moving downward (his jump crests just before the Goomba hits him) this counts as "stomping" on an enemy, even if that enemy is above him. The additional bounce from this Goomba also allows him to make it up to the platform, which he wouldn't have otherwise! (Murphy VII 2013)

This raises the following question: Is this type of traversal cheating? Is a player that is exploiting the game cheating, or not? Was Murphy's computer program cheating? And can computer programs even cheat?

To Cheat or Not To Cheat

In the world of video games, cheats usually allow players to subvert the original mode of gameplay, either by easing the game – adding extra lives is just one example – or just to achieve certain locations, events, or obtain goods that they couldn't otherwise get. Cheats usually are hardcoded in the system, and many times they are development tools that allow programmers to explore the game world when they are working on it. Summarising, they may start as development tools and when they reach the hands of the players they become cheats. So, we may say that they are intentionally programmed into the game system.

On the other hand, when exploiting the game, the player is pursuing new fields of possibilities previously unseen and unintentionally programmed into the system, thus explor-

281 A Goomba is a common and classic enemy in Super Mario games.

ing the game beyond what was previously established and tested. We may even say that the player is aware of the game as a computational system and that she seeks its frailties. So, now the question is: can this be considered cheating?

> Lessig has suggested that "code is law," but if code is law it is law as a "management of infractions." (Goffrey 2008)

We do not think so. We believe that the player is not cheating the game, but *breaking* it. We use this term because the game may actually collapse! The system may become unstable and crash, the player may be prevented from progressing in the game, as the sequences of certain events may be shuffled resulting in paradoxes and other abnormal activities, behaviours and events. Depending on the glitches and how they affect the system, the traversal may become rather unpredictable.

> Not all players see exploits as cheats, for a couple of reasons. First, they are available to all players shortly after they are figured out, and can sometimes become an acceptable part of gameplay, at least in particular games. They thus function as another aid for gameplay, much like strategy tips or maps made available to any player dedicated enough to search for them and then practice their use. Likewise, most of these exploits require no alteration of the game code—another practice that signals cheating to players. Many players reason that because it is not specifically prohibited by the developer's code, it might not be a cheat. (Consalvo 2012, 115)

So, cheating subverts the ludological system, adding changes to the original rules, to a mode of play, or to the game state. Exploiting the game consists in breaking it, in exploring the limits, the fallibilities and shortcomings of the system that supports the game itself without changing its rules. The glitches were actually there all the time; they are part of the system. So we may say that the major difference here is that cheats are intentionally designed, and that glitches are accidents. We may say that the latter are accidental rules of the system.[282]

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282 "Although I've called many of the activities cheating, it's important to remember that at least some of them are still debated over and argued about, whether they should be conceptually defined as belonging to either the cheating or skillful gameplay category. Exploits can easily reside in either location, depending on the particular trick and the player community. Social engineering varies and can also be thought of as a skilled variant of playing the game (or the gamer), rather than doing something unethical. Yet the use of technological code—hacks, bots, or third-party programs—seems to raise more of a red flag for those wishing to demarcate lines between cheating and fair play." (Consalvo 2012, 126)

> The algorithm, which Turing understood as an effective process for solving a problem, is merely the set of instructions fed into the machine to solve that problem. Without the algorithm then, there would be no computing. (Goffrey 2008)

9.4 Conclusions and Future Work

We have defined five types of ergodic traversal: from 1) making mutually exclusive choices; to 2) accessing different and optional paths and layers of information; to 3) crafting relationships regulating the disposition of actors within the game-world towards the player and each other; to 4) acting in a system that monitors the actions of the player, whether she is aware of that or not, and that makes its decisions based on that; and to 5) exploiting the game, taking advantage of the system's frailties, problems, and inconsistencies in order for the player to explore alternative narratives operating in a part of the system that is untested, accidental, and not meant to exist. All of these are dependent on the player's actions, but provide different experiences.

The potential pervasiveness of the profiling traversal makes us ponder on how all of these types of traversal relate with each other. What kind of relationships may be established between them? No doubt that many video games consist of diverse types of traversal. Yet, they differ from each other. Thus an understanding of how they function together is necessary. And finding the nuances that mark those differences is something to undertake, as examining those variations may lead us to more targeted definitions. By grasping this we can aim at a better understanding of gameplay dynamics and at a deeper discernment about player experience, an experience that is promoted by distinct concurrences between hardcoded and emergent events. Acknowledging that can ultimately lead to the unraveling of new and innovative games, or at least alternative ways of experiencing and thus designing them. So, understanding their relationship seems now even more crucial to future studies on this subject.

Also, the discussion about whether exploiting the game was or not cheating, raised another question: Can cheating be another type of traversal? If cheating is different from exploiting, can it consist in an alternative way of experiencing the game? And how does that differ from the other types of traversal?

This fact makes us wonder if there are more types of traversal that still operate in a similar fashion. In other words, it makes us wonder if there is a way of traversal that consists in adding new elements, tampering or even hacking the system, breaking the boundaries of the system itself.

On another subject and considering the fields of game design and of game development, one could say that profiling is similar to what is called *player behaviour modelling* (PBM). But, although they operate in overlapping fields, they diverge in perspective. PBM is a game design technique that is often put in motion with a main goal of creating models/abstractions of players in order to raise overall player satisfaction, regulating predictability, difficulty, etc., something that occasionally happens before actual play.

As a mode of traversal, profiling consists of an experience that emerges from the relationship between the emergent and the hardcoded narrative, and as such it is a phenomenon that occurs in runtime, that is solely witnessed while playing. Profiling may result as an expression of some PBM techniques in action, but it does not solely rely on PBM techniques, and neither do the results of the implementation of PBM techniques solely express profiling traversals. In fact, the outcomes of several procedures in PBM are the result of activities seeded in other kinds of traversal, namely through what we defined as *prefiling*.

Thus, considering these facts and despite their divergences, a thorougher study on what kinds of modelling procedures can be classified as profiling needs to be developed.

As a final remark, we believe that these types of traversal not only contribute to a definition of the player's personal experience of journey through a given video game, but may also provide insight on the experience of the interactor while using other computational media, in diverse fields of study from interactive media art to user experience and interaction design.

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Part iii: Wrapping-Up

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10. Analyses

In this section we do not aim to analyse video games in an attempt to prove that the model works flawlessly. We believe that such a course of action would neither serve as proof of the model's infallibility nor of its applicability, therefore risking in serving no concrete purpose at this point of the work. Instead, to move away from what at this stage could be understood as 'data dump', in this section we aim at an explanation of various ways in which this model can be used for the analysis of player-system action in video games.[283]

We start by enunciating a brief summary of what to look for when analysing video games with this model:

- Chronology: Are the player-system actions focused on altering or replaying events, are they attentive to the present time, or are they concentrated on anticipating events?

- Responsiveness: Are the player and the system responsive to each other's actions, are they listening to each other's output but not responding, are they doing the opposite of that, or are they completely inactive?

