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# Video Games, Narratives, and Complexity

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# LIST OF PUBLICATIONS

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# AUTHOR'S CONTRIBUTION TO THE PUBLICATIONS

Publication number 3: "Miyazaki's Hybrid Worlds and Their Riddle-Stories: Western Tropes and Kishōtenketsu" has been co-authored with Dr. Francesca Arnavas. The work has been equally divided between the two authors.

Publication number 4: "INDCOR White Paper 2: Interactive Narrative Design for Representing Complexity" has been co-authored with many colleagues, members of the COST Action 18230 – INDCOR. As one of the editors, I have been correcting and merging texts produced by all authors, giving the final shape to the publication. I have also contributed with portions of text.

Publication number 5: "INDCOR white paper 3: Interactive Digital Narratives and Interaction" has been co-authored with many colleagues, members of the COST Action 18230 – INDCOR. I have contributed with portions of text.

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Publication number 10: "Framing the Dilemma – The Influence of Immersion in Ethical Choice Making" has been co-authored with Dr. Marie-Luise Meier. The work has been equally divided between the two authors.

# INTRODUCTION

«All play means something»

Johann Huizinga, Homo Ludens (1950), p. 1

Exploring complexity is a complex task. Complexity calls for a plurality of approaches, for transdisciplinarity, and for the integration of different methods, perspectives, and epistemological foundations (Ollagnier-Beldame, 2022). In this sense, complexity pushes the boundaries of individual disciplines to seek for contributions from other, seemingly distant perspectives. This is what makes complexity such a fascinating topic, and its study such an enriching experience. Interestingly, also the object constituting the second half of the title of this work – video games – can be said to blur interdisciplinary boundaries. As possible instances of *Gesamtkunstwerk*, works of art making use of possibly all art forms (Backe, 2020), video games ask for a plurality of perspectives and approaches to grasp their entirety.

Throughout the argument that will develop in the upcoming pages, I discuss why and how complexity and video games can be mutually illuminating. Complexity is often used to talk about video games. Most frequently, complexity is intended in a strictly algorithmic sense, as a function of the rules and the intricated combinations they can give rise to (Perkis et al., 2023; Wardaszko, 2018). Elsewhere, complexity is used to talk about communities of players that gather within and outside the games themselves, giving rise to an ecology of actors and media products that show clear signs of complexity (Ensslin, 2022; and in part Caracciolo, 2024). In this work, I will investigate instead the complexities that are linked to the game-player encounter. My two main goals in this work are: 1) to shed light on what kinds of narratives video games feature and on their formal organisation; and 2) to have a better understanding of how video games construct meaning in collaboration with their players (and vice versa). After all, not by chance Salen and Zimmerman write that "games are remarkably complex" (Salen & Zimmerman, 2005, p. 1).

In analysing the complexity of video games I present a plethora of approaches and perspectives in a theoretical triangulation – a mixed and multimethod analysis of the same phenomenon (Denzin, 2015) – that helps elucidate nuances that would otherwise get lost. The three disciplines whose approaches, perspectives, and methods I borrow most heavily from are game studies, narratology, and cognitive sciences. These three theoretical perspectives find different entanglements and configurations throughout the text, but they are constantly at the backdrop of the discussion and always guide the argumentation.

Cognitive narratology is one of these configurations, one that brings together narratology and cognitive sciences, and it constitutes the most pervasive approach employed in this work. Cognitive narratology focuses on "the mental states,

capacities, and dispositions that provide grounds for – or, conversely, are grounded in – narrative experiences" (Herman, 2014, p. 46). From this approach I draw not only concepts and methods, but also the perspective and the general focus on the mental activity of (in my case) players, as elicited and guided by video games. In this sense, aligning also with reader-response theory, I focus on the experience of the player with the game – both the "online" response of the here-and-now of gameplay, and the "offline" response captured by deferred accounts of player's experience, like written reviews of games. Through this perspective, however, I not only aim at analysing players' responses, but also at discussing video games as artifacts designed to elicit such responses. Therefore, methods and concepts from game studies (and the overarching field of interactive digital narratives studies), narratology, and cognitive psychology and neuropsychology are intertwined to grasp the complexities of video games. However, given the pluralizing and transdisciplinary needs of discussing complexity (and video games), I occasionally also resort to concepts and methods from film studies, human-computer interaction, semiotics, and game design and programming, and I employ both quantitative and qualitative empirical methods to support my theoretical discussions.

In more specific terms, the complexity of video games will be analysed employing two notions of complexity. To facilitate the flow of the argument, the sections discussing these two notions have been grouped into two parts. Each of this part is formed by two chapters.

The first notion of complexity I investigate in relation to video games is the complexity of videoludic[1] narratives – analysed in Part I. Narrative complexity is a relatively new paradigm in the analysis of narratives that apply complexity theories to different aspects of storytelling, narrative organization, and cognitive responses to them. The implications and informative value of this new perspective have been recently analysed in works like Grishakova and Poulaki's (2019b) and Walsh and Stepney's (2018) edited collections. However, the kind of complexity encoded and presented to the audience by different communication media is variable, and highly dependent on media affordances, customs, and expectations of their users. Despite the ever-growing importance of video games in the current cultural landscape, the heuristic value of complexity theories is still largely unexplored in the context of narratives in the interactive digital medium. This is the first significant gap in the literature this work aims at addressing.

In Chapter 1, I discuss the formal complexity of video game narratives and what makes a videoludic narrative complex from a formal point of view. I identify the narrative devices that are often used to make narratives formally complex, and I examine specifically the shape these devices take in video games. I analyse different titles spanning across a large portion of the history of video games through several close readings. These readings help to support my view of video game narratives as generally complex.

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[1] "Videoludic" is intended here as an adjective that defines something that has to do with or is related to video games.

In Chapter 2, I investigate the cognitive effects that formally complex narratives have on their players. Epistemic emotions like confusion and cognitive dissonance sprout from the employment of different cognitive functions and thinking styles, and they are generally considered the diagnostic sign of narrative complexity. To empirically substantiate this connection between complex narratives and specific video game players responses I report a quantitative study analysing the players' reactions to two very different narratives of two very similar games. I then provide thoughts on the appeal of the complexity of video games narratives and how this view can help designers create more intriguing videoludic narrative experiences.

The second kind of complexity I analyse in relation to video games, in Part II, is the complex system that comes into being when a game is encountered by its player, and specifically when the player engages in the active, configurative (Eskelinen, 2012) sensemaking process, distinctive of videoludic products. In this part of the discussion complexity refers more specifically to the notion of complex systems.[2] Most of the studies analysing the elements that impact the game playing experience and the expressive elements that participate in its construction focus on these elements in isolation or, at best, in clusters. This perspective, while shedding light on these particulars, cannot capture the complexity of the entire experience of playing a video game. A theoretical framework that can provide a more holistic stance on this complexity is the second contribution of this dissertation to the academic discourse on video games.

In Chapter 3, I propose my complex-systemic perspective of the game-player collaborative sensemaking. Throughout the text I not only discuss elements forming the collaborative sensemaking system, and the working of this system as a whole, but I also provide a mereological perspective, to capture the relation among parts and between parts and the whole. I also discuss the aspects that emerge from this collaborative sensemaking, the first of which is the linear game (and narrative) experience. As I will show, this complex-systemic perspective can provide a holistic view of the ways video games co-construct meaning with their players, in a flexible and scalar theoretical framework. This framework manages to accommodate and encompass the vast majority of currently existing literature on the semiotics of video games without being reduced to it. Before concluding the chapter, I investigate how this complex collaborative sensemaking system works in actual gaming practices by examining the working of a real game, also highlighting the ways in which the designers guide the game-player collaboration.

In Chapter 4, I report a study specifically designed for and aimed at empirically supporting the complex-systemic perspective of the game-player collaborative sensemaking. I describe the object used for this study and how it has been designed on the basis of the theoretical framework outlined earlier. After illustrating the methodology employed and the design of the testing game for the

[2] In simple terms, a complex system is an arrangement of intricate and interrelated parts that work together to form a unit that is greater than the sum of the parts. This definition will be further complicated in due time.

experiment, I report the findings and discuss the results in relation to my theoretical framework. From this analysis it ultimately emerges that the validity of the framework is supported by empirical data and that the framework can be said to aptly explain the collaborative sensemaking of video games.

The two notions of complexity investigated in Part I and in Part II must necessarily come together, as they both apply to the very same objects of study – video games. In Part III, I delve deeper into what it means for video games to feature complex narratives understood through complex sensemaking. By joining both notions of complexity, I highlight the hermeneutic potential that this junction affords and the cognitive effects it might trigger.

In Chapter 5, by employing the theoretical perspectives outlined in Part I and in Part II for the analysis of a single case study, I discuss how the two approaches can be brought together to allow a further productive scrutiny of video game experiences. I also highlight the reasons why the considerations on narrative complexity are both reinforcing and being reinforced by those on complex sensemaking, and vice versa.

In Chapter 6, I introduce a potential paradox sprouting from the considerations advanced so far, namely that of the apparent double complexity of video games. As complex narratives understood through complex sensemaking, video games might look, from a theoretical point of view, cognitively unmanageable. In this chapter, I foreground the actual improved cognitive economy that results from the encounter of the two complexities. In particular, I explore four cognitive economy strategies that make this double complexity cognitively manageable, drawing on empirical findings in cognitive psychology and neuropsychology. This gives first insights on why games can be both popular and complex forms of entertainment, being complex in theory but without causing cognitive overload.

The focus of the current study is therefore on two complexities sprouting from the encounter of a game and a player. Additional layers of complexity exist beyond the game-player encounter. Complexity is often used to talk about game rules and the intricated combinations they can give rise to (Perkis et al., 2023; Wardaszko, 2018). Communities of players gather within and outside the games themselves giving rise to an ecology of actors and media products that show clear signs of complexity (Ensslin, 2022; Caracciolo, 2024). These additional and broader considerations will be left to future studies.

A few terminological notes are needed before embarking in this *complex* journey. In the current work, the term *sensemaking* will be adopted to stress co-constitution of meaning between a (videoludic) artifact and its player. To be noted is also that in this discussion I will align with Adami (2017) in using the term "meaning" in the rather general sense of "idea" or "concept". This quite broad understanding of the term parallels the use done in Salen and Zimmerman (2004), and in the vast majority of the academic discourse on video games that followed since. The term is intended as a far-reaching notion that includes not only well-defined ideas, but also "vague, fragmentary, undeveloped, intuitive, ambiguous, non-conceptual and pragmatically oriented" ones, and which is "relevant to a wide range of media types and communicative situations" (Elleström, 2021, p. 12).

In addition, it should be noted that the term "meaning", in the academic discourse about video games refers broadly to any kind of idea that a game could represent, including stories, game rules (as the proceduralist view supports, cf. Mateas, 2005) and ethical, political, social and aesthetic value (as the anti-proceduralist view supports, cf. Sicart, 2011). I will abide to this rather broad conception of "meaning" throughout this dissertation. Furthermore, in discussing video games narratives I will abide to Mejeur's definition, reading "narrative in games is the embodied cognitive process of sequencing signs drawn from a game's story (its collective possible objects, representations, and actions) into a discourse (consisting of events and chains of events) through play" (Mejeur, 2019, p. 63). Mejeur's definition is particularly useful in this context as it takes the move from recent narratological perspectives but it recontextualises them for the specificities of video game narratives. This definition is also useful to highlight the game-player collaborative effort that lies at the basis of video game narratives. I will return on the latter in Part II and Part III of the dissertation. I will therefore intend "story" as the potential sequence of events that a game can instantiate, and "discourse" as the events as they are individually presented to the player.

Another specification that is needed at this point is that throughout the dissertation, I will talk specifically about games that can be categorised as interactive digital narratives (IDNs), i.e. those games that encompass a clearly delineated narrative in which players' have a degree of agency.[3] From now on, when I talk about "video games", I will refer specifically and solely to this kind of digital artifacts unless differently specified. In the discussion, I will resort interchangeably to literature on video games and on interactive digital narratives, as from the point of view of the narratives they feature, the same considerations can apply to both.

My findings and their implications, too, apply to both fields, as they highlight certain narrative constructions and sensemaking mechanisms that are usual in games and IDNs alike. This work then is useful in giving a name to, raising awareness of, systematise, and operationalise the game design practice of creating complex narratives, a practice which often goes unproblematized. My study also shows that this customary practice in game (and specifically narrative) design has specific and so far underexplored cognitive effects, the exploitation of which can enhance the appreciation of games and their narratives. Additionally, the results

[3] The two names define two rather different phenomena, at two different granularity levels. Video games are a *cultural* medium based on the digital (*material*) medium, as they rely on digital technologies but they have their own customs and expressive languages (on the three meanings of 'medium', cf. Ryan, 2005). On the other hand, the respective community of researchers sees IDNs as something in between a collective name for several (*cultural*) media and a (*cultural*) meta-medium in its own capacity. Typical examples of IDNs are interactive fiction and drama, interactive documentaries (e.g. the Emmy award winner *Last Hijack – Interactive* (Pallotta et al., 2014)), interactive movies (e.g. *Black Mirror: Bandersnatch* (Slade, 2018)), VR narrative experiences (e.g. *Zena, an interactive VR film* (Reyes, 2017)), and a number of video games (e.g., *Detroit: Become Human* (Quantic Dream, 2018)). For these reasons, not all video games are IDNs and not all IDNs are video games.

of this research have resonance more broadly in narratology and media studies. They can partly explain the appearance of increasingly more complex narratives in the current narrative mediascape, while also addressing the artistic potential that complexity bears. Furthermore, the perspectives I outline here significantly contribute to the discussion on how video games afford the (narrative) experiences they afford, through a strong and flexible framework that has empirical support. This framework could even be applied to explain the sensemaking processes of other media, therefore foregrounding a broader reach of the theories presented. The conclusions I ultimately draw can elucidate why video games can be thought of as particularly useful in representing complex issues, and they open very promising lines of research in empirical game studies and empirical narratology.

If "all play means something", as Huizinga writes (1950, p. 1), my ambition here is to highlight the complex ways in which (video game) play means *complex* something, in an ultimately accessible way.

# PART I

# VIDEO GAMES AND COMPLEX NARRATIVES

«The creative mind plays with the objects it loves»

Carl Gustav Jung, Psychological Types (1971), para. 197

In the introduction to this work, I identified the two notions of complexity related to video games that I touch upon. Throughout this part I will analyse the first one, i.e. the complexity of video game narratives. As I have anticipated, I will discuss here the formal complexity of narratives and the response of the audience to such formal organizations. In more specific terms, the scope of this chapter encompasses two related objectives: 1) to analyse what makes a narrative formally complex, and 2) to discuss what kind of response complex narratives elicit, and why they do so. The two chapters composing this part will deal with these two perspectives.

The formal complexity of narratives concerns the organization of narratives themselves, i.e. how narratives are structured and constructed. Chapter 1 will be dedicated to the discussion of what makes a narrative formally complex, specifically regarding video game narratives. The chapter will therefore deal with "the internal processes by which narratives move from beginning to middle to ending" (Herman et al., 2012). Two interrelated dimensions of formal complexity can be distinguished: a quantitative dimension – how many elements comprise the narrative, and a qualitative one – how these elements are tied together and shown to players. These dimensions are configured in different ways through several narrative devices used to make narratives formally complex. I will discuss, throughout the chapter, the most common of such devices in video game narratives. After this rather theoretical part, I will present a more hands-on discussion and a series of case studies that will help to show how these devices are integrated in practice in some real narrative video games, and the kind of analysis required to recognize them. Through both the theoretical and the practical analysis I identify a sort of intrinsic, customary, almost "natural" complexity of video games narratives.

However, formal complexity "translates into complex forms of recipient engagement and becomes synonymous with the difficulty of perception and interpretation" write Grishakova and Poulaki (2019a, p. 6). It can be indeed stated that complex are those narratives that, due to certain qualities, intentionally generate epistemic emotions in their audience – the players, in my case –, where epistemic emotions "result from cognitive appraisals about the (mis-)alignment between new information and existing knowledge or beliefs. More specifically, epistemic emotions can be triggered by discrepant or contradictory information

that prompts cognitive incongruity, and they can influence cognitive information processing and the generation of knowledge" (Vogl et al., 2021, p. 41).

Already from these descriptions it is possible to observe that narrative complexity has been theorized as a function of the audience response: in a video game, a narrative device is making a narrative more complex when it is participating in generating specific player response. Therefore, in Chapter 2 I will look closely at the cognitive effects that narrative complexity produces. I will present the current understanding according to which specific cognitive responses are regarded as the symptoms of narrative complexity. To do so, I will look more closely at something akin to readerly dynamics, "the readers' responses to the textual dynamics" (Clark & Phelan, 2020, p. 16), but more participatory and embodied, which could be called "userly dynamics" (this also following the theorization of the 'userly text' in Knoller, 2019; see also an earlier use of the term by Chandler, 1995). I will discuss why scholars tend to understand epistemic emotions such as heightened cognitive load, cognitive dissonance, and confusion, as indicators of narrative complexity, and what are, in narrative cognition, the factors that participate in eliciting these responses. I will then highlight, through a case study, empirical evidences relating specific response of players to particular formal organizations of videoludic narratives. Towards the end of the chapter, drawing further on the results of the case study, I will also provide thoughts on the reasons why we enjoy complexity and specifically complex narratives in video games. Lastly, I will provide thoughts on why these considerations could be important and useful in the game design practice and for understanding current directions of our mediascape.

My intention is therefore to use complexity theories as an informative hermeneutic tool, to shed light on the construction of video games narratives and the effects they elicit in their players. In recent years, a number of works discussed the complexity of TV series (Mittell, 2006a, 2015), movies (Kiss & Willemsen, 2017; Willemsen & Kiss, 2022) and other narrative media (see the many contributions in Grishakova & Poulaki, 2019b). Only a few attempts in investigating narrative complexity in games have been conducted so far. In his recent book *On Soulsring Worlds: narrative complexity, digital communities, and interpretation in Dark Souls and Elden Ring* (2024), Marco Caracciolo analyses the complexities that revolve around games produced by the Japanese developer FromSoftware and their fandom. Caracciolo's work is very punctual, but restricted to the analysis of only a handful of games and therefore presents a narrower scope than mine. Similarly, Astrid Ensslin discusses different forms of complexity related to video games but without distinguishing formal complexity, embodied cognitive reactions of players, and audience response in general. While remaining insightful with regards to the metaleptic nature of games, her chapter is not directly applicable for the analysis of video game narrative complexity. Lastly, Cassandra Barkman discusses formal complexity in ways that are closer to my current effort. However, her work addresses formal complexity without connecting it with the cognitive effects it elicits, and the characteristics she discusses are not thoroughly connected to established concepts of narratological inquiry. As a result, her

findings are difficult to operationalise and reuse as hermeneutic tools to systematically analyse anrrative video games and video game player responses. Therefore, a systematic, scalable and reusable analysis of narrative complexity in video games is still mostly missing, just as a discussion of the formal aspects that produce certain cognitive effects. This part of the dissertation aims at filling specifically these gaps in the academic discourse.

# Chapter 1
# Formal complexity and video game narratives

Formal complexity in the sense discussed here concerns the arrangement and construction of narratives.[4]

In very general terms, formal complexity can be somehow equated to a deviation from "the norm", i.e. from different sets of conventions (set by the medium, by the genre, by the socio-cultural *milieu*, etc.) or from humans' everyday experience of the world. This "norm", taking names such as "principles of narrative design",[5] is usually strictly followed by creators of narrative artifacts to help the audience easily navigate them. Therefore, if complex narratives are those that deviate from simplicity, this can lead to the early conclusion that complexity and simplicity are two opposites. Some caveats to this early conclusion must be pointed out. Formal complexity and simplicity are not discreet categories, but rather continuous ones. Elements of simplicity and of complexity can (and more often than not *do*) coexist in a single narrative, and the degree of formal complexity of a narrative is not universal (Grishakova, 2020, 2022a).[6] These caveats prevent a definite and absolute assessment of the complexity of a narrative, but they do not mean that formal complexity cannot be analysed in non-absolute ways.

Initial insights on formal complexity could be identified by reading in negative some prescriptions on how to create understandable and simple structures of information. An instance of this can be found in Kuvich and Perlovsky (2013), who list a number of directions to keep informational structures simple and to reduce the complexity of the representation employing them. They state that:

> "The structure must contain elements that allows [sic.] for fast decision. Fast decision means certainty."
>
> "The structure must be relational. Relation is a constraint that reduces the risk of combinatorial explosion."
>
> "The structure must be hierarchical and nested. In that case, complexity is reduced to a particular level. This also allows for using context and fast and effective navigation and search in every direction."
>
> "The model structures should have effective mechanisms for maintaining knowledge base." (Kuvich & Perlovsky, 2013, p. 304)

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[4] Different other *complexities* can be studied as related to video games, like game complexity (i.e. the number of possible scenarios the rules can generate), but discussing these other notions is outside of the scope of the current effort.

[5] E.g., in https://pixune.com/blog/game-narrative-developing-a-story-that-works/

[6] It should also be noted that there is significant variation in the degree of formal complexity perceived in a narrative. What for one person is very complex, for another one could be very simple. This variation is dependent on several also contextual aspects, such as socio-cultural background, education, etc. I will discuss this more in depth in Chapter 2, which deals more closely with audiences' (and specifically players') response to complexity.

If these requirements are deliberately disrupted in the formal organisation of a narrative, the said narrative is made more formally complex. We could therefore say that by keeping a narrative unclear and ambiguous, with non-consequential relational chains and a-chronologic time flows, by including feedback loops and recursion between ontological levels, by creating a narrative that complicates the reconstruction of an easily understandable linear story, and by impeding the immediate scaffolding of new knowledge, one can obtain a good degree of formal complexity. However, to have a clearer idea of what makes a narrative, specifically a *video game narrative*, more formally complex, it is useful to expand these initial insights and unpack in more specific terms what it is that makes narratives formally complex.

Following Thue's suggestion to divide hypercomplex phenomena into less complex ones for the sake of clearer understanding (Thue, 2020), it might indeed be useful to break down formal narrative complexity into smaller, more manageable and less abstract parts. The first part of this chapter is guided by this specific aim, i.e., discussing in more depth and specificity what makes a video game narrative formally complex. While most of the discussions on narrative complexity existing so far focus on cinema and TV series (e.g. Hven, 2017; Kiss & Willemsen, 2017; Mittell, 2015), or aim at an analysis of a limited set of games (Caracciolo, 2024), my scope is to provide a broader perspective, analysing the formal complexifications typically found across many games and genres.

The second part of the chapter will push this understanding even further, to argue that video game narratives can be considered quite formally complex in general. To achieve this, after a broader discussion I will report the results of the close reading of several narrative video games that present different kinds of formal complexity. These case studies will not only highlight further the reasons why video game narratives can generally be considered complex, but also, methodologically, they demonstrate how to investigate the complexity of the narrative of a video game. This method of analysis will be helpful in Chapter 2, to analyse empirically the response of players to formally complex narratives.

Formal complexity stretches across two dimensions, the quantitative and the qualitative. In the next part, I will analyse more in details what these two dimensions entail.

## 1.1 Dimensions of formal complexity

Talking about narratives' formal complexity, Grishakova and Poulaki argue that "complexity amounts to an organization and patterning involving a multiplicity of elements and their connectivity and variety, evoking surprise and wonder" (Grishakova & Poulaki, 2019b, p. 2). We can indeed regard the formal level as encapsulating two dimensions, namely: 1) the multiplicity of varied and connected elements forming a narrative, and 2) their organization and patterning. The multiplicity of elements, their density, and the resulting informational richness

are to be considered as a matter of quantity, while their organization is a qualitative feature of complexity.

Quantitative formal complexity is reflected by and depends on the number of constituents of a narrative (cf. Ensslin, 2022). It is often seen as the main, or sometimes the only, source of complexity, particularly from the layman's perspective. This view also comes from discourses on complexity pertaining to other disciplines: in linguistics, for instance, "complexity" is intended as a purely quantitative feature (e.g. "['complex' is a preposition] which consists of more than one word" (Matthews, 2007, para. 1)). In video games narrative design, quantitative strategies can provide a not negligible help in complexifying a narrative and making it more semantically dense, but they are expensive to implement both economically and in terms of time. They are also arguably the most difficult to manage since the result might look contrived if not properly thought-out and organised.

Nonetheless, quantitatively rich storyworlds are by now a custom in many narrative video games. Murray defines this as one of the four essential properties of digital environments, calling it the "encyclopaedic" property, i.e. "the capacity to represent enormous quantities of information in digital form translates into an artist's potential to offer a wealth of detail, to represent the world with both scope and particularity" (Murray, 1997/2017, p. 83). This capability of embedding and presenting an immense number of information, and therefore of representing a storyworld in great detail, is therefore not an exceptional quality but one of the main features of narrative video games.

On the other hand, qualitative formal complexity is directly linked to the idea that formal organization contributes to the overall meaning or, as Clark and Phelan puts it, that "one of the principal lessons of structuralism properly understood is that structure can convey meaning" (Clark & Phelan, 2020, p. 13; see also Bordwell, 2007). Qualitative strategies heighten the semantic ambiguity of narratives without necessarily altering their semantic density. While not as prominent to become an essential property of the medium, qualitative formal complexity is nevertheless a very widespread custom in video game narratives.

These two dimensions will help to discuss the complexity of video game narratives also in relation to their intrinsic properties, inherited by the representational standards and practices of the medium video game. Furthermore, they provide a distinction that is useful in discussing the different narrative devices for the of formal complexification that will be highlighted in the next pages, both at the level of the story and at the level of the discourse. It is important to note, however, that the distinction between these two dimensions is quite blurred, and some strategies of complexification can present both quantitative and qualitative aspects. For the current effort, these two dimensions will be used to pinpoint important aspects of the narrative devices, rather than to discuss a categorization of them.

## 1.2 Narrative devices of formal complexity

Certain devices are frequently found in formally complex narratives. In this section I will discuss the most common ones, specifically in relation to their use in narrative video games. Their informativeness will be considered also in light of the two dimensions of formal complexity highlighted above.

The narrative devices presented are to be regarded as ways to complexify a narrative. I am not arguing, however, that a narrative presenting one of these devices is therefore automatically complex. Rather, what I argue is that a narrative employing these devices should be regarded as *more complex* than it would be without them. The overall complexity of a narrative is therefore to be assessed on a per-case basis. The list of narrative devices presented here is to be intended as a guide for such assessment and has been developed specifically to analyse video game narratives.

Notwithstanding the fact that the formal complexity of narratives has been analysed by several researchers (see e.g. Buckland, 2014; Mittell, 2015; Hven, 2017; Kiss & Willemsen, 2017; Grishakova & Poulaki, 2019b; Martín Núñez & Navarro Remesal, 2021), a systematic collection of narrative devices commonly found in formally complex video game narratives is still missing. As mentioned, Marco Caracciolo recently thoroughly analysed the complexity of four specific games (the three instalments of the *Dark Souls* series (FromSoftware, 2011/2018) and *Elden Ring* (FromSoftware, 2022)). However, his analysis is not aimed at a systematic collection of devices, and consequently his results are less widely applicable. On the other hand, Barkman provides a first attempt to analyse the formal complexity of video game narratives. Her discussion is based on four "characteristics of video games storytelling" (namely, "discovery, space, diegesis, emergence") (C. J. Barkman, 2024, p. 2). These characteristics are each a mixture of narrative devices and interaction and user experience design customs. The result is that Barkman's terminology is not systematically connected to established concepts in the study of narratives nor of video games, and it provokes the unnecessary proliferation of the terminology related to this line of inquiry. Her categories are also somehow blurred and interchangeable, which results in uncertain distinctions and a difficult further application of her findings. The more systematic analysis that I propose here has the advantage of being more scalable, more easily employable, and more directly able to explain a wide variety of phenomena without the need to readjust its own descriptive categories.

Lastly, to be noted is that these narrative devices are descriptive but not necessarily prescriptive: they capture how narratives are most frequently made complex, but they do not necessarily exhaust all the possibilities available to make a narrative formally complex.

### 1.2.1 Non-linear temporalities and disruption of cause-effect relationships

The main and the most common narrative devices found in formally complex narratives are the presence of non-linear temporalities[7] and the disruption of cause-effect relationships. Non-linear temporality is to be intended as a mostly qualitative phenomenon in which the linear unfolding of time is subverted so that past, present, and future are scrambled and do not flow in their natural way. Similarly, the disruption of cause-effects relationships is to be intended as occurrences in which effects are presented before causes, contrarily to the very nature of "causes" and "effects".

Different scholars look at these devices from different angles. For instance, Hven supports the understanding of complexity as deviation from the conventional temporal order (Hven, 2017). He identifies in films like Memento (Nolan, 2000) particularly explanatory examples of this device. In *Memento*, a narrative that is relatively simple from a quantitative perspective, is made more formally complex through the subversion of the time flow in the discourse, using flashbacks. Correspondingly, in narrative video games non-linear temporalities can be observed at the time of the *discourse*, when time travel and looping do not imply temporal non-linearity in the story. In *The Legend of Zelda: Ocarina of Time* (Nintendo EAD, 1998), for instance, players are able to jump back and forth of seven years at their will, but without real effects at the level of the story. Contrarily, non-linear temporalities can be observed solely at the level of the story, when they encompass time loops or time short-circuiting. *Time Splitter 2* (Free Radical Design, 2002), for instance, revolves around an alien species that is engaging war with humanity in the past through time travel, but this has little effects for the discourse as each level flows linearly. In some cases, non-linearity impacts both the story time and the discourse time, as in the 2010s *Prince of Persia* series (Broderbund et al., 1989/2024), which entirely revolves around the so-called "Dagger of Time"[8] and its ability to change time, both affecting the story

[7] These include achronies and anachronies in the Genettian sense (Genette, 1972/1992; cf. also Viegas, 2024 on analepses in video games), but also polychronies (Herman, 2002) and all "randomly non-linear" forms of temporality that games can exhibit (Eskelinen, 2012). It should be noted that video game stories (as the potential sequence of events that a game can instantiate – see Introduction) do not necessarily have a completely structured chronological or anyways linear order. For instance, side quests can often be started at different stages of the main quest. This presupposes that not all events in the storyworld are temporally structured in a linear way. However, the temporalities I refer to here are only those found in the player-specific, instantiated narrative, in which non-linearity is still understood as a kind of deviation or complication of the time of clocks and calendars. This is not to say that non-linear temporalities cannot regard the story, as I am going to show, but that non-linear temporalities are not directly linkable to the complexity of narratives if observed *a priori* the instantiation of the story.

[8] In the game series, the Dagger of Time is a special weapon that is able to rewind time at the will of the holder.

and its configuration by the game engine following the player's interaction – the discourse. [9]

Pier, on the other hand, identifies the subversion of the principle *post hoc ergo propter hoc*[10] as a complexifying device, mentioning examples of denaturalized causal flows like "retrograde or backward causality" and "causal loops". (Pier, 2017, p. 541; cf. also the earlier discussion in Grishakova, 2011). This principle is deeply rooted into the human experience of the flow of time and causal links, and it is therefore rather apparent how disrupting it conforms a major complexification of the narrative. In games like *Return of the Obra Dinn* (Lucas Pope, 2018), *Outer Wilds* (Mobius Digital, 2019), and in other games with a strong investigative counterpart, the effects of past actions are presented at the beginning of the narrative, while causes are uncovered as the game progresses.

Ryan similarly argues that having a major impact on the complexity of a narrative are the "discrepancies between the temporal sequence and the causal network", adding that to greater discrepancies between causal networks and temporal sequences correspond more complexity (Ryan, 2019, pp. 41–42). Some of these discrepancies started to be so common in video games to become even customs of the medium. For instance, it is normal for a game to rewind time to an antecedent moment when the player character dies. This, together with the other more particular examples discussed above, shows that often the narrative devices of time non-linearity and of cause-effect disruption also have important gameplay-related effects. Sometimes, they can even configure as game mechanics. For instance, through the Dagger of Time, designers of *Prince of Persia: Sands of Time* (Ubisoft Montreal, 2003) expanded the narrative device of non-linear time to a gameplay device, by affording players with the possibility of reverting time at their will, with several gameplay repercussions. The same could be said for *The Legend of Zelda: Ocarina of Time* (Nintendo EAD, 1998). This highlights the fact that temporality is never a pure concept in video games, as the discourse time can be modified and complexified through interactivity – willingly, as in the case of time-disrupting mechanics, or unwillingly, as in the case of the player characters' dying.[11]

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[9] A further example could be *The Legend of Zelda: Majora's Mask* (Nintendo EAD, 2000), where the narrative unfolds over a perpetually repeating three-days cycle. This also affects the discourse, as the game practically starts from the beginning after a certain amount of real playing time. This brings another dimension of temporality into questions, which is that of real time. The discussions on the temporality of games, and specifically of video games, are numerous and revolve around several temporal structures that surround games and gaming (e.g., the time it takes to play a game, the time represented in a game, the loss of time awareness connected to gaming, etc.). These discussions will be left to further studies as they are less directly connected to narrative formal complexity, but for a more extensive discussion on the temporality of video games the reader can see Cristopher Hanson's *Game Time: Understanding Temporality in Video Games* (2018).

[10] "After that therefore because of that".

[11] The customary mechanisms of pausing, and of saving and reloading, while having temporal repercussions seldom have complexification effects

### 1.2.2 Cruxes, non-closure, and unreliability

Omitting narrative-relevant information is another common qualitative device for the formal complexification of video game narratives. These omissions can configurate in different ways.

Porter Abbott defines a crux as "a critical point, often a gap, in a fictional narrative where there is an insufficiency of cues, or where cues are sufficiently ambiguous, to create a major disagreement in the intentional interpretation of the narrative" (Abbott, 2008, p. 231). Cruxes are among the most frequently employed devices to complexify a narrative. Just as for similar narratives in other media (cf. Bordwell, 2023 for movies), mystery and detective games almost entirely rely on the use of cruxes. Extensive use of cruxes is also found in games of the *soulslike* subgenre,[12] where the narrative is extremely fragmented (see below) and presents a severe abundancy of gaps to be filled through inferencing. These are also features of what have been defined as "archaeogames" (Reinhard, 2018; Caracciolo, 2022), i.e. games that reproduce questions typical of the archaeological inquiry, like the uncertainty of archaeological finds, the complication of a linear chronological understanding of the story, and the "open-ended quality of archaeological interpretation" (Caracciolo, 2022, p. 29).

Another typical instance of omission of narrative information is the absence of narrative closure, i.e. when it is not reached "the phenomenological feeling of finality that is generated when all the questions saliently posed by the narrative are answered" (Carroll, 2007, p. 1). A telling instance of narrative non-closure is Nolan's movie *Inception* (Nolan, 2010), in which the absence of a definite end can be said to generate two alternative stories: that of a man finally returning to his children, or that of a man trapped in a fake, oneiric happy ending. Similarly, the game *Limbo* (Playdead, 2010) introduces a problematising element just before the end, leaving players with an "opening" rather than a closing of the story. This device is also exploited by games that foresee or hope to have a sequel. An example is Visceral Games' *Dante's Inferno* (Visceral Games, 2010) where, after traversing a world similar to the Dantean Hell, the protagonist ultimately arrives at the shores of the mountain of Purgatory, just seconds before the game ends. The device of negating narrative closure can also come hand-in-hand with game genres conventions. In most games of the *roguelike* genre[13], for instance, the

[12] *Soulslike* refers to a subgenre of action role-playing games characterized by punishing difficulty, a large narrative apparatus conveyed one small bit at a time, and a risk-reward gameplay mechanism where players lose resources upon death. The term originates from games of the *Dark Souls* series, produced by the Japanese house FromSoftware, which have been the first games employing the combination of these game and narrative designs extensively. Recent games belonging to this subgenre are *Elden Ring* (FromSoftware, 2022) and *Lies of P* (Neowiz Games & Round8 Studio, 2023). For a detailed analysis of the use of this narrative device in four games of the Japanese company FromSoftware, see Caracciolo (2024).

[13] The *roguelike* genre is characterised by procedurally generated levels and permanent death. Players face a unique configuration of levels and enemies at each run, and they have to start from the beginning each time they are defeated. The term originates from the 1980 game *Rogue* (A.I. Design, 1980). More recent variations of the genre feature persistent upgrades and mechanics borrowed from other genres, and are usually referred to with the term *roguelite*.

absence of narrative closure is related to the absence of a proper end to the game. This genre of video games, at least in its recent implementations, is characterised by gameplay-heavy moments interspersed with more narrative-driven ones, as often bits of narrative content are found randomly in the procedurally generated environment and/or after each death of the player character. To provide a narrative support to the infinity of gameplay moments they can generate, these games often do not entirely close their narratives, always suggesting that possibly new information can be disclosed by continuing to play.

Lastly, unreliable narratives are those in which parts of the narrative cease being coherent due to the specific design choices of omitting or hiding narrative-relevant information.[14] It should be noted that only deliberate deception is being considered here, as those narratives that seem unreliable due to an incoherence of the narrative do not present complexifying strategies, by definition. Unreliability leaves a high degree of uncertainty both about the status of the information omitted and about the status of that which is presented.[15] Sometimes, the unreliability is unveiled at some point of the narrative (generally towards the end), which triggers a retrospective evaluation of its entirety (cf. also the concept of "anagnorisis" (Baldick, 2008)). In other cases, there is no overt discovery of the unreliability, as for the case of the Italian novel *La Coscienza di Zeno* (Svevo, 1923/2022), where the lies of the protagonist and narrator are never overtly disclosed. In narrative video games there are numerous instances of the employment of this narrative device. A deceptive narrative is famously found for instance in *Bioshock* (2K Boston, 2K Australia, 2007) where players eventually discover that their guide throughout the game turns out to have been willingly misleading them by presenting only a partial view of the reality. Another famous example of heavy narrative unreliability is *The Stanley Parable* (Galactic Cafe, 2013), where a meta-narrator constantly tries to push the players towards certain directions by lying and deceiving them.

[14] As also discussed by Saroğlu (2023), the concept of unreliable narrator is only partly applicable in video games, although attempts at using it have been made (e.g. by Roe & Mitchell, 2019; see also the discussion on modes of narration in games by Arjoranta, 2017). Often, unreliability is disconnected from a proper narrator and arise from game mechanics (cf. the concept of 'ludic unreliability' in Gualeni & Van de Mosselaer, 2021) or from the distortion of the focalisation that is metaleptically reflected on the player, who have access to the game- and story-world through the character's point of view. The character that is not always necessarily impersonating the figure of a narrator, and sometimes figures only as a metaleptic alter-ego of the player (cf. Ensslin, 2022). A more fitting concept is that of *unreliable narration*, to which I will adhere here.

[15] Kiss and Willemsen (2017) identify two kinds of deceptive unreliability in complex movies. The first refers to a restricted objective view, when only a part of reality is presented, misleading the audience. The second indicates a subjective imperfect presentation, which refers to a narrative biased by the (distorted) subjective perception of a homodiegetic narrator.

### 1.2.3 Multiple lines, (branches,) embedded stories, and perspectives

The presence within a single narrative of several storylines, the intertwinement of different embedded stories, and the presentation of several perspectives can be regarded as devices for making narratives formally complex by quantitatively expanding them, but it has several also qualitative aspects.

The multiplicity of storylines, multilinearity, can refer in this context to two senses of the term, namely the use made by Ryan to refer to stories with multiple alternative branches (Ryan, 2006), and the use typical of the literature on IDN studies that refers to narratives with simultaneously-progressing storylines (e.g. Koenitz et al., 2021; Koenitz, 2023). To avoid confusion, I will refer to the former as "multiplicity of branches", while the latter will remain "multiplicity of lines".

The proliferation of narrative branches is often found in narrative video games due to their interactive nature. More specifically, this device appears in those games with branching structures in which players are presented with multiple story alternatives and significant dramatic agency. For instance, in *The Wolf Among Us* (Telltale Games, 2013/2014), the same situation can have several very different outcomes depending on players choices, and eventually the whole story can have a number of different endings. This multiplicity of branches complexifies the narrative by generating alternative directions for the same story, which must be prospectively probed to evaluate the expectably most desirable outcome. In particular cases, several of these alternatives are explored within a single narrative. This happens for instance in movies with alternative branching storylines (e.g. Sliding Doors (Howitt, 1998)), in literary fiction (e.g., *The French Lieutenant's Woman* (Fowles, 1969/1998)), but it is considerably rarer in video games.

Narratives with multiple simultaneous storylines are often found in video games as well. For instance, in *Breath of Fire IV* (Capcom Development Studio 3, 2000) the story of the protagonist and of the main antagonist are developing at the same time, presented in alternation to players before eventually coming to the clash. This is the most frequent way in which games employ this narrative device, i.e. presenting alternatively the story of different characters.[16] In rarer cases, the multiple lines progress synchronically and not in alternation, as it is the case for the main narrative line and the so-called "Sadie's story" of Halo 3 ODST (Bungie, 2009)[17]. The development of multiple stories in one narrative goes against the so-called Aristotelian *dicta* of simplicity – the unity of time, place and action[18] – and

[16] Similar phenomena can be identified, e.g., in games like Final Fantasy VIII (Square, 1999) and IX (Square, 2001), and in Halo 5 (343 Industries, 2015).

[17] A more detailed analysis of this case will be provided in chapter 2, in the section "Part I 2.2 Formal complexity and cognitive responses – a study".

[18] As Edwin Simpson pointed out already in the late 1870s, the "Aristotelian unities" are a misnomer, as they actually result from the misreading of Aristotle's *Rhetoric* by the Italian tragedy writer Gian Giorgio Trissino.

complexify the narrative by means of generating different but interwoven narrative arcs.

Another increasingly usual feature of video games is narrative structures with multiple embedded stories. With this I mean here a kind of storyworld that is not focused on a single story but embeds a number of other smaller, self-contained ones. The typical videoludic example is that of side quests[19] running in parallel with the main one. On the one hand, these additional story arcs are not part of the main story, and are, by definition, not mandatory for the completion of the main quest. On the other hand, they are not completely detached from the main story either, as they are inserted in the same storyworld and often shed a clearer light on characters, places, fictional cultures, etc., often giving a more vivid substance to the world. This complexifies the narrative by expanding the number of interconnected stories participating in the creation of the overall storyworld. Narrative video games ever more often present impressively huge worlds, populated by sometimes hundreds of characters, each with their individual motives and stories. This causes a proliferation of interlinked narratives that complexify the overall narrative apparatus of the game.

Maybe less frequent in video games for entertainment purposes is the presence of multiple perspectives over the same situation, which, too, can highly complexify the narrative. In *Detroit: Become Human* (Quantic Dream, 2018), for instance, players control alternately three characters during an android insurgence. The three characters have very different positions in the resulting clashes (leader of the insurgence, policeman, and fleeing person caught in the middle), which parallel three rather different perspectives over the situation and theme at hand. This complexifies the overall narrative by prompting players to maintain several competing views on the same storyworld. This device appears with particular frequence in serious games and in journalistic interactive digital narratives, like *Mission Zhobia* (&RANJ, 2013) and *Last Hijack Interactive* (Pallotta et al., 2014), respectively.

Another device that could be called into question in this discussion is the multiplicity of featured characters. However, in video games the presence of multiple characters complexify the narrative only when it translates into one of the four multiplicities listed here (of branches, lines, embedded stories, or perspectives). For instance, in RPG games it sometimes happens that the presence of several characters forming the party is largely irrelevant in terms of narrative complexity, as it does not imply the presence of multiple lines, branches, embedded stories or perspectives. In *Baldur's Gate* (BioWare, 1998) it is possible to clearly observe the difference between a situation in which the multiplicity of character entails additional embedded stories, storylines, and perspectives, and one in which this proliferation of characters is irrelevant to the complexity of the narrative as it does not translate into one of the other four multiplicities. This game allows players to either welcome in their party characters created by the

[19] A quest can be conceived as "an identifiable objective that the player is given, but that is not necessarily identical to the game's overall objective" (Domsch, 2013, p. 81).

game designers, each with a personality and a story, or "empty" figures, created through an in-game creation tool to be good fighters but lacking all other traits including a psychological dimension and a background. In the first case, if players decide to have full-fledged characters in their party, their multiplicity complexifies the narrative as their individual personalities and motives add smaller story arcs, diverse perspectives, etc., while this does not happen in the latter case of players deciding to only have "empty" characters. For this reason, the multiplicity of characters can be disregarded as a narrative device directly causing the complexification of a narrative.

The four multiplicities often occur in combination, so that the multiplicity of perspectives or storylines generally entails a multiplicity of embedded stories. For instance, in the aforementioned *Detroit: Become Human*, the storylines of the three characters providing their own perspectives are followed in alternation. Indeed, having different perspectives over a theme or situation and/or multiple storylines, necessarily require a multiplicity of embedded stories. However, this is not always and not necessarily the case as, e.g., narratives with multiple embedded stories are not necessarily multi-linear. For example, when the fictional world is at a moment of relative peace and no significant events occur, players can follow side stories without this meaning multi-linearity (as it happens with some of the side quests in *Final Fantasy VII* (Square, 1997), when no events are impending). Finally, stories with multiple branches do not require a multiplicity of embedded stories, of storylines, nor of perspectives, and vice versa.

As already mentioned, multiple embedded stories, multi-linearity, and multi-perspectivity complexify a narrative that features them by quantitatively enriching the storyworld, but they can also create the preconditions for or co-occur with other more qualitative complexification devices, like non-linear temporalities or the fragmentation of narrative-relevant information (see the next section).

It should be noted also that it is possible to some extent to "fake" the presence of multiple branches (and possibly embedded stories), by making the narrative seemingly richer than it actually is, through tricks that are sometimes well-known to game designers, like fake choices. For instance, in *Final Fantasy VII Remake* (Square Enix Business Division 1, 2020), players are sometimes given the possibility to choose the unfolding of dialogues, but the direction players decide to give to the conversations have no real impact on the development of the story.[20] On the other hand, those that are generally referred to as "games as a service"[21], often hint at rich backstories that do not actually exist and that are created only at a later moment (if at all). This happens extensively for instance in *Genshin Impact* (miHoYo, 2020). In this game, the presence of several nations and ancient civilizations has been mentioned since the very first release in 2020, when only

[20] The use of fake choices was and sometimes is massively employed in video games, sometimes overtly and other times less so. It is somehow helpful in giving players a perceived sense of agency, while actual dramatic agency is none.

[21] With this, I mean to refer to a particular business model in which content is constantly added to a game, continuously expanding its world and narrative universe.

one nation existed, making the story and politics of the world appear complex and entangled without having actually developed yet this complexity and entanglement. With subsequent additions and expansions, some of these nations and civilizations came into existence, while others are still waiting to actually be developed and even designed. These deceptions are somehow qualitative strategies to pretend the presence of quantitative ones.

### 1.2.4 Narrative fragmentation

The fragmentation of narrative-relevant information (or narrative fragmentation) in video games is often related to the exploration freedom and dramatic agency afforded to players, so that generally to more freedom of exploration corresponds more narrative fragmentation.[22] This device can be conceived as a particular way of presenting information and as such is a qualitative strategy.

A fragmented narrative in the sense employed here is one in which narrative-relevant information are not presented subsequently in time, or in which they are scattered around the game world. Fragmentation is therefore intended both in spatial and chronological sense. For example, in *Hades* (Supergiant Games, 2020), players discover parts of the story always in the same location, but at different times, while, in *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011) each bit forming the rich storyworld of the game is found in a different location.

Fragmentation is often found in narrative video games. It is particularly frequent intended in a spatial sense, specifically in open-world video games in which players are free to roam a vast map filled with characters and stories.[23] In these cases, as mentioned earlier, multi-linearity, multiple embedded stories, and multi-perspectivity enable (and in some way require) the fragmentation of narratives. Fragmentation can sometimes be fostered or suppressed also a result of player's afforded freedom: in *Grand Theft Auto: San Andreas* (Rockstar North, 2004), for instance, players can decide to follow some of the embedded stories in a linear order or in a scrambled one, thus enhancing or reducing narrative fragmentation. However, in the example of *Hades* it is possible to observe that little afforded freedom of movement (only one quite small map is really free to be navigated, while the others are essentially meant just to be traversed unidirectionally) does not impede the fragmentation of the narrative.

Some games have made narrative fragmentation a significant part of their fortune. Most of the immense narrative apparatus e.g. of *Dark Souls* (From-Software, 2011) is vastly reliant on extremely fragmented narrative bits. For instance, each item collectable during the game has a short description in which a very small portion of story is unveiled (normally through not more than a couple of sentences at a time). In addition, the design of the world often suggests specific

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[22] However, more narrative fragmentation does not necessarily imply more freedom afforded.

[23] Open world games feature a virtual world that the player can explore and approach freely, without constraints regarding routes, objectives, and, sometimes, ways to achieve them. It often also involves environmental storytelling (Jenkins, 2003).

happenings through environmental storytelling. Similar instances of fragmentation are found in all games of the *soulslike* subgenre and in archaeogames.

### 1.2.5 Metalepsis

The disruption of narrative frames has been discussed as yet another device for the formal complexification of narratives (cf. Kiss & Willemsen, 2017). I intend metalepsis here as the disruption of ontological boundaries between narrative layers (called 'ontological metalepsis', in the terminology by Ryan, 2006; on the basis of Genette, 1980; see Pier, 2016 for an exhaustive discussion of metalepsis and related studies). Metalepsis complexifies narratives by blurring the borders of different narrative levels, sometimes at multiple even meta-narrative planes, so that it becomes difficult to reconstruct the ontological status of each level.

Metalepsis often features in video games. Particularly in tutorials, it is quite frequent to find diegetic characters instructing players on the functions of buttons or menus – extradiegetic elements. However, these kind of metalepses can hardly be considered to complexify the formal aspects of the narrative, as they have very little narrative relevance.

Different are the cases in which metalepses are used in a more substantial way, as in the virtual reality game *Superhot* (Superhot Team, 2016). This game features a metanarrative in which players suddenly find themselves, or their first-level avatar, wearing a VR helmet within the second-level narrative. In examples like this, games challenge the very structure of their own storyworlds by operating a disruption of the narrative stack (Ryan, 2006). Substantial uses of metalepsis can be found even in quite early narrative video games. For instance, in *Metal Gear Solid* (Konami Computer Entertainment Japan, 1998), the player's character is asked to input a communication frequency that is printed on the box of the CD of the game itself. Similarly, in *Xmen 2* (Headgames, 1995) players are required to reset their console to advance in the game narrative, and in *Metal Gear Solid 2: Sons of Liberty* (Konami Computer Entertainment Japan, 2001) an in-game virus is showed to be infecting the hardware itself on which it is run (console, television), crossing the boundaries of fiction into a player's house. These metaleptic phenomena transgress and blend reality and fiction, and blur the ontological boundaries between them in ways similar to the theatrical break of the fourth wall (see also the "*Verfremdungseffekt*" (distancing effect, alienation effect) in Brecht's Epic Theatre (Brecht, 1977)). Even more substantial is the case of augmented-reality (AR) games, in which reality and the storyworld are entangled closely. For instance, in *Pokémon Go* (Niantic, 2016) and *Ingress* (Niantic, 2013), players walk in the real world to find points of interest in the fiction.[24] Often and increasingly metaleptic devices are also accompanied by intermedial aspects. An example is provided by the indie game *Buckshot Roulette* (Mike Klubnika, 2023), in which

[24] This systematized use of metalepsis can be considered a "weak" metalepsis, as it is not anymore a disruption of ontological boundaries, but a featured mixture of them (cf. Matzner & Trimble, 2020).

parts of the story are to be recovered by piecing together a number of clues obtained through extra-diegetic sources, including writing to certain email addresses, calling a phone number, scrutinising the game trailer, and visiting external websites. Similar cases have been recently used to advertise new seasons of popular TV series, like *Stranger Things* (*Stranger Things*, 2016).

Ensslin, drawing on Ryan's view of new media as metaleptic machines (Ryan, 2006), even supports the understanding of video games as inherently metaleptic, since "the semiotic and cognitive phenomenon of avatar embodiment represents a form of ontological metalepsis" (Ensslin, 2022, p. 415). This type of metalepsis will not be touched in this chapter as it sprouts from the interactions of players with it. I will return to this in Chapter 3.

Metalepsis could be seen as a primarily qualitative device to complexify a narrative. However, it sometimes also shows some quantitative qualities. By merging the real and the fictional, the kind of metalepsis employed there enriches the storyworld with elements of the real world.

### 1.2.6 Non-conventional structures and tropes

Resorting to narrative structures and tropes different from those to which audiences are accustomed can qualitatively complexify the narrative in ways that are not encompassed by the devices discussed so far.

Speaking from a Westerner perspective, Hollywood productions made us used to more-or-less stable reinterpretations of the Hero's Journey (cf. e.g. Vogler, 2007), and to stories that revolve around conflict situations (see Zipes, 1993 and his claims on conflicts in western fairy tales). Being customary, these patterns are recruited to make a narrative simpler and easier to understand. Employing different narrative structures and tropes is therefore bound to cause complexity. Movies of the Japanese director Hayao Miyazaki from Studio Ghibli, for instance, recruit some Western cinematic traditions and hybridize them with the East Asian narrative structure, namely the Japanese Kishōtenketsu.[25] This narrative structure leaves the Westerner wondering something along the lines of "I still couldn't tell you what any of the themes were, what any character's arc was supposed to be, or what even happened. An absolutely bizarre experience that made no sense".[26] This sort of confusion is often found in commentaries of

[25] Kishōtenketsu is the Japanese name for a narrative structure that was born in ancient Chinese poetry. It became a widespread way of organising different kinds of discourses (e.g., in rhetorical contexts, in essay writing, in narrative construction) in a number of Asian cultures. Academic literature on Kishōtenketsu or similar East Asian structures written in European languages is extremely limited – with to my knowledge only one exception (Arnavas & Bellini, 2023) – and more research is needed. For some general regards, though on linguistics, cf. Hinds (1982). For academic literature dealing with this narrative structure in Japanese, c.f. e.g. Takemata (1976), Takahashi (1993).

[26] Review of the movie *The Boy and the Heron* (Miyazaki, 2023) posted on the review aggregator Metacritic. Available online at: https://www.metacritic.com/user/eckerm/. Last checked on 03/04/2024.

Miyazaki's movies, and it sprouts from the complexification brought by the employment of non-standard (at least in Westerners' eyes) conventions.[27]

Kishōtenketsu and Asian traditions are of particular importance and interest in the contemporary videoludic landscape, with the Japanese *Square* being one of the main and trend setting industries in video game design, *Nintendo* being one of the most productive and influential actor in the entire market (both hardware and software) since the ancient times of the medium, and Chinese titles being in a constant rising trend (it should suffice to see the increasing popular success of titles such as *Genshin Impact* (miHoYo, 2020)), in addition to a number of influential South Korean productions (like *Ragnarok Online* (Gravity, 2002), and more recently *Lies of P* (Neowiz Games & Round8 Studio, 2023)).

Similarly, unexpected mixture of genres, of elements that do not naturally belong together, or other disruptions of the conventions of the medium can be seen as complexification strategies. For instance, the game *Doki Doki Literature Club!* (Team Salvato, 2017) operates a sudden (and metaleptically connotated) genre switch from dating simulator to a much darker visual novel; *Frog Fractions* (Twinbeard Studios, 2012) famously operates several switches in genres, visual style, and gameplay mechanics, tied together by an almost non-sense narrative progression obtained through the juxtaposition of unrelated (or distantly related) events. These unexpected merges of elements generate interpretive difficulty for the players.

Elsewhere (Arnavas & Bellini, 2023) I have discussed the cognitive explanation of this complexification device, but for what concerns the current discussion, presenting non-standard (from the audiences' perspective) structures and tropes is a device that can significantly complexify a narrative.

### 1.2.7 Seriality

From a quantitative point of view, serializing a narrative is bound to make the storyworld explode in size. Often times – but not always – this implies additional complexity for the narrative. Seriality is a common phenomenon in video games. Some of the most successful video games series already touched their 35th anniversary, with over 20, sometimes over 30, published games belonging to the same series (e.g., *The Legend of Zelda*, *Final Fantasy*).

Literature on TV series identified two main kinds of series: episodic and serial. As Gerrits maintains, referring to Mittell's work (2015), "in the episodic form each episode resets back to a 'steady-state equilibrium' regardless of previous plot developments and introduces a variable element to generate a new instantiation of the show, requiring a strong sense of plot closure all its own" (Gerrits, 2022, p. 220). Serial narratives, on the other hand, show a "cumulative narrative that builds over time" (Mittell, 2015, p. 18). However, the episodic/serial distinction

[27] Similarly, it is likely that exclusively Western narrative conventions produce similar confusions to East Asian audiences, but their identification and discussion are beyond my current scope.

does not completely apply to video games, probably due to the specificities of the medium.[28] Video games almost always feature mostly self-contained narratives, even when they are part of a game series. This is because they are intended and expected to be somehow stand-alone products that do not strictly require players to have knowledge of previous instalments of the series to be played and generally understood. In this scenario, a more productive distinction than the one between episodic and serial narratives would be that between bound and unbound narratives.

Video games series with bound narratives feature continuing stories, or stories shared between the different titles (e.g. the *Halo* series, in which the main games tell the continuing story of a character fighting a war, and the spin-off focus on events occurring at the same time but in different locations during the same war). Unbound video games series, on the other hand, present in each instalment a story that is different and completely unrelated to the others (e.g. most games of the *Final Fantasy* series). A middle ground between the two are semi-bound series, in which the narrative of each game is only distantly related to those of previous titles, in which the same characters are inserted in different storyworlds, or in which the games share the same storyworld without for this featuring the same characters and story. Examples of semi-bound series are the *Pokémon* video games franchise (Game Freak & ILCA, 1996/2021), in which all games share the same world but mostly without intersections between each narrative, or the *Kingdom Hearts* franchise (Square, et al., 2002/2020), in which characters from other games (and a number of different other sources) are brought together in the same narrative.[29]

While this might seem counterintuitive at first sight, semi-bound and unbound video games series appear as the most frequent and the most successful franchises.[30] However, it is not uncommon that single instalments of unbound series germinate bound narratives themselves (e.g. *Final Fantasy X-2* (Square Product Development Division 1, 2003) continues the story of *Final Fantasy X* (Square

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[28] Notable exceptions to this general principle are games produced by Telltale Games, which have a strong episodic nature. The already cited *The Wolf Among Us* (Telltale Games, 2013/2014) is composed of five episodes that constitute serial narratives in Mittel's terms.

[29] This triad of bound, semi-bound and unbound seriality in video games reminds the one proposed by Ryan for transfictional relations (Ryan, 2008; see also Thon, 2015), in which transposition "preserves the design and the main story of the proto-world but locates it in a different temporal or spatial setting" (Doležel, 2009, p. 206), expansion "extends the scope of the proto-world by filling its gaps, constructing a prehistory or posthistory, and so on" (Doležel, 2009, p. 207), and modification "constructs essentially different versions of the proto-world, redesigning its structure and reinventing its story" (Doležel, 2009, p. 206). Transformation and expansion, in Ryan's triad, are featured in bound series, while modification is the phenomenon occurring more often in semi-bound video games series.

[30] The fortune of semi-bound and unbound franchises could be ascribed to the fact that they afford more creative freedom and more variability in the narratives they can produce, while continuing a single narrative by adding yet another bound narrative to it is likely to get to a saturation point relatively quickly.

Product Development Division 1, 2001)). Even in unbound series, inter-game citations and remainders are frequent, so that players are always somehow reminded that they are playing only a section of a bigger whole, and at the same time rewarded for their knowledge of the other instalments of the series. The degree to which this applies clearly varies and, expectedly, the closer the bound between one instalment of a series and another, the more references are presented. For instance, *Halo 3* (Bungie, 2007) presents several references to the happenings of *Halo 2* (Bungie, 2004), to which it is a direct continuation, while *Final Fantasy VII* (Square, 1997) almost none to *Final Fantasy VI* (Square, 1994), its unbound predecessor. As it should already be evident, in such a complicated intersection of related, semi-related, or unrelated but cross-referenced narratives, the resulting complexity is significant.

The actual impact of seriality on the formal complexity of narratives is however quite variable. Bound seriality by itself might not have a huge impact on the complexity of the narrative if it just entails a simple story cut into a number of episodes, each linearly telling a part of the whole. When the different instalments are connected in less linear ways, the organic addition of narrative content in the interstices of an already existing storyworld can significantly complexify the resulting narrative. It can imply a partial revision, re-contextualisation, or recast of the causes and/or effects, of the events of the original narrative in a way similar to that caused by an unveiled unreliability (cf. Section 1.2.2 Cruxes, non-closure, and unreliability). The retrospection in this case is possibly even more pervasive and more frequent, as the original and the new narratives might have several points of contact capable of triggering it (as it happens e.g. in the aforementioned *Halo 3 ODST*). Similar but less frequent retrospective evaluations are likely to happen for semi-bound seriality, as the original narrative and the new one are more loosely connected. Lastly, unbound seriality does not directly impact the complexity of the narrative at hand, but it entices unrelated narratives into a larger narrative universe.

A caveat to these considerations, however, is that the complexification given by seriality is particularly subjective, as it relies heavily on individual player's knowledge: if one player is not familiar with other instalments of a series, the complexification of seriality can be heavily impacted. Normally, since each video game is generally quite self-contained, the lack of knowledge of previous titles in a series entails a loss in perceived complexity. This is particularly true for semi-bound and unbound series. In other cases, the contrary could occur, and the complexity of the narrative is increased for non-knowledgeable players, as relevant information are omitted in one game because contained in another of the same series (e.g. in strictly bound series, like the main Halo storyline), thus resulting in a crux (see 1.2.2 Cruxes, non-closure, and unreliability). This is mostly the case for instalments coming after the first one of bound and semi-bound series.

### 1.2.8 Para-devices: intermediality and transmediality

I discuss intermediality and transmediality last as they are not strictly speaking narrative structures or devices, and they might be better thought of as para-devices.

Intermediality complexifies narratives by blending different media and by making use of the specificities of one in another, so that the resulting effect is that of a complex mixture of two different media conventions.[31] In this regard, Mieke Bal pointed out that "intermediality is a productive confusion, and in this it espouses the fundamental complexity of narrative. Like synaesthesia, it counters unwarranted separations of domains" (Bal, 2019, p. 266; cf. also Grishakova & Ryan, 2010). As intermediality intended in these terms does not quantitatively enrich the storyworld, but rather impact on its presentation, it should be conceived as a mostly qualitative complexification device.

Videoludic examples of intermedial phenomena are numerous, but the most interesting for the current discussion are the direct evocation of one medium into another (named "medial transposition" in Rajewsky's influential typology (Rajewsky, 2005, p. 51; cf. also Grishakova, 2023b)) and the emulation of aspects of one medium in a different one (Rajewsky's "intermedial reference" (2005, p. 52)). On the one hand, an example of the former phenomenon (the direct evocation of one medium into another) is the old game *Star Wars – Episode I: The Phantom Menace* (Big Ape Productions, 1999), in which clips from the homonym movie were inserted to give narrative relevance to interactive and more action-oriented sequences. In this and similar cases, the intermedial aspects require players to switch interpretive frames and to resort to different hermeneutic mechanisms, based on the different customs and conventions of the media involved. In particular, for the game *Star Wars – Episode I: The Phantom Menace*, players have to switch between the hermeneutic mode of cinema and that of (retro) video games. On the other hand, the latter phenomenon (the emulation of some aspects of one medium done into a different one) is clearly exemplified by the game *XIII* (Ubisoft Paris, 2003). The visual counterpart of this game is strongly influenced by comic books, presenting gutters between scenes and onomatopoeic textual representation of sounds (see Figure 1.1). In cases like this one, the intermedial aspects are so deeply ingrained in the game that a switch in hermeneutic frames is not even possible. Rather, two interpretive modes must be held valid simultaneously – in *XII*, that of comics and that of video games.

[31] Through the concept of "intermediality" I refer to all sorts of interactions between two cultural media (mirroring the use done in Grishakova, 2023b; cf. also Grishakova & Ryan, 2010; Hennig, 2015).

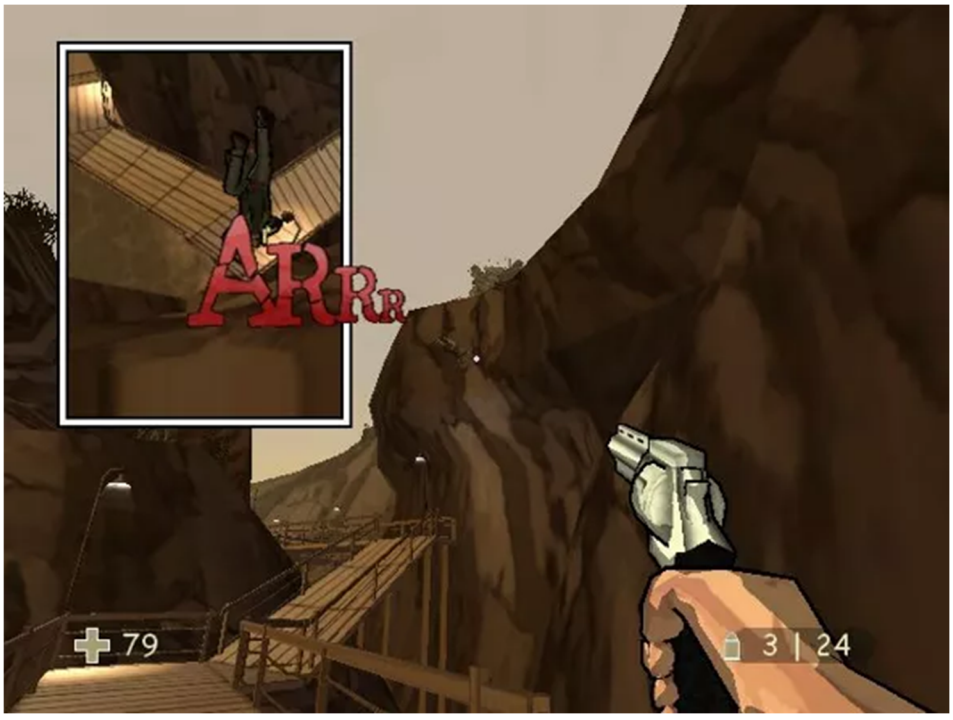


*Figure 1.1 – Screenshot from XII where the gutter and onomatopoeias are visible.*

Similarly to seriality, more and more often games feature transmediation (e.g. games made from movies or vice versa) or employ transmedial elements (e.g. characters taken from fairytales or myths, places borrowed from literature, etc.).[32] Some particularly stunning examples of such phenomena in narrative video games are those represented by the various instalments of the *Kingdom Hearts* series (Square, et al., 2002/2020), which seem to take transmediality to the extreme, bringing together characters and settings coming from Disney movies (e.g. Aladdin, but also non-animated characters like Captain Jack Sparrow), from comics (Donald Duck), and from popular culture (Lewis Carrol's Alice), alongside original ones (like the main protagonist, Sora) and ones coming from other video games series (such as Cloud, from *Final Fantasy VII* (Square, 1997)).

These phenomena expand the narrative of each game, movie, or literary work, inserting it into a system, an ecology of self-contained yet connected narratives

[32] In line with Grishakova (2023b), and Hennig (2015), among others, with transmediality I intend the transfer of features or entities across media. These transfers regard themes, motifs, characters, settings, etc. Instances of transmediality can be found in those characters borrowed from Norse mythology and appearing in comics, movies, and video games, like Thor. In these transitions between media, characters (just as themes and motifs) are subject to change also because of features and customs of each specific medium. As such, it can be argued that transmediality builds on the audience's popular cultural memory (Kukkonen, 2017) to re-introduce elements that they already know or are at least aware of, and further expand them.

which are in constant dialogue, and which both constrain and allow each other's existence, as the narrative of each of them become part of the ground on which new content can be created. This complexity is systemic, as it sprouts from the accumulation of elements into a galaxy of already-gravitating narratives.

Just as for seriality, the actual impact on narrative complexity of intermedial and transmedial phenomena is variable. However, due to the manyfold nature of these phenomena (Grishakova & Ryan, 2010), a per-case assessment of their complexification power is needed.

### 1.2.9 Conclusions of narrative devices of formal complexity

To recapitulate, in general terms formal complexity is the property of video games narratives that feature such devices as non-linear temporalities and the disruption causal order, cruxes, non-closure or unreliability, multiplicity of lines, branches, embedded stories, or perspectives, narrative fragmentation, metalepses, non-conventional narrative structures and tropes, serial features, and intermedial or transmedial phenomena. I have highlighted examples of how these narrative devices are employed in video games to make their narratives formally complex.

In the next section I will discuss more closely and directly the complexity of video game narratives, also in relation to some of the conventions and representational affordances of the medium. As I will show, these devices manifest themselves also due to specific choices in terms of game mechanics and conventions of specific genres. This will help highlight the generally complex nature of video games narratives.

## 1.3 Video games and complex narratives

While there have been discussions on the formal aspects of video games narratives (cf. e.g. Domsch, 2013; Gjøl et al., 2019), a systematic investigation of the status of video games with regards to narrative complexity is still missing – notwithstanding such initiatives as Ensslin's (2022) and Barkman's (2024). In this section I will apply the theoretical discussion provided above to analyse in more detail the narratives of different video games. This section has two objectives: first, to exemplify the use and the identification of the abovementioned narrative devices in actual video game narratives; second, to argue that the narratives of video games pertaining to different genres and traditions can be considered overall complex as they customarily show these complexification devices. For the analysis of formal aspects and for the identification of the narrative devices present in games, I relied on the technique of close reading and in particular on Bizzocchi and Tanenbaum's expansion of it to game studies (2011, 2012). The findings reported below sprout from playing through the games while specifically paying attention to these elements. The results of this analysis will show that video games encompass narratives that are generally quite complex.

A caveat must be pointed out before proceeding: I will not touch upon the complexification that comes from user interaction, as formal aspects of narratives are features pertaining the construction of narratives and their organization. However, this does not at all mean forgetting the existence of players and their status. Video games narratives are always constructed around not receptive readers but active, interacting players. The impact and reaction of players' interaction will be addressed more in depth in the upcoming Part II and III.

Narrative devices to formally complexify narratives are almost necessary for video games. This is due to the very nature of the videoludic medium, as the tension between narrative and interactivity requires compromises that can almost only be solved by means of formal complexification. Video games narratives cannot be represented in audio-visual(-haptic) form for a spatial, procedural, participatory and encyclopaedic medium (Murray, 1997/2017) in the same way as they are for a text-based (or any other media) form.

The procedural and participatory properties of digital media (and therefore, by extension, of video games) require formal complexification as well. First of all, they call for narratives with multiple branches[33], as the dramatic agency afforded to players entails a number of alternative directions for the story. This rends the narrative development ambiguous, as alternative paths remain unexplored but hinted at. It matters little if each of these alternative developments can actually happen or not: is not all ambiguity, also in complex films, a specific and specifically adopted device? Furthermore, interactivity usually implies the possibility of failure and death of the player character. This causes time non-linearity, as often the death of player characters prompts the game to revert in time to a moment when they were still alive. This could show that even the narratives of those (increasingly) rare games which narratives do not exhibit complexification devices can still be considered having a degree of narrative complexity due to their inherent interactivity. As Grishakova and Poulaki argue, "Narrative complexity has been understood as the lack of a classical (Aristotelian) structure […] replaced instead by fragmented, distributed, *interactive* narratives" (Grishakova & Poulaki, 2019a, p. 9) [emphasis added].

Undeniably, a lot of games still heavily rely on different forms of pre-scripted sequences to represent the main happenings of their narratives.[34] This does not at all deny the fact that most part of video games storyworlds is represented through clues embedded in the (digital) environments: worlds full of characters and props for players to interact with and discover. Players can and *will* physically explore these worlds, find its objects and meet its inhabitants, uncovering their own personal stories, places, and roles in the world, in an ecology of micronarratives (Jenkins, 2003; cf. also Ensslin, 2022). This custom is rooted in game conventions

[33] Not by chance, academic and public discourses on the branching structures of digital narratives have been extensive, with specialized literature counting up to nine shapes alternative to the traditional "single branch" linearity (see Ryan, 2001).

[34] Even though this custom seems to be slowly dissolving in favour of a more organic narrative representation.

to the point of considering disappointing worlds not rich and dense enough in micronarratives (as was famously the case for the first version of *No Man's Sky* (Hello Games, 2016) and more recently for *Pokémon Legends: Arceus* (Game Freak, 2022), both severely criticised for their poorness in this regard). This in turn means that video games are not only capable of being quantitatively rich (as their encyclopaedic property calls), but they are expected – and to a certain extent *required* – to be quantitatively rich, to present multiple embedded stories and storylines, and the more so given the constant advancements of technology and computing power.

Lastly, a such rich storyworld, with its parts scattered over a path that is increasingly less predictable (as increasingly more freedom of exploration is given, in ever bigger open worlds), fragmenting the narratives becomes a custom and almost a requirement. In order not to restrict this freedom, time is made to flow differently for players and for Non-Player Characters, and sometimes also between Non-Player Characters. For instance, when the player is assigned with a urgent task (e.g., witness a specific drug dealing encounter, and follow a specific train convoy on which the dealers jump to escape in *Grand Theft Auto: San Andres* (Rockstar North, 2004)), the urgency is seldom transferred to the entire storyworld, which keeps being explorable ideally forever without any actual repercussion (the drug deal will never happen if the player is not in the right position to see it, and the train will always go by at the right moment for the dealers to escape on, no matter the time of the day). Furthermore, Non-Player Characters assign side quests, pursue their own goals during the narrative or anyways follow their own directions, adding side stories to the central, most important one. This multi-linearity and multiplicity of embedded stories enable and sometimes require further fragmentation of the narrative.

To these more general considerations, very often several specific devices of formal complexity can be identified in the narrative of a single game. The employment of such devices is influenced by game design choices and by genre conventions.

It should be noted once more, before proceeding, that complexity is a relative property of as narrative, and therefore the complexity of narratives should be assessed on a per-case basis.[35] To exemplify the kind of analysis necessary to assess the formal complexity of a specific videoludic narrative, in the remaining of the current chapter I will examine three case studies. In each of these examples, complexity comes from different devices, employed with different results.

The order of the case studies is chronological, by date of publishing. This will show contextually that complex narratives have not been a custom only of narrative

[35] If one is longing for an absolute measure of narrative complexity, I would suggest that a narrative is absolutely complex when it presents a reasonable number of strategies to formally complexify it. This also following Chakravartty, according to whom complexity is the "possession of a clustered subset of some set of properties, no one of which is necessary but which together are sufficiently many" (Chakravartty, 2007, p. 158). What could be considered a reasonable amount is left to one's intuition to define.

video games of recent years, but that they have accompanied the videoludic medium for a long time. Given these premises, there is no clear correlation between the year of production of games and the complexity of the narratives they feature. One could expect that the various improvements in the technology related to video games (both hardware, with increasingly powerful machines, and software, e.g., ever smarter artificial intelligences to populate a storyworld with) should allow and somehow prompt the creation of increasingly complex narratives. However, the minimal technical requirements to create complex narratives have been reached decennia ago, and indeed older games do not necessarily show less complex narratives – which is to say that, in more general terms, the complexity of a video game narrative is unrelated to its date of production.

### 1.3.1 Final Fantasy VII

*Final Fantasy VII* (Square, 1997) is generally acknowledged as being among the best video games produced, and one of the reasons of the success of PlayStation. This 1997 Japanese-made game tells the story of Cloud, a mercenary who joins a pseudo eco-terrorist organization. The said organization aims at stopping a world-controlling megacorporation from draining the planet of its life essence to turn it into an energy source. A series of vicissitudes sends the protagonist and his allies in pursuit of Sephirot, a former soldier and member of the corporation who is seeking to destroy the planet with the aid of extraplanetary forces. Before facing Sephirot, players will also have to defeat a sort of defensive mechanism of the planet and prepare for the impact of a comet. During the journey, Cloud will undergo a severe psychological shock when discovering that almost the entirety of his memories is fake and do not actually belong to him.

*Figure 1.2 – Screenshot from the game Final Fantasy VII (Square, 1997)*

While the narrative of *Final Fantasy VII* is rather linear and does not admit much of players' dramatic agency, even the simplified summary provided likely sounds quite confusing. The confusion is arguably due to the multifaceted and apparently unfocused construction and content of the narrative. How is pro-ecological terrorism linked to the necessity to defeat the defences of the planet, and how does all of this relate to alien forces and Sephirot? The answer resides in the narrative tradition from which the game partly draws, which is not Western but East Asian, rooted in the Kishōtenketsu structure. While it is probably true that the narratives is also quantitatively rich, showing a quite big world and a number of many-sided characters with deep and entangled stories, its formal complexity is mostly due to the non-standard (for the Western audience) narrative tradition from which it draws, presenting happenings in the life of the characters rather than a single, conflictual and unequivocally polarized situation with clearly marked "good" and "evil" sides.

It should be noted that the game also presents a particular instance of unreliability of the narrative. As said, towards the end of the game the player discovers that a significant portion of Cloud's (the main protagonist) memories are wrong, which calls for a "complete retroactive rearrangement from memory that requires reasonably high cognitive effort" (Kiss & Willemsen, 2017, p. 55). In the discussion on unreliability as a complexification device, I have mentioned that two kinds of deceptive unreliability can be identified. These are the restricted objective view, when only a part of reality is presented, and subjective imperfect presentation, when a narrative biased by the (distorted) subjective perception of an intradiegetic narrator. In this game, the unreliability of the narrative configurates somewhere in between, as it involves both kinds of unreliability at the same time. Players experience the narrative directly as it unfolds, with no openly subjective point of view. However, they are kept unaware of the reality regarding Cloud due to a very intricate set of misunderstandings and uncalled mistakes in the dialogues between the characters. The cumulative knowledge of the characters around Cloud would be sufficient to uncover the wrongness of his memories since the very beginning of the game. Yet, this cumulative knowledge is never reached, as the gaps in the information of each character are never mutually filled. This configures, therefore, a restricted objective view, since it features only a partial presentation of the reality of the story. And still, due to this artfully managed restriction of reality, players are drawn to see and interpret events according to the subjective belief of Cloud, therefore being inserted in a distorted subjective perception of the storyworld and of the place of the protagonist in it.

Lastly, *Final Fantasy VII* is part of the *Final Fantasy* series. As said, *Final Fantasy* is an unbound series, and *Final Fantasy VII* has little to do with its predecessors and successors, in terms of narrative. It presents however a number of references to previous games (e.g. recurrent characters' names and roles, enemies, abilities, etc.) which call for a number of connections within the instalments of the unbound series. Furthermore, several bound narratives (in the form of games, movies, novels, comics, and a TV series) germinated from *Final Fantasy VII*, which include both prequels and sequels to the narrative of the game. In addition,

two recent titles loosely retrace the story of the game, adding and modifying many details. While obviously not present at the moment of the initial release of the game, these additional bound narratives still participate in the overall complexity for the knowledgeable player at the current moment.

An elaborate set of misunderstandings and mistaken views of reality, together with the non-conventional narrative tradition in which it is inserted and the convoluted serial aspects make the narrative of *Final Fantasy VII* a complex one. In Table 1-1 a summary of the complexification devices identifiable in this game.[36]

*Table 1-1 – Summary of the devices employed by the narrative of Final Fantasy VII.*

| Narrative device | Present in FFVII? | |
|---|---|---|
| **Non-linear temporality** | | NO |
| **Disruption of cause-effect relationships** | | NO |
| **Cruxes** | | NO |
| **Non-closure** | | NO |
| **Unreliability** | YES | |
| **Multiple storylines** | | NO |
| **Multiple embedded stories** | YES | |
| **Multiple perspectives** | | NO |
| **Multiple branches** | | NO |
| **Narrative fragmentation** | | NO |
| **Metalepses** | | NO |
| **Non-conventional structures and tropes** | YES | |
| **Seriality** | YES | |
| **Intermedial aspects** | | NO |
| **Transmedial elements** | | NO |

### 1.3.2 The Elder Scrolls V: Skyrim

An explanatory example and a good manifestation of the quantitative dimension of complexity in narrative video game environments can be found in *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011) (referred simply as *Skyrim* from now on). This rather old (in videoludic standards) action role-playing game tells the story of an unnamed hero in whose veins flow the blood and soul of dragons, and who is bound to defeat the evil dragon Alduin, "the world eater".

[36] This table and the similar ones for the other analysed games must be regarded as purely summarizing tools, and not as descriptive ones, meaning that not necessarily a game showing less "YES", i.e. employing less complexification devices, are necessarily less complex, as this depends also on the frequency and pervasivity of these devices.

*Figure 1.3 – Screenshot from the game The Elder Scrolls V: Skyrim (Bethesda Game Studios, 2011)*

The game features more than 1150 unique characters, each of which is endowed with their own story, issues, or personal quests, each intertwined with one another, and all inserted in, and interacting with, a land of approximately 40km$^2$, made of more than 660 marked places, countless unmarked ones and an alternative sub-terrane world of approximately the same size. All of this is narrated through circa 60,000 unique dialogue lines and more than 350 in-game books telling stories of the world and of its inhabitants, for a total of more or less one million written words[37].

In addition, *Skyrim* features an open world with many short story arcs in the form of side quests. Even though the game is "objective driven", meaning that players have a specific objective to pursue at all times, they are free to roam in the world and explore it at will. Players often find themselves entangled in many quests simultaneously in progress (as it can be seen on the left side of the screen in Figure 1.4), and it is not rare that dozens of even conflicting quests are active simultaneously, if a player does not actively and carefully seek to avoid it. As it can be observed, and as it was anticipated, the freedom of accessing narrative-relevant events afforded by open world structures calls for a number of devices of formal complexification. Given the dimension of this storyworld and the wide freedom it affords, multiple embedded stories are necessarily entangled in one another, where more than one storyline is progressing at the same time. This also causes some instances of multiplication of storylines, and it allows the game to show multiple perspectives of the civil war raging throughout the game. These different perspectives sometimes take the form of branches in the narrative, so that players can decide to join forces with one or the other faction in the civil war

[37] As an easy comparison, one could think that The Lord of The Rings trilogy has a word count of about 517000 words.

and discover the results of this taking sides. Exactly in this complicated interconnectedness of several mutually impacting elements take form the complexity of the narrative of *Skyrim*.

If we take the perspective of a single quest, Skyrim loses much of its complexity. Even if a single quest often involves many characters and places, the presentation of those elements, of objectives and goals, and of results, happens in a simple, linear way, displaying a very standardised structure: 1) a quest is given to the player, who 2) performs what is requested to eventually 3) obtain a reward. As emerges from Figure 1.4, the record of sub-goals of a quest is (with minor exceptions) quite linear, as it is their presentation (1), pursuing (2), and completion (3). However, if we look at the video game from a broader perspective, these rather simple embedded stories build up to an impressive quantity of interacting narrative elements, increasing the density (and fragmentation) of the narrative, and ultimately making *Skyrim* an impressive videoludic storyworld. This shows, as already discussed, that simplicity and complexity go hand-to-hand, and that from many instances of simplicity can emerge an overall complexity.

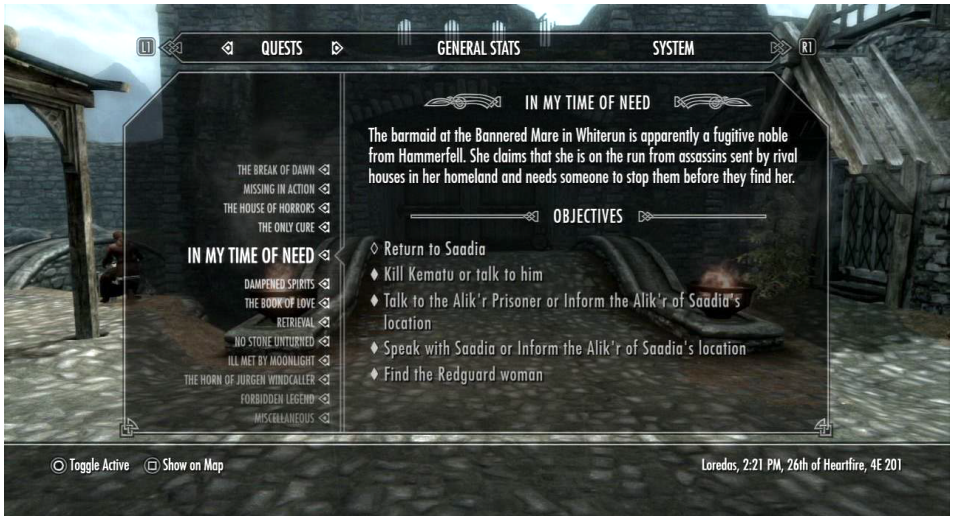


*Figure 1.4 – Screenshot of the quest log screen of Skyrim. Active quest names are showed on the left side of the screen; tasks of each quest are showed on the right side (ordered from the most recent to the least recent).*

An addition to the self-contained complexity of *Skyrim* is also given by its elements of semi-bound seriality. A huge number of references from previous instalments of the *The Elder Scrolls* series are present in *Skyrim*, which is the fifth instalment. Not only world-wide conflicts, societies and cultures in this title are the "natural" continuation of those appeared in the previous games (particularly in *The Elder Scrolls IV: Oblivion* (Bethesda Game Studios, 2006)) but sometimes what are "legends" in *Skyrim* were the main story of previous games, and those considered mythological heroes and gods in *Skyrim* were the player characters in previous titles. This expands the extension and depth of the storyworld, complexifying the

narrative by fragmenting it further and dispersing the extensive narrative apparatus beyond the single game and into the semi-bound series to which it belongs.

Lastly, the hundreds of in-game books also introduce intermedial aspects to the game as they are presented in the book format. These kinds of objects, like books and other forms of reproduced printed literature, have been termed "ludex" (Milligan, 2019) and can be found in a number of games. In *Skyrim*, they also add a sort of intradiegetic seriality, as some of these books are part of a series composed by up to twelve titles (e.g., the "A Dance in Fire" in-game book series, with seven instalments).

Because of all the reasons touched above, Skyrim can be said to be a game with a quite complex narrative. In Table 1-2 a summary of the complexification devices identifiable in this game.

*Table 1-2 – Summary of the devices employed by the narrative of Skyrim.*

| **Narrative device** | **Present in Skyrim?** | |
|---|---|---|
| **Non-linear temporality** | | NO |
| **Disruption of cause-effect relationships** | | NO |
| **Cruxes** | | NO |
| **Non-closure** | | NO |
| **Unreliability** | | NO |
| **Multiple storylines** | | NO |
| **Multiple embedded stories** | YES | |
| **Multiple perspectives** | YES | |
| **Multiple branches** | YES | |
| **Narrative fragmentation** | YES | |
| **Metalepses** | | NO |
| **Non-conventional structures and tropes** | | NO |
| **Seriality** | YES | |
| **Intermedial aspects** | YES | |
| **Transmedial elements** | | NO |

### 1.3.3 Hades

*Hades* (Supergiant Games, 2020) has been variously discussed in academic literature from a number of points of view, including its theatrical aspects (Junius et al., 2021), and its use of mythology (Morgan, 2022; Quero, 2021). The game belongs to the *roguelite* genre, providing an endless gameplay during which players are supposed to find their way out of a dungeon made of different rooms (the combination of which is procedurally generated, meaning that it changes at each run). Every room is filled with a number of enemies to defeat before being able to proceed. Designers of Hades artfully made use of these customs of the *roguelite* genre in many ways, linking them closely with the underlying narrative to deliver a coherent narrative experience, artfully reinterpreting the Greek mythology. The game centres around Zagreus (the player character), one of the sons of the god of

the Underworld Hades. Fed up with the authoritarian reigning of the father, Zagreus tries to escape Hell with the help of the Olympian gods, while a number of dead shadows and famous figures try to stop him (the Furies, the Lernaean Hydra, Theseus and the minotaur Asterius, and Hades himself).

*Figure 1.5 – Screenshot from the game Hades (Supergiant Games, 2020)*

As mentioned, the designers made narratively relevant the continuous deaths and re-run that the *roguelite*/*roguelike* genre entails, framing defeats as yet another returning to the father's mansion after an unsuccessful attempt to escape the Underworld. Between one run and the next, when Zagreus is in Hades' mansion, players can discover the various reasons that led to his longing for freedom. Incidentally, this will lead Zagreus (and the player) to discover details about his past, his mother Persephone, and the relations between the deity of the Underworld and those residing in Olympus. What initially seems the story of a rebellious teenager turns out being the legacy of hundreds of years of skirmishes between deities, in a narrative that keeps unveiling effects but significantly delays the discovering of causes. Details of the story are progressively uncovered by means of a number of short conversations (consisting of a few sentences) exchanged between various inhabitants of Hades' mansion, or with the Olympian deities encountered during the runs. New conversations are unlocked after each failed attempt to escape the Underworld, or by gifting objects gathered during the escapes to the encountered characters. This latter method of discovering information inserts a significantly wide branching of the narrative, as the choice of whom to gift these objects to impacts the discovery of one or the other parts of the story. Furthermore, many NPCs show an alignment in the Olympus-Underworld dispute, providing several perspectives with which to regard the happenings. This could be said to shed more light on a (mythological) controversy, but it is another narrative device complexifying the narrative, as discussed. Additional smaller embedded stories are uncovered as Zagreus talks with a few distinguished figures in Hell that can be

encountered randomly, such as Sisyphus, Euridice, and Patroclus, and a few antagonists, like the three Furies.

Therefore, the formal organization of Hades complicates its narrative by fragmenting it in a series of short bits of information that need to be patched together like pieces of a jigsaw puzzle. However, this jigsaw puzzle appears to be full of missing pieces, in the form of cruxes, so that its completion is made increasingly more difficult. Furthermore, the narrative point of view centred on Zagreus insert in the narrative an element of unreliability regarding both truths and lies, which leads players to disregard a number of truthful information coming from the father Hades, and to completely accept the partial truths of other gods – Zeus in particular, a renowned liar in mythology. This is further complicated by the "political" interests of Olympian deities, sprouting (as it will eventually be uncovered) from old disagreements. In this entangled assemblage of bits of narrative and partial truths, a last complexification device exploited is the open-endedness of the narrative. Zagreus cannot survive for more than a few moments even when finally making it outside of the Underworld, and dying brings him back to the house of his father. Therefore, Hades has virtually no end. How many times will Zagreus attempt to escape? Will he eventually be able to live outside of the Underworld? Will Hell's guards improve enough to prevent his escape? How will the disputes between Olympus and the Underworld be sorted out? These are just some of the questions that remain necessarily unanswered, as the procedurality of the *roguelite* genre allow for infinite replays and the game never openly signals the conclusion of the narrative.

In addition to this strictly internal formal complexity, contextual elements further complexify the narrative, first and foremost in the heavy use of transmedial elements. Characters of Greek mythology have each an enormous apparatus of related stories attached to them, sometimes presenting even significant incongruences between each other. For instance, the very figure of Zagreus is associated with at least three different traditions. In his first appearances, Zagreus is seen as one of the highest deities (associated with Gaia), but Orphism sees him as son of Zeus and Persephone, and Aeschylus links instead Zagreus to Hades, as his son or even as the God of the Underworld himself (for more details, see Gantz, 1993). Characters with a more prominent position in the mythology (e.g. Zeus, but also Achilles, etc.) have exponentially more complicated stories. At least a part of these intricated and interwoven backstories are acknowledged in the game, which also explodes the figures of the involved characters to their exponential size. This is particularly true for players with at least some knowledge of Hellenic mythology, but these characters often refer to these backstories in the game, thus hinting this complexity also to non-knowledgeable players.

The complexity of the narrative of Hades is therefore sprouting mostly from its presentation of the underlying story, hidden in a cloud of noise (lies and untrusted truths) and fragmented in small bits that need to be pieced together to obtain the bigger picture – but an always partial one. Transmedial aspects also participate in the complexification of the narrative, and the more so for players who know more about Greek mythology. In Table 1-3 a summary of the complexification devices identifiable in this game.

*Table 1-3 – Summary of the devices employed by the narrative of Hades.*

| Narrative device | Present in Hades? | |
|---|---|---|
| **Non-linear temporality** | | NO |
| **Disruption of cause-effect relationships** | YES | |
| **Cruxes** | YES | |
| **Non-closure** | YES | |
| **Unreliability** | YES | |
| **Multiple storylines** | | NO |
| **Multiple embedded stories** | YES | |
| **Multiple perspectives** | YES | |
| **Multiple branches** | YES | |
| **Narrative fragmentation** | YES | |
| **Metalepses** | | NO |
| **Non-conventional structures and tropes** | | NO |
| **Seriality** | | NO |
| **Intermedial aspects** | | NO |
| **Transmedial elements** | YES | |

### 1.3.4 Conclusions of the analysis

Looking at Table 1-4 summarising the results of this analysis, it is possible to observe some general phenomena.

*Table 1-4 – Summary of the narrative devices employed in the games analysed to formally complexify narratives*

| Narrative device | FFVII | Skyrim | Hades |
|---|---|---|---|
| **Non-linear temporality** | | | |
| **Disruption of cause-effect relationships** | | | X |
| **Cruxes** | | | X |
| **Non-closure** | | | X |
| **Unreliability** | X | | X |
| **Multiple storylines** | | | |
| **Multiple embedded stories** | X | X | X |
| **Multiple perspectives** | | X | X |
| **Multiple branches** | | X | X |
| **Narrative fragmentation** | | X | X |
| **Metalepses** | | | |
| **Non-conventional structures and tropes** | X | | |
| **Seriality** | X | X | |
| **Intermedial aspects** | | X | |
| **Transmedial elements** | | | X |

First, it is visible that the multiplicity of embedded stories is the most frequent device that can be found in narrative video games. This was expected and is in line with the theoretical presupposition outlined above of games often involving various intertwined embedded stories. Second, that the multiplicity of embedded stories, perspectives, branches, and the presence of narrative fragmentation can be seen as often co-occurring. This, too, was foreseen in the theoretical discussion. However, as theorised and as Table 1-4 shows, the co-occurrence is not a strict necessity, as sometimes it does not verify (e.g., in *Final Fantasy VII* the multiplicity of embedded stories does not imply the others).

A third conclusion is that the table can also provide a meta-insight, showing the unquantifiable nature of narrative formal complexity. The devices for the formal complexification of narratives can be applied in several ways and with a number of nuances, at different granularity levels. Their pervasiveness and impact on the overall narrative can also significantly differ from one game to the other. Nonetheless, while complexity emerges as a relative feature that should be investigated on a per-case basis to reveal itself fully, the table format is useful for a quick overview of the devices most widely employed in a game. Through an empirical case study, in Chapter 2 I will show how this rather schematic description could be employed to predict player response to video game narratives.

Lastly, the analysis conducted here shows that complexification devices can be detected in videoludic narratives across a big portion of the history of the medium and spanning over several genres. While additional analysis is required to describe in more precise terms the complexity of each video game, as discussed, the preliminary findings of this study are that narrative formal complexity is a pervasive feature of video games.

## Conclusions of Chapter 1 – Formal complexity and video game narratives

I have started this chapter with a theoretical discussion of some of the complexification devices often employed in narrative video games. While the quantitative richness of narratives is often regarded as the main source of complexity, quantity is not the only (nor by any means the main) way to formally complexify narratives. Several narrative devices to complexify narratives are qualitative and are capable of making complex even a relatively quantitatively poor narrative. I have identified several of these devices, explained and exemplified them. I have then provided a more specific discussion of three games that feature a number of such devices, to further substantiate my theoretical claims, to show the kind of analysis useful in identifying the ways in which narratives are made formally complex, and to provide a (brief) historical perspective, showing that narrative (formal) complexity can be found throughout several decades of the relatively short history of the videoludic medium.

From both the theoretical and the more hands-on analyses it can be concluded that narrative video games are, in one way or another, often featuring quite complex

narratives. This should not come completely unexpected: in video games, participatory by their very nature, finding ways to complexify and add depth to their spatial, procedural, participatory and encyclopaedic narratives has in some sense always been a design requirement. This realization, and the noticed increase in popular fortune of complex narratives, could be combined arguing for a (at least partial) causation beyond simple correlation: as video games become more and more popular, so do their ways of narrating fragmented, diverse, unexpected, or ambiguous – in a word, complex – narratives.

Among the further directions for research, it would be exciting to investigate the connection that narrative complexity displays with storyworld complexity, and in particular with the cognitive process of "mapping words onto worlds" (Herman, 2009, p. 71). Furthermore, developing a customised ordinal scale to describe the impact of the devices presented here on the overall complexity of a narrative could bear interesting results, but would need a broader analysis, encompassing a much bigger sample of narrative video games, that will be left to the future.

Formal complexity in itself is, however, just a starting point, a tool in the authorial hands that can be deemed useless *per se*, if not paralleled by a certain specific reception and response by the audience to which it is presented. This is the reason why it is needed to investigate complexity at another level, that of the players response to complex narratives, which is seen by many scholars as the diagnostic sign of complexity – i.e., as the sign that a narrative is indeed complex. In the next chapter, will analyse what can be considered a typical response to complexity, and why and how it is elicited by and linked to formally complex narratives, before proceeding with empirical evidence to discuss this strict bond.

# Chapter 2
# Player response to complex videoludic narratives

Considering specific cognitive responses as the symptom of narrative complexity is the arrival point of many scholars (including, e.g., Cutting (2019), Knoller (2019), and Cohn (2019)), so much that heightened cognitive load can be considered the diagnostic sign of complexity (Grishakova & Poulaki, 2019a; Kiss & Willemsen, 2017).[38] In general, then, one can say that complex are those narratives that pose above-average cognitive challenge to their audience. More specifically, the insurgence of confusion and other epistemic emotions are generally regarded as the most easily recognizable and identifiable cognitive response to a complex narrative: "the complexity of narrative […] lies in its strategies of confusion" (Bal, 2019, p. 266). Other phenomena usually regarded as signs of complexity, as we are going to see, are suspension of understanding and cognitive dissonance (cf. also Kiss & Willemsen, 2017; Hven, 2017). The narrative devices discussed in the previous chapter elicit these cognitive responses by leveraging on particular effects of several cognitive functions.

## 2.1 Cognitive processes, epistemic emotions, and narrative devices

In general terms, complexity can be argued to hinder evolutionary selected functions for optimizing our cognitive efficiency that has been termed the "fast and frugal heuristics" (Gigerenzer & Todd, 1999). They are aimed at saving time and energy by preventing us from considering of all details of every situation we are faced with and instead making us rely mostly on learned and rooted patterns. Fast and frugal heuristics characterize a mode of thinking that is automatic, unconscious, and fast, and that has been termed "System 1" of thinking (Stanovich & West, 2000; see Kahneman, 2013 for a more popular rendition of the theory). Formally complex narratives significantly impede our evolutionarily-selected cognitive functions of optimization by transgressing these deeply ingrained patterns, thus prompting a slower, rational, and more expensive – in terms of cognitive effort – thinking mode. This more rational thinking mode, referred to most often as the "System 2" of thinking (Stanovich & West, 2000; Kahneman, 2013), is opposed to System 1. Kahneman exemplifies the kind of tasks performed by the two systems, including two particularly interesting points:

[38] "The heart of complexity does not lie in intricate narrative structures by themselves, but in the felt experience and cognitive effect that such compositional disruptions can create", write Kiss and Willemsen (2017, p. 27). In a similar fashion, Grishakova and Poulaki maintain that formal complexity "translates into complex forms of recipient engagement and becomes synonymous with the difficulty of perception and interpretation" (Grishakova & Poulaki, 2019b, p. 6).