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283 We are, however, aware that analyses of large groups of video games can be useful, specially e.g to help discerning what are the most common/uncommon types of actions in which genres, or in which eras or generations, etc.. But at this time, that would be a frivolous task, since it would not be focused on validating this model but on inspecting a large amount of games, a statistical analysis whose results would not demonstrate how the model functions and what are its basic capabilities. That is why that is a task that is not part of the goals of this work but for future studies.
Concluding, what is of most importance at the current level of development of this work is to demonstrate various ways of using this model, of how various types of analyses can be performed and what kind of results do they return. In other words, this chapter is focused on the applicability of the model.

- Thinking and Actuation: Do the player's actions derive from a thought out plan, are they based on skills mastered by rote, or are they seeded on the physiological operations of their body?

- Transcoding: Does the player have a proxy in the game world? If so, how do the player's actuations relate with its actions? If not, what is the scale of the player's actuations in relation to the scale of the game world?

- Focus: 1) Does the player have a short, long or no time span to act? 2) Does the player witness the game through a single frame, non-simultaneous frames, or simultaneous frames? 3) When playing the game, is the player's sensorial scope narrow, wide, or does it encompass the totality of the game world? 4) When the player realises two or more actuations simultaneously, are they automated, non-automated or both?

- Depth: Are the player's actions centred on 1) an internal process of interpretation and simulation, 2) exploring the game system's behaviour, 3) reconfiguring the system's behaviour within the boundaries of predeterminate parameters and values, or in 4) adding new actors and behaviours to the game system?

- Traversal: Does the player mainly traverse the game by 1) choosing from mutually exclusive paths, 2) exploring optional paths, 3) regulating the surrounding social network of actors, 4) having their behaviour analysed and interpreted by the system, which then establishes courses of action by itself, or 5) exploring malfunctions within the game system?

When confronted with the necessity to answer these questions, one may wonder if the player does not execute the exact same actions all the time, in which moments of the game should these questions be arisen? In other words, since the behaviours and actions of both the player and the system may change over the course of the game, does a classification of action like this needs to be revised each time that happens? And, should one proceed towards a description of action involving all of these dimensions or just focus on particular ones? With these questions in mind, we decided to ground the analysis procedures on two main issues: *scope* and *approach*.

10.1 Scope

In the same way that actors are constituted by networks of other actors, actions can also be constituted by simpler actions: e.g. sneaking is a complex action constituted by hiding, moving silently, observing and understanding other actors' actions, etc.. Using this model one is able to inspect those various levels. However, when analysing or designing a video game it is often a good idea to focus on its main features, which in terms of gameplay consist of its core mechanics.[284] Either consisting of a single action or being "composed of a suite of actions" (Salen and Zimmerman 2004, 316), a "game's core mechanic contains the experiential build blocks of player interactivity[, representing] the essential moment-to-moment activity of players (…). During a game, core mechanics create patterns of behavior, which manifest as experience for players." (317) Therefore, the core mechanics of a game pinpoint to a general profile of how the player interacts with the system.[285] Examining that profile is a good way to start, an effort that requires an inspection of the actions that emerge from the core mechanic, actions that are enacted over and over during play, and that from hereafter – to simplify – we will refer as *core actions*.

On the other hand, there are also *local actions*, which can be characterised as those that occur only at particular situations – sometimes taking place just once during the entire game – and that may completely differ from every other action in the game. These actions are the result of game mechanics that are able to produce momentary but radical alterations on a game's traditional functioning, in order to add a sort of transient variety to the game, conveying singular experiences to the player. In fact, some of the examples we provided throughout this work are seeded by local actions. The moment of confrontation with the sniper 'The End' in *Metal Gear Solid 3: Snake Eater* (2004) is such an example.[286] The game's core actions do not consist in having the player wait about a week to eliminate their enemies, however, in this case, that is a feasible course of action.

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284 "Every game has a core mechanic. A core mechanic is the essential play activity players perform again and again in a game." (Salen and Zimmerman 2004, 316)

285 For more information on core mechanics see Adams (2014, 351), and game mechanics see Sicart (2008), Järvinen (2008), and Adams and Dormans (2012, 1).

286 See section 4.3.1.1.

While local actions may add some variety and surprise to an otherwise repetitious game, when too frequent they may compete with the core actions, which may eventually break a game's consistency. In a similar way, the more the number of core mechanics a game possesses the more fragmented it may also become, something that, according to Koster, may eventually lead to "kitchen-sink design":

> It's a massively multiplayer strategy-based real-time shooter with RPG character development, puzzle game combat, a racing subgame, and you play it on a dance mat! (Koster 2005, 127)[287]

Therefore, an analysis focused on the core actions of a video game will reveal the foundations of the experience of the player. Hence, if one wants to analyse the player-system actions in a given video game in general terms, an inspection of the core actions is advised. Conversely, an inspection directed at a game's local actions aims at an understanding of particular events that imprint change in an otherwise potentially foreseeable experience.

10.2 Approach

The action-based relationship between the player and the game system is grounded on all 7 dimensions, which in conjunction give origin to diverse types of actions that shape the player-system relationship. In order to proceed to an analysis, whether focusing on core or local actions, we may wish to follow different approaches, from which we propose three: *descriptive, comparative,* and *relational.*

10.2.1 Descriptive

A descriptive analysis consists in listing the variables for each and all 7 dimensions, giving us a general perspective on the action-based composition of a given game. If we consider that each description cannot include more than one variable in each dimension, we may quickly find that, considering the current state of this model, there are 2.332.800

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287 Extracted from the text in a illustration, which sarcastically depicts a fictional game being presented in a game fair booth.

possible combinations.[288] The objective here is to choose one of those particular combinations by picking the variables in each and all dimensions that better describe the actions being inspected.

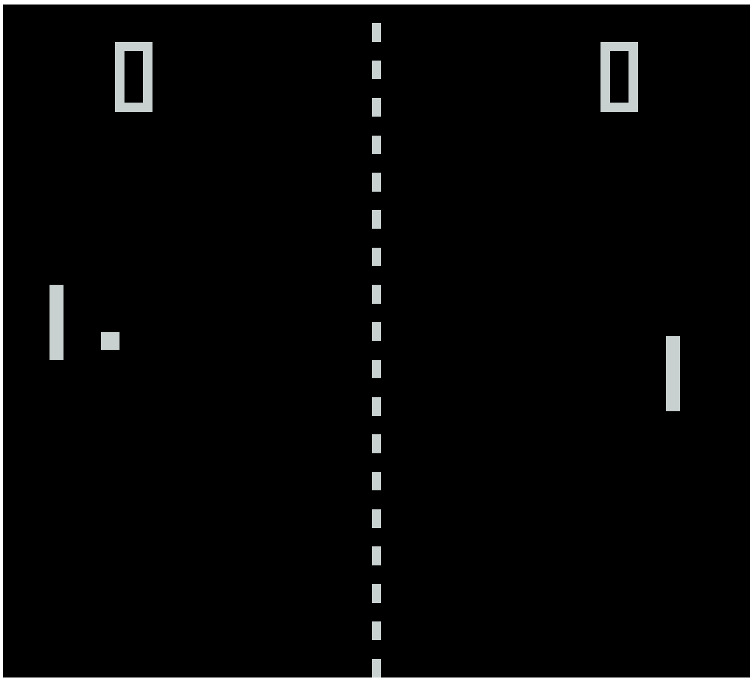


Figure 10.1: A screenshot of a version of *Pong* (1972).