System 1:

- "Detect that one object is more distant than another.
- Orient to the source of a sudden sound.
- Complete the phrase "bread and…"
- Make a "disgust face" when shown a horrible picture.
- Detect hostility in a voice.
- Answer to 2 + 2 = ?
- Read words on large billboards.
- Drive a car on an empty road.
- Find a strong move in chess (if you are a chess master).
- Understand **simple** sentences.
- Recognize that a "meek and tidy soul with a passion for detail" resembles an occupational stereotype." (Kahneman, 2013, p. 23) [emphasis added]

System 2:

- "Brace for the starter gun in a race.
- Focus attention on the clowns in the circus.
- Focus on the voice of a particular person in a crowded and noisy room.
- Look for a woman with white hair.
- Search memory to identify a surprising sound.
- Maintain a faster walking speed than is natural for you.
- Monitor the appropriateness of your behaviour in a social situation.
- Count the occurrences of the letter a in a page of text.
- Tell someone your phone number.
- Park in a narrow space (for most people except garage attendants).
- Compare two washing machines for overall value.
- Fill out a tax form.
- *Check the validity of a* ***complex*** *logical argument*." (Kahneman, 2013, p. 24) [emphasis added]

The absence of regularity often introduced by complex narratives makes it more difficult to rely on patterned information, and it asks for more attentive, and hence more expensive, response. Complexity calls for conscious attention, effortful reasoning, and logical computation, as it transcends the expected and the usual. Complexity is therefore necessarily more bound to the usage of System 2, as it is largely ungraspable with the quick and stereotype-based System 1.[39]

It has been observed that the unexpected poses problems to cognition, as "the cortex has a learning algorithm that naturally finds whatever hierarchical structure exists and captures it. When structure cannot be found, we are thrown into confusion" (Kuvich & Perlovsky, 2013, p. 304). This causes a specific psychological state that Festinger defines "cognitive dissonance" (Festinger, 1957; see the use done in Kiss & Willemsen, 2017), i.e. the mental disposition that results

[39] Although the two should not be seen as dichotomous and discreet, but as nuanced and constantly performing hands-offs to one another.

from holding conflicting beliefs. Confusion, in this regard, is thus to be considered as the status in which the audience is not able to reconstruct a single, definite belief guiding their overall interpretation of the narrative. This, however, while still assuming the existence of a definite interpretation that can be reached. This assumption is the primary motivation that allows the existence of complex narratives in the first place, and it pushes the audience to engage in the cognitively demanding effort of dealing with complex narratives. On the contrary, if one would be openly presented with randomness, one would seldom look for authorial intention in it as there would be none by definition, and therefore one would not engage in the hermeneutic game of interpretation presupposed by complex narratives. What Kiss and Willemsen call "puzzlement" (Kiss & Willemsen, 2017), then, could be intended as a sort of suspension of understanding, a status in which one expect comprehension to be possible, but not achieved yet.

With regards to narratives, expectations about narrative patterns are both generated by and disrupted in, and through, particular formal organisations. Reconsidering the narrative devices described in the previous chapter, it can be observed that several of them present a deviation from the norm – either of an experientially grounded understanding of the world, or of well-established narrative conventions (such as the "Aristotelian" simplicity for Westerners). In particular, non-linear temporalities and the disruption of cause-effect relationships interfere with our everyday experience of two very basic regularities of human life. The always-forwarding progression of time,[40] and the consequent necessary development of the causal chain, are at the basis of our perception and understanding of reality, and their disturbance is therefore a major deviation from our experiential norm. Therefore, in the detective-style game *Return of the Obra Dinn* (Lucas Pope, 2018), the a-chronological presentation of the happenings is significantly complexifying the narrative, and it constitutes one of the main riddles to solve. Expectations regarding the narrative can also go unattended when it is constructed following structures and tropes that are not well-ingrained in the mind of players, as I observed happening in *Final Fantasy VII* (Square, 1997), where the complexity mostly resides in the narrative being structured following East Asian traditions. On a meta level, intermedial phenomena violate players' expectations regarding the regularity of the interpretative frames to be employed, while metalepses disrupt the expected consistency of the ontological boundaries of a representation.

Similar effects are produced by the uncertainties coming from other narrative devices discussed in the previous chapter. Cruxes, non-closure, and unreliability, while somehow transgressing the expectations coming from our customary encounters with narratives – and in particular the expectation to have more-or-less complete, self-sufficient and reliable information – they most strongly confuse players by generating uncertainty over the narrative. Uncertainty, together with

[40] Notwithstanding possible different cultural conceptions of temporality that could impact the perception of the representations of time, from a Westerner's perspective such as that employed here the linear progression of time is the commonly assumed norm (Heinze, 2013).

the unattended expectations, often trigger our tendency to infer missing information – what has been called our predisposition to "fill in the gaps" (cf. Thon, 2016). This inclination pushes audiences (or players, in the case of games) to generate inferences regarding the narrative, which in turn creates some degree of certainty and, with it, further expectations. These certainties and expectations, too, can then be disrupted, thus creating a sort of "vicious" cycle of disattended self-inferred expectations calling for new inferring, and so on. *Soulslike* games excel specifically in exploiting this inferring-and-disrupting tendency, providing extremely little certainties over their narrative. Other cognitive mechanisms further problematise this tendency and foster its confusing effects. Among these are the "egocentric bias" (Lombardi Vallauri, 2021) – our inclination to uncritically trust the results of our own mental speculations – and the "principle of commitment and consistency" (Cialdini, 2009) – our disposition to stick to our beliefs. These two mechanisms can produce strong expectations regarding the narrative, which can cause an equally strong cognitive dissonance if disrupted.

Furthermore, by preventing the establishment of an immediately definite understanding, complex narratives significantly heighten the cognitive effort required for being processed. The more so the more complex, that is, the more pervasive, deep, and/or the more extensively present in the story or in its presentation the devices of formal complexification are. In this sense, devices like the presence of multiple lines, branches, embedded stories, or perspectives within a narrative, and the fragmentation of the narrative, impede an immediate understanding by multiplying the amount of information to be processed. This heightens the required cognitive effort as, according to cognitive load theory, "the mental integration of different sources of information increases cognitive load" (Reinwein & Tassé, 2022, p. 524). This effect is quite visible in many guises and is well demonstrated by the example of *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011) reported above, where the individual embedded stories are relatively simple in themselves and complexity germinates from their numerous entanglements. Serial and transmedial features have similar effects on cognitive load.

Moreover, in addition to the difficulty in computing[41], confusion and cognitive dissonance can be regarded as resulting also from the very perception of complexity.[42] An early indication that we may be dealing with a complex narrative is indeed the perception of a multiplicity of elements. As Grishakova and Poulaki observe, this recognition is part of the basic narrative comprehension procedure and stems from the awareness of informational density in a narrative (Grishakova

[41] Computing in this context refers to human cognitive processing and not to the technological computation of a computer.

[42] It should be noted that, from a cognitive perspective, it is debated whether perception already includes structuring and therefore computation: the two moments are in a very tight relationship, with necessary and uncountable feedback loops, in a way that makes it practically almost impossible – and hermeneutically unproductive, in addition to argumentatively confusing – to distinguish the two in a clear way (Hodent, 2021). Therefore, I will not operate here a clear distinction between the two, which would be unjustifiably and unnecessarily structuralist.

& Poulaki, 2019b). The reason why we can see both perception and computation as causes of the response to complexity resides in their role in the cognitive process of comprehension of a representation. This is also hinted by Magliano and colleagues as they talk about "the interplay between the cognitive and perceptual processes" (Magliano et al., 2019, p. 149). They show that cognitive functions work precisely through these two aspects (perceptual and computational), and they thoroughly explore them through the concepts of front-end and back-end processes. Their front-end processes involve perception or, in their own words, the "extraction of information from sensory input" (Magliano et al., 2019, p. 152). This information is used to create a linear understanding of the story, a "representation […] of what is happening 'now' in the narrative world, represented in working memory" (*ibid.*). The information extracted is then passed to back-end processes, which subsequently add the new incoming information to a relational assemblage, necessary for comprehension.

This mutual dependence between front-end and back-end processes in understanding a representation is arguably what permits authors to create complex narratives, as both these processes can be manipulated by authors through the formal aspects (cf. Bal, 2019), not least through the narrative devices for the formal complexification discussed in the previous chapter. In this regard, one might be drawn to regard complexifying devices of the quantitative kind to be impacting on the perception of complexity, and qualitative strategies to impact on the computation. As the concepts of front-end and back-end processes reported above should suggest, however, this is quite a simplification. Besides highlighting further the fact that the two are related and difficult to be clearly distinguished, qualitative strategies can and do impact the perception of complexity (e.g., by introducing resistances to effortless perception), and quantitative strategies have a role in cognitive computation (for instance by heightening the number of information sources to be integrated simultaneously).[43] This shows once more that front-end and back-end processes are strictly related, and that perception and computation are entangled and interdependent in generating responses to a complex narrative.

To summarize, narrative complexity resists our immediate understanding as it transgresses what is expected and "normal" (intended as "that which rests within the canon of normativity"). These transgressions cause cognitive dissonance and activate a more rational but cognitively expensive mode of thinking. While, as demonstrated, narrative video games feature generally complex narratives, the actual complexity of them depends on the amount, pervasiveness, and mode of application of the formal devices discussed in Chapter 1, so that more numerous, more pervasive, or more deeply present devices corresponds to a higher

[43] For instance, both multi-linear and narratives with multiple embedded stories force the players' attention to split between different tasks, which is likely to give rise to what has been called the "divided attention deficit" (see Lien et al., 2006), a decrease in cognitive performances that could contribute to the overall higher cognitive effort required.

requirement of cognitive effort, more marked insurgence of cognitive dissonance, and stronger epistemic emotions.

These theoretical considerations on cognitive reception of complexity, however, significantly lack of tangible proofs specifically related to video game narratives, and to the link between video game narratives formal complexity and players response. The next section is an attempt to fill this gap. To achieve a view of the link between formal organization and cognitive responses that is more deeply grounded in empirical data, I will report on an analysis of the narratives of two video games and of the responses that these narratives caused for their players.

Before proceeding with the empirical analysis, it is necessary to note from a more pragmatic perspective, that a further factor impacting the audience response to complexity is personal disposition. Knoller, expanding the claims by Rauterberg (1995), suggests that "skill, which increases mental complexity, reduces activity complexity" (Knoller, 2019, p. 105). In simpler terms, what Knoller argue is that being skilled in dealing with narrative complexity (or any kind of complexity), reduces the cognitive effort required. Every member of the audience is different in this regard, and can tolerate different degrees of complexity. Attempts have been made to link specific personality traits to the tolerance and even enjoyment of complexity. Willemsen and colleagues, for instance, empirically demonstrated that tolerance to everyday ambiguity and preference for cognitive-effortful activities significantly impact the cognitive processing of complex narratives (Willemsen et al., 2022). These are interesting results that pave the way to obtaining a clearer idea of how different contextual factors (cultural background and *milieu*, education, etc.), impact the reception of narrative complexity. The effects of the devices to make narratives formally complex is therefore inversely proportional to how much each player is accustomed to them, resulting as less impactful to those for whom complexity is more within their paradigm of the norm.[44] Individual fluctuations in the cognitive response to formally complex narratives are therefore normal and to be expected. This is also to bear in mind for the empirical study to which I am directing now.

## 2.2 Formal complexity and cognitive responses – a study[45]

The aim of this study is to delve deeper into the players response to complex narratives, to ultimately add empirical evidence to the intuitive but untested argument according to which certain cognitive responses are positively linked to

[44] This "normalization of complexity" can possibly also shed additional light on the reasons for the increase in popularity of ever more complex narratives in the current mediascape: the more audiences are exposed to complex narratives, the less cognitively demanding they progressively get, thus the more complex future narratives can be, and so on – at least to some degree.

[45] This subsection is a reworked version of the article: Bellini, M. (2021). Formal Organization and Complex Responses to Video Games Narratives. Proceedings of the ACM on Human-Computer Interaction, 5 (CHI PLAY), 275:1–275:17. https://doi.org/10.1145/3474702.

the formal complexity of narratives. In more specific terms, the research question driving this case study is: does a more complex narrative produce proportionally higher insurgence of epistemic emotions (and, specifically, confusion)? Answering this question will not only endorse the correlation between formal complexity and the players response to it, but it will shed more light on the nature of this correlation. In addition, it will be useful to identify feasible strategies to manipulate the latter through the former. Therefore, while the research question deals more directly with the "whether" (whether a relation exists), it will also help to discover more of the "how" (how a complex narrative produces epistemic emotions).

To investigate this, I decided to look at the differences in response of players to two videoludic narratives of different complexity. The analysis therefore comprised three steps:

1. Define the degree of formal complexity of the two games. This had been done through a close reading, following the same procedure described in Chapter 1 (and in particular in "1.3 Video games and complex narratives").
2. Infer the overall audience response to these narratives. To do this, I analysed thousands of online reviews by players of the two games, specifically looking at comments regarding their narratives.
3. Compare the results of the study of the formal complexity of the two game narratives to the results of the study of the responses, to discover whether a correlation exists.

The results of the study show that a positive correlation between the employment of narrative devices for formal complexity and certain cognitive responses is clearly visible. This entails a first empirical proof supporting: 1) the validity of the devices posited in Chapter 1 as descriptors of narrative complexity, 2) the possibility of recognizing them as predictors of certain players response, and 3) their legitimacy as tools to elicit such responses in players. Moreover, the analysis highlights that narrative complexity has an impact on the overall appreciation of a game both by players and by critics. Therefore, an additional finding is that 4) the narrative devices for making a narrative formally complex discussed in Chapter 1 can also be tools to create compelling narratives and more enjoyable video games.

### 2.2.1 The games

The two games I am going to compare contrastively are *Halo 3* (Bungie, 2007) and *Halo 3 ODST* (Bungie, 2009). This choice is based on one main reason: the two games are comparable.

There are a number of contextual factors that can impact on the formal complexity of video games narratives. Among them are genre(s), players expectations, developers' customs, publishers' demands and hardwires intended for their access. Resorting to these two games reduces the differences caused by such aspects, as the two games come from the same series, are ascribable to the same

genre (First-Person Shooters – FPS),[46] employ the same mechanics for interaction and are inserted in the same storyworld. Therefore, their respective audiences should reasonably have the same expectations, given also that they have been released within a short period of time one after the other. In addition, both games have been developed by Bungie and published by Microsoft Game Studios, which entails the same customs by developers, and the same requirements by the publisher. Both games were initially released for the Xbox 360 game console.

In addition, even if the overall average completion time of the two games is not the same (precisely, Halo 3, with an average 9 hours completion time, is almost 30% longer compared to Halo 3 ODST, with an average 7 hours),[47] both titles include 9 playable missions, preceded and followed by short video clips narrating the events happening around the playable periods, and both games have an introduction and an epilogue under the form of longer videoclips. For these reasons, for the sake of my analysis, they can be considered of the same average size.

This premise is of particular importance because it shows that the games can be compared as almost equals for everything but the complexity of their narratives. Indeed, although FPS games are not traditionally narrative driven, the two games exhibit two very different approaches to narrative. This, added to the points of contact already listed, make these two *Halo*s the perfect case study for a comparative analysis aiming to reply to my research question.

A brief summary of the stories and of the overall receptions of the two games is reported here:

- Halo 3, released in 2007, is generally seen as one of the best video games produced for Xbox 360, mainly for its multiplayer features.[48] In this game, the player assumes the role of a cybernetically enhanced supersoldier fighting an ally of alien races known as "Covenant", and the semi-sentient collective-minded parasitical organisms called "Flood". The narrative of this game is quite linear, despite some turnovers. To put it very simply: for religious beliefs, the Covenants want to activate some technological artifacts (known as "Halos", for their ring shape) which will destroy all the sentient beings of the galaxy. Humans ally with a rebel Covenant race and work together with the Flood to stop the activation of the Halos. When this danger is averted, the Flood turns aggressive, and eventually the protagonist and allies activate a small-scale Halo, destroying the central mind of the parasites and saving the galaxy.

[46] First-person shooters (FPS) are a genre of video games characterized by a first-person perspective, placing the player in the role of a character whose experiences are viewed through their eyes. FPS games typically focus on fast-paced action and shooting mechanics.

[47] Statistic data on the completion of *Halo 3* and of *Halo 3 ODST* has been taken from the website HowLongToBeat.com. The information reported refer to the "All Styles" completion time, which is the average completion time of around 1200 players for *Halo 3*, and 714 for *Halo 3 ODST*. The statistics have been last checked last time on 04/06/2023. Link to the data on *Halo 3*: https://howlongtobeat.com/game/4263 – Link to the data on *Halo 3 ODST: https://howlongtobeat.com/game/4264*

[48] This claim is based on reviews of the game both by critics and by players, aggregated in the page: https://www.metacritic.com/game/xbox-360/halo-3

- Halo 3 ODST, released in 2009, is generally seen as an average game[49] and its main strength is indeed the narrative. The main story is that of an unnamed Rookie of the Orbital Drop Shock Troopers (ODST) division during the character's first mission: the landing aircraft transporting the ODST team is crashed, and the team members are spread across New Mombasa (a futuristic African city). After regaining consciousness, hours after the crash, the Rookie tries to find the way across the alien-infested city to regroup with other team members, by looking for beacons they have left behind during their respective wanderings across the city, after the crash. Finding one of the beacons will take the player back in time to see the story of the respective team member at different moments, until the point of the loss of the beacon. When the whole team is finally gathered, the members together collect an important discovery from a data centre and eventually flee from the city while it is being destroyed by the alien forces.

As mentioned, I will first analyse the formal complexity of these games, and the devices of complexification they employ.

### 2.2.2 The formal aspects

For the analysis of formal aspects I relied on the technique of close reading as described in Chapter 1. In practice, I played both games two times, at different difficulty levels. In the second iteration, due to the lower difficulty level, I focused more particularly on the narrative organization. In particular, the focus of this close reading has been to note the differences in complexity of the two narratives, specifically in terms of the devices of formal complexification highlighted in Chapter 1. I have been looking for non-linear temporalities or disruptions of cause-effect relationships, for cruxes, narrative non-closures or unreliability, for multiple lines, branches, embedded stories, or perspectives, for fragmentation of the narrative, for instances of metalepsis and for structures and tropes not typical of the genre and/or tradition in which the games are inserted, for serial elements, and for the para-devices of transmedial and intermedial and transmedial phenomena.

The analysis has shown that *Halo 3 ODST* is richer than Halo 3 in terms of lines, branches, embedded stories, and perspectives. *Halo 3* presents only one embedded story (which can be easily overlooked and is quite distantly related to the main story), while *Halo 3 ODST* has a structure with multiple embedded stories, with seven embedded stories meaningfully interwoven to each other. Of these seven embedded stories, six revolve around the ODST team members, while the seventh is generally known as Sadie's story. I will further elaborate on Sadie's story in a short while, as it provides interesting insights in many respects – not least due to its synchronic representation. In addition to this, *Halo 3* features

[49] This claim is based on reviews of the game both by critics and by players, aggregated in the page: https://www.metacritic.com/game/xbox-360/halo-3-odst

one timeline, while *Halo 3 ODST* has seven. Furthermore, in *Halo 3 ODST* the seven embedded stories also entail different points of view on the alien attack to the city. In particular, while the six stories of the ODST team members give different but still aligned perspectives (they show different folds of the attack but all from a soldier's eyes), Sadie's story adds the point of view of the civilians suddenly involved in a war.

The employment of these devices is in direct relation with other complexifying devices, the most noticeable of which is the fragmentation of the narrative of *Halo 3 ODST* to a rhizomatic structure (Deleuze & Guattari, 1977).[50] This game displays some characteristics of an open-world game, giving the player a relative freedom of action. Together with its multiple embedded stories, this produces a navigable hypertext-like narrative through which players can access the different stages of the narrative in whatever order they prefer. This textual organization is made possible by the various manipulations of time, with multiple flashbacks to different moments in time that disrupt its linear progression. Due to this non-linear temporality, and because of the way the flashbacks are triggered in *Halo 3 ODST*, effects are presented well before their causes: the player looks for beacons left behind by the Rookie's teammates, and finding those beacons triggers the flashbacks, which end with the loss of that same beacon. Here is a brief example of how one these flashbacks work:

After the Rookie finds a partially destroyed optics of a Surveillance Drone, the flashback sequence embodying Dutch (one of the ODST crew) begins. Thirty minutes after the crash, Dutch finds himself in a natural park not far from the city, and he eventually manages to join a group of Marines and their Captain. As they make their way to the Space Elevator, however, this breaks and begins to fall, due to the damages taken from the alien attack. Dutch then decides to reach the city and he eventually manages to jump with his vehicle from a ravine, landing abruptly in a square of New Mombasa. After a few seconds, a Surveillance Drone explodes for the damage suffered, dropping an optics at Dutch's feet.

The rhizomatic structure coupled with the alternation of present time and flashbacks to different moments in the past also introduces cruxes in the narrative, particularly because of the difficulty of easily reconstructing the structural order of the flashbacks.[51] Because of these choices in game and narrative design, the relatively simple narrative is made formally complex in its presentation.

*Halo 3*, by contrast, presents an overall linear flow of time, and the presentation of cause-effect relations follows their natural order. For comparison purposes it can be mentioned that *Halo 3* – which features a typical and widely employed structure for an FPS game – does not even provide a map for its levels. This is due to their extreme linearity: players cannot wander freely in the game

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[50] A rhizome is a non-linear network in post-structuralist theories.

[51] At the beginning of each flashback, players are shown an indication of *when* the events recounted happened, but only for a brief moment, and it is anyway of little help if one is not methodically marking such information, which is not usual for players, in particular for players of FPS games.

world, being constrained to follow a specific and pre-determined route, with the related linear unfolding of the narrative.

With regards to the serial aspects of the two games, it should be first noted that they are both instalments of the same (*Halo*) series. However, while *Halo 3* presents itself as the direct continuation of the events of *Halo 2* (Bungie, 2004), involving even the same protagonist, *Halo 3 ODST* is inserted in the same story-world and timeline, but it centres around different characters, with the events of the "main" *Halo* series developing in the background, and being just the overall, wider context. These two different positions in the series can be related to additional complexity or reduced complexity, depending on the knowledge of each player. In *Halo 3*, several references to the preceding games are made. These help the knowledgeable players in recalling previous events, and act as a simplification by further linearising the narrative. However, for non-knowledgeable players the same references can complexify the narrative by referring to a mysterious (and therefore unclear) past. On the other hand, while the references of *Halo 3 ODST* to other instalment of the series can go unnoticed to the unknowledgeable players due to the relatively self-contained nature of the game, fans of the series can spot a huge number of references, strongly entangling the game to the entire series. For these reasons, it is difficult to state in which of the two games seriality complexify the narrative, as it should be addressed on a per-player basis.

Lastly, while no such occurrences appear in *Halo 3*, *Halo 3 ODST* presents a strong transmedial reference, i.e., what I called before "Sadie's story". This is a second and subordinate story arc included in Halo 3 ODST that provides many interesting reflection points. While playing as the Rookie, players can listen to a number of audio files, by downloading them from different interfaces connected with the artificial intelligence supervising the city of New Mombasa. These "audio logs" (as they are called in-game) tell the story of a girl who tries to flee from the city during the alien attack, as war breaks out. The story of the girl, named Sadie, is arranged to echo the structure of Dante's *Inferno*: the thirty files are divided into nine chapters called 'Circles', each one representing and paralleling one of the nine Circles of the Canticle, and portraying the related sin. Furthermore, and not accidentally, the artificial intelligence protecting and guiding Sadie (and later, chronologically speaking, to the Rookie) through the city is named "Vergil", the name of Dante's *duca* (Dante Alighieri, 1321/1965, Inferno, II 140, ff.). Other references to the *Comedy* could be spotted in the design of some environments and pictures related to Sadie's story. These references bring closer two very distant artifacts, i.e. the game and the poem, and by drawing connecting lines, it deepens and complexify the narrative of the game while giving a new shape to the Medieval poem, transmediating it.[52]

It should also be noted that, as I mentioned earlier, Sadie's story is one of the seven embedded stories interwoven in the narrative of *Halo 3 ODST*. However, the case of Sadie's story is particularly interesting because it complexifies the

[52] Obviously, these references could be grasped only by players who are at least somehow familiar with the poem.

overall narrative not only by means of adding to the multiplicity of embedded stories and storylines, but also because of its synchronic presentation to the player. The recordings through which this story arc is recounted are played while the user is engaged in other activities: running, shooting and, in general, normally playing the game and accessing its main narrative. This causes a layering of narratives that fosters the overall complexity by giving players two different storyworlds – or at least two different views of a storyworld – to decode, synchronically. This blurs the narrative layers, embedding Sadie's story into the Rookie's. Such synchronicity of represented storyline is absent in *Halo 3* and no metalepses take places.

Therefore, as anticipated, *Halo 3* can be seen as considerably less complex than *Halo 3 ODST*. The table developed in Chapter 1 to describe the formal complexity of video games narratives (Table 1-4) is helpful here in providing a summary of the formal complexity of the two games analysed (Table 2-1).

*Table 2-1 – Results of the analysis of Halo 3 and Halo 3 ODST regarding the formal complexity of their narratives*

| Narrative device | Halo 3 | Halo 3 ODST |
|---|---|---|
| **Non-linear temporality** | | X |
| **Disruption of cause-effect relationships** | | X |
| **Cruxes** | | X |
| **Non-closure** | | |
| **Unreliability** | | |
| **Multiple storylines** | | X |
| **Multiple embedded stories** | X | X |
| **Multiple perspectives** | | X |
| **Multiple branches** | | |
| **Narrative fragmentation** | | X |
| **Metalepses** | | X |
| **Diverse narrative structures and tropes** | | |
| **Seriality** | X | X |
| **Intermedial aspects** | | |
| **Transmedial elements** | | X |

Drawing from these findings and from the theoretical considerations done in the first part of this chapter, *Halo 3 ODST* is expected to produce higher insurgence of epistemic emotions in players. Given that the only major difference between the two games is the varying employment in their narratives of the devices for the formal complexification, if this hypothesis is verified it would mean that there exists a positive correlation between the employment of these devices and a certain players response. In order to verify the hypothesis, I analysed two sets of

crowdsourced data under the form of game reviews,[53] which therefore served as proxies for players thoughts. I looked into players' response for mentions of confusion or difficulty in understanding the narrative for the two games. In the next section, I will report the findings of the crowdsourced analysis on the response of the players to the two games, one at a time, starting with *Halo 3 ODST*.

### 2.2.3 The response of the audience

The reader should be reminded again of the fact that these games are focused on shooting abilities and fast-paced action. Their target audience is typically not necessarily interested in narratives, and even semi-interested players might tend to leave aside in their reviews the narrative elements due to the design decisions of developers, dictated in particular to the genre these games belong to. Scarce interest in narrative elements is indeed highly represented in the reviews analysed. However, for the sake of proving my hypothesis, it is nonetheless interesting to see whether a difference between these two non-narrative-focused games is detectable.

It should be noted also that this method can provide noisy data, due to the unfocused approach of reviewers. However, given the high number of entries, a high probability of finding at least some interesting points still remained. While reading the entries from the corpus, I looked for considerations about the narrative of the game, about the way the story is represented, and about confusion and misunderstanding related to narrative comprehension, as per the theories discussed above. A manual approach was preferred for two main reasons:

1) I could not rely on a previously explored set of keywords to confidently filter the reviews, and therefore,
2) because I expected to find a very limited number of useful reviews, a non-tested automated analysis had a higher risk of missing this scarcely represented phenomena.

The reviews of *Halo 3 ODST* amounted to a total of 2044 entries, published between 2009 and 2020. As per the discussion above, a manual qualitative analysis has been conducted on this corpus, by reading them one-by-one. Reviews were accessed directly from the abovementioned websites. Out of this se of reviews of Halo 3 ODST, many talked about the game mechanics and an overall "fun" provided by the game. Only 22 seemed to show some form of detected complexity.

[53] Game reviews have been gathered from the aggregator of reviews Metacritic (https://www.metacritic.com/game/xbox-360/halo-3-odst, https://www.metacritic.com/game/xbox-360/halo-3), which includes reviews from Amazon.com (https://www.amazon.com/Microsoft-Halo-ODST-Xbox-360/dp/B001HWB68K/ref=cm_cr_arp_d_product_top?ie=UTF8, https://www.amazon.com/Halo-3-Xbox-360/dp/B000FRU0NU), and from the digital distribution service Steam (https://store.steampowered.com/app/1064272/Halo_3_ODST/, https://store.steampowered. com/app/1064271/Halo_3/). All reviews have been retrieved last on 16/02/2021.

All the 22 reviews are reported below. Their numbering is provided only for easiness of reference. Errors in spelling and grammar are in the originals.[54]

It is particularly significant for the current purpose to note that the complexity of the narrative received direct praises at least in some reviews from users:

1. "It works exceptionally well by weaving the entire story together in a way that no linear series of levels could"
2. "One thing I recommend doing is collecting all the audio log collectibles […] Think of them as the B-plot of an episode of an old detective story, you can watch the episode without it but it feels great to see it and the A-plot intertwine at the end."

These players seem to have detected and appreciated some forms of narrative complexity in *Halo 3 ODST*. I will return on the appeal of complex narrative in the upcoming pages. For now, it is interesting to notice that among the reviews there are even more explicit examples pointing at narrative complexity:

3. "The story is presented in a unique multi-perspective structure, jumping between the various members of our colorful ODST squad"
4. "The story is interesting & like an iceberg."
5. "The story is very non flowing, even if it is good I couldn't tell because it's so choppy"
6. "noir vibes and jazz play while you piece the story together."
7. "The plot was totally awesome. Though it tends to be a bit confusing towards the very beginning, everything slowly begins to come together until the very end at which point you realize that every mission had a purpose in creating the story."
8. "Why people would like to see a story in mixed order is beyond me"
9. "The story is good but you have to pay a lot of attention or else you will be confuse (a lot of flashbacks, changes of characters, etc)"
10. "[the story] is told through flashbacks and is somewhat difficult to understand your first time through. You might be confused at times, but in the end, it all makes sense."
11. "The flash-back/flash-forward way the events unfold can be confusing at times, but by the end it'll make sense as everything that happens comes to a head."

[54] Each review reported was written by a different reviewer. Nationalities and other biographic data of the reviewers are unknown as they have not been registered by the review portals. All but one review were originally written in English. The only non-English review is number 12. It is relatively safe to argue that the author of review 7 is German, but further information is unknown.

12. “You can also hear the audio logs being set to music. Unfortunately, these often overlay the sounds if you keep running and then get involved in fights. It’s a shame.” [my translation from German]

These examples acknowledge the presence of some forms of complexity. The author of review 1 detected the multilinearity, while review 2 identified the multiplicity of embedded stories. Review 3 hints at the several perspectives presented in the game, and review 4 seems to refer in general to the quantitative dimension of the narrative, too: paraphrasing the metaphor, what is expressed is the sense of having to deal with something much bigger than it initially appears. Example 5 might be intended as both related to the quantitative dimension, detecting the multitude of elements in which the narrative is divided, and to the qualitative side, which is “chopped”, probably due to the multiple flashbacks, thus highlighting the narrative fragmentation. Review 6 and 7 detect narrative fragmentation, too, but this time considering it as a positive feature. A number of reviews (8–11) also talk about the non-linear temporality. Especially worth noticing is also review 12 which, apart from referring to the metaleptically layered narratives presented in the game, shows an initial identification of a different kind of complexity, or at least of some problems that might arise when it is used for layering narratives, namely the difficulty of the simultaneous perception of multiple messages, in this case due to the audio settings of the game. A more thorough discussion of this kind of complexity will be conducted in Part II of this work.

Other reviews of Halo 3ODST present interesting insights on the cognitive processing of narrative complexity:

13. “Unlike any other FPS, you start missions by finding the loose pieces of garbage in a very big map. After the first mission, you can explore fully and recover more pieces in virtually any order you choose. [...] It makes an already lackluster story even more confusing.”
14. “A couple of days before of this review I [asked] a friend […] if he liked the game […] he answered me with a no […] he added about not following the story”
15. “the campaign is slightly confusing to follow, but if you are buying it just to kill aliens and not for the story it is a fine campaign to play.”
16. “Bungie has delivered a good story that fills in as much as it confuses.”
17. “The game sadly has a bit of a confusing story-line”
18. “The story is confusing”
19. “This game is just weird, story is not coherent”
20. “It’s something only adults or late adolescents will understand.”
21. “The campaign also gets hard to understand”
22. “i don’t understand many things also in the story”

These reviews fundamentally converge towards detecting a difficulty in processing the narrative of *Halo 3 ODST*, making the narrative hard to understand. While this set of reviews might seem to mean that narrative complexity is to be avoided as players dislike it, there are a number of counterarguments to this idea. I will discuss them in a short while.

The second set of reviews, related to Halo 3, was composed by 4833 specimens written between 2007 and 2020. For the analysis of this second and bigger group of reviews, I adopted a different approach, similar to the one found in (Mäkelä & Schmidt, 2020): I focused on the keywords that, during the analysis of the first corpus, were used to talk about the narrative of the game and about how players reacted to it. The list of keywords is the following: "story", "plot", "campaign", "understand" and "understood" (grouped under the search term "underst"), "confuse" and "confusing" (grouped as "confus"). This allowed to filter the reviews to only include those that most likely bear informativeness, i.e., those that most likely deal with the narrative or its comprehension. The filtering was done using the internal filtering tools, when possible (for *Amazon.com*), and browser-provided search options (for *Metacritic* and *Steam*) otherwise. The set resultant from this filtering (made of 679 entries) underwent a process similar to that for *Halo 3 ODST* reviews and therefore have been analysed manually to look for some form of detected complexity.

The study of the reviews of *Halo 3* highlighted interesting phenomena for my analysis, too: most of the reviews that talked about the narrative focused on its suitability as a follow-up from the previous titles of the series and on its high resonance, but no one seems to mention matters related to complexity. On the contrary, it was even possible to find a claim of the simplicity of the game narrative – there referred to as "campaign":

> "Amazing game. Better than Halo 2, more vehicles and weapons. Campaign is so much more fun and better to understand than halo 2"

Even though the author of this review was evidently not interested in the narrative, the claim of its simplicity is still evident. Furthermore, confusion appears to be scarcely represented, with only a handful users reporting perplexity regarding the narrative itself. However, for all these handful of cases the respective author admitted to not be familiar with the previous two instalments of the series. This confusion is therefore somehow unsurprising, and it shows that at least some form of complexity can sprout from the seriality of the otherwise quite simple narrative of *Halo 3*. However, as mentioned in the analysis of the formal organization of the two games, this complexity is of little interest with regards to the comparison conducted here as too much dependent on the individual player.

In the end, only one instance excepts the vast majority of reviews of *Halo 3*, by saying:

1. "The game's story was completely confusing, plot holes everywhere."

The author of this review evidently detected at least some complexity, specifically in the form of cruxes.[55]

From this analysis emerges therefore a very scarce representation of confusion and other epistemic emotions in the set of reviews related to *Halo 3*, as only the one instance reported above has been found.

Results of the analysis are summarized in Table 2-2.

*Table 2-2 – Results of the analysis of the reviews of the two games*

| Game | Total reviews | Reviews reporting confusion or other epistemic emotions |
|---|---|---|
| Halo 3 | 4833 | 1 |
| Halo 3 ODST | 2044 | 22 |

Another phenomenon that emerged from the analysis and that is worth mentioning here is the fact that many reviewers (both players and critics) pointed at the carefully constructed narrative of *Halo 3 ODST* and regarded it as one of the main strengths of the title. What is even more interesting to notice is how the narrative apparatus has been received, often in overt comparison to other instalments of the series:

> "The story presentation and characterization clearly evolved beyond what we're used to witnessing in prior Halo games."
>
> "There are people who prefer a story in a video game and those who don't. For those that enjoy a good story, Halo ODST makes up for the lack of story in Halo 2 & 3."
>
> "Bungie's latest storytelling method in ODST is certainly unique and captivates the imagination from beginning to end"
>
> "ODST is a nice surprise. Leaving alone the extra-value added by a new game mode and 3 new maps for the multiplayer experience, the main campaign is involving, and remains one of the best stories of the franchise"
>
> "The story is more interesting and coherent than Halo's narrative has ever been"

This seems to mean that a complex narrative may be ultimately an advantage for narrative video games. The claim seems to hold even when not all the players are interested in it, as it is the case for games belonging to the FPS genre. Moreover, the last one of these reviews also foreshadows an additional interesting point: the more complex narrative of *Halo 3 ODST* is there described as being more "coherent". Reading further the review of the critic Anthony Gallegos', it seems to emerge that devices such as the multiple perspectives, embedded stories and

[55] As Table 2-1 shows, *Halo 3* does not make a massive use of cruxes, but given the shortness of the review it is not possible to exactly understand what the author was referring to. One possibility is that, similarly to those just discussed, this review, too, has been written by a player with scarce knowledge of the other games in the *Halo* series, but this cannot be verified with current data.

storylines deepen the psychological dimension of the game, and avoid the reckless succession of grand fights of other *Halo* games.

### 2.2.4 Findings and discussion

The analysis conducted highlights that at least some narrative complexity is identifiable in both games, notwithstanding the significant differences between them in this regard. Due to the extremely limited representation of confusion, incomprehension, and misunderstanding generated by the game narrative – only one full-fledged case – I can conclude that generally low cognitive challenges in understanding the narrative of *Halo 3* have been detected by players.

Given that the set of reviews of *Halo 3* was more than double in size compared that of *Halo 3 ODST*, and even assuming a possible margin of error, it is evident that my hypothesis is verified: the more formally complex *Halo 3 ODST* did provoke a higher insurgence of confusion and epistemic emotions in its players in comparison with the more formally simple *Halo 3*. The study supports a positive answer to my research question "does a more complex narrative produce proportionally higher insurgence of epistemic emotions (and, specifically, confusion)?".

These findings are a first proof supporting some important points of my theoretical discussion. First, they empirically support the idea that formal complexity and a certain type of player response are related. [56] This is in accordance with the findings in the academic literature on the topic, as discussed above (see Section 2.1 Cognitive processes, epistemic emotions, and narrative devices). Secondly, they show that the devices of formal complexification outlined in Chapter 1 are useful in describing the formal complexity of video games narratives. Thirdly, this leads also to the claim that the complexity of response is predictable to some extent. Even more, this case study shows that the response of the audience can be orchestrated, and epistemic emotions can be evoked, by moulding the formal complexity of a narrative through the devices pinpointed in Chapter 1, as per the hypothesis.

Stepping out from considerations about my hypothesis, an additional, more general trend emerges from this analysis. Considering the data scrutinised in the current study, it can be observed that the otherwise considered mediocre *Halo 3 ODST* received praise specifically and mainly for its narrative – which, as discussed, is complex. This provide a first proof to argue that narrative complexity can be considered a factor in creating engagement and pleasure, at least for a certain part of the audience. This is also observed by Perlovsky, who claims that "satisfactions or dissatisfactions of the knowledge instinct are experienced as

[56] It is possible to argue that the same effects could be achieved by low-level or badly constructed narratives. However, the current study is not aimed at an absolute assessment of narrative quality, but rather at contrastively juxtapose the narratives of two games. In this context, and similarly to Willemsen (Willemsen, 2021) I showed that to a more formally complex narrative correspond a certain audience response, and therefore that these two aspects are somehow correlated.

aesthetic emotions" (L. Perlovsky, 2016, p. 1972). Therefore, an additional finding is that the narrative devices for making a narrative formally complex discussed in Chapter 1 can also be tools to create compelling narratives that resonate more deeply with their audience, that can be greatly appreciated by players, and that foster the overall appreciation of those games that embed them.

Some general reasons for the attractivity exerted by complex narratives have been identified in the academic literature, and looking at their specific applicability to the complexity of narrative video games could bear interesting results. The next section will deal specifically with the appeal of complex narratives in video games.

## 2.3 The appeal of complex videoludic narratives

From the discussion conducted in the previous parts of the chapter, and more specifically given the heightened cognitive effort complex narratives demand, the confusion they elicit, and the cognitive dissonance they produce, one could expect the generation of narrative complexity to be a rather deprecated practice in any production. Yet, as the findings of the study suggest, a complex narrative can be positively received by players, to the point of being considered one of the main strengths of a game. The impact of narrative complexity on the appreciation of a narrative has been detected in movies and TV series (Hven (2017), Mittell (2006b), Kiss and Willemsen (2017)), and is evidently present also in digital games. Specifically regarding the complexity of video games narratives, Roth and Koenitz have found evidence proving that the more a narrative is complex, the more interest it induces in its players (Roth & Koenitz, 2019). This can also be observed in the fact that increasingly complex narratives are significantly growing in popularity in audio-visual media (Bordwell, 2023), and possibly even more in video games. Indeed, the identification of interest and enjoyment as another significant response to complexity is a growing line of inquiry that is providing interesting results (cf. e.g. Hven, 2017; Kiss & Willemsen, 2017, 2018; Mittell, 2015; Willemsen & Kiss, 2020, 2022).

Kiss and Willemsen identified several possible reasons why impossible puzzle films, i.e. movies with particularly complex narratives, could appeal to their audiences (Kiss & Willemsen, 2018). Of particular interest in this analysis is their concept of hermeneutic play, i.e. a loop in sensemaking for the probing of multiple, sometimes even contrasting, interpretive hypothesis. The hermeneutic play of impossible puzzle films is based on a probing mechanism that tries to predict the structural position of smaller-scale events and characters' dispositions in the larger-scale storyworld represented. This sort of interpretative mode is exactly the one also inherent to video games play. Players are tasked to act upon a certain situation after having considered possible variables, possible outcomes

of their actions, and the possible reactions of other characters and players,[57] which also necessarily prompts a probing of the narrative meaning of the information received at each step, and their structural position in their overall story-world. In video games, in which players are already required to perform a sort of probing due to interactivity, this means that sometimes a double probing is required.

This double probing is arguably required for video games with particularly complex narratives, or for narrative sections that are particularly complex, where players might be puzzled enough to require an additional and parallel hermeneutic loop. As the study reported above suggests, a double probing might be prompted by *Halo 3 ODST*, and not by the less complex *Halo 3*. In *Halo 3 ODST*, a double probing is also likely to be prompted by Sadie's story and specifically by the metaleptically-connotated multiplication of narrative layers. In these cases, the probing mechanism happens both during the here-and-now of the game, to traverse the game world and decide with which elements to interact next, and during the wider-range narrative understanding, to check, confirm, or confute an intricated net of hypotheses (cf. also what have been called reading strategies of 'literary games' in Ensslin, 2014). It is therefore possible to also argue a correlation between this double probing – or the additional hermeneutic play – with the more substantial use of the narrative devices described in Chapter 1.

This hermeneutic play, Kiss and Willemsen maintain, is sometimes elicited by a seek for the aesthetic pleasure resulting from the use of specific mental competences, which mere exercising may be enjoyable in itself. Korthals Altes referred to this aesthetic pleasure with the name of *Funktionslust*, "the pleasure taken in exercising a mental or bodily function" (Korthals Altes, 2014, p. 23).[58] Complex narratives elicit this pleasure by requiring cognitive effort for the mental reconstruction of the story.

Hermeneutic play has also another appeal for the audience, namely the sort of empowerment that it affords. Complexity, and the uncertainty that frequently accompanies it, often allow for different interpretations of the narrative. While this effect might seem to be mostly elicited by cruxes, non-closure, and narrative unreliability, the examples reported in the study above show that all narrative devices can introduce uncertainty in the narrative, allowing for additional freedom of interpretation. The resulting interpretive freedom entrusts part of the control into the hands of the audience, stepping away from the authorial authority into a more "participatory" way of representation. In this way, the usually only passive role of a spectator becomes more active, and more empowered. While this obtained freedom might be considered pleasurable in itself, it also responds closely to two needs discussed by self-determination theory (Deci & Ryan, 1985; cf. also Tamborini et al., 2010), namely "autonomy" as a "sense of volition or willingness when doing a task" (Deci & Ryan, 2000, p. 237) and "competence", a need for

[57] This could be considered the hermeneutic basis for the "interactivity of planning and execution", typical of interactive digital narratives, and described by Koenitz (2023, p. 3).

[58] The term itself is taken from Bühler (1926).

challenge and for "conquering that challenge" (Deci, 1975, p. 92). In the case, for instance, of complex cinema, autonomy and effectance are exercised at a cognitive/hermeneutic level. In video games, participatory by nature, the empowerment of the player afforded by narrative complexity finds its peak. The not unusual multiplicity of branches, and in general the freedom of experiencing the narrative that games often afford allow players to follow their preferred path and to "forge" their own stories, at least to some degree.[59] Furthermore, devices such as narrative fragmentation and multiple embedded stories allows for the additional freedom of choosing the order of accessing narrative-relevant information, though sometimes only partly consciously. The autonomy and competence discussed by self-determination theory become then ever more tangibly true in narrative video games, as it not only regards the interpretation of the narrative, but the shape of the story itself, and its direction (cf. the concept of 'dramatic agency' in Murray, 1997/2017).

It should therefore be unsurprising to find, among Kiss and Willemsen's reasons for the appeal of complex narratives, also "game logic". According to the two scholars, complex narratives are relying on a sort of game of clue hunt. This game needs to be carried out by the audience to ultimately fill-in the informational gaps and linearise the flow of these narratives (Willemsen & Kiss, 2020; on this gamified approach to narrative complexity, see also C. Barkman, 2024). The eventual reconstruction of the meaning of complex narratives therefore requires considerable cognitive effort to comprehend the diegesis. Crucial for the success of this game of clue hunt is understanding the "rules" of the storyworld, to eventually "crack the interpretive code" of the narrative (cf. Mittell, 2006a). In narrative video games, clue hunting is common, and it is related to the narrative devices discussed in Chapter 1 – in particular to those that lower the certainty over the narrative itself, like cruxes and unreliability, the non-linear temporalities and disruptions of cause-effect relationships, metalepsis, and narrative fragmentation. The interest that these narrative devices generate is positively correlated with the confusion they produce, where the confusion collimates with the awareness that a lack of information exists, and the interest relates to the rewarding cognitive satisfaction of this lack (cf. on this also Grishakova, 2022b). Similar considerations on the enjoyment of narratives with multiple embedded stories can be drawn for multi-linear, multi-perspective, and multi-branch stories. Particularly the latter is relevant in narrative video games, as one could be left to wander how the story will unfold following one's individual choices.[60] Furthermore,

[59] Several video games posit the attention specifically on this freedom and makes it among their main appeals (e.g., *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011), *Baldurs' Gate 3* (Larian Studios, 2023)).

[60] However, this also highlights a caveat: the abovementioned empowerment of players regarding video game narratives is bound to the degree of adaptability of a story. Concepts like local and global agency regarding the narrative (namely, the ability to have short-term and long-term influence over the story, respectively), are tied to Richardson's sense of wonder elicited by diverging narratives as they effectively capture how much a story can actually branch out.

non-conventional narrative structures and tropes could similarly elicit this aesthetic emotion exactly because they are novel (for the specific audience), therefore unexpected and wonderful.

Complex narratives, with their constant subversion of patterns, their innovative organization, and their stochastic dynamics, can then be intended as somehow inherently and naturally artistic. This is also reflected in the audience response. Just as complex narratives produce the specific cognitive responses touched above (confusion, cognitive dissonance, difficulty in processing, etc.) in the audience, in the same way "art slows down perceptions through 'secondary processing', amplifies prediction errors and enhances cognitive dissonance in order to activate and intensify semiotic and artistic resources, exploiting them as vehicles of aesthetic effect" (Grishakova, 2022b, p. 21). As I have shown, complex narratives often problematize deeply ingrained beliefs, giving rise to a mismatch between internal states and the representation object of interpretation and calling for the activation of "System 2" of thinking (Stanovich & West, 2000; Kahneman, 2013). This generates strong aesthetic feelings, proportional to the degree of mismatch between expectations and reality (Gjøl et al., 2019).

However, while these considerations might seem rather universal, it appears that different players tolerate different degrees of complexity. Using Goldilocks as a metaphor, Cutting suggests that "we as perceivers, like Goldilocks, tend to like best those things that are dimensionally just right – in this case, neither too familiar or unfamiliar and neither too simple or complex" (Cutting, 2019, p. 210). Confusion and interest are both necessary to our enjoyment of certain complex experiences, and they are often in a position of mutual support, as discussed (see Section 2.1 Cognitive processes, epistemic emotions, and narrative devices). In this view, the identification of a generalized Goldilocks level of complexity is a sort of Holy Grail that could be tempting to many. Reality is however more complicated than that. The right amount of complexity varies significantly between people, and cultural factors (in addition to personal dispositions) arguably have a role in the variation. A significant diachronic variation is likely to manifest as well, both among cultures and among single individuals. The complexification of societies and of the mediascape made people more used to and trained for complexity, as "fictional narratives enhance the reader or listener's attunement to increasing cognitive load" (Grishakova, 2022b, p. 12). If one were to further explore the relationship between players and complexity toleration in order to quantify the "Goldilocks level of narrative complexity", then, one would need to account for important differences introduced by age, cultural and social context, education, and personality traits. As mentioned, initial attempts in this promising direction have been done in recent times by Willemsen and colleagues (2022), but these results are somehow volatile by definition. For now, it will suffice to say that the perspectives presented here on the reasons why complex narratives can appeal their audiences, together with the discovery that narratives are one of the main factors in games appreciation (Wang & Goh, 2020), and with the results of the study reported above, leads me to the conclusion that complex narratives

(and the employment of narrative devices of formal complexity) in video games can highly impact the appreciation of the games themselves.

## Conclusions of Chapter 2 – Cognitive responses to complex videoludic narratives

Confusion and cognitive dissonance are considered the diagnostic signs of narrative complexity, and the main audience response to it. These epistemic emotions arise when we can no longer rely on fast and automatic cognitive processes to understand a narrative, and when we are therefore forced to dedicate more attention and more cognitive effort to the narrative. Generating these cognitive effects are uncertainty and unexpectedness, which can sprout from the employment of the narrative devices that has been discussed in the previous chapter. The responses of players to formally complex narratives can vary in relation to personal dispositions and preferences, but I have presented considerable empirical evidence showing that to a more formally complex narrative corresponds a significantly more frequent insurgence of epistemic emotions.

In the onset to the description of the narrative devices, I have noted that these are descriptive and not prescriptive: they capture how narratives are most frequently made complex, but they do not exhaust the available possibilities. Making a narrative complex is a fine art of balancing expectations, information, cognitive processes, and personal disposition, among other things. In this complicated setting, there are several ways in which unbalance could be inserted and confusion and other epistemic emotions could be elicited, mostly but not entirely captured by the devices discussed.

The comparative analysis of *Halo 3* (Bungie, 2007) and *Halo 3 ODST* (Bungie, 2009) has helped to shed more light on these mechanisms, and particularly on the relation between formal complexity and certain kinds of response. By comparing an analysis of the formal aspects of the game with that of thousands of players' online reviews, this study highlighted that to the more formally complex *Halo 3 ODST* corresponded a significantly higher insurgence of players' epistemic emotions, specifically confusion. Results of the analysis also hinted at the considerable positive effects of narrative complexity for the overall appreciation of narrative video games – with *Halo 3 ODST* praised by players particularly for its (complex) narrative.