Starting with a simple game, when analysing e.g. *Pong* (1972), one may say that it is a video game in which the player-system relationship is mainly directed by *present actions,* following *R:R methods,* in which the player pursues their objectives by means of *trained actions,* and through *arbitrary articulations.* The player's actions are focused on *short time spans,* where she witnesses the game world through a *single frame,* possesses a *total sensorial scope* on the game world, and is mainly engaged in *non-automated actuations,* while fulfilling *function 2, and* traversing the game by *branching.* This description seems pretty much complete, however a bit complex.

288 This is an extremely high number, and in consequence we cannot confirm the viability of all combinations. In fact, ahead we will mention the fact that some combinations are conflictual and others seem rather incompatible – a study that is aimed towards future developments.

Table 10.1: Description of the core actions in *Pong* (1972).

Chronology	Present actions
Responsiveness	R:R methods
Thinking and Actuation	Trained actions
Transcoding	Arbitrary articulation
Focus	Short time span
	Single frame
	Total sensorial scope
	Non-automated actuations
Depth	Function 2
Traversal	Branching

Pong is a very simple game. So, let's consider a very different and much more complex game, such as *Final Fantasy VII* (1997). This game exhibits three distinct core actions – **exploring**, **combating**, and **customising** – and many other local actions. Focusing on the former, exploration is set in motion when the player navigates the game world, talking to other characters, walking, running, traveling by diverse means of transportation, etc., in order to examine the game world. Combat is mainly triggered by means of random encounters while the player is exploring the game world. Upon encountering enemies, the current game world is substituted by a much smaller area, an arena where the player's characters[289] face enemies in battle. Here, the characters' actions are executed by being selected through series of menus. Defeating strong enemies requires the player to devise adequate strategies, which implies this phase to be anticipated by moments of preparation for combat. Those moments consist on customising the playable characters and their equipment to best fit the foreseeable needs in combat, taking into account that each class of enemies possesses a different set of traits. With this in mind, a descriptive analysis on this game needs to be attentive to all three core actions – which triplicates the effort.

289 The game allows a maximum of three controllable characters per battle.

Table 10.2: Description of the core actions in *Final Fantasy VII* (1997).

	Exploring	Combating	Customising
Chronology	Present actions	Preemptive actions	Preemptive actions
Responsiveness	R:R methods	Alternates between R:R and R:N, depending on the strategies and effects in battle	R:N methods
Thinking and Actuation	Trained actions	Premeditated actions	Premeditated actions
Transcoding	Arbitrary articulation	Symbolic articulation	Symbolic articulation
Focus	No time span	Short time span	No time span
	Single frame	Single frame	Non-simultaneous frames
	Wide sensorial scope	Total sensorial scope	Wide sensorial scope
	Non-automated actuations	Non-automated actuations	Non-automated actuations
Depth	Function 2	Function 3	Function 3
Traversal	Bending	Modulating	Modulating

This kind of analysis gets increasingly exhaustive the more core actions a given game exhibits, and contemporary video games can resort to quite a few. Lets e.g. try to analyse *Deus Ex: Human Revolution* (2011), a game based on at least 4 core actions: **exploring**, **customising**, **sneaking**, and **all out attacking**. In this game, the player is able to choose one from the last two actions. This is a situation very evident when core mechanics promote opposing actions. In this case, the player plays the game choosing to engage in a lethal or in a non-lethal approach, utterly shaping the experience of play.[290]

290 This ability to choose the kind of gameplay is actually one of the central features of the game.

Table 10.3: Description of the core actions in *Deus Ex: Human Revolution* (2011).

	Exploring	Customising	Combating	
			Sneaking	All out attacking
Chronology	Present actions	Preemptive actions	Preemptive actions	Present actions
Responsiveness	R:R methods	R:R methods	N:R methods	R:R methods
Thinking and Actuation	Trained actions	Premeditated actions	Premeditated actions	Trained actions
Transcoding	Arbitrary articulation	Arbitrary articulation	Arbitrary articulation	Arbitrary articulation
Focus	No time span	No time span	Long time span	Short time span
	Single frame	Non-simultaneous frames	Single frame	Single frame
	Wide sensorial scope	Wide sensorial scope	Narrow sensorial scope	Narrow sensorial scope
	Non-automated actuations	Non-automated actuations	Non-automated actuations	Non-automated actuations
Depth	Function 2	Function 3	Function 1	Function 2
Traversal	Bending	Modulating	Branching	Branching

The complexity involved in this approach assumes even broader proportions when analysing even more complex games, such as *The Elder Scrolls V: Skyrim* (2011), where the player is free to customise the playable character from an enormous variety of traits, which decisively condition the style of play. For some players this game can be about sneaking and stealing, while for others it can be about brute force, or about spells and strategy, etc..

Figures 10.2, 10.3, 10.4, and 10.5: Four screenshots from *Deus Ex: Human Revolution* (2011), exploring (top-left), customising (top-right), sneaking (bottom-left), and attacking (bottom-right).

So, an exhaustive description of a game can be achieve like this, but the more complex this gets, the less practical it becomes. In sum, this approach has the advantage to provide a full description, including all dimensions. However, its greatest disadvantage is that it is hard to manage in more complex games. With this in mind, the types of analysis we present in the following sections are based on more focused approaches, providing a deeper insight on the results obtained by this type of analysis.

10.2.2 Comparative

A comparative analysis is focused on comparing the different core actions, pinpointing their differences and commonalities, operating on the results of a descriptive analysis. This procedure allows us to do two things: 1) by inspecting what is in common between core actions, it evidences which variables are *constant* throughout the game; and 2) by locating the types of action that are not common, it raises an understanding on how the player-system pair changes behaviour, offering a view on what types of actions are *transient* throughout the game. A perspective on what actions are constant or transient along a given game give us a look into the field of possibilities that the player is constrained to when interacting with the game system.

As this is only applicable to games with more than one core action, we will start with *Final Fantasy VII*.

Table 10.4: Description of the core actions in *Final Fantasy VII* (1997) with common variables highlighted.

	Exploring	Combating	Customising
Chronology	Present actions	Preemptive actions	Preemptive actions
Responsiveness	R:R methods	Alternates between R:R and R:N, depending on the strategies and effects in battle.	R:N methods
Thinking and Actuation	Trained actions	Premeditated actions	Premeditated actions
Transcoding	Arbitrary articulation	Symbolic articulation	Symbolic articulation
Focus	No time span	Short time span	No time span
	Single frame	Single frame	Non-simultaneous frames
	Wide sensorial scope	Total sensorial scope	Wide sensorial scope
	Non-automated actuations	Non-automated actuations	Non-automated actuations
Depth	Function 2	Function 3	Function 3
Traversal	Bending	Modulating	Modulating

According to **table 10.4**, we may predicate that this is a game whose core actions **exploring** and **combating** are deeply contrasting. In fact, that difference is heavily felt when playing the game, with combats often hindering the sense of flow when the player is exploring the game world. The difference is so discernible that the game system actually loads completely different environments when alternating between these activities.[291] On the other hand, the core action of **customising** is much more easily relatable with the action of **combating**. In visual terms, this seems to be noticeable too.

291 The player actually has to wait a few seconds for the game to load the environment, in the beginning of each combat.

Figures 10.6, 10.7, and 10.8: Three screenshots of *Final Fantasy VII*, while exploring (left), combating (middle), and customising (right).

When executing the same procedure for *Deus Ex: Human Revolution*, we are automatically confronted with a higher level of complexity. The variable in TRANSCODING is constant: *arbitrary articulations*. RESPONSIVENESS is mainly about *R:R methods*, except when **sneaking** – *N:R methods.* CHRONOLOGY and THINKING AND ACTUATION vary depending on the chosen combat style, from *present* to *preemptive actions*, and from *premeditated* to *trained actions,* respectively.

In terms of FOCUS, the game is mostly played with *no time span* to act, although that is frequently interrupted upon encountering enemies (combat). If the player chooses to **all out attack** the change of behaviour is more contrasting (*short time span*), which makes the game alternate between a paused experienced (found in **exploring** and **configuring**) and a heavily agitated one. However, if the player opts for **sneaking**, the change is less contrasting (*long time span*), making the game a more paused and quiet experience, but tense nevertheless.

The game alternates between a *wide* and *narrow sensorial scope*, making combat more focused. The game is largely about witnessing the game world through a *single frame,* except when configuring, which is achieved through multiple *non-simultaneous frames* (due to the various non-diegetic menus). Regarding DEPTH, if the player chooses to **all out attack**, then function 2 assumes the predominant role, otherwise the game is completely heterogenous. Finally, the player TRAVERSES this game by *bending* while **exploring**, by *modulation* while **configuring**, and by *branching* when **combating**.

Table 10.5: Description of the core actions in *Deus Ex: Human Revolution* (2011) with common variables are highlighted.

	Exploring	Customising	Combating	
			Sneaking	All out attack
Chronology	Present actions	Preemptive actions	Preemptive actions	Present actions
Responsiveness	R:R methods	R:R methods	N:R methods	R:R methods
Thinking and Actuation	Trained actions	Premeditated actions	Premeditated actions	Trained actions
Transcoding	Arbitrary articulation	Arbitrary articulation	Arbitrary articulation	Arbitrary articulation
Focus	No time span	No time span	Long time span	Short time span
	Single frame	Non-simultaneous frames	Single frame	Single frame
	Wide sensorial scope	Wide sensorial scope	Narrow sensorial scope	Narrow sensorial scope
	Non-automated actuations	Non-automated actuations	Non-automated actuations	Non-automated actuations
Depth	Function 2	Function 3	Function 1	Function 2
Traversal	Bending	Modulating	Branching	Branching

It is a pretty complex comparison, but one from which we may extract a fact: in terms of action, this game is about the choice of playing it by means of *preemptive* and *premeditated actions* – complemented with transitions between *no time spans* and *long time spans* to act –, or supported by *present* and *trained actions* – complemented with transitions between *no time spans* and *short time spans* to act. The rest just seems to provide a particular context that, while confining the game in terms of action, does not significantly modify this feature.

Concluding, an advantage of this comparative analysis is that it enables the extraction of the main action-related features of games with more than one core action. It also better depicts the dynamic and ephemeral character of action, since it is not limited to a simple description but mainly focused on their impermanence along the game. Nevertheless, this procedure is limited to games with more than one core action.

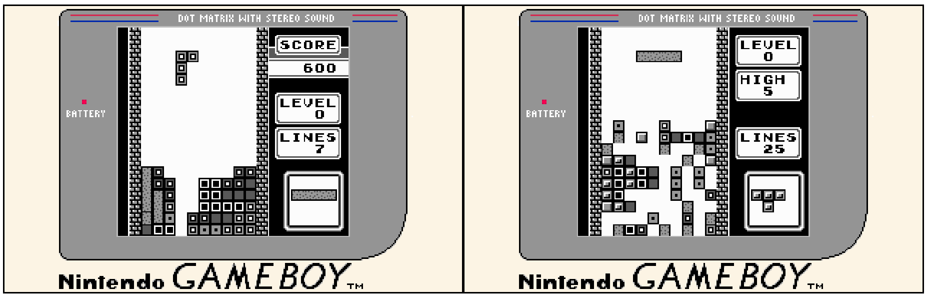
It is also possible to use this kind of analysis when comparing different versions of a given video game, something that can be used either to guarantee that the original game and its versions possess the same core actions or to pinpoint their divergences, an essential knowledge for the designer to conduct convergent or divergent player experiences.

10.2.3 Relational

A relational analysis is focused on the relationships between the variables on an *inter-dimensional* or *intra-dimensional* level, also operating on the results of a descriptive analysis.

Inter-dimensional

An inter-dimensional relational analysis is focused on the relationships that exist between the variables in each dimension, which can be characterised as *conflictual* or as *non-conflictual*. For example, we may say that one of the major challenges in *Tetris* (1984) is seeded on a conflict originated between the dimensions of FOCUS and of THINKING AND ACTUATION: the player has to arrange the descending blocks within a *short time span* while preparing the board for incoming ones, which implies *premeditated action*. The player is then confronted with the need to act quickly and to simultaneously elaborate a plan, a daunting effort that often ends up in improvisation.



Figures 10.9 and 10.10: Two screenshots of *Tetris* (1984).

Table 10.6: Description of the core actions in *Tetris* (1984) with conflictual actions highlighted.

Chronology	Preemptive actions
Responsiveness	R:R methods
Thinking and Actuation	Premeditated actions
Transcoding	Symbolic articulation
Focus	Short time span
	Single frame
	Total sensorial scope
	Non-automated actuations
Depth	Function 2
Traversal	Branching

In *Final Fantasy VII*, while **combating** the player is challenged in a similar manner as in *Tetris* – *premeditated actions* versus *short time spans* to act. However, when **exploring** or **customising** the player is not confronted with challenges of that nature.

Table 10.7: Description of the core actions in *Final Fantasy VII* (1997) with conflictual actions highlighted.

	Exploring	Combating	Customising
Chronology	Present actions	Preemptive actions	Preemptive actions
Responsiveness	R:R methods	Alternates between R:R and R:N, depending on the strategies and effects in battle.	R:N methods
Thinking and Actuation	Trained actions	Premeditated actions	Premeditated actions
Transcoding	Arbitrary articulation	Symbolic articulation	Symbolic articulation
Focus	No time span	Short time span	No time span
	Single frame	Single frame	Non-simultaneous frames
	Wide sensorial scope	Total sensorial scope	Wide sensorial scope
	Non-automated actuations	Non-automated actuations.	Non-automated actuations
Depth	Function 2	Function 3	Function 3
Traversal	Bending	Modulating	Modulating

Contrarily, all dimensions in *Pong* and in *Deus Ex: Human Revolution* seem to possess *non-conflictual* relationships.