Moving on from these findings, I have discussed why narrative complexity is appealing to video game players. Generating confusion and incomprehension, one might be drawn to see complexity as detrimental. However, there are several reasons why players, like Goldilocks, prefer their narratives to have the "just right" amount of complexity.[61] These reasons are in direct relation with the specificities of the videoludic experience and the customs of the videoludic medium –

[61] These reasons can be taken as general guidelines, but the "just right" amount of complexity can largely vary between different players, and it is predictable only to some extent.

particularly interactivity and the afforded dramatic agency. Complex narratives call for a playful approach to narrative hermeneutic, not least because they rely on a sort of clue-hunt game where the reward is the narrative. Moreover, complex narratives empower players by giving them a sense of autonomy and competence, and they evoke curiosity and wonder. The devices for the formal complexification of narratives discussed in Chapter 1 are all connected to one or more of these pleasurable effects.

This pleasurable quality of narrative complexity can be considered one of the reasons for the impressive rise of video games as a narrative media in recent years. In the conclusion to Chapter 1, I have pointed out how the increase in popularity of complex narratives in different media could be related to the spreading and increasing popularization of narrative video games.

# Conclusions of Part I
# Video games as complex narratives

Throughout this first part of the dissertation, I have shown narrative complexity as being a hermeneutically productive paradigm for analysing video games narratives. I have discussed when and how a narrative can be made formally complex, and in what sense and to what extent such complexity translates into specific players response.

The formal complexity of narratives is the focus of Chapter 1. A narrative can be made formally complex through a number of narrative devices. These possess both quantitative and qualitative dimensions and can occur also in combination in narratives, to ultimately foster formal complexity. Non-linear temporalities and disruptions of cause-effect relationships, cruxes, non-closure and unreliability, multiplicity of lines, branches, embedded stories, and perspectives, fragmentation of the narrative, metalepses, non-conventional narrative structures and tropes, serial features, and para-devices like intermedial and transmedial phenomena have been discussed as ways used to formally complexify videoludic narratives. Due to some of their distinctive features, like their procedural, participatory, spatial and encyclopaedic properties (Murray, 1997/2017), narrative video games generally employ a number of these complexification devices. As I have shown throughout the discussion and through several case studies, narrative video games can therefore be considered featuring generally complex narratives.

Specific audience response to complex narratives is commonly understood as diagnostic signs of narrative complexity. Chapter 2 described these cognitive responses and linked them to the narrative devices discussed in Chapter 1. Identified as the most prominent among the typical responses to complex narratives is the insurgence of epistemic emotions like confusion, suspension of understanding, cognitive dissonance, and in general a heightened cognitive load. These responses are elicited, through the discussed narrative devices, by the subversion of deeply ingrained experiential and/or conventional schemes and by introducing uncertainty in the narrative. Via an empirical study I have shown considerable evidence suggesting that a more formally complex organization of narratives corresponds to a heightened cognitive load for their audience, resulting in confusion. I have thus established an empirical link between formal complexity and a specific response to video games narratives. This empirical evidence supports the veracity of understanding epistemic emotions as the diagnostic sign of narrative complexity. Moreover, the study also showed the descriptive value of the narrative devices advanced in Chapter 1, their ability to predict certain players response, and their legitimacy as tools in the authorial hands to elicit such responses in players. Lastly, I have provided reflections on the reasons for the appreciation of complex narratives, what this can tell us about the enjoyment sprouting from playing narrative-driven video games, and how to enhance narrative experiences through narrative devices for formal complexity.

A better understanding of the ways of manipulating narrative complexity and of what this manipulation causes in recipients could help narrative and game designers to offer to their players the proper amount of cognitive challenge, to reach the Goldilocks level of complexity. As discussed, and as supported by the several theoretical and empirical studies mentioned, this can have a very positive impact on the appreciation not only of narratives but of narrative games in general. Furthermore, rich and complex storyworlds with intricated narratives, that offer hermeneutic play through their marked unexpectedness and uncertainty, can significantly impact replayability, or the willingness of audiences to play again the same game. Players strive to dive deeper in the world, to drill down in them (Mittell, 2015), to explore alternative paths, and in general to unpack the complexity of the narrative.

Lastly, these perspectives on narrative complexity and audience response could be further employed to better understand the cognitive mechanisms involved during the interaction of players with a video game and (particularly) its narrative. While some theories from cognitive psychology have been discussed here in relation to video game narrative understanding, the field of cognitive narratology in video games is at its initial phases of blooming. For now, the fertility of the concept of narrative complexity makes a strong case for further analysis into this research direction, and specifically into the manipulation of narrative complexity and into its effects for players, not least because little research in this direction exists yet. More theoretical and empirical studies are needed, and I hope to have opened some research directions with the work conducted so far.

Complexity is indeed a multifaceted concept, that can be applied differently to different areas of inquiry. In the next part of this dissertation, I will deal with a conception of complexity that is more closely related to how complexity is intended in the hard sciences, where the concept was born. *Complexity* as a feature of *complex systems* will be the main focus of Part II. I will analyse the degree to which video games playing can be conceived as a complex system, to describe the complexity that comes from the collaborative creation of meaning occurring between the video games and their players.

"The creative mind plays with the objects it loves" (Jung, 1928/1970, p. 107) is the quotation that opened this part. In the light of the discussion conducted so far, it seems evident that "playing with the object one loves" entails much more that it might look at first. In the next pages, I will dive deeper into this rabbit hole.

# PART II

# VIDEO GAMES AND COMPLEX SENSEMAKING

«If our lives are tales that Allah tells,
then we are the audience as well as the players,
and it is by living these tales that we receive their lessons»

Ted Chiang, The Merchant and the Alchemist's Gate (2020), p.35

In Part I of this dissertation, I have investigated the formal complexity of video games narratives, and the effects that such complexity generates in the audience. I have discussed several devices that can complexify a narrative, and I have shown why and in which capacity these strategies are often naturally present in narrative video games. I have then unpacked the kinds of response players may have to these complex narratives, and I have provided an empirical proof correlating certain narratives formal organisations to certain audience response. Lastly, I have provided thoughts on the enjoyment arising from dealing with complex narratives, and what this could mean for the video games that embed them.

The focus of this section is closely tied to a different conception of complexity and to what it means for video games and their narratives. I propose to regard the encounter of video games and their players as displaying features of a complex systems. This is, in my opinion, the very core of the entire complex-systemic view of video games, which allows for other, further considerations to be made. I will show how this perspective allows to have a holistic stance on the ways in which video games and their players co-construct meanings, and what are the hermeneutic gains of this view.

My intent is therefore to look more closely at how video games co-constitute certain meanings with their human player. In describing this process of co-constitution, I will investigate the sensemaking of players, and the ways in which this sensemaking is guided by designers through the game itself. In more specific terms, I will be looking at the interaction between games, players' bodies, and players' minds, adopting the perspective of embodied and enactive views of cognition.

In Chapter 3, I will discuss some elements (of the game) and cognitive mechanisms (of the player) that have a role in forming this complexity. Throughout the chapter, I will first build a conceptual framework to support this understanding. I will trace a route of some of the main theories that have been proposed to explain video games sensemaking, and I will outline what I mean with "sub-system of information". I will analyse three of these sub-systems separately, namely the multimodal (sub-)system, interactivity and enaction, and memory, highlighting the feedback loops between them. I will show the reasons why they

exhibit features of complexity, and I will explain why video games can therefore be regarded as generating this complex system in their encounter with players. Going further, I will apply the proposed framework for the analysis of a case study, which will provide a practical example of how these sub-systems manifest themselves in a real game. This will provide insight on how the complexity of video games manifests itself in actuality. Throughout the chapter, I will also expand on why understanding video game sensemaking as complex can be beneficial to comprehend not only how players make sense of games, but also how video games holistically represent and cue their meanings.

Chapter 4 still explores the idea of a complex system underlying video game playing, but from an empirical perspective. There, I will report the details of an empirical analysis designed and conducted to test the theoretical framework of Chapter 3 in light of actual gaming practices. Through a methodology borrowed from cognitive psychology I will be looking at real players' sensemaking, taking a sneak peek in the players' minds. The experiment is based on a custom-made video game, designed and developed specifically for testing my theoretical framework. The methodology consists of a think aloud session followed by a semi-structured interview and a questionnaire for each of the fourteen participants. It therefore comprises both qualitative and quantitative data. The results of the empirical study endorse the validity of my theoretical framework, but ask for more and more detailed further studies, both theoretical and empirical, particularly (and expectably) regarding the cognitive processes participating in the game-player collaboration. Before concluding this chapter, I will pinpoint some of the directions future research on this topic might take.

# Chapter 3
# The complexity of game-player systems

In order for players to understand the meaning of a video game, such meaning needs to be cued by the video game itself. This assumption might seem fairly obvious, and still the question of how meaning is cued through (and sensemaking is guided by) such artifacts remains open for the most part. The effort of answering this question has been pursued by several researchers, who are trying to parse and understand the functioning of the various elements forming video games. To the best of my knowledge, except for rare cases that will be touched below, most of these studies focus only on isolated elements or clusters of elements. Such research include also influential studies like, among others, investigations on lights and lighting effects (e.g. Knez & Niedenthal, 2008; Seif El-Nasr et al., 2006), on colours and colour palettes (e.g. GomezRomero-Borquez & Del-Valle-Soto, 2020; Geslin et al., 2016), on graphics in general (e.g. Lee et al., 2016; McLaughlin et al., 2010; Clarke & Mitchell, 2007), on audio-visual style (Järvinen, 2002), on music (e.g. Collins, 2013; Munday, 2007; Zehnder & Lipscomb, 2006), and on game mechanics (e.g. Fiadotau, 2015). However, these elements form the video game not in isolation but as a unified whole – as a system.

Indeed, this approach seems to be partial and partly arbitrary, like analysing the functioning of words in a novel without taking in consideration their being part of sentences, paragraphs, and chapters. Such an approach is possibly insightful but limited.[62] Salen and Zimmerman similarly argue that video games are phenomena so complex that they *must* be analysed with an all-encompassing view, claiming that "it would be ineffective (and even silly) to try and view such a complex phenomenon from a single perspective" (Salen & Zimmerman, 2004, Chapter 1). Elson and colleagues (Elson, Breuer, Ivory, et al., 2014; Elson, Breuer, & Quandt, 2014) advance similar considerations, also mentioning the paucity of research in this direction. The theoretical view that I formulate and explain throughout this chapter follows up to and addresses the concerns expressed by these scholars.

To develop a more systematic (and systemic) account of the ways in which the meaning of a gameplay experience emerges from the collaborative creating act, in the current chapter I will discuss the complex-systemic nature of the co-creation of meaning between games and players. My starting point will be Susan Stepney's definition of complex systems:

[62] It is indicative in this regard that almost all the abovementioned research on game elements is now at least a decade old, and studies in this direction are progressively becoming scarcer, as if the scientific community has implicitly realised the only partial aptness of such a focused perspective.

> "a complex system exhibits strong interactions between components, feedback between levels, emergence, self-organization, openness, adaptation, growth, and change" (Stepney, 2018, p. 27).

As I am going to show, this provides a flexible theoretical tool for a holistic analysis of video games, tying together different and sometimes contrasting findings of more specific studies such as those mentioned above.

To keep the discussion productive, informative, and even manageable, only three of the elements forming this complex system will be explored in depth, arguably the most prominent and the most clearly visible: the multimodal system, enaction, and memories. The exploration of these elements and of their interconnections will help, on the one hand, to unveil the systemic aspects of the encounter of games and players, and, on the other hand, to discuss the complexity of this game-player system. Towards the end of the chapter, I will apply my theoretical view to a scene of the game *Detroit: Become Human* (Quantic Dream, 2018), to show its informativeness with regards to the working of real players' sensemaking and to how video games support this sensemaking process.[63]

## 3.1 About video game sensemaking

The human mind uses at all times a system of interconnected cues to make sense of the stimuli that it is presented with (Kuvich & Perlovsky, 2013). Several definitions of human sensemaking refers to an "attending and bracketing cues in the environment, creating intersubjective meaning through cycles of interpretation and action, and thereby enacting a more ordered environment from which further cues can be drawn" (Maitlis & Christianson, 2014, p. 67; cf. also Eysenck & Keane, 2005). As it has been empirically shown, these cues come, among other sources, from perceptual processes, motor memories, and prediction models (L. I. Perlovsky & Ilin, 2010; Kuvich, 2005). Therefore, one cannot consider a unique source of information when approaching sensemaking – neither in the real life, nor in video games. Rather, video games should be regarded as systems of cues. The nature of the interconnections between these cues should be taken into account, too, as understanding cognitive processes "requires understanding of the entire system context" (Kuvich & Perlovsky, 2013, p. 302).

The existence of a system in video game sensemaking has been somehow recognized (e.g., by Salen & Zimmerman, 2004; Elson, Breuer, Ivory, et al., 2014; Koenitz, 2023; see below for a more thorough discussion of similar models).[64] What is less discussed is the kind of system we are dealing with when talking

[63] This understanding could be insightful for designers if properly operationalised, but showing how and to what extent this could happen is beyond the scope of the current chapter, which is intended to lay the conceptual ground and which is, therefore, primarily of theoretical nature. I will provide some reflections on the application of these theories towards the end of the current work, in the final considerations.

[64] With system I mean here a set of interacting or interrelated entities that form a unified whole.

about this sensemaking process. Different types of systems might be considered – e.g., open, dynamic, adaptive (see Maturana & Varela, 1972; and Luhmann et al., 2013 for a thorough discussion of different kinds of systems – the latter more related to social sciences). In my opinion, the type of systems that most accurately describes this process is the complex system, which is open, dynamic, and adaptive, as I am going to discuss.

The starting point of this chapter is the identification of the specific ways in which video games guide their sensemaking. Therefore, with the scope of achieving a flexible and all-encompassing understanding of the sensemaking of video games, I suggest to adopt the approach proposed by Grishakova and Poulaki (2019a) for narrative comprehension and adapt it to the digital interactive environment for general sensemaking.

## 3.2 Systems of information in video games

In the introduction to their edited volume on narrative complexity, Grishakova and Poulaki maintain that "narrative comprehension involves integration of different layers of information – rich percepts, sensorimotor experiences, attentional structuring, retrieval of memory images, and complex meaningful contexts stitched into pattern" (Grishakova & Poulaki, 2019a, p. 15). Similarly, making sense of a video game results from the synthesis of cues coming from a number of sources of information, among which are (following the direction highlighted by the two scholars):[65]

(a) *Multimodality*, i.e., the co-presence of many semiotic modes and media, typical of the digital environment, that generates a richer set of perceptually-available "signs" – intended in a semiotic sense (Hawreliak, 2018). Multimodality generate the "rich percepts" mentioned by Grishakova and Poulaki.

(b) *Scaffolding of attentional focus*: guiding players' understanding of the game, for instance by teaching them which elements are important and which are not, both at a conscious and at a pre-conscious level;

(c) *Epistemic contextualization through recollection of memories*: the information provided by the game must be checked against players' knowledge to be understood. In addition, due to the dissemination of bits of information, each piece of knowledge is to be contextualized by inserting it in a specific "place" in relation to the other knowledge. Information may come also from inter- and transmediality, and from genre-dictated customs;

(d) *Patternization for meaning-making and meaningful interaction*: e.g., by associating the specific game or portion of game to a genre, or by creating interaction-reaction patterns that could be used to predict the outcomes of an action;

[65] Although not discussed by Grishakova and Poulaki, emotional engagement can be considered another factor influencing the sensemaking process. I will return on this below.

(e) *Sensorimotor experiences*: the evocation of motorial and sensorial reactions. In the digital environment, interactivity enables and explains why video games could be conceived not only as sensorimotor in nature (Knoller, 2019), but with a very high engagement of the sensorimotor system of its players, as they always require actual physical action to some extent.

Grishakova and Poulaki's view of narrative comprehension must be adapted to be productive for video game sensemaking. In particular, the intrinsic interactivity of video games entails a cooperative creation of meaning shared between games and players, which must be stressed beyond the mainly receptive "sensorimotor experiences". The adjustments that this difference introduces will be thoroughly discussed in the upcoming pages. For now, Grishakova and Poulaki (2019a) also provide another crucial concept. They aptly advance the idea of "layers of information" to emphasize the embedding of the different information sources in an integer. The embeddedness of layers implies a "cognitive assemblage", a "contiguity in a fleshly sense [with] information transactions occurring across membranes, involuted and convoluted surfaces, and multiple volumetric entities interacting with many conspecifics simultaneously" (Hayles, 2016, p. 33). This also highlights a possibility of over-tuning, short-cutting or looping when the information sources are put into operation.

Adopting Grishakova and Poulaki's view and taking the move from the concept of "layers", I propose however to slightly modify such concept and to adopt "systems" as a term for the sources of information participating in video games sensemaking. The reasons for this change are several. Firstly, "systems" resonates more with the terminology of the field. Salen and Zimmerman, for instance, use the term "system" exactly to designate "the structure that organizes relationships between elements" (Salen & Zimmerman, 2004, Chapter 25; cf. also Sellers, 2017). Secondly, "systems" puts stress on their being constituted by individual parts. These parts interact and affect each other, and are part of a unified, systemic whole. Thirdly (and consequently), "systems" stresses the fact that these sources are in themselves groups of heterogeneous elements. Fourthly, drawing also from Hayles' claims reported above, "systems" highlights the indeterminate and non-hierarchical nature of the exchanges between the parts of the same information source, between information sources as a whole, and between individual parts of one information source and individual parts of another. Furthermore, the term highlights a sort of stability at each level of observation, as parts are somehow independent in themselves, but they form a coherent whole as one information source, and a stable more-than-combinatorial whole as an overall supersystem of information sources. Indeed, in the mind of the player all information sources are tied together in an integrated videoludic experience, emerging from the collaborative sensemaking of the video game and of the narrative that it embeds. This also stresses that some organizational principles of these systems emerge at each level of observation, but also that it is possible to design each element (and each information source) partly independently from the others,

which is what ultimately makes it possible to design for the overall resulting game playing experience at all.

As the discussion of this Part deals with different systems at two different levels of granularity (the systems of information and the system of systems that is the game-player collaborative system), to enhance clarity I will refer to the systems of information as "sub-systems" when I will be discussing the game-player collaboration system, denoting to the fact that in the current context they are systems subordinate to the overarching sensemaking system.

Sub-systems of information are not only co-present in video games. They are interconnected, interoperating and interdependent, and they give rise to a whole of a higher order by mutually informing each other. In brief, they present feedback loops. When players understand what the multimodal (sub-)system of a video game represents, and comprehend, for instance, that they are playing a horror game with an unbeatable entity chasing them – which is made perceivable through a set of semiotic resources (audio, visuals, etc.) – they will probably look for what their past experiences catalogue as potential hiding places. These places are therefore attention attractors. Players will move in the fictional world according to their understanding of the narrative and to the arrangement of these attractors, possibly even shifting between new hiding places and already-known locations. This will cause the game- and storyworld, and their multimodal presentation, to change according to players' behaviour. These changes of the multimodal presentation (and of the game state) further build the context of future developments and helps foster its meaningfulness. They trigger other players' movements, that in turn could be informed by different memories, and so on, in a circular and looping mechanism whose hermeneutic modes have been discussed by many scholars in recent times (e.g. Karhulahti, 2012; Koenitz et al., 2015; Roth et al., 2018; Knoller, 2019).[66] Perhaps unsurprisingly, this dynamic is often described through the shape of a circle or a spiral, and although the semantic of these two shapes is very different, they both *de facto* acknowledge a similar understanding of the matter as a continuous loop.

All these sub-systems of information, presenting feedback loops and multiple mutual interactions, form a complex whole from which emerges the game playing experience. However, to the best of my knowledge throughout the relatively short but nonetheless rich history of video game studies, only a handful of models tried to build a holistic view of video games sensemaking that keeps in consideration its collaborative nature.

One of the first models to describe in a somehow integrated manner the video game sensemaking has been developed by Sutton-Smith in his book *Toys and culture* (Sutton-Smith, 1986). The model comprises five parts which, according to the author, constitute the experience of video game play, namely: "visual scanning", "auditory discriminations", "motor responses", "concentration", "perceptual

[66] This mechanism itself emerges from the encounter between the designed aspects of the game and the much less predictable reaction of players. I am going to discuss this more in depth in the upcoming pages.

patterns of learning". As the publication date of the work suggests, this model is based on very early video games, and cannot account well for the multifaceted phenomena that the medium displays today. For instance, Sutton-Smith's model does not consider sensory stimuli that are not strictly audio-visual, like haptic sensations (e.g., vibrations), and cannot account for multi-player interactions.

The tentative model put forward by Salen and Zimmerman (2004) is closer to the view proposed here. As mentioned, the two scholars advocate for a more holistic view on video games as situated in the socio-cultural landscape of contemporary society and media. Building on Sutton-Smith's five-points model of game experience, they foreground a more flexible tripartite model of players' interaction with a game, a "larger system of experience that always includes some kind of sensory input, player output, and internal player cognition" (Salen & Zimmerman, 2004, Chapter 23). Figure 3.1 shows a visual representation of the model.

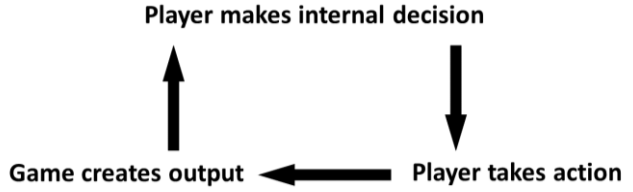


*Figure 3.1 – Salen and Zimmerman's (2004) model of player experience " (Salen & Zimmerman, 2004, Chapter 23).*

The discussion of this model does not go into much detail and its problematic points simply do not have the space to appear. Some of these issues are substantial. First of all, it is a very technical model. The clear separation between inputs, outputs, and cognition is an abstraction that holds true only if one is to regard video game play as a mechanical phenomenon, in which players' cognition only take part as one of the gears. In a description of players' experience, which is the stated scope of the model, players' minds should be considered as more than mechanical decision-making devices.[67] If we accept this view, then, the three components of this model become inappropriate, because the "internal decision" of players become more pervasive, including perception of the outputs and meta-reflection on the inputs. Players' experience and thus players' sensemaking of a video game must therefore be considered as a much more complex phenomenon. Rather than a model of players' experience, then, the model appears to be a looping pipeline describing players' interaction. Yet, Salen and Zimmerman's model provides an already advanced starting point in showing the components being in a position of interdependence and mutual reinforcement: "all three components of this model can be considered in isolation, but they only generate meaningful play as part of a larger designed system" (Salen & Zimmerman, 2004, Chapter 23).

[67] This is also in contrast to contemporary conceptions of situated cognition (cf. Ataizi, 2012).

Elson and colleagues propose another model of interacting parts, through what they call "the Integrated Model for Player Experience (IMP) framework" (Elson, Breuer, Ivory, et al., 2014; Elson, Breuer, & Quandt, 2014). This model identifies three main elements of video games that contribute to determine the playing experience, namely 1) game narrative, 2) mechanics, and 3) context dimension. In their understanding, too, the three elements are interacting and mutually informing each other: "the IMP provides a general model describing a feedback loop of uses, experiences, and effects in specific contexts with a focus on the relationships between game characteristics and experiential variables in the actual playing phase" (Elson, Breuer, Ivory, et al., 2014, p. 528). However, the aim of the IMP framework is tying together existing empirical approaches that can be employed to analyse the components forming the overall game experience. Due to this objective, Elson and colleagues only look at the interactions of their three elements to outline differences in recorded experiences of video games players. They argue that "the meaningful experiences of players are shaped by an interplay of game narrative, mechanics, and context dimensions" (Elson, Breuer, Ivory, et al., 2014, p. 524), but without further investigating what this meaningfulness is based on, namely how "game narratives", "mechanics", and "context dimensions" are co-constructed by games and players. Their model is much more oriented towards the identification enumerable measurements of players' experience than towards the creation of an informative model of video game sensemaking.

Another somehow similar attempt has been made by Toh (2018). His very detailed model (reported in Figure 3.1) has the significant advantage of integrating insights coming both from theoretical discussions and from empirical data. This makes the model quite articulate and useful in describing the particulars. However, this also makes it rather rigid and hardly scalable.[68] In addition, the primary scope of this model is identifying a typology of the relationship between ludic and narrative elements rather than a description of the sensemaking mechanisms involved in video games. This rather different scope of Toh pushes the model towards another direction, far away, once again, from general considerations on video game sensemaking, and closer to a complicated (and somehow counterproductive at stages) argument against the old ludology/narratology division.[69] Toh, however, aptly notes that while distinguishing components of video games for the sake of easier explanation and deeper individual understanding, "the distinction between different elements of the model disappears as the players perceive them as a whole" (Toh, 2018, p. 9).

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[68] Flexibility could be implicitly provided by the method employed for creating the model, as it could be said to come from the empirical data integrated in the model. Yet, given the number and diversity of video games, and the constant development of new and more innovative ones, a lack of flexibility still poses challenges to the application and overall scalability of a model.

[69] See Koenitz (2023) for a recent recollection of the ludology vs. narratology debate in video games studies.

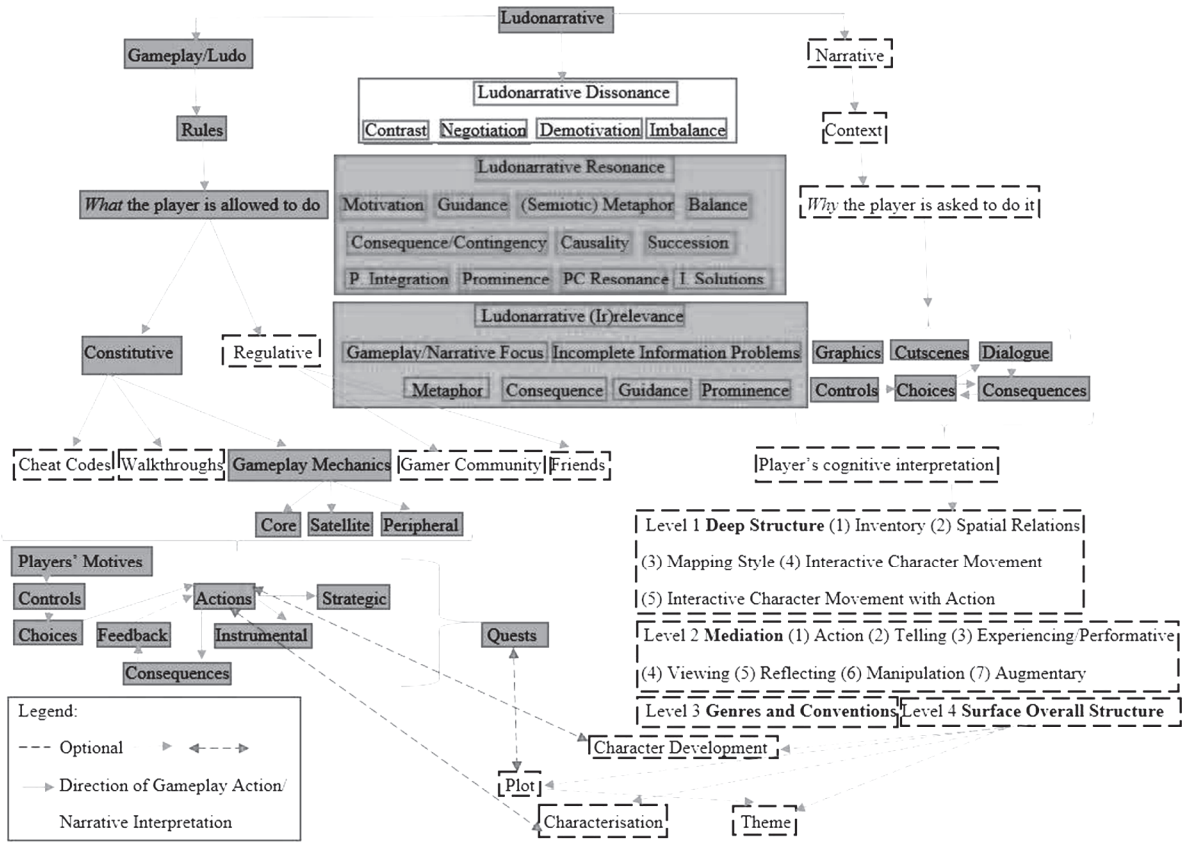


Figure 3.2 – Toh's ludonarrative model for video game analysis (Toh, 2018, p. 40).

Similar considerations could be drawn also for the model sketched out by Rambusch (2016). She proposes an equilateral triangle to illustrate "three important aspects regarding human activity and agency in gameplay" (Rambusch, 2016, p. 129) (see Figure 3.3).

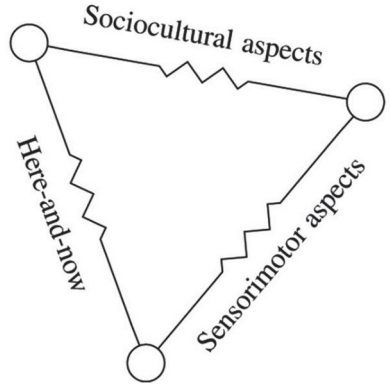


*Figure 3.3 – The equilateral triangle of "aspects regarding human activity and agency in gameplay", by Rambusch (2016, p. 129). The three aspects are represented by the sides of the triangle, while it is not completely clear what the wavy intersections refer to.*

As Figure 3.3 highlights, the three parts of the model are social and cultural norms and practices, sensorimotor aspects and the "here-and-now of gameplay". Particularly from the last item of this triad emerges the fact that the model is rather intended to discuss the situatedness of players' experience within a specific moment of the gameplay, which is paralleled by a specific moment of the players' life (and which further contributes to the situatedness of the experience). The model is thus not intended to discuss video games sensemaking. It is not intended to be a holistic model, either. For instance, it does not mention the importance of the sensorially perceivable aspects of a game. However, the model is useful in highlighting the "complexity in video game play" (Rambusch, 2016, p. 128), and the interrelation of the three sides of the triangle, "where each side represents key aspects in gameplay and where changes on one side inevitably will affect the other two sides" (*ibid.*).

The model that might get the closest to the current effort could be the one sketched out by Lindley, whose concept of "gameplay *gestalt*" (Lindley, 2002), too, points towards a systemic view of these digital artifacts. Lindley intended this systemic understanding as "a particular way of thinking about the game state from the perspective of a player, together with a pattern of repetitive perceptual, cognitive, and motor operations" (Lindley, 2002, p. 4). However, this encapsulates a still mechanical way of looking at sensemaking in video games, in which players are only one of the gears of the entire mechanism. Yet, Lindley's proposal to talk about a *gestalt*, i.e. "a configuration or pattern of elements so unified as a whole that it cannot be described merely as a sum of its parts" (Lindley, 2002, p. 4),

implies not only a systemic view, but an understanding of sensemaking as a system with significant emergent aspects.

Lastly, Hawreliak in his *Multimodal Semiotics and Rhetoric in Videogames* (2018) presents a multimodal analysis of video games that cannot be fully equated to a proper "model", but that is close in scope to my current effort. Hawreliak discusses the different modalities of games, with views that are often well aligned with my understanding of multimodality – as will be discussed below. He also argues for the inclusion of the procedurality (or the "procedural mode", in his own words (Hawreliak, 2018, p. 124)) among the semiotic modes that participate in the creation of the meaning of a video game. While the arguments in favour of this idea are sharp and generally convincing, Hawreliak proposes a view of procedurality that repeats the shortcomings of proceduralism. Namely, he discusses a view that is focused on "the practices and discourses of game designers" (Sicart, 2011, Section 'The Proceduralists'), discussing the ways in which the "procedural mode" makes a meaning apparent. Although he concedes that players' interpretive and configurative position in the sensemaking of video games has the ability to deeply impact the resulting meaning, he discusses procedurality as if detached from players ability to interact. My approach differs in this regard as it is deeply informed of players' cognitive and practical engagement in the sensemaking.

Other famous models in game studies exist, like the "MDA framework" (Hunicke et al., 2004), the "Elemental Tetrad" (J. Schell, 2014), the "design, play, and experience framework" (Winn, 2009), and the "DDE framework" (Walk et al., 2017). However, these are tools aimed at analysing games by formalizing their properties in an attempt to produce game design guidelines. While they are surely insightful and productive, these models focus on the design of video games and not on sensemaking. As such, these frameworks do not bear much interest for the current effort. On the other hand, in the context of IDN studies Koenitz proposes the SPP model as both a descriptive and productive tool (Koenitz, 2023). With his model, Koenitz describes the IDN artifact "as a dynamic *system* which facilitates an interactive *process* involving the audience as interactors resulting in objective (recorded) and subjective *products* (retellings)" (Koenitz, 2023, p. 94) [emphasis in original]. As he demonstrates, this model is a good analytical framework for IDN, able to account for the procedurality and participatory nature of these artifacts. However, while acknowledging the configurative hermeneutics inherent to IDN and video games, Koenitz does not further discuss the specificity of this collaborative sensemaking.

As it emerges from this brief recapitulation of existing frameworks and models to describe players' engagement with a video game, what I propose here is not a completely different position on shared knowledge, but rather a readjustment of perspective on how a number of elements are tied together in a systemic, complex whole. Throughout the chapter, I will show the reasons why this description works to portray the sub-systems of information involved in the collaborative sensemaking of video games, to better describe the "complex ways of engaging with video games" (Perron & Schröter, 2016, p. 20).

As mentioned, I operate here a heuristic division that helps keeping the discussion not only productive and informative but also manageable. Therefore, I intend to discuss only three of the sub-systems of information, possibly the most important ones,[70] namely:

- multimodality and the multimodal system, which parallels Grishakova and Poulaki's "rich percepts" (cf. also Nake, 2016)
- interactivity, enaction, and sensorimotor experiences, and
- memory and recollection – or "retrieval of memory images" (Grishakova & Poulaki, 2019a, p. 15).

My subdivision is heuristic, as said, and it is not meant to be exhaustive. Discussing these three sub-systems and how they interact with one another is only meant to give a sense of the higher order of complexity of the collaborative sense-making process shared between video games and their players.

### 3.2.1 Multimodality and multimodal systems

Video games always feature the co-presence of a number of different semiotic modes, among which are text, still and moving images, speech, music, sound effects, and haptic feedback[71] (see Bateman et al., 2017c for a more detailed analysis of the multimodal nature of video games).[72] Not least for this reason, video games are often considered one of the most all-encompassing multimodal means of communication (as noted also by Toh, 2018; and Zagalo, 2019), to the point of being deemed examples of *Gesamtkunstwerk*, the total work of art, due to the synergy of different media they often exhibit (cf. Backe, 2020; and in some regards also Smith, 2007). However, as reported by Dunne (2014), Zagalo (2019) and, with a different terminology, Backe (2020), studies on the multimodal aspects of video games and on how these aspects impact the expressive functions of games are generally scarce and mostly resorting to theories of multimodality[73] borrowed from the distantly related discipline of film studies (cf. e.g. Burn, 2016),

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[70] Similar triads have been proposed in other models (e.g. in Salen and Zimmerman's, in Lindley's).

[71] Haptic percepts, or haptic feedbacks, include vibrations, adaptive triggers (as those in the PlayStation 5 DualSense controllers: https://www.youtube.com/watch?v=7gJLVQy-bvM), force-resistant racing wheels, or the adaptive sensory feature of the recent PlayStation VR2 headset, defined an "intelligent tactile element" (https://blog.playstation.com/2022/01/04/playstation-vr2-and-playstation-vr2-sense-controller-the-next-generation-of-vr-gaming-on-ps5/). As King and colleagues argue, "the experience of playing a video game is also highly tactile" (King et al., 2009, p. 95).

[72] As I am going to show in the current section, this holds true even for games that employ less semiotic modes than standard video games, like audio games (games that relies entirely or almost entirely on audio output that are generally designed for players with visual impairment (Fiadotau, 2018)).

[73] Multimodality is sometimes called "multichannel communication", as in Ryan (2006), or "transcoding", as in Manovich (2002).

with only a few notable exceptions (particularly Hawreliak, 2018). In this section, I will propose a systemic understanding of multimodality which, for the reasons that will be shown shortly, is better suited to discuss multimodal communication, at least when (but not necessarily only when) related to video games.

Multimodality has been recognized as one of the defining properties of digital systems (Ryan, 2006), and, as manifestations of the digital media, video games are themselves inherently multimodal. Multimodality refers to a method of representation that integrates multiple semiotic modes.[74]

Adami, talking about multimodality, maintains that:

> "(1) all communication is multimodal; (2) analyses focused solely or primarily on language cannot adequately account for meaning; (3) each mode has specific affordances arising from its materiality and from its social histories, which shape its resources to fulfil given communicative needs; and (4) modes concur together, each with a specialized role, to meaning-making; hence relations among modes are key to understand every instance of communication." (Adami, 2017, p. 451)[75]

Drawing on this definition of multimodality, it might be argued that multimodal communication – and therefore all communication,[76] as per Adami, and also Kress (2010) – employs a system of semiotic modes, in which each mode participates in the creation of the overall meaning (see also Backe, 2020).[77] This is particularly evident in video games, where meaning is often represented through a number of semiotic resources, as said.[78] The same idea is also maintained by

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[74] With "semiotic mode" I intend here "a set of socially and culturally shaped resources for making meaning: a 'channel' of representation or communication" (Jewitt, 2013, p. 253; cf. also Halliday, 1994; Kress & Van Leeuwen, 2001).

[75] Adami here intends to highlight not that a single mode cannot communicate meaning, but that in actual communication, multiple modes are present, and a holistic view of meaning necessarily require a multimodal analysis.

[76] According to Cook, even music in itself is multimodal (cf. Cook, 2000). However, some representations have a higher degree of "multimodality" than others: while agreeing that written text do have multimodal features, its degree of multimodality is undeniably lower than that e.g. of theatre, which can recruit much more semiotic modes (and theatre has indeed been considered another possible incarnation of the *Gesamtkunstwerk* (cf. Fusillo & Grishakova, 2020)). A discussion of the degree of multimodality in different media is far from the scope of this section and will not be addressed further.

[77] Grishakova pushes this understanding even further, maintaining that even human cognition is multimodal (cf. Grishakova, 2010).

[78] In very extreme cases, the multimodality of a game could be depaupered to the point of the game becoming almost (but not actually) monomodal. For instance, if one imagines a game similar to *Tetris* (Pajitnov & Pokhilko, 1984), but without sounds, colours, numbers, and text, without the progressively higher speed, and without differently shaped pieces, its multimodality could be questioned. Yet, in the movement of the pieces and in the disappearance of lines when completed, some multimodal aspects would still remain. If one is to remove even these aspects from this skeletal *Tetris*, then the result would end up being no longer a video game, but a static rectangle with immobile squares in it. I thank Prof. Mikey Goldweber for suggesting this thought experiment that pushes the concept of multimodality to its extremes.

Backe, who opens to the view of video games as media[79] based on an interplay of artistic practices "combined in a totalizing whole" (2020, p. 200). Backe also states that to create this totalizing effect, there is a need for "a careful *systemic integration* of elements" (Backe, 2020, p. 203; cf. also Marquard, 1983) [emphasis added].

This systemic perspective that encourages to see the overall meaning as coming from an integration of parts can explain phenomena such as the so-called McGurk effect,[80] or the experiment reported by Faulstich in the introduction of his *Grundkurs Filmanalyse* (2013), where the same videoclip employing two different pieces of background music arguably conveys to the viewer two different meanings (see also the Kuleshov Effect in montage[81]). In these cases, meaning emerges from the interplay of several visual or audio-visual elements, which only together give rise to a final, unified message of higher order (cf. also Eskelinen, 2001; and Egenfeldt-Nielsen et al., 2019 on the role of sound for immersiveness and the enhancement of a unified gaming experience). An even more extreme case of how much our perception is multimodal is that described by Mancini and colleagues (Mancini et al., 2011), according to which pain, as an haptic-neural sensation, is dependent on vision.

As Ryan maintains, "the affordances of language, pictures, and music complement each other, and when they are used together in multichannel media, each of them builds a different facet of the total imaginative experience" (Ryan, 2006, p. 20, see also 2012). In a multimodal communication, the modes "do not entirely retain their original character but begin to influence each other in dynamic and sometimes unpredictable way" (Hawreliak, 2018, p. 20), which means that it is practically impossible to identify a "main" semiotic resource of which the other modes are accompaniments or support.[82] Video games players are presented with

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[79] "A medium is best seen as a historically stabilised site for the deployment and distribution of some selection of semiotic modes for the achievement of varied communicative purposes." (Bateman et al., 2017a, p. 123).

[80] The McGurk effect demonstrates that our hearing of certain speech sounds depends on the shape of the mouth that we see producing them (cf. Mcgurk & Macdonald, 1976). Various empirical inquiries of this and related effects have been conducted over the years (see e.g. Lindström et al., 2012).

[81] The Kuleshov Effect is a cognitive phenomenon in film editing, first demonstrated by Soviet filmmaker Lev Kuleshov in the early 20th century. It illustrates how viewers derive meaning from the juxtaposition of images rather than from individual shots. In his experiment, Kuleshov presented a neutral expression of an actor alongside different contextual images – a bowl of soup, a coffin, and a child. Audiences interpreted the actor's expression differently depending on the accompanying image, suggesting that the meaning is not inherent in the individual images but emerges from their relationship (see Kuleshov, 1974).

[82] This does not mean that differences in saliency do not exist even in highly multimodal representations like video games. One mode can be made salient while another recede into the background or even disappear temporarily. For instance, during a dialogue between two characters text could take a background role as subtitles or even be completely absent, to regain a prominent position e.g. when the player picks up and read a letter in the game. "Which mode […] is made salient depends on the game system's control and the players' perceptual

multiple, sometimes competing and other times mutually reinforcing or redundant messages coming from, among others, graphics, text, music, sound effects, spoken dialogues and haptic feedback(cf. Hayles, 2016). Multimodality is therefore presupposed to be the result of a deliberate choice aimed at producing a communicative utterance that has inherent unity and which is intended to be experienced as a whole.

This is precisely the reason why it can be useful to conceptualize multimodality not only as a (sub-)system[83], but as a system exhibiting complexity itself. It is a system of bits of information, partially autonomous both at the objective (music and sound effects do not need each other to express their very own meaning) and at the subjective level (audiences do not need music to understand sound effects, and vice versa), oriented towards the transmission of a message of higher order, which emerges from their intercurrent, interdependent, and interoperating occurrence. This same "message of higher order" that emerges in more-than-combinatorial ways and sometimes outside the direct control of the authors (cf. the uncertainty of system design as discussed in Koenitz & Eladhari, 2021) also justifies my view that video games are based on complex multimodal systems: immersive totalities experienced through a synergic co-presence of modes, rather than through their simple co-occurrence.

The complex multimodal system of video games brings advantages. Multimodality offers the possibility to represent a wealth of details, to a degree sometimes impossible for a single mode. On this, Grishakova talks about the "incompleteness and inability of a single medium to capture the multimodality of natural perception" (Grishakova, 2023a, p. 5). This capability of video games is also closely related to the encyclopaedic capacity of digital media as defined by Murray (Murray, 1997/2017). Additionally, multimodal media are more likely to generate immersion: Steuer (1992) talks of a "breadth of information", a stream of sensory percepts simultaneously presented to the audience, which functions as a great facilitator of immersion. Moreover, the redundancy that multimodality affords can be very useful in conveying important information (Hodent, 2018). While all of these elements must be carefully crafted to turn out useful for game and narrative design purposes, they make video games capable of bearing a huge potential in terms of representational capabilities, thanks to their complex multimodal systems.

In addition, through the interplay of different semiotic modes, multimodal systems can show large set of messages not necessarily referring to a single

focus and actions" (Toh, 2018, p.36). This is also due to the dynamic and interactive nature of video games and their underlying engines, but it is not exclusive of the medium. Cinema, for example, can easily operate saliency switches, too. Less so photography and written text. In general, it seems that representation with a higher degree of multimodality can naturally operate saliency switching much more easily than those with a lower degree of multimodality, not least for the quite obvious reason of encompassing a smaller number of modes.

[83] From now on, when talking about the multimodal system, I will adopt the wording "multimodal (sub-)system" only when necessary to stress its being part of the overarching sense-making system.

meaning. For instance, graphics and music can cue two different sets of meanings for players to make sense of. This is the case for instance when players are consulting a map and suddenly hear a change of music, signalling the approaching of an enemy, as it sometimes happens in *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011). Even more, it seems it is not needed that the same perceptual medium delivers unique messages at all times. Sound can be used to convey narrative-relevant information, using a narrating voice, while also being recruited to mimetically represent the happenings within the game world, e.g. with sound effects resembling the sound of characters' steps, as it happens in *Halo 3 ODST* (Bungie, 2009).[84]

As Salen and Zimmerman maintain, the multiplicity of semiotic modes implies a multitude of ways to represent the narrative of the game. They support this idea with their concept of "narrative descriptor", where:

> "a narrative descriptor is any component of a game that participates in the game's system of representation. Instructional text, in-game cinematics, interface elements, game objects, and other visual and audio elements are all narrative descriptors" (Salen & Zimmerman, 2004, Chapter 26).

The multimodal (sub-)system can therefore be employed to give a huge amount of narrative information to players, employing the same sub-system of information that makes the game world perceptually available. This implies that, in a way, the multimodal system can be considered as a complex system of narrative descriptors, i.e. a complex system of narrative-relevant information presented through different semiotic resources. The considerations on the capability of the multimodal system to represent a different set of information with each different semiotic mode mean that these narrative descriptors can and often do co-occur, and sometimes compete for players' attention in cueing their sensemaking – as it was mentioned happening in *Halo 3 ODST* (Bungie, 2009). The overall narrative therefore emerges also from the interplay of these narrative bits, and it is not completely combinatory. This also shows the importance of carefully building the multimodal (sub-)system of a video game to cue players' sensemaking regarding the narrative towards certain directions. Building the multimodal (sub-)system of the game-player dialogue must therefore be done paying attention both to the guiding potential of the designers, and to the butterfly effect typical of complex systems, according to which each (no matter how small) element is potentially capable of changing the entire system.

To sum up: multimodality is the co-presence of a number of semiotic modes used for sensemaking. While studying video games, multimodality should be better conceived as a multimodal (sub-)system in which each semiotic mode is in

[84] A more thorough discussion of this phenomenon happening in *Halo 3 ODST* has been provided in section "Part I 2.2 Formal complexity and cognitive responses – a study". It is notable that among the reviews analysed in that section, one reviewer mentioned exactly this multiplicity of semantic content in the multimodal system.

a complex relationship with the others. This constitutes one of the sub-systems of information of video games.

Zagalo (2019) talks of video games as complex audio-visual objects that are variable and infinite, for it is always possible to obtain slightly different experiences by interacting with them. Interactivity is precisely the element on which I shall focus in the next section. When compared with receptive audio-visual media, video games are characterized by an interactive dimension, which enhances their complexity. More relevantly to this discussion, interactivity is also what enables them to afford enaction and offer sensorimotor experiences.

### 3.2.2 Interactivity, enaction, and sensorimotor experiences

Action, and specifically interaction, constitute the main and fundamental distinctive feature of the videoludic medium. Video games not only *afford*, but also *require* action to instantiate one single coherent experience among the many potential ones. This is the reason why I argue that video games are about sensorimotor experiences, intended as *sensorial experiences made available through motion*, and in which enacting one's own character plays a crucial role. In addition, according to enactive views of cognition, motion and interaction are also necessary for the very understanding of a representation, including a videoludic one.[85] When dealing with video games, then, one should consider enaction as an extremely relevant concept.

In this discussion, there is an ontological distinction to be made between enaction in a practical sense, i.e. players' active (although mediated) participation in the video game in the shoes of a more-or-less diegetic character, and enaction in a cognitive sense, i.e. players' sensemaking as being shaped by the mediated interaction with the represented environment. These enactments are strictly tied together, as I am going to show throughout this section, and they are both profoundly impacted by the multimodal (sub-)system of the video game, on which they strongly rely.

In an effort to disentangle the confusion sprouting form the double meaning of the term "enaction" in the current context (and in video games studies), I will talk about enaction in a cognitive sense as *cognitive enaction*, and enaction in a practical sense as *practical enaction*. I will consider the two meanings as separately as possible, showing their interconnection only afterwards. These different sensorimotor experiences are necessary to extract an experience from the game (practical enaction) and to understand it (cognitive enaction), and they are therefore a defining feature of the objects of this analysis, and a further (sub-)system of information for video game sensemaking. They are also what justify the view of meaning co-construction as including meaning co-production in video games, as I am going to argue.

[85] Enactive views of cognition actually maintain that motion and interaction are necessary in general to make sense of the world that surrounds us (Polvinen, 2023).

*Cognitive enaction* is the sense less explored in the academic literature on video games. In the onset of his book *Action in Perception*, Noë claims that "the world makes itself available to the perceiver through physical movement and interaction" (Nöe, 2004, p. 1). Noë is one of the main supporters of the enactivist paradigm in the study of human cognition. Enactivism proposes that cognition arises from the dynamic interaction of a subject and its environment. Cognition does not happen only in our heads but is situated in an environment and co-constitutive with the external world, through action. In the context of video games, Salen and Zimmerman similarly mention that "players gain information about the game world by interacting with it, by interpreting it, by playing with signs to see what they might do or what they might mean" (Salen & Zimmerman, 2004, Chapter 25; for similar considerations, see Rambusch, 2016).

This entails that interaction can only be understood by mediately inhabiting the fictional world and by understanding its representation, its physical and cultural features, rules, and affordances. Vice versa, we can fully think in and of video games only once we have understood our (and our characters') relationship with the game world, including our (mediated) bodily affordances. This can be achieved only by interacting with the game itself (cf. Lindley, 2002). Clear examples of this kind of enactive cognitive function can be easily experienced while playing games whose main characters are animals. After a few minutes of playing as a cat in *Stray* (BlueTwelve Studio, 2022), for instance, one is already almost seamlessly considering small pipes, handrails and ledges as reasonable passageways, therefore embodying and enacting the cat *as a cat*. Without this cognitive enactment, players would not be able to successfully navigate the game, as there would be no way of thinking about such small passageways as viable for a human.[86]

*Practical enaction* has a richer tradition in the academic literature on digital media and specifically video games. It refers to a more practical way of conceiving enaction, and it regards interaction as the way in which the game provides an individual experience to the player. In games, "players enact and witness stories" (Ensslin, 2022, p. 412). Indeed, in video games we, as players, *have to* inhabit the environment. It is necessary for us to actually *act* in order to make the world *be*, in the very practical sense that (inter)acting is required by the computing engine to generate a sensorially perceivable representation of the fictional environment (see the similar notion of 'playformance' in Frasca, 2007). Contrarily to receptive media, video games are not pre-determined, but rather they

[86] One could even say that, in some games, correctly understanding the enactive affordances is part of the very reason for playing them. This is particularly true for instance in games that include multiple characters each with different abilities or bodily affordances, like *Final Fantasy X* (Square Product Development Division 1, 2001), in which different characters and/or elements are better suited to face different monsters, a feature that complicates and make more interesting the combat system.

are generally constituted by a set of "possibility spaces"[87] and "protostories".[88] Game designers do not create a product that exists *per se* in a unique, immutable form. On the contrary, video games are based on an interactive engine that requires exchanges between the player(s) and the computing unit, where the computer actively responds to the physical inputs coming from the player and the player actively responds to the multimodal sensory inputs coming from the computer. Eventually, the experience offered by a video game emerges from players' constant interaction. In this interaction, "the player must be seen as both implied and implicated in the construction and composition of the experience" (J. Newman, 2002, Section 'Playing Games'). In video games, sensorimotion and practical enaction are indeed crucial parts of the generation of the experience itself. This is not true for on-paper literature:[89] the narrative of a book exists *in abstracto* identical to every reader, while in a video game it is instantiated in a specific way (among the often countless possible ones) only through interactions with the game- (and therefore story-) world. A video game changes and evolves internally in response to intrasystemic dynamics, whereas in books these are extrasystemic, and do not impact the objective shape of the configured experience.[90] Similarly, Milesi claims that accessing video games is in a way "paralleling quantum physics, where the fact of observing changes the state of what is being observed" (Milesi, 2019, p. 160). The very fact of observing the video game – which can be done only through practical enaction – changes the game itself. This enaction therefore substantiate, through instantiation, a linear experience among the many possible.

In the real world in which the player is situated, the action ranges from the movement of a finger (using a controller, a mouse, or a keyboard) to the involvement of the entire body (when using e.g. a virtual reality equipment, augmented reality technologies and/or motion capture devices[91]), but it usually translates into a movement with a much wider range and scope (cf. the notion of 'amplification of inputs' in Ciccoricco, 2010). Practical enaction therefore further subsumes two levels of interaction: the interaction of the player with the hardware, and that of the software with itself, for instance in terms of the in-game character exploring

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[87] Possibility spaces are different possible configurations of the system underlying the game that allow moment-to-moment development, and which can realize myriad of outcomes (Bogost, 2007).

[88] Protostories can be conceived as the narrative counterpart of the rather game mechanics-oriented term "possibility space" as intended by Bogost. A protostory is the set of all possible stories that the interactive engine can generate (Koenitz, 2015, 2023; Roth et al., 2018).

[89] The same could be argued for films, audio recordings, or any other non-interactive narrative medium.

[90] Non-interactive media like literature still have different meanings for different readers, but these differences are subjective, and do not change the "blueprint" on which sensemaking is based.

[91] Some of which can even capture gaze direction, that allow enhanced exploit by designers of movements only partly conscious like eye motion. An example is the HTC VIVE Pro Eye: https://www.vive.com/us/product/vive-pro-eye/overview/

the fictional world. Only when these two interactions are in place, players are able to instantiate, through practical enaction, the unilinear game experience (for similar considerations see the concept of 'embodied metalepsis' in Ensslin, 2022).[92]

For practical enaction to be meaningful, the video game (and therefore the multimodal (sub-)system – the perceptually available side of the game) must respond in a coherent way to the player.[93] This is applies at different levels of granularity: from the overall behaviour of the sub-system, to each separate semiotic mode forming the multimodal aspect of the game (see e.g. the considerations by Collins, 2013 on the coherence of sonic responses to players' actions), from the long-term narrative effects, to the short-term sensory response to an action.[94]

The coherence of these exchanges, and the meaningfulness of practical enaction, is necessarily based on cognitive enaction, i.e., on the cognitive reconstruction of meaning obtained by inhabiting the world of the video game. The two conceptions of enactivism are therefore to be considered as symbiotic, simultaneous and mutually informing, and each one preconditions the other. Hurley argues that "to understand the mind's place in the world we should study these complex dynamic processes as a system, not just the truncated internal portion of them" (Hurley, 1998, p. 2). Given that practical enactment is required to instantiate the game- and story-world, cognitive enactment necessarily takes the move from the result of this instantiation. Inhabiting the game environment, which is necessary to make sense of the game, constitutes exactly the practical enactment that produces the instantiation itself. At the same time, cognitive enaction is the pre-requisite to make sense of the video game and therefore it is necessary for being able to practically enact one's own role in the game environment. In general, cognitive enaction is necessary to understand how to interact with the game- and

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[92] In video games, practical enaction is far from free. Jenkins discussed a mode of narrative representation in video games as "enacting stories", referring at the similarity between the narrative construction by players in digital games and that by actors in improvised theatre such as the Italian *Commedia dell'Arte* (Jenkins, 2003). According to Jenkins, in both cases the actants are given a variably loose scaffold to follow, and relative freedom between the structural knots of this scaffold. The individual narrative unfolds between the pre-determined knots with relative freedom for the actors/players, provided that they follow the restrictions of their "roles" (dictated by the game designers, or by the scriptwriter/conventions of the genre). On the relative freedom of players, see also Bateman (2017c).

[93] Virtually, this applies also the other way, as players have to respond in a coherent way to the game. However, given the way in which video games are generally designed, there is no incoherent interaction available for players, as e.g. all buttons are mapped (possibly with a null function, but still mapped), thus there is little space for incoherent interaction from the players' side. In particular cases, if the buttons are not mapped, they are simply ignored by the game, which still prevents the possibility of incoherence. These latter cases happen for instance when playing a GameBoy game on a computer, through an emulator.

[94] A point in this is that of motion sickness: when there is a sensory conflict between perceived movement and the body's actual movement, players are likely to experience motion sickness (cf. on this also Rambusch, 2016).

story-world. This mutual dependence is also the reason why it is not possible to consider cognitive enaction as a purely mental phenomenon.[95] This entangled double mechanism, for how much confusing might sound in writing, is quite intuitive and in a constant cycling motion. In more simple terms, in video games "the subject does not only observe what s/he lives out, the subject lives out what s/he observes" (Milesi, 2019, p. 160 – translating Delaume; while Aarseth, 1997; and Lehto, 2009 advance similar arguments).

The symbiotic nature of cognitive and practical enaction can be observed using as examples two extremely similar game worlds, namely those of *The Legend of Zelda: Breath of the Wild* (Nintendo EPD, 2017) and *The Legend of Zelda: Tears of the Kingdom* (Nintendo EPD, 2023). Given the similarity of these games and their worlds, the differences in players' cognition resulting from different enaction affordances become evident. The two very similar games prompt very different ways of conceiving the surrounding environments as a result of, for instance, the ability to "ascend" through rocks and other objects, available in the newer game but not in the older one. In *Breath of the Wild*, players who want to reach the top of a mountain have to find an appropriate wall and foresee a strategy to climb it up: they must calculate the approximate height of the slope to foresee whether the limited stamina of the character would allow to climb it in its entirety without falling. In *Tears of the Kingdom*, on the other hand, in addition to the normal climbing ability players can also position their character underneath a protruding object (rock, fallen tree, etc.), and activate the "ascension" ability, to immediately find themselves standing on the top of said object. This causes a significant shift in players' cognition regarding the environment. Whereas in the older game a protuberance would mean impossibility to climb due to physical restrictions, in the newer one it means faster access to the top. Whereas in the older game a damaged pillar would mean a hard boundary, in the newer one it means an opportunity to get faster to the peak. Thus, players of *Tears of the Kingdom* would look at their surroundings very differently than players of *Breath of the Wild*, due to their different enactive cognitive understanding of the surroundings, and they will consequently behave in a significantly different way. This shows therefore that practical enaction informs cognitive enaction, and cognitive enaction informs practical enaction. Both enaction types are, as it is probably apparent, based on the perceivable representation of the world, made available through the multimodal (sub-)system, which is therefore strictly influencing enaction.

Furthermore, through interaction players can enact characters in their respective storyworlds, discovering and piecing together the narrative. This mode of

[95] It is actually not really possible to consider cognitive enaction as merely and fully mental, as such a tenet would negate the very essence of enactivism. What this specification is intended to point out is rather that cognitive enaction is to be considered part of the sensorimotor experience of video games (and not part of the contextualising cognitive mechanism that I am going to discuss in Section 3.2.3) because of the very strict symbiosis it shows with practical enaction.

relating to the narrative is required by video games to instantiate the narrative itself, and therefore to enable and guide its sensemaking. The reason for choosing Mejeur's definition of narrative in this work becomes therefore ever more apparent. As stated in the introduction to this work, Mejeur define narrative in video games as "the embodied cognitive process of sequencing signs drawn from a game's story (its collective possible objects, representations, and actions) into a discourse (consisting of events and chains of events) through play" (Mejeur, 2019, p. 63). This embodied cognitive process of sequencing through play is closely paralleling my argument of the role of enaction in video games, as it highlights the embodied role of the player in co-constructing narrative meaning on the basis of what the game offers. The procedural property of video games, and their spatiality (Ryan, 2006; Murray, 1997/2017) afford specifically this. Indeed, games often feature complex ecological and ubiquitous narrations, in a narrative organization that has been compared to a building plan (cf. the concept of 'Narrative Architectures' by Jenkins, 2003). The view of video games narratives as architectonic blueprints made of smaller parts helps better conceive the scope and extension of the narrative potential of the complex set of elements composing the video game and its narrative. This mode of representing and cueing stories in video games is offered by both the multimodal system and the interaction afforded and required by video games. Grishakova maintains that:

> "contemporary 'complex devices,' such as videogames, are not reduced to a pre-given structure of action dictated by a digital program: the digital storyworlds and characters are able to change in response to players' actions. Thus, instead of a stable storyworld, there is a permanently and interactively changing 'narration.' The interplay and change of human agents and systems is mutual" (Grishakova, 2020, p. 491).

Shibolet adds that interaction has a role in narrative comprehension of video games due to its informative power on the sequentialization of events (Shibolet, 2018). This means that a mutual reinforcement between narrative understanding and interaction is in place when it comes to sensemaking in video games.

An additional implication of the interactive nature of video games is thus that in these complex interactions between players and games, authorial control dissolves, as authored narratives become part of a bigger, complex whole, co-constructed by players also in relation with their individual experience with the narrative. This is visible in particular with quests, which can be seen "as micro-narratives set within an overarching multithreaded narration" (Egenfeldt-Nielsen et al., 2019, p. 216), and which order of appearance is largely left for players to (more or less consciously) decide, thus lowering the authorial control further and heightening the self-organization of the game-player system, nurturing the emergent aspects that make video games complex narrative systems.

Not only the multimodal (sub-)system but interaction, too, can participate in the game-player co-creation of narrative. Cheng (2007) provides an example of such co-creation in the game *King Kong* (Ubisoft Montpellier, 2005). In a scene in which the player character is tied at a stake, the interaction afforded to the

player is limited to a single button instead of the usual ten-twelve. In this situation, Cheng maintains, one would expect the player to feel constrained by the game mechanics, but the exact opposite occurs instead. The scholar justifies it saying that "this occurs because the limitations imposed upon the player are not due to any arbitrary reason of game mechanics, but arises [sic] from a situation that makes logical sense in the game world" (Cheng, 2007, p. 21). This means that the situation is justified by the narrative and, more importantly, by the interaction elicited by the narrative, in a mechanic made narratively relevant through kinaesthesis: being the player character tied to a stake, players experience the bodily restraints through interactivity limitations. On the other hand, Cheng's example highlights a caveat, that of design: interactions are afforded by the video game, but they are not naturally occurring in such artifacts. Rather, they are designed in a specific way. As such, they must be crafted to support or even require one or another kind of kinaesthetic interaction and enaction by players. Therefore, the narrative representation impacts the understanding of interaction mechanics, and vice versa. In case of a successful design in this sense, additional feedback loops, aptly made explicit in the reported example, are realized in this interplay of multimodal (sub-)system, narrative, game mechanics, and sensorimotor experiences. Similarly, Hjialtason and colleagues (Hjaltason et al., 2015) provide empirical evidence showing the narrative potential of game mechanics.

To summarize, video games offer sensorial experiences that are made available and comprehensible through motion, which therefore constitute an aspect strongly integrated in the sensemaking of video games themselves, and of their narrative. Both actual hand or body movement of the player and its amplified translation in the fictional world are required to prompt the dynamic generation of the fictional worlds featured in these artifacts, through practical enaction. However, studies of cognition agree that action and interaction are also necessary to understand the specific world in which players are inserted, through cognitive enaction. In video games, where the participatory world is represented through a (sub-)system of semiotic modes, sensorimotor experiences and multimodal subsystems are in a relation of mutual reinforcement, regarding both cognitive and practical enaction. Knoller similarly concludes that multimodality and kinaesthesis mutually reinforce each other, and that embodied responses to external stimuli "can serve as a locus of additional feedback loops that are part of the narrative experience" (Knoller, 2019, p. 112), because interacting with a video game has indeed a sensorimotor nature, and this sensorimotor quality has a sensemaking potential.

However, our cognition is always grounded in our background knowledge. This holds true both for our everyday life in the real world and for our encounters of fictional, fantastic worlds. There is indeed an assumed structural resemblance between real, perceptual experiences and imaginative, fictional ones, which has been a commonplace of cognitive theories in literature and art, and which I think is equally significant in video games. Memory is the cognitive mechanism thanks to which we make sense of the current situation through previous knowledge.

### 3.2.3 Memory and recollection

Memory retrieval is a cognitive process that involves the recollection of previously learned information or past experiences from long-term memory. The importance of this cognitive function in narrative sensemaking has been recognized since the 1930s (Bartlett, 1932/1995) and has been studied for a long time now (e.g. by Bruner (1961), Zwaan and Radvansky (1998), Gerrig and McKoon (2001), and many others), including with empirical analyses by literary scholars such as Miall (1986) or Bortolussi and Dixon (2003). Even within video game studies, the idea of building upon the knowledge of players to support comprehension is long-standing (see e.g. Jenkins, 2003), and has informed game design practices for a long time. A specific discussion of the grounding of sensemaking in previous knowledge or of the exact kind of background information on which sensemaking is based lies beyond the scope of the current analysis. However, the points raised by research on memories suggest it to be a further source of information in video games' sensemaking. Scope of the current section is to unpack this source and describe its relationship with the other two identified so far.

One of the assumptions of the study of memory retrieval in accessing cultural objects and works of art is the idea of the experiential nature of sensemaking. This idea has been investigated by many researchers, and particularly in foundational works by Fludernik (1996) and Herman (2002, 2003). Summarizing the positions on the mnemonic and experientially-grounded nature of human cognition, Caracciolo states that "readers respond to narrative on the basis of their experiential background" (Caracciolo, 2014b, p. 5). Similarly, Walsh maintains that narrative "can mediate between explicit propositional knowledge, knowing that, and experiential knowledge by acquaintance, knowing of" (Walsh, 2018, p. 58). This is "the core of narrative logic, grounded as it must be in embodiment, in experience" (*ibid*.). This informative function is guided by "experiential traces" (Zwaan, 2008), i.e., by memories that direct one's evocation of past experiences.

Memories can be argued to be a source of information involved in all kinds of sensemaking. For instance, players need no explanation about gravity. They expect gravity to be present, i.e., they expect Mario from *Super Mario Bros.* (Nintendo R&D4, 1985) to fall back on the ground after a jump, without any need for further justification. This automatic assumption is grounded in our experiential background as living beings on Earth, and informs our sensorimotor interaction with a digital world or, in general, with any product requiring this sort of knowledge. As Herman argues, memory is an "organization of prior experience into patterns of expectations for current experiences" (Herman, 1997, p. 1050; similar conclusions are also drawn by O'Regan & Noë, 2001 talking about visual experience). Players' motion in *Super Mario Bros.* is therefore dictated not only by the multimodal (sub-)system through which the game-world is made perceptually available, but also in response to players' experiential (and embodied) knowledge of gravity. Jumping is perceived through the multimodal (sub-)system, but the kind of movement is automatically understood through the recollection of the real-

world experience of pushing oneself off a surface and into the air by using the muscles in the legs and feet. In addition, as Wilhelmsson suggests with the concept of "Game Ego", the identification of players with their characters and avatars[96] depend as much on sound, images, and tactile feelings as on players' experiential knowledge of having a physical body (Wilhelmsson, 2008). Therefore, only through the mutual reinforcement between the multimodal (sub-)system and the players' knowledge the sensorimotor interaction is made meaningful and, one might argue, even understandable. In more practical terms, this is also supported by Zagalo, when he claims that video games players "look for information outside of the realm of representations, and then integrate everything within so as to respond to the choices required of them" (Zagalo, 2019, p. 96).

As it should be noted, the considerations about Mario jumping are valid as long as there is a resemblance between what is represented by the multimodal (sub-)system of the video game and the experiential traces stored in players long-term memory (cf. Elleström, 2021). However, no exact resemblance between the experiential content of one's memory and the representation at hand need to be present. Rather, what is needed is an indexing that can even be minimal, as soon as it enough to recuperate one's memory through which contextualize the content of the representation. Taking back the example of *Super Mario Bros.*, it is undeniable that no human being has ever experienced jumping in two dimensions. Yet, the two-dimensional rendering of the game poses no problem in recuperating the experiential traces related to jumping, as the representation is giving enough audio-visual clues through which to evoke the relevant memories. This is particularly crucial in video games, where photorealism is not always possible, and different visual styles (e.g. 2D, low poly, pixelated) and camera settings (e.g., third-person, isometric, 2D) would otherwise prevent the recollection of memories.

However, memory does not only refer to experiential traces, but also to memory content intended in the more general sense. As Grishakova maintains, "texts allow the readers to fill out textual gaps by making inferences from real-world situations or scenarios evoked by the text" (Grishakova, 2022b, p. 10). This background knowledge includes all kind of information not directly provided by the game currently played but derived from previous encounters with similar games, other cultural objects, and everyday experience. In video game studies, the importance of intertextual and extra-textual knowledge has been long recognized (e.g. by Salen & Zimmerman, 2004). Similarly to experiential traces, also this kind of more general recollection works in analogous ways for both the narrative and non-narrative comprehension of video games. This can be seen by looking at how easily players understand different instances of the same "operational logic"[97] (Wardrip-Fruin, 2009). For instance, video games players

[96] Characters here refer to entities with pre-defined features, motives, and stories, while avatars are closer to dolls, blank figures, often highly customizable by players, made specifically for improve impersonation, immersion, and projection of one own's motives and intentions.

[97] Wardrip-Fruin speaks of operational logics as of patterns in the interplay between data, process, user experience, interaction, author and audience.

understand the functioning of an operational logic like collision detection without major difficulties across different games, both two- and three-dimensional. This understanding is based on previous real-world sensorimotor experiences, but it also requires recollection and retrieval of memories of other instances of collision detection in other games, to foresee what will happen next. Even less grounded in experience, but not less rooted in memory, are the logics of quests or that of assertive artificial intelligences (which are other operational logics identified in Wardrip-Fruin, 2009).

"All games reflect culture", suggest further Salen and Zimmerman (2004, Chapter 29). This cultural situatedness directly implies that they require cultural knowledge to correctly guide the sensemaking process. The degree to which this is true clearly varies (or one would not be able to understand anything of distant cultures), but generally the cultural background of players can be seen as organizing their sensemaking in fundamental ways (cf. Kukkonen, 2013), and can affect the understanding of both the content and the form of a representation. This aggregate of information must be carefully considered in designing a meaningful experience, since all cultural objects negotiate their meanings with the cultures in which they are created and accessed.

Social, cultural, and personal background also influence the formation of other specific kinds of relevant memory structures, in particular scripts and schemata (also called schemas) (cf. Schank & Abelson, 1977; Rumelhart, 1980; Stockwell, 2002). Rumelhart defines schemata as data structures representing our knowledge about the world that enable us not only to understand, but to perceive (Rumelhart, 1980). It has even been argued that schemata are what eventually allow us to act (cf. on this Douglas & Hargadon, 2000). On the other hand, in their influential work on cognitive psychology, Schank and Abelson define script as a "standardized generalized episode" (Schank & Abelson, 1977, p. 19), or, in other words, behavioural patterns shared among a socio-cultural groups and evoked through more-or-less conscious recollection. Ultimately, scripts are mental constructs that guide our understanding of the world and reduce the required cognitive effort by abstracting patterns, i.e. finding reliable regularities (cf. Schank & Abelson, 1977; Rumelhart, 1980; and the empirical test in Wirzberger et al., 2018). Being low-level structures, scripts and schemata are somehow shared between large groups of people. For this reason, one can expect players of a video game to mostly comply with shared scripts and schemata.[98] For instance, Kiss and Willemsen maintain that, in cinema, "viewers use basic spatial schemas [grounded in embodied orientation and navigation] in 'mapping' narrative plot structures, for instance, through the mental projection of image schemas, or by mapping one's own familiar action patterns onto the experiential paths of the fictional characters" (Kiss & Willemsen,

[98] A caveat to this is that they are neither prescriptive, nor deterministic, which means that one can also expect players to transgress them. Indeed, scripts and schemata are flexible structures: known patterns can be infringed and new patterns can be created (cf. Grishakova, 2022b). This have sometimes defamiliarizing effects, but it is rather common in video games (cf. Tempini, 2019).

2018, p. 62). As such, the recollection of these patterns can affect the players' understanding of the multimodal (sub-)system and can elicit actions, therefore influencing interaction (cf. also Salen & Zimmerman, 2004). Schemata also include sensorimotor information (up-down schema, source-path-goal schema), which is particularly relevant for video games, given their sensorimotor nature discussed above. For the same reason, video games also elicit the retrieval of scripts, i.e. of standardized behaviours to adopt in specific situations. Specifically talking about video games, Ciccoricco suggests that scripts and schemata evoke contexts that elicit different experiences, but also that different kinaesthetic experiences may prompt the recollection of – and the contextualization through – different scripts and schemata (Ciccoricco, 2010). This is immediately true when players have access to the specific relevant script required by the game. When a specific script is not available, other similar scripts need to be adapted for the situation (Kolodner, 2002).

In concert with cognitive enaction, then, memory participates in the contextualization of games and of the events happening therein, by bridging the gaps between the represented world and different kinds of previous knowledge. Sensemaking works thanks to a relational network between expressed information and background knowledge. According to Magliano and colleagues, sensemaking is based on recollection of the previously-built understanding of the world connected to what is represented in an artifact (Magliano et al., 2019).[99] This ability to understand new situations from prior knowledge and experiences allows us to function in novel scenarios even in video games – it permits us to make decisions with only limited input, and to predict what might be the result of these decisions.[100] This is one of the cognitive bases of Koenitz's interactivity of "planning and execution" (2023, p. 3), one of the main features of interactive digital narratives and video games.

Memory is not a fixed set of data though, and new memories can be built not only through living, but also by interacting with a video game. For instance, playing a game can give rise to new scripts and schemata, both personal and shared. The community of assiduous players of the *Grand Theft Auto* series (Rockstar North et al., 1997/2021) share a behavioural script about what to do when chased by the police. Similarly, the community of *Pokémon* (Game Freak & ILCA,

[99] The inferences bridging between long-term memory and the representation at hand are often times of the abductive kind (Peirce, 1932; on the difference between inductive and abductive reasoning, cf. Grishakova, 2022a). Bartlett similarly supported that "remembering is not the re-exitation of innumerable fixed, lifeless and fragmental traces. It is an imaginative reconstruction" (Bartlett, 1932/1995, p. 213).

[100] Notwithstanding our constant training and possibly our evolutionary selection to draw such inferences, once should note that mistakes can still be done, and are not necessarily infrequent. This means that correctly cueing players for them to recall the correct information is a crucial factor to achieve the desired result and to avoid unexpected outcomes. This suggests that also correctly creating additional knowledge and guiding its scaffolding in easily retrievable clusters is equally important for flawless progression into more and more advanced phases of the game.

1996/2021) players share a schema linking colours to elemental affinity: yellow creatures are electric types, pink monsters are fairy types, etc. (on this, cf. again Tempini, 2019). An additional example is the fact that many video games create a sort of environmental grammar in recognizable patterns, decoded on the basis of visual (and sometimes auditory) clue, like the cracked walls in *The Legend of Zelda: A Link to the Past* (Nintendo EAD, 1991), which imply the possibility of bombing them to open new passages. The mnemonic contents of these examples are created (*learned*) during the game play activity and are heavily influenced by games rules (sometimes opposite to the "rules" of real life, like in the case of *Grand Theft Auto*), and later guide the further interactions and inform the sense-making of players, which in turn will create new memories, which will guide interaction, and so on, in a cyclic manner.

Caracciolo (2014b) similarly supports the existence of feedback loops between our experiential background and a specific narrative artifact. In this sense, a sort of two-way movement can be identified even between the players' previous experience and a game narrative. Caracciolo further maintains that "experientiality is a complex, dynamic relation in which real-world and story-driven experiences become intertwined" (Caracciolo, 2014a, para. 12; cf. also Fludernik's idea of an "incomplete homologization of the fictional and the real worlds" Fludernik, 1996, p. 35). This means that not only by interacting with a game players build new memories with which to further interact, but also that by interacting with and understanding the narrative of a game, players build new memories with which to further understand the narrative. The additional complexity that narratives exhibit specifically for the fact of depending on this complex system can be conceived (with Grishakova & Poulaki, 2019b) as "systemic complexity of narratives".

Furthermore, research in cognitive neuroscience showed evidence supporting a correlation also between memory and sensory perception (Schacter et al., 2012; Pearson, 2019). In video games, the sensory inputs come from the multimodal (sub-)system with which they are made perceivable. Comprehension of the multimodal (sub-)system and of the sensorimotor experiences are therefore based on the contextualization and understanding grounded in players recollection of memories (see on this the idea of conceptual metaphors as unification of senses and mind in Danesi, 1989; further considerations have been advanced also by Fahlenbrach, 2016; Powlesland, 2022a). However, at each moment the multimodal (sub-)system, and practical and cognitive enaction, provide elements that feed in the players' long-term memory, which will be used for further understanding and contextualization, and so on, cyclically (Hodent, 2021).

This shows that the three sub-systems of information discussed here, namely the multimodal (sub-)system, interactivity, and memory, are in a position of interoperation, interdependence, and interoccurrence, where each one informs and is informed by the others, in a loop. At the beginning of a game, our understanding of it is necessarily based on memories not connected to that specific game, but when such memories are finally constructed, we can increasingly rely on them to foster our understanding of the game and of its behaviour. In addition to guiding one's sensemaking of the individual game, this newly developed understanding

will then become part of our general and experiential background knowledge and, if shared by enough people within a socio-cultural group, it could possibly become a part of the culture of that group. Taking back the *Grand Theft Auto* (Rockstar North et al., 1997/2021) example and unpacking it further, we can lay bare the mutual informativeness between these three sub-systems. Players of *Grand Theft Auto* will, while playing one of the games for the first time, at some point be chased by police. This is shown to the players by means of the multimodal (sub-)system. The role of the police does not necessitate to be explained explicitly, as players likely know what the police job covers (i.e., the background knowledge of players of the real world or of other media products contain information about police practices). By interacting with the game during the chase, players will quickly understand that they need to hide, and they will look for hiding places. Eventually, the chase will come to an end, and players will be left to wander freely again. During other chases by the police, and thus during other interactions with the game, players will explore further their possibilities, and they will understand, for instance, that certain actions tighten the police grasp while others loosen it. This also means that not only by interacting with a game players build new memories on the basis of which to further interact, but also that by interacting with and understanding the narrative of a game, players build new memories with which to further understand the narrative itself. These effects are triggered by practical enaction in the game world, but they influence also cognitive enaction as they shape the understanding of the environment, and are made perceivable through the multimodal (sub-)system of the game. Players will therefore continuously update and integrate their memories on the basis of how the game reacts to their interaction, and on these memories, they will interact further, causing further reactions, showed by the multimodal (sub-)system, and so on.

Thus, to briefly recapitulate: to situate ourselves in the (real, or fictional) world, and therefore to understand it, we contextualize the situation in which we are presently involved through a comparison with previous experiences and with a background knowledge (individual and/or shared within a sociocultural group), rooted in memory. At the same time, we continuously build additional memories from the events that we live and from the contacts we have with games and other cultural objects. These memories are then used to process the game- and story-world – which for video games is multimodal, and interactively constructed – in a looping circle. In the light of what expounded so far, it is therefore possible to consider the recollection of memories (of experiences, previous knowledge, and culture) as a third sub-system of information participating in the overall video game comprehension.

What has been conducted until this point is a discussion of three sub-systems of information that have a role in the sensemaking of video games. We have seen that video games are made perceivable through a multimodal (sub-)system in which each semiotic mode is in a complex relationship with the others (1). They offer sensorial experiences that are made available through motion (2), and they rely on memory to be understandable (3). As they mutually inform each other and mutually depend on each other, these three sub-systems present relationships of

the complex kind, such that each one is interdependent from, and intercurrent and interoperating with the others, to give rise to a whole of higher order.

I should also note, as mentioned, that the emotive dimension surely has an important role in sensemaking (Anable, 2018; Frome, 2019; Nacke et al., 2016). Several studies (A. Damasio, 1999; A. R. Damasio, 2005) show that cognition is always entangled with emotions. Emotional dispositions can be said to impact and be impacted by all three sub-systems discussed until here. For instance, the multimodal presentation can elicit certain emotions in the players (e.g., a dark basement can cause fear) and emotions can interfere with interaction (e.g., fear can prompt players to approach the basement more cautiously), and can be connected to memories (e.g., dark basements experienced in previous games that scared the player). Furthermore, emotional aspects could be conceived as having meta-causes and inter-granural loops. *Epistemic emotions* as discussed in Part I, for instance, are part of the response of the audience and as such could be conceived as aspects emerging from the sensemaking, but progressing in a narrative video game very often depends on resolving the dissonances presented by the narrative itself, so that dealing with confusion becomes part of the sensemaking itself. As these brief examples might already show, the relationship between emotions and sensemaking is extremely complicated and would risk of driving me too far from the point of the discussion conducted here. For these reasons, I decided to return on the topic in my future work.

## 3.3 Systems of information and complex systems theory

As a final step towards asserting the validity of this theoretical perspective, I ought to take back Stepney's definition of complex systems: "a complex system exhibits strong interactions between components, feedback between levels, emergence, self-organization, openness, adaptation, growth, and change" (Stepney, 2018, p. 27), and briefly discuss the features there highlighted in relation to video games sensemaking. Following Stepney, by relying on a number of sub-systems of information, video games are complex because they exhibit: strong interaction between components, feedback between levels, emergence, self-organization, openness, adaptation, growth, and change. In the next sections I will briefly discuss in more specific terms how each of these features apply to the game-player sensemaking system.

### 3.3.1 Strong interaction between components

In a biological complex system, the elements forming the system are interacting in a symbiotic way, so that, for example, insects pollinate flowers, fruits feed animals, carcasses fertilize grounds helping flowers strive. In a similar fashion, the three sub-systems of information described are mutually informing and reinforcing each other. For this reason, the video game multimodal (sub-)system, the interactions it requires and affords, and the recollection it demands are

inseparable from each other. Without one of the three, the game as a whole would simply not work. Without a sensorially-available appearance, the game would not be perceivable; without interaction (and enaction), its internal state would never change and thus it would not be instantiable.[101] Without being grounded in previous knowledge at least to a minimal degree, it would simply not be understandable.[102]

Inside the multimodal (sub-)system, the elements forming it also work in concert, with parallels between the different semiotic modes: audio, video, text, and haptic sensations. The interactions afforded and required by video games, similarly, are made meaningful by sensorimotor patterns (e.g. a certain button that is associated to a certain action). As I have shown, they also depend on each other, with practical enaction allowing physical exploration, necessary for cognitive enaction, and cognitive enaction providing the embodied cognitive processes necessary to think and therefore act. The exact working of our memory mechanisms is still largely unknown, but I have discussed different mnemonic structures that have been shown to operate when the recollection of experiences or other memories is at work, supporting each other in a symbiotic way.

The sub-systems of information therefore trigger numerous feedback loops thanks to which each of the three informs and at the same time is informed by the others. These interactions are so tight and frequent that in player's perception there is no distinction between these components. This was shown empirically by Toh (2018) through analysis of gameplays and players' interviews.

### 3.3.2 Feedback between levels

The feedback between levels refers to the bi-directional influence of the elements pertaining different levels of granularity of a complex system. For instance, the behaviour of a single person in the complex system human society can shape and be shaped by the behaviour of its members, which can shape and be shaped by the professional group, which can shape and be shaped by society at large.

In video games sensemaking, as mentioned, each sub-system of information is composed by a number of interconnected parts. Each of these parts has the potential to become a dominant orienting the sub-system, which in turn can change the overall complex sensemaking system: the so-called "butterfly effect". For instance, imagine the setting of the first level of a game in a quiet forest at night, with crickets chirping, in which players can freely wander to explore the area. In this case, the game experience resulting from the collaborative effort of games and players is guided by an overall sense of quietness and peace. On the other hand, if in the same situation a single, sudden loud noise is included, the entirety

[101] Or, without affording sensorimotor interaction, it would not be a video game, and as such it would even fall out of the domain of inquiry.

[102] Or even impossible: as implied also by the principle of minimal departure (Lewis, 1983; Ryan, 1980), if reality without fiction is madness, fiction without reality is impossible (cf. on this Mikkonen, 2011).

of the multimodal (sub-)system will start to be perceived as significantly different, no more quiet and peaceful. This means that the difference introduced by a single sound effect somehow shapes the entire multimodal system. In addition, this change in the multimodal system would produce a shift in players' contextualisation of the current experience, also entailing a change of their interaction strategies (e.g., they will no longer wander freely in the forest, but they will walk with much more care and suspense). Therefore, the single sound effects (a part of the multimodal (sub-)system) oriented the entire multimodal (sub-)system, and in turn changed the complex system that give rise to the game playing experience. In relation exactly to this, Grishakova argues that "starting from micro-level formal and stylistic entities to intermediate-level syntactic narrative structures, to macro-level thematic and semantic units within which the formal micro-entities blend into patterns and constrain macro-level units" (Grishakova, 2022b, p. 13).

Taking again the multimodal (sub-)system as an example, each mode constituting it can shape the comprehension of the overall presentation. Often, moving images have the strongest position in video games, therefore showing a significant power in this regard, but music, too, has a strong influence on many occasions,[103] and a textual signpost can direct the understanding of the entire represented world, etc. Similarly, it is possible to observe in many games that the introduction of one mechanic changes the whole gameplay and the cognition behind it. For instance, the ability to automatically reach the top of buildings and rock with one button press in *The Legend of Zelda: Tears of the Kingdom* (Nintendo EPD, 2023), which was not present in the very similar predecessor (*The Legend of Zelda: Breath of the Wild* (Nintendo EPD, 2017)), changes entirely the way of thinking about the environment, as mentioned, and therefore impact on the way of cognitively enacting the storyworld. In a similar fashion, a cognitive schema can trigger a series of behavioural scripts and memories, etc. Indeed, one could even argue that this is the very way in which the stream of consciousness works, with a series of (sometimes loose) connections between dot memories and information.

Elements of one sub-system can also impact another sub-system, so that the multi-level feedback is realized not only within the same information source. For instance, what Yee and Bailenson call the "Proteus Effect", i.e. the fact that visual features of avatars impact players' behaviour, implies feedback between visual elements and practical enaction. Other examples of this are many of the so-called "easter eggs",[104] in which very small pieces of audio-visual information are used to elicit the memory sometimes of entire cultural traditions.

[103] I have already talked about the McGurk effect and the experiments with soundtracks by Faulstich in the section on multimodality and multimodal systems.

[104] Easter eggs are "information (text, sound, imagery) hidden by the developer within the game for discovery by the player" (Conway, 2010, p. 147). They generally contain references to other popular products (games, movies, literature, but also songs, sculptures, etc.).

### 3.3.3 Emergence

Emergence is the more-than-combinatorial result of the interaction between the elements constituting a complex system. Walsh argues that "emergence is a quality of the "macro behaviour" of a system, as opposed to the behaviour of its interacting components, while the underlying behaviour of these components […] is nonetheless what produces the emergent macro behaviour" (Walsh, 2018, p. 50).

The co-presence of different interacting sub-systems of information, together with the feedback loops between different levels of them, produces a video game playing experience as a unified whole which is more than the sum of its single elements taken separately. Pressing buttons on a remote controller while looking at a Leonardo painting cannot be deemed "playing a video game", because there is no relationship between the perceivable elements and the interaction modes. The video game experience only emerges when this relationship is established.

Salen and Zimmerman regard emergence as a crucial aspect of games, and they add that:

> "Meaning is emergent." […] "Representation in games emerges from the relationship between a rigid, underlying rule structure and the free play of meaning that occurs as players inhabit the system. Game designers must pay close attention to the play of meaning within a game, crafting individual instances of player interaction within a larger field of representation. As a game designer creates a system of rules, he or she is also creating a vast space of representational possibility, a space that becomes meaningful through player interaction." […] "Creating context as a mechanism for sensemaking is a critical concept for game designers. It is why our definition of game design refers to the design of a context, rather than an artifact. The design of play is the design of an interactive context from which meaning can emerge." (Salen & Zimmerman, 2004, Chapter 25)

The overall gameplay experience, then, is to be regarded as emerging from these phenomena of interaction and feedback loops, happening in the co-constitution of meaning between video games (their author through the games) and their players.

There are also other phenomena that emerge from the complex collaborative sensemaking. Immersion[105] and presence,[106] are among these emergent phenomena. In simple terms, the state of being absorbed by a representation, and in particular the illusion of being part of it, are based on the feeling of actually inhabiting the world represented, and on the sense of having impact on it. These

[105] Immersion is here intended in the general sense of the state of being absorbed by a representation. There have been several theorizations of the notion of immersion in video games. See Therrien (2016) for a detailed recollection of the most relevant.

[106] Presence is described as "an experience of a perceptual illusion of realistic embodied interaction in a virtual world, not simply as spectator but as a participant with agency" (Powlesland, 2022b, p. 2). Presence has also been called the "experiential counterpart" of immersion (IJsselsteijn, 2004, p. 136).

illusions sprout from cognitive and practical enaction, as inhabiting the world means repositioning one's enactive cognition within the representation and adhering to its rules (physical, social, etc.), and having impact on it means exercising one's afforded practical enaction. These states are emergent mainly because they are not determined in a direct way, but they are rather a third-order design product: authors do not design immersion and presence, rather, they design the multimodal (sub-)system and the interaction mechanics (first-order) that afford cognitive and practical enaction in a metaleptic manner[107] (second-order), which produce in players the sense of immersion and presence (third-order). Elena Gorfinkel, as cited by Salen and Zimmerman, similarly support the idea that "immersion is not a property of a game or media text but is an effect that a text produces. […] immersion is an experience that happens between a game and its player, and is not something intrinsic to the aesthetics of a game" (Salen & Zimmerman, 2004, Chapter 27; see also Rogers et al., 2023 on the concept of 'designing for an experience'). This also allows a specific cognitive movement of players, who transgress the ontological boundaries of the real world to somehow inhabit the fiction (cf. Ensslin, 2022). We can observe this in the very fact that players tend to speak in third person of a movie character, but in first person of the video game character they control. This understanding is not new, and has been already proposed and pushed to its cognitive consequences, e.g., by Gee: "a video game creates a three-way interaction among the virtual character's mind/body (the player's surrogate), the character's goals and the player's goals, and the design features of the virtual world in terms of affordances for effective action" (Gee, 2008, p. 259), so that we can identify a three-way immersion in video games, afforded by the sensorimotor experiences they allow and require.

The complex collaborative sensemaking of video games shows its impressive potential for generating emergent aspects when multiple players are participating in the overall experience. In multiplayer video games the overall storyworld emerges from the loosely bound interaction of sometimes impressively large communities of players simultaneously active at the same time in the representation. This makes storyworlds not only sprouting from designers' decisions, but also from players creative interaction with games. This allows video games, unlike other representational media, to be able to scaffold the generation of different systemic levels which, combined and intertwined inside a single fictional world, can give rise to complex relationships, and ultimately to even entire societies. These societies, while being mediated by technology (and, as such, "virtual"), are also based on varying degrees of real human participation.[108]

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[107] That is, players transcend their own ontological essence as humans on earth to become part of the representation within the artifact (for further reflection on the metaleptic nature of video games, see Ryan, 2006; and Ensslin, 2022).

[108] An example that can show to what lengths this hybrid status can be pushed is the so-called "Corrupted Blood Incident", happened in 2005 in the online game *World of Warcraft* (Blizzard Entertainment, 2004). Due to an error of developers in coding the spreading of a negative status, a dangerous epidemic spread uncontrollably in the game world. This in-game event attracted

A final important emergent aspect of video games is what is usually called "emergent narratives", which are the narratives created by players while navigating the game- and story-world. In essence, they describe the individual, unique and not entirely repeatable result of interaction and interactive storytelling, which is more different and articulated the more freedom the player is given. Emergent narratives have particular importance in those games that are referred to as *sandboxes* (e.g. *Minecraft* (Mojang, 2011), *The Sims* (Maxis, 2000)), that is, titles in which minimal limitations are placed on players, allowing them to wander and even change the virtual world at will. Emergent narratives are generally influenced by a number of factors dictated by the developers (e.g. game rules, world design), but practically unique in their organic development. In the case of multiplayer game sessions, simultaneous but different narratives can be generated for each player, depending on the actions in the game world. Emergent narratives are indeed "emergent" as they sprout from each players' interpretation (intended here also in an "actorly" sense) of the complex dialogue between games and their players. Emergent narratives can be largely unpredictable, which well fit into the definition of the phenomenon as "emergent".

It is not superfluous to note that these emergent phenomena received significant attention in the academic debate as important reasons for video game playing (for summative discussions, see Thon, 2014; Therrien, 2016). What the complex-systemic point of view could add to these theories is that, as emergent aspects, these effects are difficult to abstract from individual features of video games, and should be regarded as systemic macro-behaviours.

### 3.3.4 Self-organisation

Complex systems are self-organized, as the emergent macro-behaviours are not dictated by a controlling agency and therefore the top-down control is minimal or absent. The fluctuations of the stock market, a complex system by definition, are largely not governed by a single person or institution. Of course, individuals could impact on the entire system in significant ways, but without controlling the reaction of the other interacting elements of the system. As Grishakova maintains, "the weaker the authorial control the more powerfully the systemic dynamic interferes" (Grishakova, 2022a, p. 6).

The notion of self-organization might sound the trickiest among the ones touched, given an undeniable coordination underpinning video game design. However, video game sensemaking does not work according to a set of deterministic rules. Due to the individuality of players, the specific ways in which sensemaking operates are predictable and analysable *in abstracto* only to a certain degree. Elleström, talking specifically about video games, mentions that:

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the attention of epidemiologists interested in the impact of a spreading disease in society (e.g. Lofgren & Fefferman, 2007). It is needless to say that latest events linked to the COVID-19 pandemic caused a renewed interest in this fictional epidemics and its implications (cf. Elker, 2020).

> "Such games are normally constructed and designed by several minds, but the point here is that the actual media products (the many realised sensory configurations that are mediated by screens and sounding loudspeakers each time the game is being played) are also created by the players. Accordingly, we have a kind of communication involving several producing minds that have created certain frames for interaction and resulting consequences (when designing the game), one or several producing minds that create the actual media product in their interaction with the evolving media product (when playing the game) and one or several perceiving minds that are actually the same as those minds that interact with and hence produce the media product: the specific realisation of the possibilities of the video game." (Elleström, 2021, p. 25)

Video games sensemaking is therefore partly unbound from authorial control both at the objective level, and at the subjective one.

As discussed, video game designers ultimately create a blueprint from which many individual experiences can be instantiated through interaction (cf. Section 3.2.2 "Interactivity, enaction, and sensorimotor experiences"). The choices done in practical enaction, and therefore the actual instantiation of the game experience, are left to the player, and the more freedom is afforded, the more this objective autonomy is accentuated. In this sense, objective self-organization could be seen at its peaks in open-world games like *The Legend of Zelda: Tears of the Kingdom* (Nintendo EPD, 2023) or *Red Dead Redemption 2* (Rockstar Studios, 2018), or in procedurally generated games like *No Man's Sky* (Hello Games, 2016).[109] The added freedom in constructing one's personal experience out of the video game increases indeterminacy and therefore weakens authorial control (cf. Stang, 2019).[110] Additional steps towards self-organization are being quickly taken by integrating Large Language Models (LLM) and other generative artificial intelligences to create increasingly less predictable (but still controlled) video game content, even at runtime (i.e., while the game is running).[111] An even improved self-organization could be achieved once projects like *Realspawn*[112] will be fully integrated in widely available games, and once content will be more directly and widely generated by users. With these technologies, the authorial control will be thinned further, although it can never fully disappear.

At the subjective level, on the other hand, given the complexity of the game-player encounter, and the different cultural, social, and personal backgrounds of

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[109] The freedom from authorial control can also be detected for instance in the exploitation of glitches and bugs.

[110] This without touching on multiplayer video games, in which the meaning of the game emerges from the loosely bound interaction of sometimes impressively large communities of players.

[111] See for instance the preprint by Park and colleagues on generative agents (2023) and the more forward-looking blog post by Buser (2023).

[112] *Realspawn* project uses generative interaction theory to design persistent player narratives in digital game worlds, basically transforming players' interactions into integrated game content, cf. http://www.realspawn.com. The authorial control in this case would then be restricted to the selection of the tool to employ for the generation of content, and how this tool is tuned.

each player, sensemaking is not to be the same for all people, and it is not to be exactly what the authors intended while designing the game. The identification of a discrepancy between authors' intentional meaning and audiences' reconstructed meaning is intuitive and lies at the basis of semiotics. As Elleström suggested, "to say that a media product represents something is to say that it triggers a certain type of interpretation. This interpretation may be more or less hardwired in the media product and the manner in which a person perceives it with her or his senses, but it never exists independently of the cognitive activity in the perceiver's mind" (Elleström, 2021, p. 39; for similar considerations that are less recent but that refer directly to video games, see Aarseth, 1997).

Talking about cognitive assemblages as clusters of technologies and individuals, Hayles maintains that "their transformative potentials are enabled, extended, and supported by interactions between human and technical cognizers. Hybrid by nature, they raise questions about how agency is distributed among cognizers, how and in what ways actors contribute to systemic dynamics" (Hayles, 2016, p. 34). From this, and from the discussion of the present chapter on the complex ways in which video games and their players collaboratively construct the game experience, it is relatively easy to argue that the comprehension of a video game is *guided* by authorial design, but never *dictated* by it. Given that one's individual sensemaking of an artifact is necessarily based on one's cognition "the resulting mental representations may differ significantly from player to player and from playing session to playing session" (Thon, 2015, p. 10). This holds true in all cases, and even for very simple games the result of the complex collaborative sensemaking can differ considerably. As I will discuss in Chapter 4, this is also what permits to observe the complexity of sensemaking through any game, even not extremely complex ones.

Designers' intentional meaning, therefore, blurs out in the practical enaction and in the players' part of the game-player collaboration. Even more, considering that often players can see intentionality when there is none, and vice versa, and considering also our tendency towards cognitive optimism,[113] players have a sort of self-supported improved autonomy in the collaborative sensemaking process, where their inferred meanings reinforce themselves and can therefore strongly guide the overall sensemaking, in directions not always in line with authorial intentions. Bateman suggests the same, arguing that when we consider, in movies, that "everything that is seen and heard on screen may have been planned and designed, we can begin to imagine just how highly complex the resulting product might become. Everything from someone blinking to someone else walking across a scene in the background to a bird chirping off-screen may have been designed into the film precisely when seen or heard" (Bateman et al., 2017b, p. 327). This means that the complex system of information sources organizes

[113] "We are 'cognitive optimists' […] we assume that our spontaneous processes are highly reliable, and that their outcome does not need to be checked" (Lombardi Vallauri, 2021, p. 46) [my translation from Italian]. See also the "egocentric bias" – our inclination to uncritically trust the results of our own mental speculations – as discussed by Lombardi Vallauri (2021).

itself, at least at the level of player's cognition, around each individual player's sensemaking. As interaction designers often state, it is possible to design *for* an experience, but it is never possible to fully design *the* experience (Rogers et al., 2023).

From the considerations advanced in the current section, one paradox might seem to follow. If the player side of the game-player collaboration is introducing self-organization both at an objective and at a subjective level, thus becoming partly unpredictable, how can then video games still mean somehow the same for all players? The Pareto principle (Pareto, 1897/1964) could be brought as resolution of this apparent paradox. The Pareto principle is a phenomenon observed in relation to various complex systems, and particularly in economics, business, and sociology. The principle posits that roughly 80% of effects stem from 20% of causes. In other words, a significant majority of outcomes are typically driven by a minority of inputs. This means that within a system, a small subset of elements tends to disproportionately influence the overall behaviour or outcomes (M. Newman, 2005). In my case, the Pareto principle entails that while arguably relatively little is in the complete and direct control of the author in the game-player collaborative sensemaking, most of the resulting gameplay experience is still dictated by these few elements. This aptly explains how millions of players worldwide, each with their unique socio-cultural background and individually instantiated game session, can have an overall similar experience playing the same video game, notwithstanding the several differences introduced in the game-player collaboration by each of these players.

### 3.3.5 Openness and Adaptation, Growth, and Change

Openness in complex systems is the feature of being able to accommodate additional elements within them without collapsing. This is due to their ability to adapt to changed internal or external circumstances, reorganizing themselves to new stable configurations. This stability and capacity to encompass increasingly more elements allows the system to grow. The adaptability of the system, its openness and its ability to grow, make the system highly susceptible to change.