These conflictual relationships seem to aim at some sort of operational challenge, in the sense that the player is confronted with the necessity to act in ways and under conditions that are contrasting.

Intra-dimensional

An intra-dimensional relational analysis is focused on pinpointing eventual changes in the variables of a given dimension. This is a situation evident in games where the player is forced to transform *premeditated actions* into *trained actions*, for example.[292] However, that is not the only case. When **combating**, the dimension of *responsiveness* in *Final Fantasy VII* alternates between R:R and R:N, depending on the strategies and effects in battle. Combat in this game can be highly complex, since each type of enemy possesses a distinct set of traits, and the weapons, equipment and abilities at the player's disposal change throughout the course of the game. Therefore, depending on the abilities of the enemies and those of the player the state of RESPONSIVENESS may drastically change, from significant alterations in speed to complete paralysis.[293]

Siren: Blood Curse (2008) and *Fahrenheit* (2005) can also serve as examples here, since these games feature constant transitions between *single frame* and *simultaneous frames* (FOCUS).[294]

Figures 10.11 and 10.12: Two screenshots of *Siren: Blood Curse* (2008), displaying a *single frame* on the left, and *simultaneous frames* on the right.

If a comparative analysis pinpoints which dimension states are transient between core actions, an intra-dimensional relational analysis also aims at identifying their transiency but within the same dimension. This is a first step towards an understanding of what

292 See section 5.5.
293 The combat system in this game is complex mainly due to the immense types of actions that can be performed. These are promoted by the characters' abilities, that are provided by equipment and 'materia' – elements carrying particular abilities that need to be attached to the equipment of the playable characters in order to be used.
294 See section 7.2.2.

these transitions provoke in the player's experience. Sometimes they are the result of simple game mechanics, as the multiple simultaneous perspectives on the game world in *Siren: Blood Curse* or in *Fahrenheit*. Other times they are the result of highly complex mechanics, composed of numerous types of distinct actions, as is the case of RESPONSIVENESS in *Final Fantasy VII*'s combat.

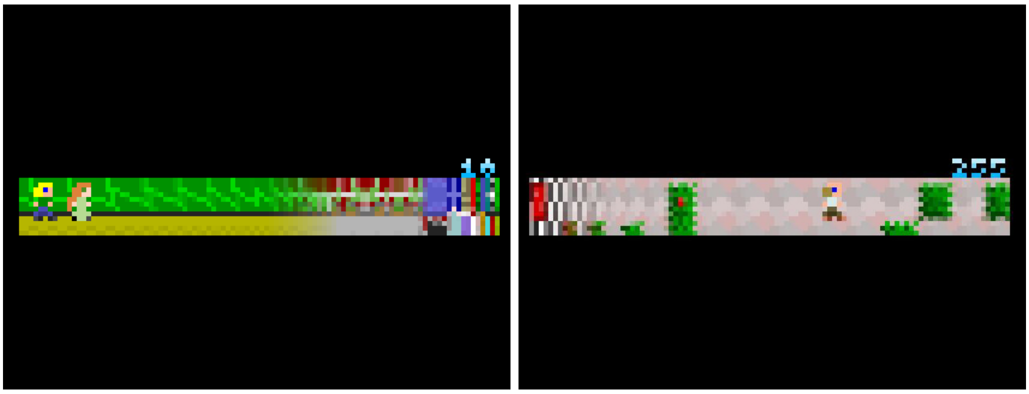
10.3 Considerations

There are some issues regarding the analysis procedures that we would like to enunciate before proceeding to the conclusions of this work. The first of those is that these procedures are not an exact science. They rely on assessments that are very based on qualitative appreciation, and, as such, results may vary depending on who conducts the analysis. Nonetheless, this should not be seen as a frailty but as a characteristic inherent to qualitative research.

Another aspect we wish to mention is that a classification of a video game obtained by an analysis of this kind does not substitute a categorisation by popular genres. Nor was that our intent. We started this work with a brief discussion on popular genres in order to confirm that they are disorganised categories. They are suitable for a general purpose categorisation of video games, ranging from gameplay mechanics to iconography, theme, etc.. However, they suffer from being too restrictive, simply because they consist of preconceived combinations of already very specific and also preconceived ad hoc concepts. Conversely, the model we propose solely aims at categorising the action-based relationship between player and the game system. In consequence, an analysis of this kind only embraces a part of the multitude of perspectives that popular genres so disorderly do. However, in our view, it is an extremely significant one.

Proceeding to a different topic, we may say that the use of this model extends beyond categorising of video games or the actions in them. Analysing games through this model may grant us means to understand their procedural rhetorics.[295]

295 See Bogost (2007). See Frasca (2007) on video game rhetoric.



Figures 10.13 and 10.14: Screenshots of *Passage* (2007), in the beginning with a spouse (left) and closer to the end with no spouse (right).

We will use *Passage* (2007) as a case study since the author described his intentions in *What I was trying to do with Passage* (Rohrer 2007).

> Passage is meant to be a memento mori game. It presents an entire life, from young adulthood through old age and death, in the span of five minutes. Of course, it's a game, not a painting or a film, so the choices that you make as the player are crucial. There's no "right" way to play Passage, just as there's no right way to interpret it. However, I had specific intentions for the various mechanics and features that I included. (2007)

Upon an analysis on the game, we may come to the conclusion that the central dimensions in its procedural rhetoric are TRAVERSAL and FOCUS.

Table 10.8: Description of the core actions in *Passage* (2007).

CHRONOLOGY	Present actions
RESPONSIVENESS	R:R methods
THINKING AND ACTUATION	Trained actions
TRANSCODING	Arbitrary articulation

Focus	Long time span
	Single frame
	Narrow sensorial scope
	Non-automated actuations
Depth	Function 2
Traversal	Branching

In *Passage* the dimension of traversal plays an essential role. In fact, according to Rohrer the game is a metaphor, a reflection about the particular choices people make that, while affecting their lives, will ultimately and always result in the same outcome: death.

The game resorts to *branching* in the following terms: 1) the player may choose to join up with a spouse, which doubles the score but prevents the player to travel to certain parts of the maze; and 2) treasures are less common in the north section – where the path is more straightforward – and more common to the south – where the opposite happens. Symbolically, in the perspective of the author, the message is: if you choose to share your life with someone else, everything will seem to be more worthy, but you will loose agility being constrained in terms of what you are able to do with your life; on the other hand, you may choose the retain that agility but only if you also remain alone.

> You have the option of joining up with a spouse on your journey (if you missed her, she's in the far north near your original starting point). Once you team up with her, however, you must travel together, and you are not as agile as you were when you were single. Some rewards deep in the maze will no longer be reachable if you're with your spouse. You simply cannot fit through narrow paths when you are walking side-by-side. In fact, you will sometimes find yourself standing right next to a treasure chest, yet unable to open it, and the only thing standing in your way will be your spouse. On the other hand, exploring the world is more enjoyable with a companion, and you'll reap a larger reward from exploration if she's along. When she dies, though, your grief will slow you down considerably. (2007)

FOCUS also plays an interesting role here. "The 'long' screen, of course, represents a lifetime. As you age in the game, your character moves closer and closer to the right edge of the screen. Upon reaching that edge, your character dies." (Rohrer 2007) The *narrow sensorial scope* of the player points to the indeterminacy of the future events and the building up of memories.