The list of sub-systems of information discussed here is not exclusive, nor prescriptive. As I mentioned, the ones touched are only some of the elements that constitute the complex gaming experience. Different elements of the sub-systems could be present in specific video games without preventing the functioning of the game-player collaboration. For instance, not all games make use of haptic feedback or even of visuals. Similarly, as mentioned, the game experience still emerges notwithstanding sometimes largely different socio-cultural backgrounds of players. The same applies if designers add an element of one of the sub-systems to an existing game (thus somehow altering the already-functioning game-player sensemaking). This happened for instance in 2018 when Bethesda Game Studios released a virtual reality version of the already-published *The Elder Scrolls V:*

*Skyrim* (Bethesda Game Studios, 2011).[114] This adaptation was possible because the initial sensemaking system is open to external influences and can readjust itself to include further sources of information (in this case, different haptic percepts, proprioception, different interaction mechanics, etc.), changing internally without being disrupted. In addition to foreshadowing the openness of the complex sensemaking system in video games, this latter example also shows that this system is highly adaptable, as it can accommodate an increasing number of sources of information without collapsing, just readjusting itself. For instance, transforming Skyrim world into a virtual reality experience did not cause the destruction of the entire sensemaking of players but rather its spontaneous adaptation (and, in a way, self-re-organization).

Even more than this case, adaptation becomes apparent if parts of the subsystems of information are removed (e.g., in the case of audio games, or when one switches off the audio from a normal video game). In that case, the ability of the complex sensemaking system to adapt shows its sometimes incredible strength. A particularly telling example of this is given by the content creator and professional player Sven Van de Wege, also known as "Blind Warrior Sven",[115] who, notwithstanding his blindness, participates in world championships of the game *Street Fighter 6* (Capcom, 2023).[116] This adaptation seems to follow the biological principle of vicariance, which Rabatel also applies to interpersonal interaction, maintaining that "if a particular function is not performed by a particular biological organ or through a particular display […], then the function can be performed by others" (Rabatel, 2022, p. 60).[117]

An additional implication of the adaptability of the sensemaking system is that the meaning of each individual part does not change the meaning of the subsystems, which turns out to be stable and supported by itself. This also means that not everything necessarily needs to point in the same direction as the overall meaning, since players tend to focus more on the whole and less on the parts. This should be taken with caution as it implies that each element forming each subsystem is potentially capable of changing the entire sensemaking system, thus redirecting the overall meaning and the resulting game playing experience. A per-case assessment needs to be done in this case, which, given the self-organization of the system discussed above, could turn out to be a rather complicated task. However, the Pareto principle discussed above could still be invoked to explain how from this potential instability of meaning one can still expect a resulting stability, as a relatively small subset of elements could be said to largely guide the overall game-player collaboration.

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[114] https://store.steampowered.com/app/611670/The_Elder_Scrolls_V_Skyrim_VR/

[115] https://blindwarriorsven.com/html/about.html

[116] See one of BlindWarriorSven's fights in the Evolution Championship Series 2023 (EVO) at the following link: https://www.youtube.com/watch?v=Nqe0lJxPHLM

[117] As it might appear evident, at least in this case the adaptation comes from the player side of the collaborative sensemaking. The game (thanks to the designers, obviously) somehow collaborates by providing enough non-visual clues to enable this adaptation.

The system is therefore subject to change, in directions presenting a variable degree of likeness, and with possibly unpredictable results. The systemic change that can germinate from a readjustment of one element can have a kind of butterfly effect applied to the entire sensemaking. Since a complex system has many variables influencing its outcome, every small variation can cause a great difference in the results.

Lastly, as I have shown different times, the feedback loops realized by the interactions between the different sub-systems and/or their elements feed into each other. So, for instance, practical enaction provides the embodied experience needed to cognitively enact the storyworld, and cognitive enaction allows to think about available actions for practical enaction. Furthermore, the multimodal (sub-)system builds memories that are then retrieved to enact, which change the multimodal (sub-)system itself, which is the basis for new memories, etc. These mutual reinforcements make the game-player system grow due to purely internal dynamics. The increasingly deeper understanding of the game and of its narrative are the results of this growth.

After discussing the defining features of complex systems (Stepney, 2018) in relation to the video game-player collaborative sensemaking, I can eventually conclude that the two present striking similarities. The gameplay experience therefore does emerge from the complex systemic nature of the collaboration of games and players for video game sensemaking.

In order to better show the hermeneutic usefulness of understanding video game sensemaking as a complex system, however, I need to observe how this complex sensemaking is exploited by game design practitioners, and how players' sensemaking works in video games. In the next section, I analyse a scene of a video game and I discuss how the scene works, particularly in relation to the design (and interactions) of the three sub-systems of information described above. Considering the scene as a "dialogical single case study", I will approach it as a complete whole (though one that is open-ended), a "complex singular event", focusing on relationships among elements within it (cf. Marková et al., 2020, pp. 6 and 5, respectively). Even though short and relatively self-contained, this scene constitutes a representative example of how players' sensemaking works in complex ways, of how this sensemaking is guided by the videoludic artifact, and, ultimately, of how the game play experience can be considered as emerging from this complexity.

## 3.4 Case study: the fish scene in *Detroit: Become Human*

*Detroit: Become Human* (Quantic Dream, 2018) is a narrative-driven adventure game particularly appreciated by players and critics for its narrative design and for the narrative it embeds. It is strongly focused on ethics of technology and philosophy of artificial intelligence, and it has been largely discussed in relation to moral values and the ethical dimension (cf. Meier & Bellini, 2021; Craig et al., 2020; Pallavicini et al., 2020; Holl, 2019). The game is set in a futuristic Detroit

in which extremely smart anthropomorphic androids have been developed and are employed to carry out all sorts of jobs, in a quasi-slavery condition. The player switches control between three androids that developed self-awareness and personal conscience, discovering and directing their journeys. The first of these characters (in order of appearance) is Connor[118], a detective android employed to hunt "deviants", i.e., self-aware robots.

In the very first level of the game, players enact Connor on a crime scene: after a short cutscene showing him on an elevator, the doors open, and players are free to walk around the entrance of a messy but fancy apartment. The player might notice in the corridor a broken aquarium embedded in the wall on the left, and a fish floundering on the floor. The fish is signalled by an icon for interaction above it. There starts what I here refer to as "the fish scene". It is a very short scene, lasting around 30 second of real play time if the player is actively interacting, and it has a quite simple framing. However, this scene has been artfully constructed by designing the three sub-systems of information presented above, and by modelling their interactions. Even in the few seconds the scene lasts and despite its simple framing, it is possible to identify the complexity of the game-player collaboration in it, and how sensemaking works.

Just as most video games, *Detroit: Become Human* is based on a multimodal (sub-)system: the sensorially-perceivable part of the game is constructed through the use of a number of concurrent modes, like images, text and audio. In particular, in the fish scene we find:[119]

- moving images (e.g., the fish floundering): also used to capture the players attention when Connor is in the corridor – depicted in Figure 3.4)
- still images (the exemplary image of the fish brought up by *Connor*'s computational unit and made visible for the player in an overlayed interface – Figure 3.5);
- music (in the background), extradiegetic and with emotional valence;
- sound effects, with both mimetic and symbolic intents (the splashing of water provoked by the fish and the pulsation when Connor's computing unit is turned on – which also signals when players have a choice to make –, respectively);
- text, in an homodiegetic (e.g. the "ANDROID" writing on the back of Connor's jacket – Figure 3.4), heterodiegetic (the indications to players on how to interact, and the output of each interaction – Figure 3.4, Figure 3.6), and blurred position (the text with information about the fish, which is unclear whether is seen also by Connor or not – Figure 3.5) (about the position of the user interface of video games with respect to the diegesis, cf. Bellini, 2018);

[118] Connor will be here referred to as a male due to its apparent masculine look, but it is not completely clear in the game whether androids have a defined sex or gender.

[119] A video version of the fish scene is available here:
https://www.youtube.com/watch?v=qJCt_TNjH24

- haptic feedback, with a mimetic intent (if players decide to save the fish, while putting it back in the tank they will feel three mild vibrations paralleled by three movements of the fish in Connor's hands. Contrarily, no vibrations are triggered if the fish is left on the floor).

These elements can be traced back to two ontological levels, namely the diegetic world of the game and the extra-diegetic user interface, that suggests interaction affordances and other meta information.


*Figure 3.4 – Connor stands in the corridor where the fish scene takes place. On its back it is possible to read "ANDROID". The broken fish tank is visible on the wall on the left. On the floor lies the fish, right next to Connor's left leg. An overlayed interface signals the possibility to kneel down near the fish by moving the right analogue stick towards the player's body (down). Screenshot from Detroit: Become Human (Quantic Dream 2018) for PlayStation 4.*


*Figure 3.5 – Connor's computational unit shows information about the fish in an overlayed interface. Both text and still images are visible. Screenshot from Detroit: Become Human (Quantic Dream 2018) for PlayStation 4.*


*Figure 3.6 – An overlayed interface shows players how to perform one of the two available interactions. By moving the right analogue stick away from their body (up), players can decide to leave the scene immediately without saving the fish. By moving the stick to the right and then perform quarter a clockwise circle, players can save the fish by putting it pack in the tank. Screenshot from Detroit: Become Human (Quantic Dream 2018) for PlayStation 4.*

The systemic understanding of the scene emerges from the interplay of these elements, producing a carefully crafted whole. But in order to understand this multimodal (sub-)system, we as players of the video game need to enact in the represented world and trigger some sort of interaction. Otherwise, the game will remain stuck forever right at the beginning of the level. By moving our hands we explore the fictional environment, and by walking around it we get to the fish scene. Once there, we are required to act two additional times:[120]

1. in order to initiate the fish scene, we need to crouch and observe the fish closely. This is suggested by the interaction icon appearing above the fish itself, which reads "KNEEL DOWN", with an indication to move the right analogue stick (otherwise used to orient the camera) towards the player's body (down) (Figure 3.4);
2. to interact with the fish scene, players are given two options (Figure 3.6):
   a. to leave and let the fish die, by moving the stick away from the player's body (up), or
   b. to save the fish, by moving the stick on the right, and then perform quarter a clockwise circle, moving therefore from 3hr to 6hr.

Depending on the performance of either action, the game responds differently and therefore adapts the multimodal (sub-)system accordingly: if the fish is left to die, Connor simply stands up, the fish remains on the floor and the player can proceed moving around immediately.[121] If the fish is saved, Connor picks it up and, after looking at it, he puts it back in the aquarium, looking at it swimming away. This latter situation also triggers an event in the extra-diegetic user interface, showing a text that reads "software instability", and an upward arrow symbolizing an increase.[122]

In this simple example, we can already see the looping between the interaction made relevant and required by the multimodal (sub-)system, and the responses required to the multimodal (sub-)system by the actions of players – through their movements in the real world, which triggers an amplified movement in the fictional world, and which is taken as inputs by the engine running the game.

The reader might have already detected also the informativeness of the recollection of memories: players comprehend the fish scene, created through the multimodal (sub-)system, due to previously-built knowledge and abductive inferential thinking. One needs knowledge of fishes, of fish tanks, and of fish tanks made of glass, to understand that the fish fell off the aquarium which was

[120] These interactions refer to the PlayStation 4 version of the game and might differ slightly for other platforms.

[121] No information about the fish is given if players do not initiate the fish scene, but it is plausible to assume that it would die if not explicitly saved.

[122] The clear meaning of this indication will be disclosed to players only later in the game. Its function is to hint at the slow development of self-consciousness by the android controlled by the player.

somehow broken and is dying on the floor due to absence of water to breathe through. One can also understand only thanks to previous real-world experience and/or background knowledge that the fish is going to die if left on the floor, or it is saved by putting it back in its tank, even if half empty. The very existence of the in-wall fish tank contextualizes the whole scene in an expensive apartment, context that is further enhanced by the exotic fish species.[123]

Even the exemplary image and the text description of the fish brought up by Connor's computational unit (Figure 3.5) needs grounding in experience of encyclopaedias and of multi-layered image composition. Similarly, the mimetic sounds are mimetic as soon as they resemble the real world – or at least the players' expectation of the real world –, by definition. Furthermore, though perhaps a bit redundantly, also reading a text necessarily require background knowledge and reading skills.

Enaction is based on memory and experience, too. This is particularly visible in this scene: thanks to a third-person camera free to revolve around the character's head, players have the feeling of manipulating with the right analogue stick of their controller the head and eyes of the character, and with the left analogue stick its body, with a forward direction always oriented away from the player's body (up). For as complicated as it might sound in writing, this movement is very familiar and intuitive even for players with minimal experience (cf. Rambusch, 2016 on human cognition extended to video games controllers, which she calls 'act of embodying'). In addition, the engine requires a specific movement to instantiate the fish scene, namely moving the right analogue stick towards the player's body (Figure 3.4). This movement, which normally would cause the head of the character to tilt towards the floor, is here metaphorically[124] associated with bringing into focus something that is laying on the floor – Connor indeed crouches and the multimodal (sub-)system shows the fish scene. Similarly, in order to decide whether to save the fish or not, players can:

1. bring forward Connor's hand and pick up the fish, by moving the right analogue stick to the right and rotate it, with a movement similar to what is going to be Connor's hand gesture to pick up the fish; or
2. stand back up ignoring the fish, by directing *Connor*'s attention upwards, moving the right analogue stick away from their body (up) (Figure 3.6).

[123] An additional level of recollection could also be detected at the end of the scene if the fish is saved, when players with a reasonable knowledge of science fiction tropes would be able to predict possible meanings of the increasing software instability of *Connor* on the basis of their past experiences with genre-specific customs. However, I will not touch here upon the conception of genres as complex entities (cf. on this Sinding, 2012), nor on prospective and retrospective narrative comprehension (see e.g. Walsh, 2018), as they would drive me too far away from the scope of the current work.

[124] Here, metaphorically refers to the use of an embodied cognitive metaphor linking attentional focus to the movement of the head.

In these cases, too, the interaction modes are fluid and require very little explanation because they are grounded in human experiential knowledge. Designers and developers made use of this shared experiential knowledge to improve easiness of interaction and of comprehension of the scene. These interaction mechanisms highlight also the exploitation of conceptual metaphors (Lakoff & Johnson, 1980/2008), which, as mentioned, are often deeply grounded in our bodily experience and therefore in our enactive cognition.

Moreover, the scene also highlights how context-relevant memories are constructed and stored for future use. Being the very beginning of the game, this scene is not strongly contextualized within the overall narrative, and the choices have little grounding above the experience-based one. However, being so early in the narrative, every choice and every information provided could be said to significantly inform the understanding of the rest of the game. Saving the fish, for instance, rewards players for behaving empathically by offering additional narrative content, specifically the indication that a certain "software instability" already affect Connor. This foregrounds a possible malfunctioning in the android's artificial intelligence is incoming, which will have significant impact in the player's understanding of the current level and of the entire game. The scene provides also other narrative-relevant indications, like the ways in which androids obtain information regarding the world surrounding them. Other practical information is also taught through this scene, like how to interact, the symbolic use of graphics and sounds, where and when an interaction is available, etc. All these information is then memorised, and they are retrieved whenever necessary in the ways described above.

The brief analysis shows how the theoretical reflections outlined in the previous sections of this chapter have very practical confirmations in real video games. As we have seen, video game sensemaking is guided by the three sub-systems of information discussed, at the very least. I have shown how, in *Detroit: Become Human*, the multimodal (sub-)system through which the game is made perceivable, the practical and cognitive enaction that are the basis of interaction, and the recollection of memories through which the game is contextualized, are tied together in a complex relation of interdependence and mutual reinforcement. This shows that the collaborative sensemaking of video games can be conceived as a complex system formed of interconnected, interoperating and interdependent sub-systems. Video games authors rely on these sub-systems to guide players' sensemaking and to have certain video game playing experiences emerging from it.

## Conclusions of Chapter 3 – The complexity of game-player systems

In this chapter I presented theoretical evidence supporting the complex-systemic nature of the game-player collaborative sensemaking effort.

Building on Grishakova and Poulaki's view of narrative sensemaking as coming from the synthesis of different layers of information, I showed how we can see

three of these layers (or, in this context, "sub-systems") as present also in video games, how they interact with each other and how they can therefore be conceived as forming a complex system. The three sources of information treated in this chapter are:

- the multimodal (sub-)system, which comprise all perceptually-available elements forming the video game,
- the interactivity afforded by the video games, which produce sensorimotor experiences for the players and afford and require enaction for the narrative to develop and be understood, and
- memories and their recollection, that is, the retrieval of past experiences and background knowledge of the players, also in terms of personal and shared scripts and schemata.

In light of Susan Stepney's definition of complex system, according to which "a complex system exhibits strong interactions between components, feedback between levels, emergence, self-organization, openness, adaptation, growth, and change" (Stepney, 2018, p. 27), I examined why the game-player system can be argued to exhibit all features of complexity.

I then showed, through a practical example, how designers mould these subsystems and model them to provide the basis for the game playing experience. Exactly for this reason, we can, and should, conceive video games as complex themselves, as their meaning results from a complex collaborative sensemaking.

However, for how much these theoretical speculations might seem to make sense, they are still purely theoretical. To give more substance and to have stronger claims over the validity of my theoretical framework, in the next chapter I will present an empirical study aimed specifically at supporting the validity of this complexity of the collaborative sensemaking process.

# Chapter 4
# Testing the complexity of game-player systems

In the previous chapter, I have posed the theoretical basis for understanding the game-player collaborative sensemaking as a complex system. Using Stepney's definition of complex systems as a starting point, I have discussed the features of these systems in relation to the game-player collaboration, demonstrating the resulting complexity of this sensemaking act. To support and substantiate my theoretical claims, throughout this chapter I will present and discuss the results of an empirical study. The aim of the study is to corroborate the complexity of the collaborative sensemaking, and to have a more hands-on understanding of its functioning.

The results of this study empirically support this theoretical understanding and contribute to understand how sensemaking works in general. Furthermore, the details provided on how the required materials were developed and on how the study was conducted will also highlight a methodology useful for looking into players' sensemaking mechanism, and they will provide insights on the design of custom video games aimed specifically at this kind of analysis.

I will first outline the research questions for the current study and discuss how these research questions have been addressed and through which study object. I will then provide the details on how the study object – a custom video game – has been developed following the theoretical framework it aims to test. After a description of the study population and of the setup and process of the experiment, I will report the findings related to each research question, before discussing what these findings mean with regards to the theory I am trying to corroborate and beyond.

## 4.1 Research questions

According to the theoretical starting point of this study, players' sensemaking is a collaborative process that works by synthesizing different sources of information that are interacting with each other in complex ways. Therefore, the main research question that this study is aims at answering is:

- Is video game sensemaking based on the complex system of information formed (at least) by the game multimodal presentation, players' interaction and players' memories?

However, following Stepney's definition and the theoretical background lied out in the previous chapter (Section 3.3 and following), to answer this main research question it is necessary to corroborate that the game-player system shows: strong interaction between components, feedback between levels, emergence, self-organization, openness, adaptation, growth, and change. The main research question, thus, must be subdivided into a number of sub-research questions. These

could then be addressed individually to collectively answer the main question in the end. Thus, my sub-research questions are:

S-RQ1. Are the multimodal (sub-)system, the interaction and the memories affecting each other?
S-RQ2. Are all these three components presenting feedback loops with each other?
S-RQ3. Are the feedback loops affecting different levels of granularity?
S-RQ4. Are there more-than-combinatorial aspects that emerge from the interaction of the components?
S-RQ5. Is there a degree of self-organization?
S-RQ6. Can we detect openness in the system?
S-RQ7. Can we detect adaptation in the system?
S-RQ8. Can we detect growth in the system?
S-RQ9. Can we detect change in the system?

Finding the answers to these research questions is not trivial, particularly because complexity is a complex phenomenon in itself.

The decision of employing yes/no research questions has been taken here with the intention to have an approach that is both hypothesis-driven and explorative. On the one hand, this empirical study is aimed at testing the validity of the theoretical framework presented in Chapter 3, and therefore must be guided by hypotheses to be proved (or disproved). However, on the other hand, hypotheses would considerably restrict the insightfulness of the analysis[125] as they would not provide information on the *how*: how does the complex sensemaking work? Following this line of thought, it was decided to resort to this kind of research questions because in asking the *whether*, they necessarily require looking at the *how*. Indeed, as the reader will notice, the answer to each of these questions will be accompanied by observations on interesting phenomena detected and ultimately on how the answers have been obtained. Therefore, these questions will help to shed light on the specific effects and interpretive consequences of the features to be inquired, in addition to their mere corroboration.

VA description of the game employed for the analysis, of the methods chosen, and of the results of this study will be provided in the next sections.

## 4.2 Design of the game

A custom game has been designed and developed strictly following the necessity to answer the research questions. Game design guidelines and standard procedures (see e.g. J. Schell, 2014) have been subdued to these particular requirements, and bent accordingly when needed. For instance, the principle of coherence between

[125] Besides this, testing hypotheses requires quantitative data that are not the focus of this study (cf. Croucher & Cronn-Mills, 2024).

user inputs and software outputs has been willingly disrupted on several occasions to observe participants' reaction. Throughout this section, the specific decisions that have been taken during the design phase of the testing game will be discussed. This will help to highlight the custom features of the game and its aptness in replying to the research questions.

The design of the game was done following strictly the theoretical framework presented in Chapter 3 and objectives of the current study. It should be noted that the argument that this study aims at corroborating entails that playing any game necessarily involves the complex collaborative sensemaking discussed in Chapter 3. This allowed relative freedom in many of the design choices taken while creating the testing game (including, e.g., genre, graphic style, narrative design, interaction mechanics, etc.). Two main principles therefore guided the design phase, in apparent opposition: a principle of simplicity and one of complexity. While the need for simplicity comes from the requirements of the empirical research (among which are the need of reproducibility of the experiment, the need of manageable data, the need of a low amount of noise, and the need of few, controlled, independent variables (Stoll et al., 2022)), the need for complexity comes from the very research question this empirical research tries to address. The design and development phases of the testing game were characterised by the necessity of finding a balance between these two principles. This was realised by mixing standard and well-established conventions of video games with non-standard and unexpected behaviour and elements, as will be described more in details below. Therefore, on the one hand the testing game allows to observe the sensemaking process in conventional situations, which is necessary to obtain data that are reliable for video games in general (and not just for the testing game). This also makes the complexity of the sensemaking system more clearly visible as it allows to examine the complex working of players' cognition in a situation of as minimal noise as possible. On the other hand, the controlled disturbances injected in the sensemaking through the manipulation of the game and through its non-standard behaviour is helpful to better observe the sensemaking system and its functioning. As said, the validity of using a relatively simple game to test the complexity of this sensemaking act is not by any means a contradiction (see also Section 3.3.4 "Self-organisation"), and it allows not only to have a more controlled environment and an easier manipulation of it, but also to lay bare the complexity of the sensemaking.

The development of the video game and of the related tools (described below) has been conducted by two students of computer science of the University of Bologna.[126] The details provided in this section result from notes taken during the iterative design and development phases.

[126] The game has been developed using the game engine Godot, version 3.5.1 (https://godotengine.org). The assets used for the game (like environments, backgrounds, enemies' sprites and other props) have been bought or otherwise found as royalty free material in the "game asset" section of the website itch.io (https://itch.io). Graphic assets have been edited as needed using the online graphic tool Piskel (https://www.piskelapp.com). Sound

The game presents itself as a 2D "platform-adventure"[127] game in five levels. For reasons that will be described below, the story has been designed to be somehow stereotypical but vague in its details. In short, a dark figure suddenly appears in a realm, it defeats the several knights that face it, one of the knights survives, traverses a series of levels, and eventually defeats it. The graphic was chosen to be in two dimensions, with a "pixel art" graphic style (see Figure 4.1 and following).[128] The pixel art style was adopted because assets in this style are easily and widely available, and modifications and additions are easy, fast, and cheap to implement. Similarly, the platform-adventure genre and the two-dimensional world were chosen to keep the game as accessible as possible for the players/participants. In addition, 2D platform-adventures are relatively easier to design and develop, which has been deemed an advantage in an already theoretically complicated effort.

The obstacles that will be described below have been placed "in clusters", meaning that each set of one or more obstacles is intercut by a short quiet area, without dangers. This aligns with game design standards (J. Schell, 2014), and it is deemed helpful also to facilitate participants' thinking-aloud, as they break an otherwise fast-paced action that is potentially problematic for the reliability of the vocalisation (Knoll, 2018). For the same reasons, the overall difficulty of the game has been designed to be generally low, so that it is relatively easy to traverse the game. Players are also given the possibility to first test each of the available mechanic one at a time in a safe environment, before inserting them in more complicated settings, also in combinations.

In proceeding further with the description of more specific details on the design of the game, the elements composing it will be described in the respective order of appearance (or at least *a possible order*, due to the branching of the game). Screenshots with the entirety of the game are provided, in Figure 4.1 to Figure 4.6.

assets have been equally bought from itch.io or created *ad hoc* using the open-source software Audacity (https://www.audacityteam.org). The elements of the Graphic User Interface are standard assets provided by the game engine.

[127] Platform games are action video games in which players move the character in levels with uneven terrains and suspended platforms of varying height that require jumping and climbing to be traversed. The example of the genre *par excellence* is Super Mario Bros. (Nintendo R&D4, 1985). Platform-adventure games, sometimes called *Metroidvania*s, fuse platformer fundamental features with elements of action-adventure games, in our case the ability to shield and wield a sword.

[128] Pixel art is a graphic style in which images are built using pixels or group of pixels as building block, in a manner somehow resembling the mosaic composition.

*Figure 4.1 – Introductory clip of the testing game.*

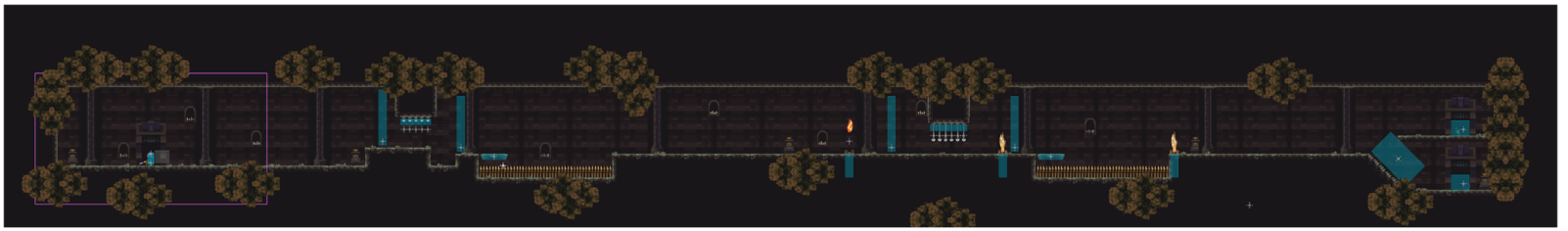

*Figure 4.2 – First level of the testing game.*

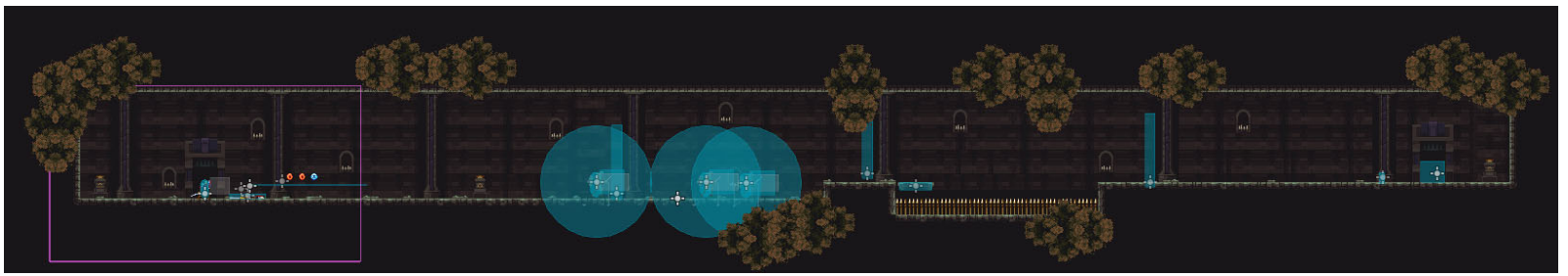

*Figure 4.3 – Sword level of the testing game.*

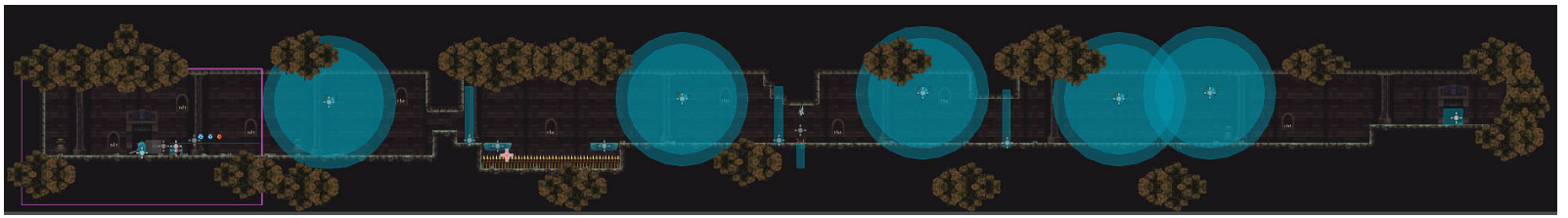

*Figure 4.4 – Shield level of the testing game.*

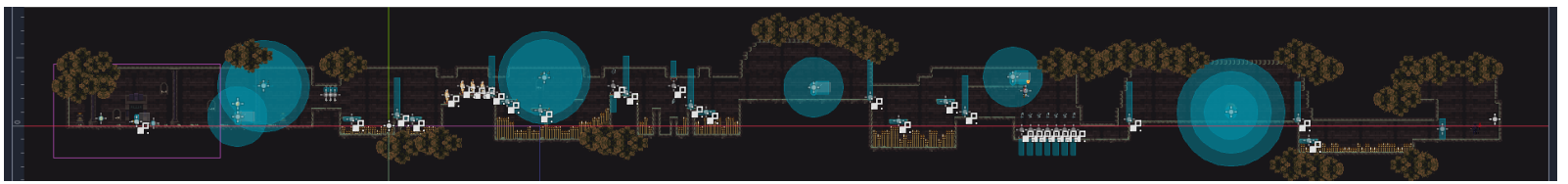

*Figure 4.5 – Twist level of the testing game.*

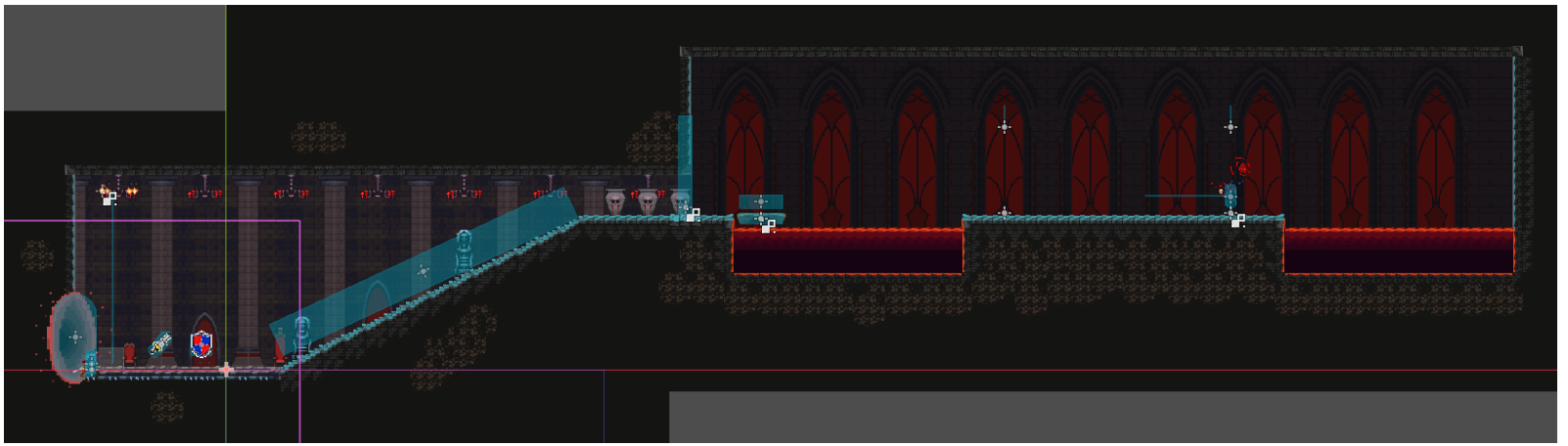

*Figure 4.6 – Boss level of the testing game.*


*Figure 4.7 – Handheld controller used by participants to interact with the testing game*

### 4.2.1 Starting clip

At the beginning of the game, players are presented with a short non-interactive clip which purpose is to give the context of the game and provide a frame to the narrative. The clip shows mountains, then an area with bones, then a cave. A black figure with red eyes, holding a red skull, is standing behind some rays coming from two floating pillars. Suddenly, the rays disappear, the pillars sit on their bases, and a low-pitched laugh is heard while the figure with red eyes stands. The figure then raises the red skull and opens a portal, traversing it shortly afterwards. The portal leads to a different location, where two blue knights run down some stairs to face the dark figure. The figure casts a spell and hits the knights who fall. The figure then summons a number of monsters and proceeds up the stairs with them. When all enemies are gone, one disarmed knight stands up again, and runs up the stairs, too. Excerpts of this clip are provided in Figure 4.1. This cutscene, built as an animation in the game engine, was designed to provide information to give a general frame to the game. It was decided to rely on a relatively standard narrative setup, with a villain imprisoned in the past eventually freeing itself and attacking the king's castle. However, it was decided to not provide a direct and clear explanation of the happenings (e.g., the reason for the imprisonment of the dark figure, and how and why it was released). Rather, details of the story were intentionally blurred and made vague (e.g., the castle is not overtly marked as such, no king is shown, etc.). These decisions were taken in order to observe the sensemaking that would emerge from players' interaction and interpretation of the stereotypical but vague events presented (S-RQ4 and 5), and to witness the ways and extent to which the complex sensemaking system informs narrative interpretation (S-RQ6).

### 4.2.2 Main interactions

After this cutscene, the actual game begins (Figure 4.2). Players find themselves in the castle, with a wall close to their left and the road ahead on their right. The left-to-right road was chosen to keep the most established standard movement of platformer games. In addition, the progression left-to-right is a deeply ingrained conceptual metaphor (at least for the Western audience, cf. Pitt & Casasanto, 2022).[129]

A wired handheld controller similar to an Xbox 360[130] was used as input device (see Figure 4.7). The basic interaction affordances of the game were chosen to be:

- Walking, performed by moving the left analogue stick, as standard for almost all video games. The players are able to move both towards the left of the map, and towards the right, at all times (except where traps or other environmental props prevent it).
- Jumping, performed by pressing the button A (right side, at the bottom).

No description or explanation of these two main interactions is provided during the game. This specific choice was taken with the purpose to observe the players' reliance on very-well-established customs of the videoludic medium, and the effects this have on the sensemaking (S-RQ1 and 2).

### 4.2.3 Main obstacles, and checkpoints

Throughout the game, players find several recurring obstacles. Among these are: platforms at different heights, spiked pits with moving platforms floating above them, temporized spears falling from the ceiling, and temporized flames blowing from the ground. They have been placed in different configurations, sometimes combined, to give more diversity to the level. These obstacles make the game more challenging for the participants, keeping it as close as possible to a real game experience.

The scope of these obstacles is threefold. First, they can be considered puzzles that can clearly show the interconnection between the multimodal (sub-)system of the game and players' interaction strategies (S-RQ1 and 2). In particular, the uneven terrain, with several steps, is expected to prompt players to jump, while the temporized traps (moving platforms, spears, fires) require reflexes and understanding the correct timing. These, being basic interactions with a game, were created specifically to show the working of players' sensemaking. Increasingly complicated combination of traps and obstacles were placed to observe the evolution of participants' behaviour. By having obstacles recurring several times it

[129] It occurred during P3 playthrough that due to unexpected circumstances caused by the checkpoints, the participant could only proceed by walking from right to left (thus opposite of the customary direction). P3 considered this extremely confusing.

[130] https://www.xbox.com/

is also possible to observe the participants' learning of the interaction strategies (S-RQ1, 2 and 8).

The second objective is to expose participants' contextualisation through recollection of memories of traps and obstacles: the game is made to present no evidence that obstacles and traps are to be avoided or bypassed carefully because potentially dangerous. Therefore, if participants naturally and unpromptedly avoid traps and other obstacles, this would mean that their perception, and the resultant interaction, would be based on a set of memories not related directly to the current game (as no such information are given) and therefore rooted in a wider mnemonic context. Whether this contextualisation is based on memories of other platformers, of other games, or of life in general, was hard to conclude *a priori*, and the actual experiment would shed more light on it (S-RQ1 and 2).

Lastly, and coincidentally, traps and deadly obstacles can help to highlight the behaviour and thought of participants upon the death of their character. Touching the active traps or falling in the spiked pits cause the death of the player character, accompanied by a vibration in the controller. The player character is consequently teleported to a previous location. This "teleporting to a previous location upon death" is clearly not foreseeable through real world-related memories or experiences, but it is still expected to be not surprising for the participants to the experiment,[131] as it is a custom in video games. Thus, in this case the set of memories retrieved for the contextualisation of the happenings is expected to be specifically rooted in video games-related knowledge, observing which functioning can bear interesting results (S-RQ1 and 2).

In many games of the platformer genre players are forced to restart from the very beginning of the level upon death. This was deemed unfeasible for the experiment, as it could mean very long play sessions and frustrated players. Furthermore, participants' attention is expectedly split between playing the game and thinking out loud, which could increase significantly the probability of death of the character (Knoll, 2018) and cause additional frustration and prolongation of the sessions. To avoid this, an arrangement of frequent checkpoints was implemented. Nineteen checkpoints have been included in the game, which is intended to have a play time of about ten minutes. Upon death, the player character is then moved to the last checkpoint location reached. Seventeen checkpoints were placed in the safe spaces between obstacles. Two additional checkpoints were added after the pilot study, to further reduce possible frustration and overextension of play times.

### 4.2.4 Crossroad

Towards the end of the first level, a choice is given to players: a platform in the higher part of the screen leads to a door framing a translucent sword, while the road proceeds in the lower part of the screen, to a door framing a translucent

[131] Participants are selected to be expert players who engage in video game playing more than every second day, so at least three times a week for at least one hour per session.

shield (Figure 4.2). Players are left to choose freely which way to follow. The decision to provide a branching in the game was taken to observe participants' behaviour and, in particular, the reasons for their choices (S-RQ 1 and 5). While the choice seems to be between obtaining a sword and obtaining a shield, in actuality the game is designed such that each player will end up obtaining both, as the choice only impacts the order in which these two are obtained (i.e., choosing the sword door at the crossroad only entails obtaining the sword first and the shield immediately afterwards, and vice versa). However, the exact scale and implications of this choice are not shown openly. Therefore, this moment is particularly interesting for unveiling participants' thoughts on their decision making.

In designing the details of this choice, two factors were considered. On the one hand, players are expected to propend towards the sword, due to the often more prominent usefulness of offensive weapons over defensive ones in platform-adventure games. On the other hand, the lower door is significantly easier to reach, as it is sufficient to proceed straight, while the upper door requires a timed jump to reach it. In order to stimulate a more attentive attitude, a more reasoned choice, and in particular a longer choosing time (thus to elicit additional and more clear talking for the think-aloud) these two factors are put in contrast: the easier-to-reach door is assigned to lead to the shield, while the harder-to-reach door is assigned to lead to the sword.

### 4.2.5 Doors

When the player character passes in front of a door, an icon showing a Y enclosed in a yellow circle (resembling the Y button in an Xbox controller) appears, indicating the possibility of interacting by pressing the Y button on the controller. This interaction mechanic was designed with the intended scope of highlighting the relation between the multimodal (sub-)system and players' interaction with as little interference from memories as possible, being Y a button not standard for entering doors (thus, without a strong mnemonic connection) (S-RQ1). Choosing the Y button to interact have also the advantage of the button being far from the natural, at rest position of the hand of the player. This helps to avoid unintended pressing, which for the current experiment categorizes as detrimental noise in the data.

Doors are placed at the end of each area, for a total of three regular doors and a door/portal (see below). Approaching the doors always make the yellow Y appear, suggesting how to interact with them. After the first door, it will be already possible to test whether memories have been built regarding the strategies to interact with doors: will players take their time to understand what the game is suggesting through the multimodal system, or is this set of memories already informing interaction? Such an analysis will be conducted by looking at how long it will take participants to interact with doors, observing whether significant differences are noticeable between the first encounter with doors and the following ones. Additional information could be extracted by looking at participants'

behaviour when reaching doors (e.g., whether they look at the controller to locate the Y button or not, when, and how often) (S-RQ1, 2 and 3).

### 4.2.6 Sword

Entering the door with the translucent sword (or after having completed the shield level), players are transported to a new area, the *sword level*. In this level, too, a wall is not far from the left of the door. On the right, a dead knight, with the same uniform as the player, is lying next to a sword. When the player character gets close to the dead knight and the sword, another Y button appears, indicating the possibility of interaction (in this case, the possibility of picking up the sword, suggested by placing the button close to the weapon and the dead body). This second use of the Y as interaction button can both test the memory of the players, who discovered the use of the Y button shortly before, and observe the creation of new information to be passed to memory, specifically the expansion of the Y button capabilities as general-purpose interaction button (S-RQ1 and 2).

Once the sword is picked up, other three icons appear, representing the buttons: B, B, X (Figure 4.3). These indicate the combination of buttons that must be pressed to attack using the sword. By pressing the three buttons within a short period of time, the player character performs a slash with the newly found sword. Relying on a relatively complicated combination of buttons (also referred to as *combo* in gaming jargon and in this text) had two main purposes: it avoids unintended or repeated pressing of buttons without a real intention, and it requires learning and practice to be mastered and used seamlessly, that is, to be passed to memory as a skill. By designing this interaction affordance as a combo, then, it is possible to observe whether and how the multimodal system participates in establishing a skill that is passed to memory (i.e. learning, through the visual representation, that this specific button combination is used to attack) and how interaction equally builds mnemonic content (and specifically the timing of the button sequence, and the timing and exact mechanics of attacking – S-RQ1 and 2).

Players are in theory allowed to avoid picking up the sword, but they will be unable to proceed further as they will be killed by skeletons and sent back to the beginning of the game, where a checkpoint is placed. From the point of view of the theoretical model, if participants would not pick up the sword this could mean that the multimodal clue was not evident enough, or that the sword is of no interest to them – which in turn could mean that no actual information of the utility of the sword is stored in that person's memory (S-RQ1 and 2). This behaviour is not expected in participants, who are expert players.

### 4.2.7 Skeletons

Players are given a short period of time (up to about a minute) to test the attack combo, before a skeleton approaches them. The skeleton has been chosen as an enemy as quite customary in games (see, e.g., The Elder Scrolls V: Skyrim (Bethesda Game Studios, 2011), The Legend of Zelda: A Link to the Past

(Nintendo EAD, 1991)), but also to create a sort of continuity or coherence with the necromancer-like appearance of the main villain, whose magic weapon was shown to be a red skull. It should be noticed also that skeletons are shown as minions summoned by the villain during the introductory clip.

Through the skeletons, it is possible to shed light on participants' behaviour in front of ground enemies, and the set of memories this behaviour is based on. Skeletons must be defeated by performing the attack combo while at a short distance from them. It is necessary to time the attack, as skeletons are capable of attacking, too, when the player character is in the vicinity. By interacting with the skeletons, players learn their moving and attacking patterns, and the best timing to defeat them quickly. This is likely to expose how this knowledge is passed to memory through interaction (S-RQ1 and 2). Several skeletons are scattered around the game, also in combination with other obstacles.

### 4.2.8 Interactivity traps

Towards the end of the *sword level*, immediately before the door to proceed further, is placed an almost invisible trap. The trap is encountered for the first time here by all players (no matter which weapon they choose to collect first). It is also the first of the several deliberate disruptions of the normal working of the system object of study.

For easiness of reference, this kind of traps will be referred to as "interactivity traps". These traps take effect when the player character steps on them, and they disable all interactions apart from combos. To free themselves from the trap, players have to correctly perform the attack combo.

This trap is intended to be mostly invisible, to make unexplainable the reduction of interactivity it triggers – in disruption of the normal working of the system. Only very small animated purple bubbles were added on the floor beneath the trap. A faint sound and a vibration of the controller, similar to the one when the player character dies, were also added when the trap is activated. The reason for adding these small multimodal clues is to test the relationship between players' experience and the perceived multimodal system, and the extent to which one informs the other (S-RQ1 and 2). In addition, including the multimodal clues have the advantage to allow to observe players' construction of memories and of interpretive context. These additional data (related to S-RQ1 and 2, too) would be collected while retaining the inexplicable reduction of interactivity.

The expected course of event is then the following: participants fall into the first trap, not noticing it, and are confused by the non-standard working of the game, as they are stuck with no apparent possible movements. By interacting with the game, through trial-and-error, participants then understand how to free themselves, and they understand the trap as indeed a trap (S-RQ1 and 2). At the moment of falling in another of these traps later during the game, participants would not be surprised anymore, but recall this first trap and they would know what to do as they had built the relative memory. If this expectation realises, it will mean that this non-standard behaviour of the three sub-systems had become, for the

participants, part of the norm for this particular game (and therefore for the sense-making system it involves). This is therefore intended to show the adaptability of the complex sensemaking system involved in understanding video games, which can easily encompass weird behaviours relatively unproblematically (S-RQ 7). It also shows the ability of the system to grow by including increasingly new and unexpected elements (in this case, building increasingly more memories with which to further make sense of the gameplay experience – S-RQ 8).

Lastly, these traps serve the additional purpose of providing a glimpse of how participants retrospectively make sense of elements of the game. In particular, as I will explain in further detail shortly, an enemy has been created and placed towards the end of the game, which is shown to generate these traps. Through this, it will be possible to test another way in which the system grows and adapts itself, in retrospection (S-RQ 7 and 8).

Apart from these expected behaviours, the disruption of the normal working of the sensemaking system that these traps introduce will be useful to better observe the working of the system in general, foreseeably providing insights on its complexity.

### 4.2.9 Shield

Entering the door with the translucent shield (or after having completed the sword level), players are transported to the *shield level*. As usual, the path proceeds on the right, with a wall close to the left side of the door. A second dead knight is visible on the right, leaning on a shield. Getting close to the figure makes the Y button appear on top of it once again. After having picked up the shield by pressing the button, the three icons X – X – B appear, to indicate the combo used to defend using the shield (Figure 4.4). By pressing the combo in rapid sequence, the player character defends by raising the shield, also generating a blue defensive aura that lasts for a short moment. Differently from the attack combo, the shield combo requires the player character to be standing still (also due to the kind of movement designed for the enemy to be tackled with this mechanic – see the next section), which produces a difference in timing the two actions.

In addition to the reasons explained above for choosing a relatively complicated combo (avoiding unintended pressing and requiring learning), this sequence was selected because different but quite similar to the attack combo. This similarity is useful for observing in closer details the learning process: players will have not to learn vaguely the combo, and rather have to memorize the exact combinations to obtain the intended outcomes – attack, or defend (S-RQ1). The two different timings therefore stress further this difference and thus the importance to learn correctly the combos.

Just as for the sword, if participants would not pick up the shield it would mean that they saw no use of the shield for this game, or that the multimodal clue was not clear enough.

### 4.2.10 Bats

After a short period to try out the combo, a flying one-eyed demon with bat-like wings approaches. I will refer to this kind of enemies as "bats" from now on, for easiness of reference. When the player character is within reach of the bat, the monster shoots a fire projectile. The projectile can be sent back to the bat, defeating it, by performing the shielding combo with the right timing.

This enemy, and particularly its behaviour, has been designed to observe how participants will interact with it and on which basis. For this reason, no actual explanation of this mechanic was given to participants (S-RQ1 and 2). Four main behaviours are possible:

1. participants are reminded of other games with the projectile deflection mechanic (e.g., The Legend of Zelda Breath of the Wild (Nintendo EPD, 2017)) and directly proceed to deflect the projectile;
2. participants understand the deflection mechanic by trying out the shield functionalities and interaction affordance. Seeing the multimodal output of the shield combo, participants would then guess its function;
3. participants simply deduct (from the co-occurrence of shield and enemy) that the shield could deflect projectiles, without the necessity to make the extra step of testing the shield's interaction affordances;
4. participants avoid the projectile altogether, deeming it the only possible choice.

Just as for skeletons, several bats are present throughout the game, also coupled with other obstacles.

### 4.2.11 Gold coins

Only after visiting both the sword level and the shield level, the player character is transported to the *twist level*. The name of this level comes from the fact that it has several elements of disruption, twisting the normal behaviour of the system in several occasions. For this reason, it is the one that is expected to provide the most interesting data.

Similarly to all other levels, the area develops on the right, while a wall blocks the way on the left, not far from the door. However, differently to all other levels, on the left side of the door is floating a golden coin (Figure 4.5). The coin has no real value, and indeed no value has been suggested through the game or its introduction. Participants are therefore not instructed in any way to take it, nor they are suggested it could be useful or profitable to obtain it anyhow.

The only scope of this golden coin (and of a second golden coin, placed shortly afterwards, see Figure 4.5) is therefore to test participants behaviour when exposed to another well-established game custom, even when the usefulness of the action is not apparent. This will be helpful in showing the impact of memories in understanding the multimodally-constructed environment and in interacting with it (S-RQ1 and 2).

Similarly than for the sword and the shield, participants could avoid picking up the golden coins. If this would be the case, it would mean that participants would not have previous knowledge highlighting the possible importance of collectables in games (S-RQ1 and 2), or that they understood that no real value is attached to the coin. This behaviour is unexpected, particularly with the latter explanation.

### 4.2.12 Fake flames

Not long after entering the twist level, a sequence of four timed flames placed on two ground levels is found. Participants reach this area from a moving platform floating over a spiked pit. While the fake flames look and behave exactly the same as normal flames, they do not hurt the player character even when they hit it. An interactivity trap is placed so that the player character would fall into it before exiting the fake flames. Due to these design choices, participants would then try to run past the fake flames, and they would be blocked before they could exit them. They would then have to free themselves by performing the attack combo, as taught to them so far, before facing the pit with fake spikes (see below).