> At the beginning of the game, you can see your entire life out in front of you, albeit in rather hazy form, but you can't see anything that's behind you, because you have no past to speak of. As you approach middle age, you can still see quite a bit out in front of you, but you can also see what you've left behind – a kind of store of memories that builds up. At its midpoint, life is really about both the future (what you're going to do when you retire) and the past (telling stories about your youth). Toward the end of life, there really is no future left, so life is more about the past, and you can see a lifetime of memories behind you. (2007)

Lastly, the *long time span* also possesses a very interesting role here. Each play session has the duration of 5 minutes, representing the lifetime of the playable character. And, no matter what you do during that time, no matter what choices you make, no matter how many points you have, your character will inevitably die when its time is up. "Yes, you could spend your five minutes trying to accumulate as many points as possible, but in the end, death is still coming for you. (…) Passage is a game in which you die only once, at the very end, and you are powerless to stave off this inevitable loss." (2007)

Figure 10.15: The 'Fission Mailed' screen in *Metal Gear Solid 2: Sons of Liberty* (2001).

Concentrating on a very different example and in local actions, the "fission mailed" scene in *Metal Gear Solid 2: Sons of Liberty* (2001) can also serve as a short case study here. At that moment in the game, Raiden (the playable character) discovers that Colonel Campbell (the character directing the operation, and that is in frequent radio contact with Raiden) is in fact an artificial intelligence (AI) agent with a hidden agenda. When it starts exhibiting malfunctions, it tries to make the player quit the game, up to the point of simulating the 'mission failed' screen. At the top left corner of that screen there usually is a small frame displaying the diegetic part of the game. But, at that moment, the game world being depicted there is still responsive to the player's input, and as such the game continues on that small frame for a while.[296] So, this use of *simultaneous frames* (focus) – displaying the diegetic part of the game on one frame and a non-diegetic mission failed screen on another frame – not only enhances the notion of a computational malfunction that happens within the story of the game, but also tries to illude the player into thinking that the game was over, becoming a very relevant part of the AI agent's (or the game designer's, for that matter) intent to make the player quit the game at one of its most crucial moments.

The boss fight with 'The End' in *Metal Gear Solid 3: Snake Eater* (2004) is an example of the use of the N:N method in responsiveness to convey a very particular message to the player: 'The End' was actually at the inevitable end of his life.[297]

In conclusion, other examples can surely be found in many other video games, however, we will not lengthen this section pursuing that, since that falls outside the goals of this work, and also because there is still much to uncover regarding the analysis of this model. From the relationships between dimensions and their respective states to the execution of analyses across diverse genres, this model now requires a dedicated study carried out in a more analytical fashion, something that we will develop in future work. Nonetheless, a structure for analysis is set here, although that does not prevent us from reviewing or expand it in future endeavours.

296 At the time of writing this scene could be seen at https://www.youtube.com/watch?v=v5h3NkS5e1U.
297 See section 4.3.1.1.

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11. Conclusions

11.1 Summary

We started this work by surveying ad-hoc categories and genres found in popular classifications of video games, discovering that they reflect a multitude of (sometimes pretty disparate) perspectives on the medium. Later, we proposed action as a defining trait in video games, an idea already supported by other studies.

Based on that premise, we proposed a distinct perspective on the relationship between the player and the game system consisting of a framework centred on the existence of actors, defined as entities responsible for the actions that affect the game, a category in which the player and the game system are included. We explored their relationships finding that they are based on interlinked communicational systems giving shape to networks with distinct degrees of structural volatility, from which diverse and sometimes complex behaviours emerge, which in their turn lead to the enactment of diverse sequences of events constructing a narrative, which ultimately is a source of experience of the player. Following this rationale and the premisses of the MDA framework, we ended portraying its dynamics stage as consisting of a transition seeded on a transformation of action into experience.

After establishing its grounding principles, we performed a deep inspection on the actors' topology – based on networks of other actors in a recursive formative structure –, and on their mereology, access, milieu, I/O structure, and behaviour – attributes that direct the functioning of the framework, determining the conditions by which dynamics emerge.

After unveiling this framework of actors, we revealed 7 dimensions on which the action-based relationship between the player and the game system has its foundations: chronology, responsiveness, thinking and actuation, transcoding, focus, depth, and traversal. Each dimension aims at understanding how the player and the game system interact, focusing on very specific aspects of their relationship, and taking into account their similarities as actors and their disparities related with their own distinct natures.

After that, we proceeded to a clarification of how to use this model to analyse the player-system action-based relationship, considering two types of scope and three different, although complementary, approaches, setting up grounds for future endeavours.

This work never intended to be a complete theory of action in video games, but a substantiated perspective proposing that these artefacts can be seen as being action-based and analysed accordingly – a call to awareness aimed at game designers in special. Not only that, but it also poses the thought that, by designing for action, game designers are truly working with what makes video games what they are, with the underlying and fundamental concepts on which video games are built upon. And still, that by acknowledging the dimensions we propose, they will be granted alternative ways of pursuing original work – instead of being constrained to the established genres in popular culture –, as well as more concentrated at designing actions for the player.

> Game designers don't just create content for players, they create activities for players, patterns of actions enacted by players in the course of game play. (Salen and Zimmerman 2004, 317)

11.2 Limitations

The limitations of this work are seeded by the fact that each of these 7 dimensions requires further exploration, as they are yet to reveal their full potential. Although each dimension was thoroughly inspected, the primary goal of this work was to uncover them. From this point on, the pursuance of further expanding the knowledge on each of these dimensions has the potential to result in an equal number of complementary research studies. We are not saying that this work is incomplete. The dimensions were properly identified, inspected and they are quite discernible. We are however aware of their complexity and that each can benefit from further study.

There is an interesting asymmetry in the relationships between variables within each dimension, e.g. the variables in the first level of FOCUS are not mutually exclusive – *time span, frame, sensorial scope,* and *actuation automation* –, while all the variables in CHRONOLOGY are – *preterite actions, present actions,* and *preemptive actions*. The ones in the former work towards a particular combination to originate a specific state in focus, while in CHRONOLOGY that result is achievable by direct selection. Maybe that happens because in FOCUS we were able to find the underlying characteristics that lead to particular states in that dimension. Perhaps we were aware – even if unconsciously – that there are too many states of FOCUS to enumerate within the scope of this work. However, this leads us to an even more pertinent question: Can we do the same for chronology and for all the other dimensions? And by doing that will we be able to uncover even more variables/states? And is this a good way to expand our knowledge on them?

There is still much to be done regarding a study focused on the articulations between these 7 dimensions. They were scrutinised as independent phenomena – something that left traces in the modular structure of this text. However, that also didn't left enough space and resources for a more detailed inspection in their articulation, something that we only became aware of during the final stages of this thesis. Therefore, this is an effective limitation of the current state of this model. This is somewhat apparent in the *Analyses* section, and something to take notice in future developments.