The participants' expected behaviour around these flames is the same as for normal flames, thus: waiting for them to stop blowing, and quickly walk past them as they recharge. This could be deemed quite normal and expectable, not only because of participants' embodied experience of fire in general, but also because it is quite likely at this point that participants also experienced first-hand that the player character dies by touching the live flames. However, this de-coupling of the experiential tuple "flames = death" is expected to disrupt this basic assumption, and the effects of this disruption would be particularly telling of the working of the link between the multimodal presentation of the game and players' interactions with it (S-RQ1 and 2), also showing whether this decoupling is lasting enough in participants' memory to assume that the following flames (placed shortly afterwards) are equally not damaging them (S-RQ9).

The interactivity trap added before exiting the fake flames has the scope of ensuring that participants would be touched by the fake fire, but it also serves the purpose of testing the reaction to a combination of two (apparently) mal-functioning traps (S-RQ5, 7, and 8).

### 4.2.13 Fake spikes

Objectives similar to those of the fake flames are also shared by the fake spikes. Immediately after passing the fake flames, participants have to defeat a bat and pass through a spiked pit. Over this pit are floating two moving platform and a small, static one. The relative movement of the two platform with the static one is made so that it is almost impossible to not fall in the pit. However, the spikes in this pit are not actually hurting the player character, who is free to walk on their tips without dying. After detecting some difficulties and unnecessary pro-

longation of play time during the pilot, the spikes have been placed so that it is possible to proceed by walking on them to jump directly out of the pit (Figure 4.5).

As mentioned, the fake spikes have more or less the same function of the fake flames. They have been added not only as a way to double check the response of participants to the disruption of a standard behaviour, but also to reinforce an idea of the game changing its own rules. This is useful to test the ability of the game-player system to adapt to mutated circumstances (S-RQ 7 and, in some regards, 9).

The scope of placing these two "broken" traps next to each other is to show the extent of this adaptability of the system (S-RQ7). Encountering several apparently not working obstacles could have two possible outcomes in players:

- they could trigger in participants a general sense of mistrust for the system in its entirety, which would prompt them to reconsider everything they will encounter from there on. This would mean that the system is still working, and the player is trying to adapt its sensemaking to the mutated conditions.
- else, it could prompt participants to believe that something in the system has stopped working properly, and therefore that the game is misbehaving. This would mean that the system is perceived as broken, as elements of the sub-systems have fallen outside the range of adaptability.

### 4.2.14 Malfunctioning skeleton

Shortly after the fake spikes is a "malfunctioning" skeleton. The skeleton is facing the right, thus turned away from the approaching player character. The skeleton has the standard walking animation of all other skeletons, but, differently from them, does not actually move, being stuck in place without the possibility to even turn.

The scope of this enemy is to understand which system of information is prevailing in informing interaction (S-RQ 1, 2, 3 and 5). If participants would find this malfunctioning skeleton and hesitate on what to do with it due to its atypical nature, it would mean that the multimodal (sub-)system prevail over memories and experience. On the other hand, if participants would simply see the skeleton and kill it, it would mean the contrary – that experience prevail over the multimodal (sub-)system in making sense of the current situation.

### 4.2.15 Hanging ally

Moving further, participants are faced with an area on two ground levels. The bottom part continues straight, with a set of timed flames, while on the top part is visible a knight (dressed like the player character) hanging from the right edge, with a skeleton patrolling on the left side. Through a platform on the left, it is possible to jump from the bottom area to the top one (Figure 4.5). The sound of a scream is played when the player character gets close to the ally (also from the lower level). After having defeated the skeleton, it is possible to approach the ally, and getting close enough would make the Y button appear, as (by now) usual

for interaction. Pressing Y makes the ally disappear, while a sound is played acknowledging the event. No other reward is given, and the choice has no other impact.

This part of the level was inserted with the hope that it would provide some initial insights into the impact of the emotional involvement of participants. The basic idea is that no actual reason for rescuing the ally is given, while two deterrents are placed: the extra effort required to get to the top platform, and the extra effort required to defeat the skeleton. At the same time, participants could simply (and with significantly less effort) proceed on their way, ignoring the ally. If participants would try to save the ally, this would possibly mean an emotional involvement with the game emerging, in the form of an empathic response to the ally in distress (related to S-RQ4).[132] Potential statements during the think aloud might show if such a reasoning actually appear.

### 4.2.16 Head monster

The following area contains an enemy that was not encountered so far. It is shaped like a sphere with a face, or a sort of floating head (Figure 4.5). From now on it will be referred to as the "head monster" for easiness of reference. This enemy is programmed to slowly move around when alone. When the player approaches, the head monster turns towards the player character and spits a few purple bubbles that fall on the floor, planting an interactivity trap. When the player character gets too close, the head sprints forward. If it reaches a wall, it simply turns around and proceeds moving in the opposite direction. The head monster is not actually dangerous for the player character, as it passes through it even when they collide, without causing damage. Players can also ignore the head monster, and it is possible to proceed further without necessarily defeating it.

The main purpose of this enemy is to test how participants retrospectively make sense of elements of the game (S-RQ1 and 2). This enemy is shown to generate the interactivity traps that participants found on several occasions during the game. The expectation is that participants overtly recognize that the head monster is responsible for placing traps in different parts of the game. To further sustain and to give substance to this, the head is also added among the minions that are summoned by the evil figure during the introductory clip. If this retrospective sensemaking would appear in the think aloud, then, it would be a further clue supporting the idea that system grows and adapts itself, not only in a forward fashion (e.g., by continuously adding information to the mnemonic stack), but also in a backward way (by restructuring the stack itself, adding new information also next to older information) (S-RQ7 and 8).

[132] It could also mean a calculated decision, as participants could assume that having an ally fighting with them would be a strategic advantage, but it would be interesting to observe the exact reasons for saving (or not) the ally during the participants' sessions.

### 4.2.17 End of the twist level

In the last area of the twist level, after passing the head monster, the evil entity (that I will call *boss* from now on, as it is designed as the final boss of the game) make again its appearance. In a short clip, built with the engine, the same laugh heard in the introductory clip is played again, and immediately afterwards the boss opens another portal and enters it, leaving it open behind him. During this animation, the player character is stuck and cannot move.

This scene serves as the antithesis to the interactivity traps. As mentioned, while the animation is playing, interactivity is completely taken away from the players. Just as for the blocking traps, there is no real apparent (multimodal) reason for this, the only explanation of which lying in between customs of video games, where often interactivity is limited or zeroed during clips. Therefore, while the situation is in theory almost the same when blocked by the first blocking trap, players' expected behaviour is to not feel confused nor surprised by the change in interactivity, as the recollection of game standards is supplying the absence of meaningful multimodal clues (S-RQ1 and 2).

### 4.2.18 Portal

After the animation has finished, participants can move the player character towards the portal, which also emits a low buzzing sound. By getting close to it, the usual Y appears on it, signalling the possibility to interact with the button now established for entering doors.

This portal is intended to also checks the flexibility of the system in treating non-standard elements. In this case, if no difficulty in understanding the purpose of the portal or in interacting with it would be reported, and if no significant difference is detected between the time for interacting with normal doors and the time for interacting with the portal, this would mean that the system on which sensemaking is based is adaptable enough to encompass a multimodally non-standard door and understand its functioning as a standard one (S-RQ7).

### 4.2.19 Portal in the boss level

The last level of the game is the *boss level*. The main section of this area is dedicated to the final boss fight (described in the next section). Upon entering the level, participants find themselves at the bottom of some stairs. The portal is still visible on the left, and is still buzzing (Figure 4.6). However, if one goes back to it, in place of the usual Y button icon, this portal shows a crossed-out Y.

The crossed-out Y, instead of having the portal simply close, could help shed light on the relationship between the experience of the participants and the multimodal presentation. In more specific terms, participants have learned so far that doors are not re-accessible, i.e., that it is not possible to go back and visit previous areas. However, an open portal might prompt them to still check this possibility, and observing players' behaviour could be interesting in identifying the relationship between the multimodal presentation and players' experience with the game (S-RQ1 and 2).

### 4.2.20 Floating icons

Next to the portal but on the right side of the player character have been placed two floating icons, one of a sword and one of a shield. These icons have no actual function if not to disappear once the player character touches them. They are however helpful to observe the spontaneous emergence of meaning of this meaningless multimodal clue for each participant (S-RQ4). In practical terms, what is expect from participants is the belief and possibly the perception of having upgraded to their weapons by picking up the icons as it is customary in video games (S-RQ1 and 2).

### 4.2.21 Staircase and chandeliers

By proceeding up the stairs, participants can reach the boss area. Along the staircase have been placed several chandeliers that light up with a visually appealing animation when the player character passes above them. These chandeliers and the relative animation were not purposefully designed to elicit any kind of response and have been added only later following the developer's personal taste, but they turned out to be extremely insightful, as will be discussed below.

At the top of the staircase are two non-interactable jars (placed in the background) and a platform floating over a pit full of lava. While the jars are placed for mainly aesthetic purposes, the pit of lava was made to resemble the final level of Super Mario Bros. (Nintendo R&D4, 1985), one of the most iconic boss fights. This will be useful to test players' understanding of the current situation through the recollection of a "classic" of the genre (S-RQ1 and 2).[133]

### 4.2.22 Boss and ending

Once the player character reaches the centre of the boss area, the boss battle is triggered. The boss starts floating high above ground (out of the reach of the sword's slash), either next to the left or next to the right edge of the platform (between the lava pits, Figure 4.6). From this position, the boss has two moves: it can raise the red skull, summoning a new kind of ground enemies (*goblins*), or it can raise its sceptre, casting fireballs that fall towards the player character. After having performed one of these two actions, the boss goes back down on the floor level and waits for a certain amount time, before start floating again, etc. The boss has been given four health points. Each health point is consumed when the boss is hit by the player (either with a sword attack or with a deflected fireball). A health bar shows the remaining health of the enemy.

[133] Although the total ignorance of Super Mario Bros. in an expert gamer (like the participants in my experiment) is almost impossible, in the case that one is absolutely unfamiliar with this game, this recollection would simply not happen, and possibly other memories are evoked by the design of the environment.

The two different kinds of attack of the boss have been designed to check how and to what extent memory informs interaction strategies of the participants (S-RQ1 and 2). On the one hand, the goblins behave quite similarly to the skeletons, while not being visually the same. On the other hand, the boss' fireballs might be assimilated to the bat's projectiles, while not only being visually dissimilar, but also behaving slightly differently since they originate not from the boss itself (as was the case for the bats) but from random locations of the higher edge of the map. Through the boss fight, then, it will be possible to test the adaptability of participants' recollection of memories, as the same interaction mechanics are called for by different multimodal clues (S-RQ 7).

After the boss health reaches zero, the screen fades to black and a "Thank you for playing!" is displayed.

### 4.2.23 Additional features

Apart from the actual design of the game, three non-game-related features had to be implemented:

1) To allow a more precise recording of the participants' interaction with the game, a logging system has been developed that can write on a simple text file each of players' inputs. Each action (under the form of button presses) was saved in the text file as a new line.
2) To record and analyse the experiment sessions, an integration of the game with the Open Broadcasting Software (more commonly known as OBS)[134], a tool widely used for screen recording and streaming also by online streamers, was developed. The plug-in allows to connect with OBS and to start and stop recording through an in-game interface.
3) For a more precise analysis of participants' inputs versus the screen recording, it was necessary to control the screen recording software through the game engine itself. An integration has been developed to timestamp each entry in the textual log of players' inputs. Timestamped actions could then be analysed to assess in closer details the participants' behaviour during the think aloud. However, in the end, these timestamped logs have not been useful for the current analysis.

## 4.3 Methodology

Since what is to be investigated is the process of co-creation of sense between the game and its player, the sensemaking process, what is needed is to somehow have a glimpse into the cognitive functioning of players. Therefore, it was necessary to rely on a research method that could expose players' cognitive functioning. The

[134] https://obsproject.com

choice fell on the think-aloud method (Rogers et al., 2023), coupled with a semi-structured interview and a questionnaire.

### 4.3.1 The think aloud method

Think aloud is a methodology widely used in cognitive psychology and Human-Computer Interaction (HCI) research (Rogers et al., 2023), but it has been widely used also in video games research (cf. Desurvire & El-Nasr, 2013; J. S. Schell Jesse, 2008). The scope of this method is to evaluate the effectiveness and efficiency of a product or interface, and in general to understand a person's thought processes as they perform a task or solve a problem. In a think-aloud session, participants are asked to verbalize their thoughts and to express their impressions, expectations, difficulties, and suggestions while interacting with a website, application, or prototype. By vocalizing their thoughts, participants of a think-aloud session provide researchers with valuable information about their perceptions, interpretations, uncertainties, and reasoning behind their actions. As it should be noted, the think-aloud session has been shown to require non-negligible cognitive effort (Knoll, 2018). This is one of the main reasons (together with the ease of manipulation) for choosing to design a relatively simple and easy game.

Think-aloud is therefore particularly suited for the current study aimed at gaining insights into the participant's mental processes, as the think-aloud protocol ultimately "provides the researcher with an insight into the cognitive processes that go into using a product or service" (Knoll, 2018, p. 189). For this experiment, participants were provided with the video game prototype discussed above.

### 4.3.2 The semi-structured interview

In addition to the data gathered through this method, each participant faced a semi-structured interview.[135] The interview was aimed at clarifying unclear part of the voiced report and/or complementing such report, regarding a number of salient moments of the game. Participants were asked to elaborate on their thoughts, their actions, and the reasons behind those in certain moments, specifically when encountering:[136]

- The first spear trap,
- The first spiked pit with overfloating platform,
- Dying in the game,
- The first crossroad,
- The first weapon,

[135] Rouse suggests that post-session interviews are a good way to gather overall impressions of the experience (Rouse, 2005).

[136] A description of these moments is provided in Section Part I 4.2 on the design of the testing game. The interview did not have exact questions as they very much depended on the information that each participant already provided during the think-aloud. During the interview, the experimenter only relied on the list of elements reported here.

- The attack combination of buttons,
- The ground enemies (skeletons),
- The first invisible blocking trap (interactivity trap),
- The shielding combination of buttons,
- The flying enemies (bats),
- The golden coins,
- The second interactivity trap,
- The fake fire,
- The fake spikes,
- The motionless (malfunctioning) skeleton,
- The head monster,
- The fake power ups,
- The boss and its minions,
- The story of the game.

It should be noted that being an unstructured interview, not all participants received exactly the same questions. Often, most of these questions were already answered enough during the think aloud, and they did not need further inquire during the interview. All participants were asked to comment on the reasons for choosing one or the other weapon, their thoughts when encountering the first skeleton and the first bat, the first and second interactivity traps, the golden coins, the fake fire and the fake spikes, the head monster, and the boss. Two participants (P12, P14) could not be asked about the story of the game due to time constraints imposed by participants. The other points were touched on only when additional information was needed.

### 4.3.3 The questionnaire

Lastly, participants filled in a post-session questionnaire, with questions about demographic data, information on their usual play times and preferred game genres, and a Ten Item Personality Measure (TIPI) test (Gosling et al., 2003). The TIPI is a short but reliable (Furnham, 2008) 10-item measure of the dimensions forming the Five-Factor Model, an established model of personality traits.[137] This questionnaire was created with Google Form.[138]

To avoid language barriers and possible mis- or incomprehension that could be extremely detrimental to the experiment, the entirety of it was conducted in Italian (mother tongue of the experimenter and of all selected participants – see Section 4.4 on the study population). The transcripts provided in current discussion have been translated into English by the experimenter. The Italian version is provided alongside the English translation in the upcoming pages.

[137] The Five Factors, or "Big Five", as they are sometimes called, are extroversion, agreeableness, conscientiousness, emotional stability, and openness. A more detailed explanation of them will be provided in the following pages.

[138] https://docs.google.com/forms/. The actual form is available at this address: https://forms.gle/h6uDss4RD6UCEi688.

## 4.4 Study population

Given the expectably varied nature of the sources of information participating in video games sensemaking, and the difficult task of analysing players' cognition, it was decided to rely on a quite homogeneous group of participants. This decision, which could be seen at first glance at a weakness of the study, is driven by the very practical need to reduce to the minimum possible the number of independent variables and thus noise in the data set. Significant differences in age or in cultural background could have inserted unpredictability in the game-player system which, for this specific experiment, could entail the impossibility to understand the source of certain thoughts and decision. As such, a too diverse pool of participants had a high risk of rending opaque the results. For the current experiment were therefore selected only participants belonging to the same socio-cultural background and average age of both the experimenter and the two students developing the game. It was also decided to select participants with significant experience in video games' play, to avoid issues and misunderstanding coming from lack of experience in playing – and specifically in playing with a game controller.

The recruitment of the participants was done through two main channels: half of the people that took part in the experiment have been recruited through personal acquaintances of one of the students involved in the development. The student was asked to ensure that these participants did not know anything about the game, its development, its scope, or any detail about the experiment. This was also double-checked upon meeting these participants. The other half of the participants were recruited through a WhatsApp[139] group of tabletop game enthusiasts regularly meeting at the venue of the experiment (see below). A recruiting message was circulated with a vague description of the experiment. Participants booked their preferred 1-hour slot in the period September 22nd to September 26th through a form created with the scheduling tool Calendly.[140] They participated on a voluntary basis but with the prospect of a reward. After the experiment, participants received a game controller-shaped keyring as a gift.

A total of 14 people participated in the sessions. 4 participants identify themselves as females, 1 identify themselves as non-binary, the remaining 9 identify themselves as males. Their mean age is 23,5 (Min. 21, Max. 29, SD 2.5). All participants are Italians, grew up in Italy, and speak Italian as their mother tongue.

All participants declared to be used to play video games with a handheld controller similar to the one used in the study, and to have been doing this regularly (at least three times a week for at least one hour per session) for the past two years. All participants declared to not have been informed about the specificities of the study being conducted before arriving to the venue, apart from the information received for the recruitment. These two fundamental conditions (ability to use a controller, and no previous knowledge about the test) were double-

[139] https://www.whatsapp.com

[140] https://calendly.com

checked during the briefing phase, right before the experiment. Participants could take part to the experiment only once, and only one at a time, to reduce the possibility of biases sprouting from possible exchanges of information or replay.

The information on demographics, average play time, and preferred games of the participants is reported in Table 4-1.

*Table 4-1 – Demographics, average play times, and preferred games of participants*

| ID Code | Age | Gender | Avg. play time | Preferred games[141] |
|---|---|---|---|---|
| **P1** | 24 | Male | 4 hours/week | Soulslikes and shooters games |
| **P2** | 23 | Male | 7 hours/week | Loot-and-shooters games |
| **P3** | 23 | Female | 3 hours/week | Platformers games |
| **P4** | 24 | Male | 8 hours/week | Soulslikes, action, adventure, FPS games |
| **P5** | 23 | Female | 3 hours/week | Pokémon games |
| **P6** | 26 | Male | 3 hours/week | Adventure, music, platformers, roguelikes, mobile games |
| **P7** | 29 | Female | 20 hours/week | MMORPGs, MOBAs, JRPGs, roguelikes games |
| **P8** | 21 | Male | 20 hours/week | RPGs, Open-world games, games with melee fights |
| **P9** | 24 | Male | 4 hours/week | Arcade, action, adventure, crafting games |
| **P10** | 22 | Male | 24 hours/week | Racing, souslike, FPS, sandbox games |
| **P11** | 28 | Male | 20 hours/week | RPGs, sports games |
| **P12** | 22 | Non-binary | 5 hours/week | RPGs, adventure, action, shooter games |
| **P13** | 21 | Female | 30 hours/week | Indie, soulslike, MOBAs, horror, platform games |
| **P14** | 27 | Male | 4 hours/week | RPGs, fantasy games |

[141] Preferred games have been collected with an open text box where participants could freely write.

In Table 4-2 a summary of the TIPI personality profiles of the participants.

*Table 4-2 – TIPI personality profiles of participants*

| | **Extroversion** | **Agree-ableness** | **Conscien-tiousness** | **Emotional Stability** | **Openness** |
|---|---|---|---|---|---|
| **Norms**[142] | 4,44 | 5,23 | 5,4 | 4,83 | 5,38 |
| **P1** | 5 | 6 | 6 | 6 | 4 |
| | Medium High | Medium High | Medium High | Medium High | Low |
| **P2** | 2,5 | 6,5 | 6 | 6,5 | 2,5 |
| | Low | High | Medium High | High | Low |
| **P3** | 2 | 7 | 6 | 3,5 | 3,5 |
| | Low | High | Medium High | Medium Low | Low |
| **P4** | 4 | 5,5 | 6 | 6,5 | 5 |
| | Medium Low | Medium High | Medium High | High | Medium Low |
| **P5** | 2,5 | 6,5 | 7 | 5 | 4,5 |
| | Low | High | High | Medium High | Medium Low |
| **P6** | 5 | 6,5 | 5 | 4,5 | 5,5 |
| | Medium High | High | Medium Low | Medium Low | Medium High |
| **P7** | 1,5 | 4,5 | 4,5 | 3 | 4,5 |
| | Low | Medium Low | Medium Low | Low | Medium Low |
| **P8** | 5,5 | 5 | 4 | 6,5 | 5 |
| | Medium High | Medium Low | Low | High | Medium Low |
| **P9** | 4 | 4 | 3,5 | 4,5 | 7 |
| | Medium Low | Low | Low | Medium Low | High |
| **P10** | 6,5 | 7 | 4,5 | 6 | 4 |
| | High | High | Medium Low | Medium High | Low |
| **P11** | 3 | 5,5 | 6 | 6,5 | 5,5 |
| | Medium Low | Medium High | Medium High | High | Medium High |
| **P12** | 2 | 3,5 | 2,5 | 2,5 | 5 |
| | Low | Low | Low | Low | Medium Low |
| **P13** | 1 | 6,5 | 5 | 4 | 6 |
| | Low | High | Medium Low | Medium Low | Medium High |
| **P14** | 1 | 6,5 | 6 | 4,5 | 2,5 |
| | Low | High | Medium High | Medium Low | Low |

One person served as pilot tester. He belongs to the same cultural and age group. He is Italian, male, 24 years old. He has not been counted among the 14 participants to the experiment reported above.

[142] Norms values are taken from (Gosling et al., 2014) and are based on 1813 entries.

## 4.5 Setup and study process

The set up for the experiment consisted of a wall-mounted TV screen (32 inches, flat) with an external webcam placed at the top, a desk, a game controller, a set of high-end gaming headphones with a built-in microphone, and a gaming chair. The experimenter's laptop was connected to all external devices via cables. Participants sat directly in front of the monitor and played the game while being recorded by the camera. The experimenter sat to the left of the participant (about 1 metre away), at a distance from which it was possible to see the screen without interfering with the personal space or the field of view of the participants. The experimenter's monitor only showed the screen recording software (and no other information on the study itself), but it was distant enough to assume participants would not see it. A sketch of the setup is provided in Figure 4.8.

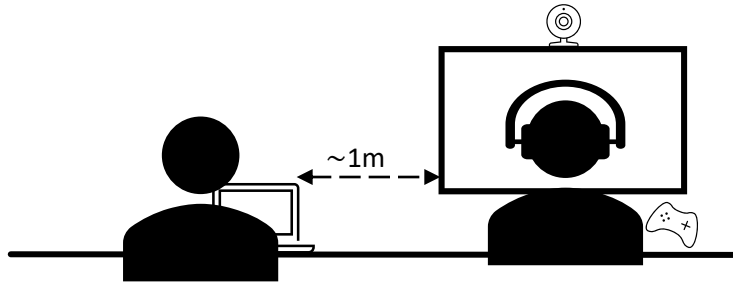


*Figure 4.8 – Sketch of the experiment setup.*

A pilot session was conducted with one participant, following Knoll's suggestion (Knoll, 2018). During the pilot were tested the procedure, the clarity of the provided instructions and questions, and the functioning of the testing game. The data gathered during the pilot session were not included in the current study, and have been only used to refine the procedure and the game for the actual experiment.

The actual study ran between September 22nd and September 26th at the gaming division of the Biblioteca Malatestiana, in Cesena, Italy. This setting was selected as more familiar and less fictional than a university room, which has been observed as causing discomfort in some participants (Knoll, 2018). Before participants arrived, the space was prepared as needed, by connecting the recording device (webcam), connecting and setting up the TV screen, launching the game engine and the recording software, testing the microphone and the headset, adjusting volumes and checking that everything was working correctly.

Upon arriving to the venue of the experiment, prospective participants were greeted in an informal manner. They were asked their gaming habits and whether they have heard from other people about the experiment and its scope. None of the participants declared to be familiar with the experiment, and all reported to be perfectly able to interact with a game through a gaming controller. All participants reported to play at least three times a week for at least one hour per session, as

required. One person admitted to not be proficient with video games and was explained that they unfortunately could not be part of the experiment.

The participants were verbally informed on the procedure of the study and on what was expected from them. In particular, they were informed that they would play a platforming game, and that they were expected to share their thoughts and the reasons for their decisions verbally, while playing. They were reassured about sharing their thoughts and about the interestingness of everything they felt confident to share. They were also advised that even what could seem obvious to them would be interesting to note. They were informed that the entire session would be recorded (both video and audio). They were informed also that they could stop the experiment in any moment in case they were not feeling comfortable anymore. Participants were then given a consent form to sign, which included a brief description of the experiment, and an agreement about the privacy of the data collected (specifically, their anonymised use for research purposes), in line with European and Italian regulations. The specific reasons for conducting the experiment were not disclosed, not to invalidate the data.

Once signed the form, participants were asked to wear the headset and fix the built-in microphone in a comfortable position in front of their mouth. At this point, they were informed that the audio-visual registration would start. Immediately after starting the recording, the actual game was launched. A game session lasted on average 13 minutes and 52,5 seconds (Min 10:49, Max 20:08, SD 02:46). Some participants required a reminder to speak after the first minutes of playing – this was issued with a neutral "per favore continua a parlare" ("please keep talking"), as for prescriptions of Knoll (2018).

After the think-aloud session, participants underwent the semi-structured interview, during which they were asked for clarifications and/or complementary information about their play experience. At the end of the interview, participants were informed that the recording was stopped. The average duration of a session (think aloud plus interview) is 24:51 (Max 40:11, Min 18:13, SD 5:26).

Participants were than thanked for their time and they were explained in more clear details the actual scope of the experiment. Before leaving, participants were rewarded for their time with a small gift and they were asked to not disclose the details of the session, of the study, and of the game. Participants were then asked to complete the post-session questionnaire, through a link. All participants completed in full all the steps of the study. The entirety of the procedure was conducted in Italian, as mentioned. [143]

[143] The full details on the game developed for the experiment an on the experiment sessions themselves are available in "Appendix III – Additional material".

## 4.6 Data analysis

The recordings of the sessions have been transcribed semi-manually[144] by the experimenter. As Knoll argues, "thinking aloud is not necessarily limited to what the participant is consciously saying. A lot of useful information can be gained from behaviours that participants may not have intended to display. For example, an angry grunt may be an indication that a participant is becoming frustrated with the difficulty of the game." (Knoll, 2018, p. 191). For this reason, while transcribing the sessions it was noted not only the words voiced by participants, but also their reactions – identifiable from their facial expressions and body language as captured by the camera. An example is reported in Table 4-3, of the moment when a participant fell in an interactivity trap.[145]

*Table 4-3 – Example of transcription, including both verbal and behavioural information*

| | **English translation** | **Original in Italian** |
|---|---|---|
| **P7 Think-aloud** | *[fell in interactivity trap] {confused look} Ok...? {does nothing} it stopped... {humming} ...why? {presses several the buttons, looks at me} I think it stopped... I think... {looks at the controller} or am I doing something wrong? {presses various buttons while looking at the controller several times}* | *[fell in interactivity trap] {faccia confusa} Ok…? {non fa niente} si è fermato… {mugugna} … perché? {preme vari tasti, mi guarda} Penso si sia fermato… penso… {guarda il controller} o sto facendo qualcosa di sbagliato? {preme vari tasti mentre guarda più volte il controller}* |

Once completed, the transcriptions consist of 59 pages.[146]

Transcriptions have then been anonymised as provided by the privacy statements participants have signed, by assigning a random number to each participant, from 1 to 14, where no connection is made between numbering and the order of the sessions nor any alphabetic order (such that, for instance, 1 is not the first participants that participated in the study nor the first in alphabetic order, 2 is not the second, and so on). Participants will be referred from now on with their assigned numbers to ensure anonymity. To avoid possible confusions with other numbers indicating other data, participants have been identified with a P before

[144] The bases for the transcripts were obtained by feeding the recordings to the Google speech-to-text tool (https://cloud.google.com/speech-to-text). The text extracted by this tool has then been re-analysed and corrected manually.

[145] The parts of the transcriptions reported here have been translated by the experimenter. Italian vernacular expressions and filler words have been translated with English ones of similar meaning and tone. In the transcriptions, curly brackets enclose behaviours (including facial expressions, actions, etc.) of the participants, while square brackets denote comments of the author indicating contextual or other information *a posteriori*.

[146] The pages are counted in Italian language, in the standard Word format: Calibri font and 11 point font size, 1.5 spaced with extra space between paragraphs.

the number (so P1, P2, etc.). From now on, I will refer to participants by using this notation.

After the transcription and the anonymisation, the gathered data has been divided in different files. For each participant, a file for the think-aloud and a file for the interview has been created. These files have then been imported into the analysis tool Dedoose, "a cross-platform app for analysing qualitative and mixed methods research with text, photos, audio, videos, spreadsheet data and more", as stated in the tool's presentation.[147]

The transcripts of the sessions have been coded using a deductive content analysis method (Rogers et al., 2023). The codes were extracted from the theoretical framework presented in the previous chapter and they have been formulated as criteria for the tagging. The author coded the transcripts and in case of doubts or a need to organize codes, he consulted more expert researchers (the two supervisors – Prof. Marina Grishakova and Dr. Frank Nack – and the researcher hosting the research visit – Dr. Catia Prandi). The analysis of the qualitative data followed the procedure outlined by Braun and Clarke (Braun et al., 2014; Braun & Clarke, 2023).

The scope of this analysis is to investigate the interconnectedness of the three sub-systems of information (multimodal system, interaction, and memory) and corroborate their forming the complex game-player collaborative sensemaking system. Due to the very nature of the research question, therefore, a basic expectation of the analysis was to highlight the presence of different features within the same data, sometimes within the same sentences, depending on the different perspectives through which they were analysed. For this reason, the transcriptions have been analysed four times separately, restarting from the clean transcriptions each time. This technique was adopted following the prescriptions of Rogers and colleagues, who suggest it for multilayer analyses (Rogers et al., 2023). This allowed to tag the text independently each time, in order to have clear and consistent data at each iteration. These data sets could then be used to answer my research questions confidently and systematically, one by one. As I will show in the discussion of the findings, this proved to be a good choice, as sometimes the same sentences do in fact highlight different features depending on the perspective taken while analysing the sentence. These nuances would have probably gone lost without separate iterations. Table 4-4 summarizes the criteria for coding the transcripts, divided for each iteration and connected to each research question.[148]

[147] https://www.dedoose.com

[148] The criteria for the analysis have been developed following the prescriptions by Rogers and colleagues (2023), and Knoll. (2018).

*Table 4-4 – Criteria for analysing the transcripts.*

| **Iteration** | **Criteria** | **S-RQ addressed** |
|---|---|---|
| *Iteration 1* | • Evidence of participants retrieving memories to explain what is presented multimodally.<br>• Evidence of the multimodal presentation affecting participants' interaction.<br>• Evidence of participants' creation of new memories based on the interactions with the game.<br>• Evidence of participants' memories affecting their interactions.<br>• Evidence of participants' understanding of their interaction affecting the multimodal system.<br>• Evidence of participants' creation of new memories based on the multimodal presentation of the game. | S-RQ1 & 2 |
| *Iteration 2* | • Evidence of small details of one of the three sub-systems having significant influence on the sensemaking. | S-RQ3 |
| *Iteration 3* | • Evidence of the participants experiencing presence within the game world. | S-RQ4 |
| *Iteration 4* | • Evidence of individual memories participating in sensemaking.<br>• Evidence of individual playstyles and understanding of game mechanics.<br>• Voiced explanations of the working of sensemaking.<br>• Evidence of information being added to a previous set of memories. | S-RQ 5, 6, 7, 8, and 9 |

In discussing more precisely the results of the analysis, the research questions will be addressed one by one. I will discuss the rationale behind the analysis conducted for each research question and I will report the findings of the study.

A preliminary finding is that participants believed that the experiment was intended to evaluate the game and its design. The actual scope of the of the experiment remained unrevealed to all participants until the end of each own session. This allows to assume that the verbalisations of the participants and in general all voiced reports and performed actions were not directly and openly intended to satisfy the current research questions, not at all dealing with the evaluation of the game, which makes the results more reliable.

It should be noted also that some phenomena are more visible in some participants than in others. For instance, P2 reports more often than others how his decision-making is based on what is presented multimodally, while P4 is apparently the participant that most often sees intentions emerging from simple software behaviours.

The results of the analysis are reported in the tables in Appendix I – Findings of the empirical study (Chapter 4).

## 4.7 Findings

### 4.7.1 S-RQ1: Are the multimodal system, the interaction and the memories affecting each other?

This research question is the *conditio sine qua non* of the current study and of the theoretical framework. While this research question might seem to bear obvious results coming from the previous theoretical discussion, it is nonetheless necessary to discuss it in depth, not least because the current study constitutes the first empirical analysis of this systemic perspective and, as such, it must pose its own bases. As such, it is also the basis for any further research that might be conducted on the topic. Moreover, the findings that will provide an answer to this question will help shed more light on the details of the complex sensemaking system. Contrarily, if this research question would turn out to be false, it would not be possible to talk of the existence of a collaborative system between games and players, let alone of a complex one. If no exchanges between the three sub-systems are identifiable, it would mean that each of them operates separately and independently from the others. If, on the other hand, only some of the exchanges are identifiable, it would mean that the sub-systems are organized in a hierarchical structure, one not of mutual exchange but of strict dependences.

In order to reply in full to this research question, it was necessary to separate each relation between the three sub-systems and test them individually. In more operational terms, the interactions of the three sub-systems can be translated into six influences:

1. The Multimodal system affects Interaction,
2. Interaction affects the Multimodal system,
3. Memories affects the understanding of the Multimodal system,
4. The Multimodal system affects Memories,
5. Memories affects Interaction,
6. Interaction affects Memories.

These six influences can then be empirically tested against the collected and transcribed dataset (see Appendix I – Findings of the empirical study (Chapter 4) and in particular the table S-RQ1 & 2). The detected presence of each of the six influences should corroborate the presence of the interaction between the three sub-systems. Therefore, if in the transcripts a sufficient representation of the six criteria can be found, this would mean that evidences support a positive answer to S-RQ1. I will now discuss each influence separately.

Before continuing, it should be noted that the six influences are here considered as macro-level phenomena, in line with the theory on which they are based (see Chapter 3). As the current experiment is the first exploration of the holistic framework of video game complex sensemaking, it has been decided to avoid focusing on fine-grained phenomena and to pay attention instead to more macro-level ones, in order to form a solid overall foundation on which further, more granular research can be conducted. Throughout the text, I will highlight some of the possible directions additional research may take.

Several behavioural clues can be brought into the discussion of this influence, among which the fact that all participants tried to avoid spears, to jump over spiked pits, to attack skeletons and to defend from bats' projectiles, to press the buttons that appeared in the screen, etc. (E1)

A number of a number of other statements and behaviours (E2–E15) show clear evidence of this influence, in different moments of the game, like the encounter with the hanging ally (E2, E3, E4), the interactivity trap (E5), the golden coin (E6, E7), the crossroad (E8, E9, E10), the fake flames (E11, E14, E15) and the combos (E12). E2 and E6, in particular, clearly foreshadows the fact that the "visual input" is the basis on which their choice regarding how to interact with the game was based. E6 also explains one of the reasons why all participants in the study saw the golden coins and went on to collect them.[149] Overall, 12 out of 14 participants clearly vocalized the recognition of this influence (all participants but P8 and P13). These findings support the existence and the wide scope of this influence, which can be observed throughout the entire game. Given these findings, it is therefore possible to obtain support for its existence.

From the evidences collected arise interesting patterns. A number of examples show that the multimodal system most often provide navigational information (E2–E9), that is, information on where and how to move to achieve success in the game. Less represented, but still present, are the cases in which the multimodal system helps in defining a game-long strategy, as it happens for E10 and E11. In E12, and arguably also E1, it is possible to observe the multimodal system informing players about interaction mechanics, i.e. how to physically interact with the game in the first place, to the point that absence of the multimodal system in this role of bearer of interaction mechanics is considered marked, at least according to P9 (E13).

Furthermore, it is visible that this influence presents itself at both a very small-scale level (when participants were faced with a particular trap, like the timed flames,[150] or the interactivity trap – E5, E11), at a medium-scale level (e.g., how to behave in portions of levels, e.g. with the hanging ally or when near the golden coins; E2–E6) and at a big-scale level, when decisions can potentially impact the entire course of the game (e.g. when faced with the potentially decisive decision on which of the two available weapons to collect; E8–E10).

Particularly noteworthy are also those occurrences in which it is possible to spot an automatic response to the multimodal stimuli. For instance, when blocked by the interactivity trap within the fake flames, eight participants reacted instinctively to the flames blowing by suddenly either pressing the jump button or pushing the analogue stick (E14). Even more fascinating is the fact that three

[149] The other reasons for this behaviour will be discussed in section 4.7.1.5 "Memories and interaction".

[150] Similarly than for golden coins, further reasons can be found to explain this behaviour, reasons that will be discussed below.

of these eight participants, when asked about the fake flames during the interview, reported to not have noticed them (E15). This could be argued to show that the influence is so well-established to trigger pre-conscious responses, at least in this occasion.

As it could be observed, all of these verbalizations are referring to visual semiotic modes (still and moving images), in one way or another, while the aural and haptic modes are do not appear in this set of data. This could seem to suggest that visual modes are particularly prominent in informing this influence, while other modes are less. However, this phenomenon could also highlight a limitation in the design of the testing game, namely audio and haptic feedback were not implemented in a sufficiently informative way. More particularly, audio and haptics were not implemented as bearing significant information for the current game, or their informativeness was not distinct enough from the visual clues. This, together with the conspicuous influence of vision in human cognition (Hutmacher, 2019), could explain the absence of aural and haptic modes in the evidence collected. More precise investigations of the other two modes could be achieved by designing a testing game with more prominence given to them than in the game employed for the current study (e.g., a haptic game, or a rhythmic game).

A side note that should be added here, that will also partly apply to other points of the discussion, is that some conceptual metaphors (Lakoff & Johnson, 1980/2008) make it sometimes difficult to understand exactly what participants mean in certain vocalizations. The clearest case is the conceptual metaphor "seeing is understanding", particularly frequent for P14, which produced examples like the ones reported in Table 4-5. While these could be somehow easily interpreted as examples of the influence between the multimodal system and the participants' interactions, they are most probably not. It is quite likely that the "vision" referred to here is not the physical perception of visual stimuli, but the metaphoric understanding of the situation in which the participants find themselves, or at least a mixture of the two. All the somehow ambiguous vocalizations of this kind have been excluded and do not figure among the evidences brought to answer this and the other research questions.

*Table 4-5 – Examples of metaphorical uses of vision.*

| **Participant and occasion** | **English translation** | **Original in Italian** |
|---|---|---|
| **P14**<br>**Think-aloud** | *seeing that the road goes on*<br>*I continue* | *vedendo che la strada va avanti*<br>*proseguo* |
| **P14**<br>**Think-aloud** | *seeing no other possibilities*<br>*I continue toward this unknown portal* | *non vedendo altre possibilità*<br>*proseguo verso questo portale ignoto* |
| **P2**<br>**Think-aloud** | *I jumped the obstacle because I could see that if I didn't jump over it I would keep dying* | *ho saltato l'ostacolo perché vedevo che se non lo saltavo continuavo a morire* |

#### 4.7.1.2 Interaction and multimodal system

Inverse to the one just discussed is the second influence, namely that between the participants' interaction and the multimodal system. This influence could be simply supported by the fact that the game worked and responded to participants' inputs as expected (thus, that the multimodal system was affected by players' inputs). However, the collected evidences allow to identify this influence in the verbalisation and/or in participants' behaviour (E16–E28).

In the current dataset, this influence seems to visibly present itself mostly when it is particularly satisfactory (E16–E21). For instance, all participants at least once expressed satisfaction (with comments or facial expressions) when overcoming obstacles (E16, E17), they acknowledged the change in the multimodal system when saving the hanging ally (E18, E19), or they commented positively the animation of candles lighting up while they walked below them in the boss room (E20, E21). This positive reaction could be due to a cognitive effect similar to what Bühler calls "Funktionslust" (Bühler, 1926), i.e., a pleasure taken in exercising a mental or bodily function. On the contrary, the absence of a multimodal reaction to a player's interaction is evidently considered marked: hardly explicable, and possibly symptom of a fallacy in the system (E25–E28). Participants considered marked even a slight mismatch between interaction and the multimodal reaction (E23, E24), while a more direct and evident multimodal feedback to interaction is mentioned as desirable (E22). These examples highlight that a correlation between interaction and the multimodal system is not only well received by players, but considered a standard and indeed a minimum requirement for the game-player system to function properly.

Therefore, the fact that players have an impact on the game and its multimodal system is supported simply by the very fact that they could actually play the game. However, the examples reported also show that all participants perceived an influence of their action over the multimodal system. Therefore, the presence of this influence is supported by the collected data.

#### 4.7.1.3 Memories and multimodal system

The third influence to investigate is that between memories and the multimodal system, and namely the influence that previous experiences and knowledge exert on players' understanding of what is presented to them multimodally. While the evidences regarding this influence are particularly numerous, they can be ascribed only to 10 out of 14 participants (E29–E56).

The evidences could be divided in two macro-categories: those that recall to the mind the experience of playing with the testing game itself (intra-game memories; E46–E56), and those that refer to external sources, including experiences with other games (extra-game memories; E29–E45). In both cases, these evidences show that memories are evidently informing participants' understanding of the multimodal system. Furthermore, as reported by at least two participants (P6, P4), memories are recollected not only based on the visual counterpart of the multimodal system, but also on audio clues (E33, E35).

With regards to extra-game memories, particularly frequent was the mention of previous knowledge when participants identified danger (spikes, spears, flames, enemies; E29–E34, E36, E42–E45). In these vocalisations, the markers "always," "usual", and similar, whose appearance is quite frequent (E29, E35, E37, E38, E42, E44, E45), refer exactly to the fact that the participants assess the meaning of these elements as well-known and predictable, due to their established existence in their mnemonic information. The memories that participants showed to be recollecting present differences in terms of sources. While for some evidences the specific sources are not completely discernible (E42–E45), some clusters of sources remain detectable, among which we can find: experience of the real world (E29), cultural knowledge (E30–E34), knowledge of customs of entertainment media in general (E35) or of video games in general (E36–E40), and reference to one specific game or game genre (E41).

Cultural knowledge is particularly interesting to observe. Statements such as "they were hostile because they were ugly" do not directly refer to knowledge or experience with other games, but it is based on a more general psycho-aesthetic view of the world that is part of a culturally situated knowledge often reiterated in entertainment products but arguably dating back to the Hellenic *kalokagathia*, the correspondence between physical beauty and purity, goodness of soul (and its contrary, the correspondence of physical deformity to abomination, corruptness, depravation) (see Jaeger, 1986 for a more detailed description).

Another interesting observation is that previous experiences with video games not only informed what was presented, but also helped to produce two alternative possible continuations of that situation, thus influencing the perception more than by just informing readings of the present (E38–E40). This entailed a sort of "over-reading" of the testing game by the participants, where non-implemented and non-hinted-at features, such as traitor allies or secret passages, were expected due to video games customs stored in participants' memory.

Intra-game memories similarly inform participants' perception of the multimodal system. The evidence collected show that the information most frequently recollected regards the function of one specific game element (E46–E51, E53), like the interactivity trap or the final boss, while information on game rules is recollected but much less frequently (E52). Quite notable is also the fact that the memories informing the understanding of the multimodal system can be superseded by different ones within a short time span and can heavily impact one's understanding of the environment from there on: after only one encounter with the fake spikes, participants expected all following spikes to be fake (E53).

On the contrary, when the expectations are disrupted and a mismatch is identified between the behaviour of the system and the memories of such behaviour, participants were thrown into confusion and detected said mismatch as a marked trait (E54–E56). This happened when elements with a certain multimodal appearance did not work as customary (according to both extra- and intra-game memories; E54), when the system showed elements that the participants knew to be out of context (E55), and when the multimodal system behaved inconsistently

with its "usual" behaviour throughout the game – particularly with regards to haptic feedback, in the collected evidence (E56).

There is therefore considerable evidence supporting the existence of the influence between memories and the multimodal system, both regarding memories inherent to the current game being played, and referring to a wider background (the real world, one's cultural knowledge, and one's memories regarding customs of entertainment media and other games). Even if this was visible only in 10 out of 14 sessions, the minimum requirement is met and the existence of this influence is supported.

#### 4.7.1.4 Multimodal system and memories

The influence inverse to the previous one is that between the multimodal system and memories. It should be noted that this influence is not very well represented in the data collected (E57–E62, E48–E52), but the minimum requirement of 70% for supporting its presence is still reached as evidences can be found in 10 out of 14 sessions.

This relative underrepresentation is probably due to the fact that it is uncommon to state sentences like "I see this and I will remember it", and it is sometimes necessary to infer the presence of this influence from less direct clues. For instance, it could be possible to argue that if memories built within the game are later used to contextualize new sections of the same game, as shown in the previous section, then some memories need to be built in the first place. However, from these indirect clues it is quite difficult to infer how much of these memories are built on the basis of the multimodal system alone.

What could still be concluded from the gathered data is that apparently this influence becomes more overt in very specific moments. Participants mentioned to be studying the multimodal system to infer and memorise different patterns (E57) among which the timing of the flames (E58), of the boss attacks (E59), and of interactivity traps (E60–E62). Lastly, from some of the evidences collected for the previous influence (specifically, E48–E52) it can be clearly concluded that participants recognized some entities as enemies at least partly because they were shown as being summoned by the dark figure in the starting clip. Even from the limited amount of evidence available it is therefore possible to observe the working of this influence. For this reason, the presence of this influence is supported by the collected data.

#### 4.7.1.5 Memories and interaction

Similarly to the influence between memories and multimodal system, in this case, too, mnemonic information can be based both on information outside of the current game (from real life, or from other fictional works including games), and on information based on and built while playing the testing game. In the transcripts it is possible to find a quite substantial number of vocalizations referring to this influence, and 13 out of 14 sessions showed evidence supporting its presence (E63–E83).

It is indeed quite common to find in the dataset this influence, reported with sentences like "I do this because I know this". Similarly to the findings of the memories and multimodal system influence, we can distinguish two kinds of memories informing interaction: extra-game memories (E63–E74) and intra-game memories (E75–E81).

A noticeable pattern with regards to extra-game memories is that, when informing interactivity, they all relate to previous videoludic experiences – in general or with a particular game. This holds true for memories informing participants about interaction mechanics (the ways to physically interact with the game; E63, E64), interaction affordances (the actions available to the player during the game, and their effect; E65–E67), and interaction strategies (the best ways to interact with the game, the ways that most directly conduct to winning; E68–E73). In fact, all participants were able to win the game without being instructed on how to interact with it (as the explanation of the interaction mechanics was willingly avoided), without having explanations on the functioning of the weapons (and specifically of the shield), and without being suggested to behave in one or another way for a quicker resolution. Particularly interesting with regards to the latter is the fact that all participants spent time to collect the two golden coins. As no value was assigned to the coins throughout the game, this behaviour has no other reasons than participants' previous experiences with other games (E72, E73).

Contrarily, the mismatch between memories on interaction and actual interaction is considered marked (E74), with a participant knowledgeable in PlayStation interaction mechanics vocalising some difficulty to adapt to the Xbox ones, adopted in the game.

On the other hand, the retrieval of intra-game memories to interact with the game itself became particularly visible when participants were faced with the boss, which behaviour was designed to mimic that of other monsters found previously. The fact that participants did mention to be behaving on the basis of what they had experienced earlier in the game (E75–E78) supports the idea that intra-game memories influenced their interaction strategies. Evidences show that the memories were retrieved to decide how to interact also with unwelcomed effects, particularly after participants got acquainted with fake spikes and learned that spikes were no more dangerous (wrongfully, but due to specific design decisions; E79–E81).

In one example, intra-game game and extra-game memories arguably competed in informing the player's interaction (E82), with extra-game knowledge ultimately prevailing – which in the end dictated an unsuccessful interaction strategy. However, contextual reasons likely impacted the prevalence of extra-game memories, namely the fact that dying is not punished in the game, which thus supports a more explorative and less cautionary attitude.

Lastly, it is remarkable that at least once participants evidently considered marked the fact of not having knowledge on how to interact when blocked by the first interactivity trap (E83). Later encounter did not cause the same effect, as at

that point sufficient information were retrievable from the participant's memory to decide the successful interaction strategy with the interactivity traps.

These examples show that this influence is identifiable in the transcript of all participants, supporting the idea that memories deeply affect the ways in which players interact with the game.

#### 4.7.1.6 Interaction and memories

The influence between participants' interaction and their memories is the last one to be discussed. That memories and experiences have been built through the testing game is visible from several behaviours displayed in-game. These behavioural evidences, in addition to several vocalisations, make it possible to state that 11 over 14 sessions showed evidence of this influence (E84–E102). It is therefore possible to support the existence of the influence between interaction and memories.

It is quite evident by looking at the play sessions that all participants became increasingly proficient with the combos and could win the game by using them, even if many of them expressed doubts and reported finding them very unintuitive at first, thus showing an enactive learning mechanism through which players learned and memorised the interaction mechanics through interaction (E84). Noticeable is the fact that participants apparently expected the design of the game to encourage and support this enactive learning (E85, E91).