The action-oriented framework, although simple in its essence, can be relatively intricate to explain, perhaps with a somewhat steep learning curve, which may reduce the likelihood of being used. However, this fact is compensated by its versatility, as a model that allows one to focus on the whole or on the constitutive parts. Therefore, we believe that a certain level of synthesis is in order for it to be easily grasped and ultimately applied with the least effort possible.

Through this model, the complexity of the actions being analysed dictate the complexity of their own analysis. The model seems to respond well when analysing simple games and actions by means of descriptive analysis. However, in more complex situations or to have a deeper insight, the assessment also becomes more elaborated, resorting not only to descriptive but also to comparative and relational analyses.

A real world use of this model within the context of design and development of video games is yet to be done. That is to say that this model was not yet employed in a more practice-based research context, in the field. It is important to notice that this is not a problem to the theoretical establishment of the model itself, but a rather welcomed subsequent study, focused on the scrutiny of its actual potential for providing new, experimental, out-of-the-box, and lateral thinking methods of conceiving and designing video games. This is something that leads us to future work.

11.3 Future work

In this section we are not focusing on each dimension separately – since that is done at the end of each respective chapter in PART II of this text – but rather on general efforts aimed at a continuation and improvement of this work. Hence, we evidence diverse subjects we believe one needs to address to accomplish that goal as well as courses of action and contexts for more practice-based work.

1) We do not believe that we have uncovered all of the dimensions nor all variables that are to be found in this context. It is not just common sense that dictates this, but also the experience we earned throughout the development of this work. Different dimensions and their respective variables were uncovered at different times and under distinct contexts, with sometimes months having passed by between breakthroughs. The most evident cases are TRANSCODING and TRAVERSAL, something can be confirmed by the dates of our related publications.

2) As mentioned in the previous section, this model requires a study on the articulations that exist between the 7 dimensions. With this in mind, we started to reflect about the existence of larger groups or areas capable of embracing diverse dimensions. For example, we believe that the dimensions of FOCUS and TRANSCODING are more related with matters regarding the interface between the player and the system than any of the others: while the former is concerned with the output of the system and input of the player, the latter does practically the opposite. Also, FOCUS and THINKING AND ACTUATION seem to be dimensions very attentive to processes much enacted on the side of the player. So, these situations can be indicative of an organisational system yet to uncover, something that may eventually become more evident as more dimensions are unveiled.

3) Still focusing on the relationships between dimensions, throughout the development of this work we came to the conclusion that there seems to be some *conceptual proximity* between some variables in diverse dimensions. Although those variables do not refer to the same things, this fact may be indicative that they may share some common grounds, since they appear to depict strong relationships that seem to point to similar directions:

- *Present actions* (CHRONOLOGY) and *short time span* (FOCUS): *Present actions* are focused on the present time, which can be characterised as the very *short time span* that is happening now. There seems to be a relationship of dependence here, as the existence of *present actions* does not seem to be possible if the player is not focused on *short time spans*.

- *Preemptive actions* (CHRONOLOGY) and *premeditated actions* (THINKING AND ACTUATION): *Preemptive* and *premeditated actions* seem to point towards the same direction, since they both appear to have an eye on future events: the first is concerned with taking action in anticipation to the future, while the second is focused on establishing a plan, no matter how simple.

- *Automated actuations* (FOCUS) and *trained actions* (THINKING AND ACTUATION): These seem to aim towards actions that are able to be patterned and reproduced with low cognitive effort. Of the cases mentioned, this is the one where we are able to find the most similarities. However, it is very important to notice that the former refers to a state of FOCUS when the player is simultaneously performing two or more actuations, while the latter refers to the description of a kind of action that actually stays between thinking and actuation. Nonetheless, they are obviously intertwined.

- *Function 3* (DEPTH) and *modulating* (TRAVERSAL): We consider this to be the case exhibiting the faintest conceptual proximity of all that were mentioned. *Function 3* consists on moulding the game system's behaviour within predeterminate parameters. *Modulating* is a form of traversal that is based on moulding the disposition of actors towards the player and each other. Again, they are not the same thing, but they seem very compatible since both consist in moulding behaviour.

On the opposite end, *conceptual farness* also appears to be a very interesting topic to study:

- *Autonomic actions* (thinking and actuation) and *mimetic articulation* (transcoding): An *autonomic action* is enacted by means of the physiologic operations of one's body. A *mimetic articulation* occurs when the player's proxy imitates the player's performance. Although we believe their combination is not utterly impossible, they seem somewhat distant since the actions of the player's proxy would have to be based on the same premises as those of the player.

- *Present actions* (depth) and *no time span* (focus): There seems to be no possible synergy between *present actions* and *no time span*, since the former are focused on the really short time span that is considered the present time, and the latter is a variable that dictates that the player has all the time she wants to act.

Studying the conceptual proximity or farness between variables in each and every dimension seems now a very relevant activity to undergo, not only to pinpoint eventual redundancies in the model, but also to understand diverse levels of compatibility between them. This is something that may help us understand if a particular action is seeded on an internal conflict or not – something that is particularly important in the relational analysis we proposed.

Furthermore, this is also a study we consider to be moving towards an understanding of aesthetics, since that conflict will be deeply experienced by the player. This is something that was expected and that we see as a natural and progressive development of this work.

4) With that in mind, we think that one of the natural courses for future developments of this work may reside in the context of designing for emotion, focusing on how the articulations between these dimensions may lead the player towards distinct emotional states. This is a very complex endeavour, and we believe that it should not be done before a reasonable understanding on the matters mentioned in the previous point.

5) As mentioned in the *analyses* section, a study focused on analysing large groups of video games to discern the most common kinds of action-based relationships of the player-system pair in diverse genres, and along different eras, generations, etc. seems quite useful for a statistical view on the subject. This is something that may pinpoint to an understanding of how the player-system relationship developed to current days, which may also help us think about what shapes it will assume in the future.

6) Focusing on a more practice-based research and in the context of convergence between video games and music we intend to use this model to study the video game player as musical performer, in a sense that she plays a video game as a musical or sonic instrument. Our interest in this subject was initially captured by Aaron Olderburg's thoughts on "audio as gameplay" (2013); by Julio D'Escriván's thoughts and works regarding "performing digital media as opposed to performing with digital media" (2014); by Julian Oliver's works that act in a similar context, namely *Fijuu2* (2006); by Chris Novello's *Illucia: a patchable videogame system*[298]; and by *The Adventures of General Midi*[299] (2014), an experimental video game that generates parts of the game world based on the content of MIDI[300] files.

With *Playing in 7D: Considerations for a study of a musical instrumentality in the gameplay of video games* (Cardoso and Carvalhais 2014b) we ignited this study, primarily aiming at discussing and obtaining feedback on this subject within the context of music and sound studies. Its purpose was to explore some of the fundamental concerns regarding the video game player as a musical performer, which utterly advocates the need to understand the computational attributes of the system, the ludological traits of the game, and mainly the dynamics of the relationship between the player and the game system.

It is here that our model comes in. We not only intend to explore the diverse behaviours promoted by distinct combinations of its dimensions but also to see what kinds of games and musical expressions emerge, in hopes of contributing to further widen the notions of musical performance and, most of all, to expand the gameplay of musical video games.

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298 More info at www.illucia.com.

299 At the time of writing, a video of this game's gameplay can be seen at https://youtu.be/eQSAwuRf-Ng.

300 MIDI is the acronym for Musical Instrument Digital Interface, and is a technical standard that allows various devices to communicate with each other, namely electronic musical instruments and computers.

This particular context was chosen for subsequent studies for various reasons, among which the following:

- It allows us to break with the typical visual-centric approach of contemporary video games to concentrate much more on their procedural nature, which is one of the core concepts of our work.

- It allows us to stay away from storyline to focus on more abstract narratives, much more aimed at composition and performance than at literature and cinema. Therefore, this path much more accurately follows our own interests, since it points to a field that is very familiar to the studies of art and design. It is also a course well-related with our own professional and social circles, something that will surely benefit the development of our work.

- Because, in our perspective, musical video games act in an area quite unexplored and yet underdeveloped, although studies focused on the intersection between video games and music/sound have been increasing.

- And, because the production of musical video games does not necessarily require big development teams, therefore accounting for less financial cost, as well as allowing us to more easily embark on the development of works of high experimental natures.

By pointing future endeavours of the work developed through the course of this thesis towards this direction, we aim not only at revising and expanding this model but also at using it in a more practice-based research, directly within the practice of game design, conception and development. A study that directs its focus towards the production of experimental artefacts with the potential for concerts, performances, and installations – something traditionally associated with an artist's or designer's curriculum – but also with great prospects for applied research on the design and development of innovative video games and musical instruments.

> Games are less of something created than something explored, manipulated, or inhabited. They are less musical composition and more musical instrument – to be played, by players. (Zimmerman 2014)

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Glossary

Agency: "(…) the power to take meaningful action and see the results of our decisions and choices." (Murray 1997, 126)

Arcade: Entertainment machine where the player inserts coins to play.

Atari 2600: Game console released by Atari Inc. in 1977.

Avatar: In this context, it refers to the player's representation in the game world.

Boss: Bosses are system-controlled opponents, usually more powerful than the opponents the player has previously faced. Boss fights or battles commonly occur at the end of a level or section in game.

Cheat: Process where the player creates an advantage for herself or for others disrespecting the rules of the game.

Chiptune: Electronic music produced using real or emulated sound chips of vintage computers and game consoles.

Computer Vision (CV): Refers to methods of acquiring, processing and analising images by means of computational devices.

Cutscene or Cinematic Interlude: Cinematic sequence of events in a video game where the player traditionally possesses no or little control over.

Dynamic Difficulty Adjustment: Refers to the dynamic adjustment of the difficulty of a particular video game to the player's capabilities.

DS, NDS or Nintendo DS: Portable game console released by Nintendo in 2004, featuring two screens in which one can be used for interaction by touch.

Dungeons & Dragons (D&D): Fantasy table-top role-playing game created by Gary Gygax and Dave Arneson, first published in 1974.

Electronic Entertainment Expo or E3: A video games and computer industries trade fair realised annually at Los Angeles, USA.

Emote: Performances executed by the player's avatar or NPCs in order to convey particular messages or emotions, usually in a theatrical fashion.

Emulator: Software that enables a computational system to behave like another computational system.

Ergodic: According to Espen Aarseth (1997), it is the non-trivial effort that is required to the reader in order to traverse the text. In our case, it is the non-trivial effort that is required to the player in order to play.

Feedback: Process where the outputs of a system are routed back at its inputs.

First-Person Shooter (FPS): Shooter video game in which the player sees the game world through a first-person perspective.

Framework: Fundamental conceptual structure for a system.

Full Motion Video: Video game sequence that consists on pre-recorded video.

Game Over: Typical message in video games announcing its end or the end of a play session.

Gamescom: A video games trade fair that has been realised on a annual basis in Cologne, Germany.

Goomba: A common and classic enemy in Super Mario games.

Heads-Up Display (HUD): Part of a video game's graphical user interface that presents non-diegetic information to the player.

Hop and Bop: A move in which the player's avatar defeats enemies by jumping on top of their heads.

JRPG: Acronym for Japanese Role Playing Game.

Joystick: Game controller that traditionally consists of a stick that stands perpendicularly centred on an horizontal base, and that the player manipulates by tilting.

Kinect: Computer vision-based game controller released by Microsoft in 2010.

Machinima: The creation of cinema by means of real time computer graphics engines, usually game engines.

Massive Multiplayer Online (MMO): Video game played by hundreds, thousands, or even millions of players online.

Musical Instrument Digital Interface (MIDI): A technical standard that allows various devices to communicate with each other, namely electronic musical instruments and computers.

Mod: A modification made to a video game in order to either create new content for it or to create a new game altogether. Mods usually require the original release in order to run.

Multiplayer: Game or game mode that is played by more than one player simultaneously.

Nintendo Entertainment System (NES): Game console released by Nintendo in 1983.

Non-Playable Character (NPC): Character in a game that cannot be controlled by players.

Nunchuck: Game controller released by Nintendo to be attached to the Wiimote.

PlayStation: Game console released by Sony in 1994.

PlayStation 3 (PS3): Game console released by Sony in 2006.

PlayStation 4 (PS4): Game console released by Sony in 2013.

PlayStation Move: Motion-based game controler released by Sony in 2010.

Platformer: A video game that traditionally requires the player to guide her avatar through a series of obstacles and platforms, most commonly by jumping.

Power-down: Something that penalises the player, usually in a temporary fashion.

Power-up: Something that benefits the player, usually in a temporary fashion.

Quick Time Events (QTE): Moment in a video game where the player is prompted to act during a very limited time span, usually happening during cut-scenes or cinematic interludes.

Random Encounter: A feature commonly used in RPGs that consists on encountering enemies and other NPCs at random.

Role-Playing Game (RPG): Game where players assume the role of fictional characters, create or follow their stories. In RPGs the actions of the players should correspond the profile of their characters.

Serious Game: Game whose primary goals stand beyond the scope of entertainment, usually aiming at instruction and learning.

Shooter, Shoot 'em up or Shmup: Game whose primary mechnanic consists on shooting enemies while avoiding their shots.

Single Player: Game or game mode in which only one player is able to play at a time.

Speedrun: A play-through in which the player tries to achieve the game's closure or particular objectives in the speediest way possible.

Tool Assisted Speedrun (TAS): Speedruns in which the player usually resorts to tools that were not originally designed for the game.

Wii: Game console released by Nintendo in 2006.

Wii U: Game console released by Nintendo in 2012.

Wiimote or Wii Remote: Motion-based game controller released by Nintendo in 2006.

Xbox 360: Game console released by Microsoft in 2005.

Xbox One: Game console released by Microsoft in 2013.

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Digital Versions in CD

1. Digital version of the thesis;
2. Digital versions of the articles published.

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