Other evidences facilitate in depth observation of the working of this influence. It is possible to identify three ways in which interaction affects memories: intentional explorative interaction, intentional confirmative interaction, and interaction without learning intentions. With intentional explorative interaction, participants try to construct new memories through a trial-and-error, without an expectation of a definite outcome but rather as a way to exclude one of the possible hypotheses (e.g., whether it is possible to crouch or not; E85–E93). Intentional confirmative interaction, on the other hand, is an endeavour undertook to solidify one's already-acquired knowledge, thus expecting a specific outcome of the action, relying on the regularity of inputs-to-outputs (e.g., rehearsing the combos; E94–E96). Interaction without the intention of learning refers to a somehow passive enactive learning, mostly achieved when failing and therefore without expectations (e.g. when dying or when falling in the interactivity traps; E97–E99). In one case, the failing was prevented by the fake spikes, but the resulting unintentional learning verified nonetheless, even if it meant overwriting other memories (E100).

Furthermore, the evidence collected show that interaction can construct memories about interaction affordances (E85–E90, E94, E99), about the most successful interaction strategies (E84, E91–E93, E97, E98, E100), and, although apparently with less frequence, interaction mechanics (E94). The evidences collected also show that through intentional explorative interaction, interaction affordances can become intra-game interaction strategies (E95, E96).

Lastly, it is clearly visible from the data collected that the absence of sufficient interaction determines absence of memories (E101, E102). This holds true both for interaction mechanics (E101) and for interaction affordances (E102).

#### 4.7.1.7 Conclusions for S-RQ1

The three relations and six influences that describe the interaction between the multimodal system, players' interaction, and players' memory have been discussed one-by-one, searching for their visible presence through the behaviours and vocalizations of the participant to the study. Some influences are more prominently visible than others, but it is still possible to support the presence of all of them. On the basis of these data, it is therefore possible to support a positive answer to S-RQ1: the multimodal system, the interaction and the knowledge ca be said to affect each other in the sensemaking process of a video game.

Furthermore, the current findings show that what has been discussed in Chapter 3 with the general notion of "memory" needs to be further problematised and expanded, as different kinds and sources of memories have been identified. The main distinction detected is that between memories that refer to the specific experience at hand (here referred to as intra-game memories), and those that refer to external sources (extra-game memories), including similar experiences (other games), embodied experiences of the real world, cultural memories, and knowledge of customs of the entertainment industry. In the current dataset, this variability is particularly noticeable with regards to its affecting the perception of the multimodal system. When affecting interaction, only memories of previous playing experiences seem to be relevant. This could be due to the genre of the testing game, and could change significantly for other kinds of games (e.g., car racing games might draw more from real-life driving experiences). As it should be evident these kinds of "memories" are not discreet categories. Their confines are blurred, and they often intersect each other (e.g., experiences with games and other entertainment products can be part of an overall cultural memory). Regarding intra-game memories, a quite curious finding is that these are overwritten with quite quickly, as only one encounter with the fake spikes created the expectation of all spikes being fake (E53, E79–81). In the dataset, it was even possible to observe the moment of overwriting as it was happening (E100).

An additional finding of the analysis conducted so far is that perception and memories, while both informing decision-making (and the resulting interaction), seem to prevail one on the other in some circumstances. For instance, the multimodal system seemed to inform decision-making more prominently than intra-game memories for many participants when approaching the portal to the boss room (E103), while the opposite was true for half of the participants when approaching the malfunctioning skeleton (E104). No correlation between average weekly play times and increased reliance on either the multimodal system or memories could be detected, but this could change if taking into consideration a lower level of expertise in playing. Such investigations are left to further studies.

While, as said, the criteria employed to filter the transcripts focused on macro-level influences, the current analysis opens the way to and invites more fine-tuned further research by constituting a theoretically and empirically-solid basis.

Lastly, it should be noted that the influences discussed in the previous sections and in the relative table were as streamlined as possible and selected to be clearly showing the direct influence of one element to another. However, in reality the influences are much more complicated and indirect. Different kinds of memories, and different elements of the multimodal system often guide in synergy how players interact, and vice versa, so that clearly distinguishing them is often very difficult.

An example of this is reported in Table 4-6:

*Table 4-6 – Example of how the six influences can often present themselves: a clear distinction of them is not possible.*

| | **English translation** | **Original in Italian** |
|---|---|---|
| **P8 Interview** | *E: how did you know that the skeletons were enemies? P: because they looked threatening, then all the entities I had encountered up to that point were attacking me, and then afterwards they had... already approached me and tried to a... hit me, so I started to slash around* | *E: come sapevi che gli scheletri erano nemici? P: perché sembravano minacciosi, dopo tutte le entità che ho incontrato fino in quel momento mi attaccavano, e poi dopo mi avevano… già mi si avvicinavo e cercavano di a… colpirmi, quindi ho iniziato a dare le spadate* |

In these sentences, it is easy to detect several reasons for P8's decision on how to interact: the "threatening look" of skeletons, grounded in P8 cultural background; the visible approaching of the enemy; the memories inherent of the current game, according to which "all enemies attacked" – all these work in synergy, forming complex constructs on which decision-making (and therefore interaction) is based.

### 4.7.2 S-RQ2: Are the three components presenting feedback loops?

To answer this research question, it is possible to rely on the findings of S-RQ1. If (and only if) all six influences and three relations are verified, a positive answer to S-RQ2 can be supported, as the six close a loop.

On the basis of the evidences discussed so far (E1–E104) and on their analysis provided above, all six influences can be observed. Therefore, a positive answer to S-RQ2 is supported: the three sub-systems can be said to present feedback loops. The circularity of these feedback loops provides support to the idea that all three sub-systems of information are affecting and at the same time being affected each by the other two, as hypothesized in the theoretical discussion.

### 4.7.3 S-RQ3: Are the feedback loops affecting different levels of granularity?

To prove or disprove this question, it is necessary to identify whether for some of the six influences discussed above we can observe a small part of one of the three system influencing the entirety of its system or of another one, or even affecting the general sensemaking process of the game. If such cases can be identified, it would mean that there is ground to support cross-granular exchanges.

Some evidences point towards a positive answer to this research question – that feedback loops can be said to affect different granularity levels (E105–E110). Among these we can identify visual semiotic modes (a part of the multimodal system) mentioned as the main or only basis for interaction (E105, E106) or for interaction and memory construction (E107). Colour, an even smaller element forming the multimodal system and specifically the visual semiotic mode, is indicated as the basis for interaction in one case (E108). Furthermore, a minor pseudo interaction mechanic such as input delays (deriving from a technical aspect of the software managing the hardware inputs) is mentioned as requiring memory construction in two cases (E109, E110). Notwithstanding the cases reported here, influences are mostly expressed as occurring between entire sub-systems.

The little evidence of this phenomenon is likely to be due to a limitation in the design of the testing game itself. To observe more clearly the existence of inter-level exchanges, or of none respectively, the design of the game should include a number of instances where, e.g., a single semiotic mode is of particular relevance in informing interaction. This would likely allow to expose the functioning of inter-level influences. However, as no such instances were present in the testing game, only spontaneous evidence could be observed at this point. These non-elicited proofs make arguably make a strong case, but their underrepresentation in the current dataset remains, making it difficult to give a definite answer to S-RQ3.

The data collected during this experiment therefore are not strong enough to confidently provide a final answer. The evidence resulting from the current dataset can only hint at a positive answer to S-RQ3. For the current piloting study, this can be considered enough, if the other eight research questions are answered positively.

### 4.7.4 S-RQ4: Are there more-than-combinatorial aspects that emerge from the interaction of the three components?

As discussed in Chapter 3, emergence is strictly related to self-organization, openness, adaptation, growth, and change. The openness of the game-player system allows it to encompass not only what has been hard coded by the creator of the video game, but also the influences and the changes that come from the players, who co-construct the experience and its meaning. The adaptability of the game-player system allows this openness to be not disruptive but productive, and it is itself enabled by the ability of the system to change and self-organize. Emergent aspects are those that sprout precisely from this self-organization, and from the

players' creative and interpretive freedom. This also means that the system can grow beyond the limits set by the designers. Therefore, some of the evidence reported here might be repeated also below, for S-RQ5 to S-RQ9.

The phenomenon that has been considered to investigate this research question is the participants' experience of presence. As mentioned in Chapter 3, immersion and presence can be considered features emerging form the interplay of the three sub-systems. It is relatively easy to detect the insurgence of the feeling of presence: syntactic constructions that employ the first person mean that participants felt themselves as being part of the game, as being present. Presence is easily identifiable in the current dataset, as all participants talked in first person about the task they were performing (E111), both while playing (E112–E114) and when reflecting upon the experience during the interview (E115–E117). Significantly, at least one participant (P1) demonstrated to be well aware of the fictionality of presence in the game, but this awareness did not prevent presence to emerge from his playing session (E118).

The analysis conducted has highlighted another emergent aspect – not foreseen in Chapter 3 – that has significant representation in the dataset, namely the considering of characters as intelligent, as possessing will, or as being able to reason independently. According to the collected evidences, some participants saw clear intentions behind basic pre-programmed software behaviours, not only when encountering the head monster (E119), which has a more varied behaviour (floating back and forth, placing traps), but also in case of extremely simple actions like those of the malfunctioning skeleton (which has a walking animation but no walking script, thus remaining still) (E120). While in the first case the timely (but random) reaction of the game instilled in the participant the belief of intelligence, in the second case, interestingly, the absence of timely reaction achieved the same result. Furthermore, one participant (P4) often addressed entities as sentient beings (E121). Lastly, three participants (P3, P5, P7) showed at least partly an empathic response to the hanging ally (E122–E124), which foregrounds an understanding of him as a sentient being. Interestingly, all these three participants identified as females. These findings show that from simple algorithmic processes comes a perception of high cognitive functions, due to a coincidental alignment between the participants' in-game behaviour, their knowledge of the situation at hand, and the timely reaction of the game. This phenomenon can therefore be regarded as an additional aspect emerging from the complex-systemic nature of video game sensemaking.

These results show convincing evidence to support the presence of aspects emerging from the interplay of the three sub-systems of information (S-RQ4).

### 4.7.5 S-RQ6: Can we detect openness in the system?

The openness of the game-player system comes mainly from the process of reception, and from the sort of dialogue between the game and the player (see Chapter 3). What the contribution of players is in this exchange is indefinite and

only partly predictable by the designers,[151] making the system quite open. The openness of the game-player system, then, is its ability to encompass not only what has been designed and hard coded into it, but also the contribution of the players in the co-creation process constituting video game playing.

For instance, the design of the graphical aspects of the game has been decided mainly for quick implementation, and without inspiration from any particular game. However, for some participants the graphic style set a solid frame of reference with which to guide their sensemaking of the entire game. A clear instance of this can be detected in vocalization of the participants immediately after the beginning of the starting clip, referring to classic arcade games (P1; E125) or retro-styled games (P4; E126).[152] The fact that the two participants vocalized two different memories is quite telling, as it demonstrates that at least part of the sensemaking process is not and cannot be in complete control of the designers, as hypothesized.

Another instance of the openness of the system, manifesting itself with regards to the interactions of players, is observable in one particular behaviour, not intended in any way during the ideation phase nor supported by the design of the game, and thus coming entirely from participants' freedom to interact as they preferred and according to their experience as players: participants looking for easter eggs or secret areas. This behaviour is quite well represented in the dataset (E127, E128).

Openness is also what allows the system to encompass different play styles, which was clear even in the small number of participants of the current experiment. It should be reminded again that even though there are ways to support different play styles through the design of a game (Koster, 2005), this was not done for the testing game, and any play style exhibited by participants has come from their own preferences and individual approaches to video games, thus showing further the openness of this system. For instance, two participants had diametrically opposite styles, with one of them displaying a very explorative behaviour (P4; E129–E130) and the other a very rushed and inattentive one (P2; E131). In another case, a participant showed to play not following the rules of the game itself, but rather his own "fair play" rules (e.g., avoiding exploiting what he perceived as bugs, such as the fake spikes; E132, E133).

A more practical openness would come from more impactful choices that afford strong local or even global agency to their players. This was not possible to achieve for the testing game, given its limited scope, budget, and development time. However, the game in its current form provided enough data to support a positive answer to S-RQ6, since several evidence can foreground the openness of the game-player collaborative sensemaking system.

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[151] It could be said to follow the Pareto principle (Pareto, 1897/1964), meaning that the majority of it is still in the hands of the designers while not for this being completely dictated by them.

[152] *Mame32* games and *Broforce* (Free Lives, 2015), respectively. *Mame32* (https://www.mamedev.org) is an emulator of several older game hardware, including arcades, old consoles and old computers.

### 4.7.6 S-RQ5: Is there a degree of self-organization?

The self-organizing ability of the game-player system is made strikingly visible when the system is trying to adapt to something unexpected and potentially system-breaking (E134–E140). In these cases, participants showed to be looking for alternative explanations of an unusual behaviour, and particularly interesting is the fact that they always did so by finding intra-game information to explain this unexpectedness. This happened for the fake spikes (E134–E136), the interactivity traps (E137) and the fake flames (E138, E139). These evidences show that the game-player system is capable to fill-in gaps and potentially senseless or inexplicable elements by re-organising itself, changing the mnemonic information as needed.[153] However, the interactivity traps which only at first generated confusion (E140), showing that the game-player system (through the modification of players' memory) re-organised itself to encompass the new element of the interactivity trap – it adapted, as will be discussed in the next section.

Looking at the sensemaking related to narrative is particularly insightful to address this research question as well. For this reason, at the end of the interview participants were asked to briefly summarize the story of the game they played. These summaries[154] differ quite substantially from one another, even more than expected. As mentioned, the general idea behind the design of the story is rather standard: an imprisoned villain frees himself and attacks the king's castle, some guards face him but are initially defeated. However, one heroic guard gets back up and eventually defeats him. Only five participants (P1, P3, P5, P6, P9) understood the story exactly as designed (E141–E143), and additional two (P10, P11) changed only rather small details (E144, E145). Other three participants (P4, P8, P13) interpreted the story changing its scope and therefore the point of the journey of the main character (E146–E148). Two participants (P2, P7) stated to be unable to summarise the story (E149), while other two (P12, P14) were not asked to summarise the story due to their own imposed time constraints. This variability shows that player's sensemaking organised differently (although sometimes slightly) on the basis of the same object of study thus showing that the control is not entirely in the hands of the designers, as per the hypothesis put forward in Chapter 3 (and particularly in Section 3.3.4 "Self-organisation"). However, this also goes in support to the view of the Pareto principle (see again Section 3.3.4 "Self-organisation") as working in the game-player system, as the overall narrative understanding mostly does not differ massively from player to player. Furthermore, it is notable that different interpretations had identifiable consequences for at least one participant's understanding of game mechanics (P13; E150), thus hinting to the fact that this self-organisation has a holistic reach.

[153] This type of self-organization comes most prominently from the player's side of the system.

[154] The full text of the summaries is available in "Appendix II – Reported summaries of the story of the testing game".

Other more subtle evidences of subjective self-organization can be observed. As mentioned in the discussion of S-RQ4, P1 and P4 saw in the multimodal presentation allusions to two different sets of memories, namely classic arcade games and retro-styled games (E125 and E126, respectively). These two different sets of memories imply dissimilar frames of reference, bringing with them different customs and rules, and therefore setting different expectations to guide the sensemaking process. In response to these differences, however, the game was still perfectly understandable, and, looking at the stories recounted by the two participants involved (P1 and P4), the overall experience turned out to be quite similar. This can support the view of the Pareto principle as working in the game-player system, too, as initial differences can end up in quite similar results.

The considerations on the difference in sensemaking produced by different backgrounds of players opens to a further investigation route, that could shed additional light on the openness and self-organization of the system. Designing and testing a game to capitalize on players' diverse backgrounds could expose the degree to which self-organization could be stretched, and can test how much the game-player system is actually open. Furthermore, additional observation of the ability of the game-player system to self-organize could be achieved by designing a game with sudden changes in visual style (e.g., from 2D to 3D, from pixelated to photorealistic, etc.), in gameplay (even switching from one genre to another, e.g. from a First-Person Shooter to a walking simulator), or other unexpected modifications (e.g. changing interaction mechanics, switching from normal video game to audio-game, etc.). Another direction of further research could investigate how these changes can overwrite existing interpretive frames, and at which point they start becoming surprising.

For now, nonetheless, the results of the tests conducted can be said to suffice to support a positive answer to S-RQ5

### 4.7.7 S-RQ7: Can we detect adaptation in the system?

Adaptation is the ability of a complex system to still work even when new things are inserted (or, possibly, removed). It can be considered one of the results of the ability of the game-player system to self-organize. As such, to investigate the presence or absence of adaptation it could suffice to cross-check the results of S-RQ5 and S-RQ6 with How the play sessions ended. In particular, if differences caused by the players' contribution (which is not fully accountable for in the design phase) in the collaborative sensemaking impede the overall playing experience (e.g., by preventing players to reach the end), or anyways caused a significant disruption of it (e.g. by causing major impediments to reaching the end), this would mean that the system is scarcely adaptable. On the contrary, if no significant difficulty in reaching the end of the game and in grasping the overall sense (though with variability) notwithstanding differences coming from the openness and accommodated by the self-organization, then the system exhibits a good degree of adaptability.

As discussed above, the system is able to adapt itself to mutated circumstances introduced by the players' side in the process of co-creation of meaning. So, for instance, the rushed playstyle of P2 caused him to miss significant parts of the game (e.g., the crossroad, the hanging ally), and the interaction affordances of one of the two wieldable weapons (the shield), but it did not prevent the playing experience to happen in full: P2 completed successfully the game, with no significant difference with, e.g., P1, who has been much more attentive throughout his play session.[155]

Even the examples of participants looking for an explanation in their knowledge about the game of apparent misbehaviours (E134–E139) shows the adaptability of the game-player system, that does not collapse even when internal issues arise. It is clear, furthermore, how the system adapted to encompass quite quickly and unproblematically the interactivity traps, initially held as problematic and "disruptive" (E140). In the end, the interactivity traps have been incorporated by the system and normalised so much that P4 even suggested to make more extensive use of such traps (E151). This a sign that the game-player system has adapted to fully accommodate interactivity traps as the norm. Particularly significant is the fact that these misbehaviours do not even need to be completely understandable or explainable to be unproblematically encompassed by the system (E152).

Furthermore, while many participants initially complained about the scarce intuitiveness of the combos, all of them eventually proceeded to complete the game without major difficulties (E84), showing a quite strong adaptability also with regards to interaction.

As it emerges, the adaptability comes mostly from the players' side. Some smaller degrees of adaptability could be achieved in particular game genres (e.g., sandbox games), where the combinatorics of the game allows for a great adaptability to the users' creative freedom, or in games powered by artificial intelligence. These phenomena could be further explored in future studies through these kinds of games. For now, the proofs discussed support a positive answer to S-RQ7.

### 4.7.8 S-RQ8: Can we detect growth in the system?

With the current experiment the aim has been to observe the growth that happens during a single run. For instance, new interaction affordances are given to participants as they progress in the game, through the acquisition of different weapons. The weapons are not only additions within the game (as they add elements to it, thus making it "bigger" than before), but they also prompt the recollection of several memories, and they provide different interaction affordances. For instance, the shield not only adds the shield itself, but it summons in the participants the recollection of possible uses for a shield – in this case also the somehow

[155] With the current demographic and TIPI data, P1 and P2 seem to present considerable differences only in terms of "Extraversion", where P1 scores "Medium High" and P2 scores "Low" (Extraversion is the quality of being "sociable, assertive, talkative, active, NOT reserved, or shy" (Gosling et al., 2003, p. 508)).

conventional ability of reflecting projectiles, apart from the more intuitive use for protection. This made the game-player system grow further, encompassing not only the shield itself, but also the contribution of the player, which in turn changed and added elements to the specific interaction affordances. It was possible to identify evidences showing that additional interaction affordances were associated with a multimodal clue, and with additional memories and knowledge, which could then be used also later in the game (E153–E155).

Furthermore, the intra-run growth of the system is also particularly visible in the case of the head monster and its relationship with the interactivity traps. As per design intentions, upon reaching the head monster and observing it place the interactivity traps, participants were supposed to understand and retrospectively realize that all (even previous) traps were indeed created by this monster. Evidence show that this was mostly the case (for all participants but P2, P3, P7, P12, and P14; E156–E158), which, together with a similar example with the fake spikes (P8; E159), highlights that the growth can happen also by adding knowledge in retrospection, on the basis of something already consolidated.[156]

We can therefore observe several instances of intra-run growth of the system, meaning that evidences corroborate a positive answer for S-RQ8. The growth of the gam-player system could be detectable by asking participants to replay the testing game. While replaying the game, their behaviour will predictably be different from the first run. This is arguably due to the fact that the participants built new memories and knowledge while playing the game, knowledge that would be used to inform this second play session. A game more specifically designed to test this inter-run growth would be the basis for an interesting follow up study.

### 4.7.9 S-RQ9: Can we detect change in the system?

The answer to this research question can be subsumed from the answers to S-RQ4 to 8. The fact that the system is open to the partly unpredictable contributions of the players, that it is self-organizing in response to these contributions, and therefore that it adapts to it, added to the fact that it grows due to internal dynamics, makes the system highly susceptible to change. Observing the system at two different moments, it is therefore extremely likely to identify differences.

These changes are quite easy to detect at large scale: looking at the multimodal presentation, at the interaction affordances, and at the players' memories, and at the ways in which these three inform each other at the very beginning and at the very end of the game (the largest scale in this context), it is quite evident that several changes occurred. For instance, once again, at the end of the game players could not only accept but even coherently explain with a narrative motivation the

[156] This notwithstanding at least one participant who did not at all carry out the retrospective realization. Being the participant P2, whose rushed attitude caused several other inattentions, this is not deemed problematic here.

reason why at some moments their character gets completely stuck by the interactivity traps.

However, several evidence support the idea that change can happen quickly, and can be observed at a much smaller scale. For instance, the spikes have provenly been dangerous for the entire game, and indeed at the encounter with the fake spikes P13 considered their behaviour (not being harmful) as marked (E160). However, shortly after this single encounter with the non-damaging fake spikes, P13 considered marked the usual behaviour of the spikes – being harmful (E161). This seems to show that at least for P13 a change has been sudden: from a certain moment on, the spikes went from being dangerous (initial knowledge) to not being dangerous (current knowledge), thus prompting a certain (and different from now on) interaction strategy. It is possible to argue therefore that while the system tends to resist change, it nonetheless changes quite quickly and relatively unproblematically. This in turn supports the idea of several possibly sudden changes throughout a game play can and do happen.

For these reasons, then, the current dataset supports a positive answer to the last sub-research question, S-RQ9.

## Conclusions of Chapter 4 – Testing the complexity of game-player systems

The nine sub-research questions that have been discussed in the current chapter paralleled the defining feature of a complex system as indicated by Stepney. Eight research questions received evidences supporting a positive answer, while one showed encouraging results but could not be entirely answered positively. At the current stage and with current results, it is possible to conclude that empirical evidences corroborate the theory according to which video games are understood through the complex game-player system, informed by the game's multimodal presentation, player's interaction and player's memories. This means that the validity of the theoretical framework delineated in Chapter 3 is supported by the empirical study conducted and described here. Even more, the empirical analysis showed that the framework outlined in Chapter 3, although already complicated, must be further problematised to encompass the complexity of players' memory, which could be said to include embodied and cultural knowledge, gaming experiences, skills, but also memories more specifically related to the game at hand. The study also found aspects emerging from the complex sensemaking system that were not included in the discussion of Chapter 3, namely the players' attribution of high cognitive function to simple software behaviours due to fortuitous alignments of player actions and game reactions.

Modelling complexity necessarily entails a reduction of the reality it models[157] and, as such, the loss of complexity. However, the current findings seem to provide

[157] Every model is a simplified version or surrogate of reality, as also maintained in the literature on knowledge representation (see e.g. Schreiber et al., 2001; Harmelen et al., 2008)

at least an initial support of the proposed model. For the current purpose, the results of the empirical investigation described here make it possible to corroborate a positive answer to the research question according to which video game sensemaking is based on the complex system of information formed (at least) by the game multimodal presentation, players' interaction and players' memories.

An additional finding is that players seem to generally entrust the design of the game to be correct, thus believing that: 1) what is present in the game is the result of thoughtful selection, and 2) the game generally work as it is intended. This appears to be true even when several signs seem to say otherwise. Apart from the evidences collected to discuss the self-organisation of the system, in which participants evidently looked for alternative explanations to misbehaviours rather than blaming them to bad game design (E134–E139), other vocalisations clearly highlight this tendency (E162–E169). As a matter of fact, for each designed disruption at least one participant showed to be trusting the design to be correct, looking for the issue to be situated somewhere else (e.g., by finding a different explanation – see the discussion on the self-organisation). Particularly interesting is the fact that this holds true even when something goes against conventions that are expectably well-established (E169), highlighting that the trust on designers' and developers' work overthrow players' memories.

Moreover, empirical research could help shed light on the theoretical inquiry regarding the relationship between emotions and sensemaking outlined in Chapter 3. The data gathered for this experiment seem to suggest that epistemic emotions (specifically confusion) influence interaction and prompt an explorative attitude, arguably with the scope of resolving the confusion (E88). They also seem to foster creative problem solving, as confused participants devised alternative imaginative reasons to unexplainable phenomena (E134–E139).

Some research questions more evidently than others lean towards additional research. I have identified them throughout the chapter, and I have highlighted a number of directions for further empirical research to investigate the collaborative sensemaking of games and players. Particularly interesting would be to repeat an experiment similar to the current one but based on a game in which audio and haptics feature in a much more prominent fashion – or even using an audio-game or hapti-game. Furthermore, expanding the pool of participants, as well as including participants of diverse ages and socio-cultural backgrounds could shed light on several differences in the game-player sensemaking system. These tests will be left to future studies. The details on how the required materials were designed and developed specifically for this kind of analysis, and on how and with which methodology the study was conducted can thus serve as the basis for these further inquiries in the sensemaking processes of video game players. However, even additional analyses of the current dataset could reveal other interesting phenomena and observations that went unnoticed so far. While I will engage in this effort myself, I provide the entirety of the collected data in Appendix III, with the hope of facilitating the work of also other researchers investigating the complexity of sensemaking.

# Conclusions of Part II
# Video games and complex systems

This part was dedicated at investigating the complexity of the collaborative sensemaking in which video games and their players participate to give rise to the game playing experience. I have shown how, through the game-player encounter, video game sensemaking can be compared to a complex system.

In Chapter 3, I built a conceptual framework supporting this view. Through an embodied and enactive view of cognition, I have looked at the contact between games, players' bodies, and players' minds. I have discussed some of the main theories that have been proposed to explain video games sensemaking. I have analysed three sub-systems of information participating in the collaborative sensemaking, namely the multimodal (sub-)system, interactivity and enaction, and memory, highlighting the feedback loops between them. I have shown the reasons why they exhibit features of complexity basing my understanding in Stepney's definition of complex systems, and I have explained why video games can be regarded as generating this complex system in their encounter with players. I have analysed how this complex systemic perspective allows a holistic understanding of how video games and their players co-create meaning, and I have then applied this theoretical framework to analyse a scene from the video game *Detroit: Become Human* (Quantic Dream, 2018), to show its informative potential and how the three sub-systems of information discussed manifest themselves in a real game.

In Chapter 4 I have reported the details of an empirical analysis aimed at corroborating the validity of the theoretical framework of Chapter 3 in light of actual gaming practices. I have described the design of the game and how it was informed by the theory, and I have illustrated the methodology chosen for the experiment. Each of the 14 participants took part in a think-aloud session, followed by a semi-structured interview and a questionnaire. I have also described the process of data analysis and reported the findings. The empirical study supports my theoretical framework, but further studies are still needed. It also calls for slight adjustments of the framework itself, particularly regarding the cognitive processes of the player involved in the game-player system. These adjustments are described in the conclusions to Chapter 4.

This theoretical perspective allows a more holistic view of video game sensemaking, encompassing but surpassing smaller-scale analyses focusing on specific aspects in isolation or in simple combination. A claim like "if the light means *a*, the colour palette means *b*, and the music means *c*; then the game means *abc*" is inaccurate and simplistic, because that is not how video game sensemaking works, according to the theoretical and empirical findings presented here. We perceive multiple elements as integrated wholes, and our enactive participation and mnemonic content impact this whole in complex ways. Therefore, the individual descriptions of the elements and even their view in combination is unpractical and does not respect the principle of parsimony, for any such discussion would

need to have an impressive number of conditions and exceptions to accurately explain the whole game playing experience. Understanding sensemaking as the synthesis of a complex system of information sources in a collaborative process, and viewing the result of this process as emergent and more-than-combinatorial, is, therefore, more accurate, more productive, and, maybe unintuitively, more simple.

This is not to say that the overall meaning of a game is therefore entirely independent from its author. Game and narrative designers can and do direct the complex sensemaking system towards certain directions, nonetheless the afforded enactive freedom and the autonomy in interpretation. In Chapter 3, I have discussed the Pareto principle (Pareto, 1897/1964) as a possible explanatory theory, highlighting how an arguably small part of the collaborative sensemaking system can orient the entirety of it to create similar (but not identical) gameplay experiences for many players.

The quotation opening this Part, taken from the short story *The Merchant and the Alchemist's Gate* by the American writer Ted Chiang, therefore aptly summarises this entire argument of a tension as well as a collaboration in sensemaking between a higher-order controlling agency (the designers, in my case) and those living in the moment (the players): "if our lives are tales that Allah tells, then we are the audience as well as the players, and it is by living these tales that we receive their lessons" (Chiang, 2020, p. 35).

In the next Part, I will investigate how the complex "lessons" (narratives) of video games are lived and received in complex ways, and how they are still entertaining and understandable.

# PART III

# VIDEO GAMES BETWEEN COMPLEX NARRATIVES AND COMPLEX SENSEMAKING

«If we were always to judge from reality,
games would be nonsense;
but if games were nonsense,
what else would there be left to do?»

Lev Tolstoy, Childhood (1852/2020), chapter VIII

In Part I, I discussed the formal complexity of narratives and the response of the audience to this complexity. In sum, complex are those narratives that pose above-average cognitive challenges to their audiences, and that cause the insurgence of epistemic emotions due to their formal organization. Because of their inherent characteristics and specificities, and due to game design practices and standards, many of the features that make a narrative complex are often identifiable in video game narratives. For this reason, videoludic narratives could be conceived as generally complex.

In Part II, I argued for an analysis of video games sensemaking through a complex-systemic perspective. I presented my theoretical framework, with which I argued for an understanding of the game-player collaborative sensemaking as a complex system. The overall meaning of a video game emerges from the interplay of a number of information sources and sub-systems. Three of these sources have been analysed in Part II: the multimodal (sub-)system, which comprises all perceptually available signs of the video game, like music, text, and haptic feedback; the interactivity, affording sensorimotor experiences and requiring an enactive involvement to instantiate a specific linear experience among the often uncountable available; and the recollection of previous knowledge, necessary to contextualize and ultimately understand the experience.

However, these two parts, detached from each other for the purpose of easier analysis, obviously come together into a unified whole, as video games and their narratives are not separated but tightly connected and even reinforcing each other.

The basic idea behind Part III is thus to explore the conjunction of Part I and Part II, including the epistemic gains that the two theoretical stances can bear when brought together, how one underpins the other, and how apparent contrasts can be resolved.

More specifically, in Chapter 5 I will analyse a case study by employing both insights on narrative complexity and on complex sensemaking. I will show how the two analytical lenses can be productively brought together and how the two

features of video games (having complex narratives, and being based on complex sensemaking) can be said to reinforce and even require each other.

However, the analysis of Chapter 5 can be said to highlight a paradox: if one is to look from the merely theoretical perspectives presented, one could conclude that video games are far too complex narrative objects to be enjoyable or even understandable. Indeed, according to the analysis conducted, video games present a generally complex narrative content via a complex sensemaking system, creating a sort of hypercomplex object, the interpretation of which could theoretically require an extreme amount of cognitive effort. Therefore, one could conclude, only very talented and/or cognitively gifted individuals could be capable of dealing with them, if at all. Yet, pragmatics tell us that the situation cannot be more dissimilar. With revenues above 200 billion dollars in 2022 and over 3 billion players worldwide, narrative video games clearly enjoy universal appreciation, and even young kids like to play with them. The question Chapter 6 tries to address is therefore: how can narrative video games be so complex in theory without being cognitively overwhelming in practice?

The arrival point of Part III is that the complex collaborative sensemaking often necessitates some complexity of the narrative, and vice versa, and that the encounter of the two complexities do not increase but actually lower the cognitive effort required to players, for reasons that II am going to discuss.

# Chapter 5
# Narrative complexity and complex sensemaking

The analytical tools outlined in Part I on the complexity of narratives will here be combined with the complex-systemic view of the collaborative sensemaking discussed in Part II, to observe how they influence each other. Therefore, in the first part of the chapter I will employ the analytical tools proposed in Chapter 1 to describe the formal complexity of narratives, namely the narrative devices for the formal complexification. I will also provide a brief study of the players response to the narrative, using the methodology proposed and refined in Chapter 2. In the second part of the chapter, I will employ the theoretical framework described in Chapter 3, and its empirically-grounded revision and operationalisation emerging from Chapter 4, to discuss how the complex sensemaking foster the complex narrative, and vice versa.

This analysis will consider the game *What Remains of Edith Finch* (Giant Sparrow, 2017), as it presents both the complex sensemaking characteristic of video games, and a markedly complex narrative, i.e. (as per my the definition provided in Part I) a narrative that requires above-average cognitive effort to be understood due to a specific formal organization.

*What Remains of Edith Finch* is a 2017 video game developed by the independent studio Giant Sparrow and published by Annapurna Interactive. It is one of the most cited examples of games belonging to the genre *walking simulator*[158]. The player takes on the role of Edith Finch, the last surviving member of the Finch family, as she returns to her old family house to uncover the stories behind her relatives' lives and (most importantly) deaths. In each room of the house is presented the story of a family member, as a unique blending of narrative and gameplay mechanics. The game presents complex emotional and philosophical questions, and the motifs around which it revolves are related to how memory and personal history shape identity.

## 5.1 Narrative complexity in What Remains of Edith Finch

*What Remains of Edith Finch* presents itself as a singularly complex narrative. The game features twelve characters (plus Edith) whose story is represented through eleven vignettes. All these are embedded into Edith's story, which serves as narrative frame. Figure 5.1 shows all these characters arranged in the genealogical tree of the Finch family. This part of the analysis has been conducted

[158] A *walking simulator* is a genre of video game that emphasizes exploration and narrative over traditional gameplay mechanics such as combat, shooting, or puzzle solving. Walking simulators are typically played from a first-person perspective and involve guiding a character through an environment, uncovering story elements. The pace is often slow and contemplative, and the design is focused on providing an emotionally charged and narrative rich experience.

through the technique of close reading, as described in Chapter 1 (see Bizzocchi & Tanenbaum, 2011, 2012).

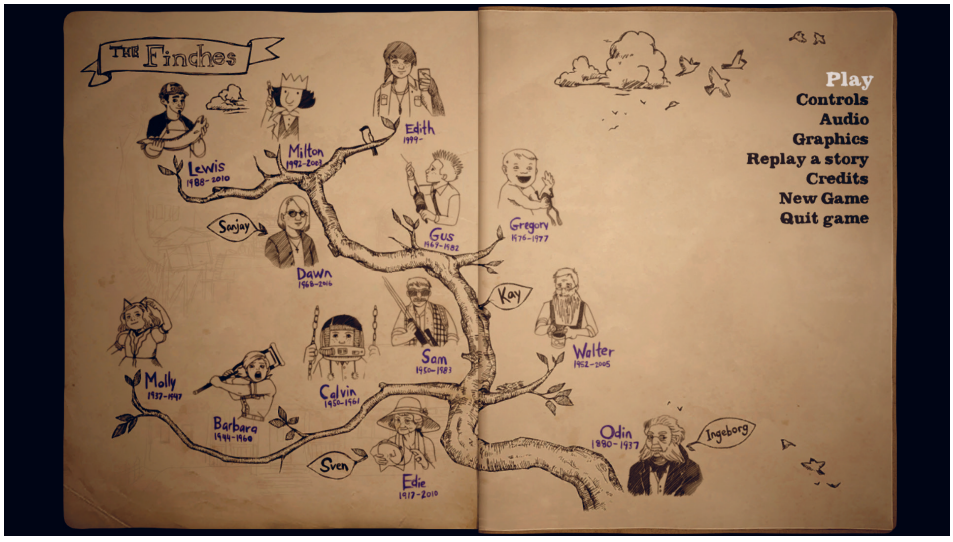


*Figure 5.1 – The Finch family tree, which also serves as the game menu. Screenshot from the game.*

One of the main leitmotifs around which the game revolves is that of reading (cf. Bozdog & Galloway, 2020 on the importance of reading in this game). The stories of all characters are uncovered by reading their respective diaries, letters, or medical reports (cf. the notion of "ludex" in Milligan, 2019). The game is organised as a second-order narrative: Edith's exploration of the house (the narrative frame for the other eleven vignettes) is shown to be written in Edith's diary, which is read by another character whose identity as Edith's son is only uncovered at the very end. The vignettes constitute therefore a third-order narrative. During some of the vignettes there is an additional – fourth – narrative level, for instance when within the vignette on Dawn and Edie, the young Edith starts reading Edie's story. These multiple embeddings of stories cause quite frequent metalepses, as elements of these third-order narratives are found again in the second-order storyworld (e.g., toy frogs similar to that presented as the main cause of the drowning of Gregory often appear around the Finch's house). The many characters also foreground several perspectives over the house and over the so-called curse of the family, which is said to be the cause of the many tragic deaths.

The narrative structure somehow mimics that of a murder mystery, as it is entirely based on uncovering the causes that led to several consequences, particularly the leaving of the house, the deaths of the family members, and later in the story the sealing of the house rooms. The narrative also presents an extensive use of cruxes, since very little of each story is told and a lot is left for interpretation. However, contrarily to many detective narratives, the mystery of the

Finches presents the notable difference of not providing a definite answer to the main question, namely who or what caused the tragic and premature death of all (but one) members of the Finch family. The game avoids putting a definite end to the narrative, as in the very moment when all answers are about to be given, through the fourth-order story of great-grandmother Edie, the narrative is abruptly interrupted as Edie's diary is ripped of the hands of young Edith and destroyed: the mystery of the curse is therefore never fully uncovered. Even if introduced as potentially resolutive of the mystery, the vignettes themselves present a blend of real and fictional elements,[159] making them not immediately reliable. The real causes of the deaths of the characters need to be inferred by piecing together plausible clues to dissipate the romanticisation. This clue hunt, which represents the main point of the narrative of *What Remains of Edith Finch* is also needed at a meta level: as players are left with many cruxes, pervasive unreliability, and the absence of closure, they are tasked to understand themselves what the curse really is, and whether it exists at all or if it is just another product of Edie's romanticisation to cope with her grief.[160]

Furthermore, the game presents additional difficulty in piecing together the narrative as the stories of the characters are presented in an order that is not chronological and only loosely following the order of birth of the family members. This also entails several inter-vignettes references that causes multiple storylines to develop at the same time in the third-order narratives. The fragmentation of the narrative is therefore quite substantial, and further complicates the work of piecing a coherent whole together.

Lastly, the game also presents several intermedial aspects, as many vignettes use the expressive language of other media. Among these we can count Milton's story flipbook, Barbara's comic-like vignette, or Odin's viewfinder toy slide reel.

As a summary, Table 5-1 highlights the high degree of complexity of the narrative of the game *What Remains of Edith Finch* (Giant Sparrow, 2017).

[159] For instance, Gregory's drowning in the bathtub due to a distraction of the mother is likely real, but the dance of the toy frog with toy ducks and whales that caused the bathtub faucet to open is likely not.

[160] Great-grandmother Edie is presented as the most probable actual author of the characters' diaries. Her romanticisation is sometimes openly presented, e.g. in the case of her husband Sven, who she wrote to have been killed by a dragon, while he was actually crushed by a dragon statue he was building in the house pond.

*Table 5-1 – Summary of the devices employed by the narrative of What Remains of Edith Finch.*

| **Narrative device** | **Present in *WRoEF*?** | |
|---|---|---|
| **Non-linear temporality** | YES | |
| **Disruption of cause-effect relationships** | YES | |
| **Cruxes** | YES | |
| **Non-closure** | YES | |
| **Unreliability** | YES | |
| **Multiple storylines** | YES | |
| **Multiple embedded stories** | YES | |
| **Multiple perspectives** | YES | |
| **Multiple branches** | | NO |
| **Narrative fragmentation** | YES | |
| **Metalepses** | YES | |
| **Diverse narrative structures and tropes** | | NO |
| **Seriality** | | NO |
| **Intermedial aspects** | YES | |
| **Transmedial elements** | | NO |

According to the theoretical and empirical analysis of Chapter 2, this formal complexity is expected to translate into a significant cognitive effort required to players. Adopting the same methodology outlined and refined in Chapter 2 (and specifically in Section 2.2.3 "The response of the audience"), I analysed a set of 4610 English language reviews of the game from *Steam*[161], to scrutinise whether instances of confusion or other epistemic emotions could be detected. This set was filtered using the keywords identified in Chapter 2.[162] The filtering produced a total of 2711 reviews. As this distilled set of reviews was still too large to be assessed manually, and because my intent here was just explorative, I filtered further the reviews using only the keywords "confus" and "underst". This produced a set of 204 entries.

The following reviews are just the most overt in showing that, indeed, the narrative required significant cognitive effort:

- "While the presentation, setting, and story were intriguing, it left me feeling confused and longing for further understanding"
- "What an awesome game! It kept me interested throughout the story, although some parts were confusing and had to take help from the internet"
- "the game does get a little confusing trying to follow all of the characters"

[161] https://store.steampowered.com/app/1627720/Lies_of_P/

[162] These keywords are: "story", "plot", "campaign", "understand" and "understood" (grouped under the search term "underst"), "confuse" and "confusing" (grouped as "confus").

- “It didn’t give me a lot of feels except confusion and a feeling that something was missing”
- “The way the story is told can be confusing to some players”
- “I’m still a bit confused after playing the game all through, because it’s so hard to know what to believe, but that’s not a bad thing as I like strange stories”
- “[talking about the missed narrative closure] this situation left me confused. What was this all about?”
- “I’m sure the story is very meaningful to the writer(s), but as a player it came across pretty clunky and confusing”
- “I was just simply disappointed towards the end. Expecting some kind of ending, reveal of the mystery or clearing up the confusion that was built up... It just felt unfinished to me. I felt like I was told a story without an ending which made no sense at all”
- “Too short, and too disconnected […] the overarching story is never resolved, or even discussed. What’s happening? You don’t begin to get the pieces to understand. There is no struggle and nothing is resolved. Just a bunch of fragmented snapshots of lives”
- “I didn’t really understand what meaning any of this had. It didn’t lead up to anything that impactful or relatable, at least for me. Honestly, the stories were the worst thing about this whole game”
- “Honestly? I don’t understand the [heck]ing plot of this game”
- “It’s very surrealist so maybe stay away from it if you like understanding absolutely everything. Cause you won’t”
- “Playing through Edith Finch is like living life – pushing to understand, finding meaning in chaos”
- “I don’t understand what the game was trying to tell us, really”
- “Maybe I’m just too dumb to understand this game, maybe I just don’t get it, or I am missing something obvious”
- “Well I clearly didn’t understand the meaning behind the ending of the story.”

These reviews clearly show that the substantial formal complexity of the narrative of *What Remains of Edith Finch* posed considerable cognitive challenge to several of its players. They also show evidently that causing epistemic emotions are exactly (some of) the narrative devices discussed. Yet, the narrative complexity in this game is nurtured by and feeds into the complex collaborative sensemaking that lies at the basis of its comprehension, in ways that are somehow surprising and wonderful.

## 5.2 Complex sensemaking in What Remains of Edith Finch

To keep the current analysis of a reasonable length, I will discuss in depth the complex sensemaking and its relationship with narrative complexity for two portions of the game, while mentioning other relevant parts only when needed. These are two particularly interesting passages of the game, as they closely entangle the narrative content of game with the complex ways in which such narrative content is co-constructed with players.

The first family member's story the player encounters is that of Molly. Once inside Molly's bedroom, the player can explore the environment using the by-now customary interaction mechanics, including the relatively standard head and body movements.[163] The main interactable object in the room is Molly's diary, through which the player can enter the third-level vignette about Molly's last night. In the meta-narration, players are initially put in the shoes of Molly as she wanders the room looking for food, after being sent to bed without dinner. At this stage, the interaction mechanics are still unchanged. After a short while, players' attention is directed towards the chirping of a bird outside Molly's window. When the player opens the sashes, Molly, wanting to capture the bird, transforms into a cat and jumps on the tree outside the window (Figure 5.2 – A). This narratively-connotated change in the body of the character requires players to recall a new frame of reference, calling into question knowledge about cats, and specifically about their bodily affordances. This knowledge is reinforced by the change in interaction mechanics, specifically designed to remind and mimic the motion of a cat. The movement becomes swifter and more sinuous, and the of ability to jump is introduced. These new mechanics reflect the new narratively justified frame of reference, but also change the cognitive enaction of participants, and therefore the perception of the environment. This in turns permits players to practically enact Molly not anymore as a human but as a cat, waling on the leafless trees, climbing on windowsills and jumping on gutters. Therefore, the narrative-relevant event of Molly becoming a cat changes the frame of reference in the player's cognition, which prompts the recollection of a new set of extra-game knowledge, which pushes the player to perceive the multimodal environment differently, which allows them to enact in it effectively, which enables the narrative to move forward.

[163] As customary, the third-person camera is free to revolve around the character's head, giving players the feeling of manipulating the head and eyes of the character with the right analogue stick, and with the left analogue stick its body, with a forward direction always oriented away from the player's body (up). This movement is intuitive to the accustomed player as it is grounded in experience of video game playing, but also in the embodied/enactive experience in the world, where moving the head is the necessary interaction to discover the surroundings (see Chapter 4, Section 4.7.1.5 "Memories and interaction"). It is maybe not surprising then that no interaction mechanics are explained at the beginning of *What Remains of Edith Finch*, just in the same way as no such explanation was given in the testing game described in Chapter 4.

Even more notable is the fact that in the short vignette regarding Molly, lasting about 10 minutes of real playing time, this kind of body switching happens not one but four times. Each time, Molly's body becomes more and more distant to that of a human, and players are required to adapt their frame of reference not only regarding motility but also sensorial aspects. After having finally captured the bird, Molly transforms into an owl, and the interaction mechanics of flying and swooping replace the swift walk and jumping. Molly-owl flies over a field, looking for the source of the rabbit's nibbling noise. The switched frame prompts the player to enact Molly-owl gliding over the field and scouting for rabbits. The extraordinary night vision of owls is mimicked through the smart use of colour contrast in the multimodal representation (black rabbits on white snowy fields), and by displaying the word "Rabbit!" above each of them (Figure 5.2 – B). After having eaten a couple of rodents, Molly transforms into a shark. At first, Molly-shark slides down a cliff. In this scenario, the interaction mechanics are limited to floundering, but after reaching the ocean beneath, players are afforded free swimming and the ability to sprint-attack. The renowned nose for blood of sharks is given to the player once again through the multimodal system, as a red scattered line leading to the prey (Figure 5.2 – C). The last of Molly's transformation is into a sea monster that crawls with a scouting tentacle into a nearby boat (Figure 5.2 – D). After eating the passengers of the ship, Molly-monster creeps into the sewing pipes of house Finch, into Molly's bathroom and under Molly's bed, waiting for her to fall asleep. While no knowledge of real sea monsters is available to players, the extra-game memories that this last transformation recall are likely grounded in other fictional scenarios. This information is then integrated with the intra-game knowledge gained by interacting with the game itself, to determine the kind of monster and its movements. The interaction mechanics for the monster are that of pushing the tentacle ahead to then drag the body forward, which suggests a crawling creature, large enough to eat human adults. This highlights that the enactive experience of embodying the monster provides narrative-relevant information, too, as it suggests details on Molly's bodily transformation.

Interesting is also the fact that the change of the spatial axis of operation of the left analogue stick for Molly-shark is not perceived as problematic. While walking as Molly-human, Molly-cat, and, later, Molly-monster, the left analogue stick is mapped so that "up" (away from player's body) and "down" (towards player's body) mean "move forward in the player character's gaze direction" and "move backwards in the player character's gaze direction", respectively. However, for Molly-shark, "up" and "down" mean "move towards the surface of the ocean" and "move away from the surface of the ocean", respectively. This change in mapping from the Z axis to the Y axis of the movement of the controller (and back) is so natural that designers did not even feel the need to overtly inform the players (e.g. with an overlayed text).[164]

[164] As a matter of fact, none of Molly's transformation are accompanied by an explanation of the changes in the mechanics.


A B


C D

*Figure 5.2 – The four transformations of Molly, namely: Molly-cat (A), Molly-owl (B), Molly-shark (C) and Molly-monster (D). Screenshots from the game.*

While playing the game, the change in the interaction was indeed not perceived as marked,[165] which further suggests that the narratively-justified change of frame of reference informed the entire sensemaking through memories, prompting an automatic switch in the embodied and enactive perception of the environment and its exploration, which, once again, allowed the process of sequencing the narrative (Mejeur, 2019).[166] Many of the vignettes of the family members present similar adaptations of the interaction mechanics, showing that this interplay and reinforcement of interaction, memories, multimodal (sub-)system, and narrative, is at the core of *What Remains of Edith Finch*.

Lewis' story foregrounds a number of other interesting phenomena in these regards. The vignette focused on the story of Lewis is the second-to-last to be shown in the game. After exploring Lewis' room, the player finds a letter written by Lewis' psychiatrist. Reading the letter starts the vignette, in which players take control of Lewis as he works in a tuna cannery. The interaction mechanics in this scene map the right analogue stick with Lewis' hand as he received fishes on his workstation from the bottom left of the screen, cuts them with the machine on the bottom right, and put them on the conveyor belt on the top right (see Figure 5.3). The movement is at first somehow requiring for the player, and it needs to be carried out with some attention to follow the right order of actions (grab the fish, cut it, pass it through). After a short while, on the top-left corner of the screen a figure on a black background and some text start to appear, representing Lewis' mind wandering. The figure is controlled by the player through the left analogue stick, and it must initially navigate a labyrinth. At this stage, the player is therefore enactively participating into two different ontological levels (Lewis' reality and his imagination), within a third-level narrative (that of the vignette, which is recounted in Edith's diary, which is read by her son). The player is required to engage with both these levels, as not moving in the daydream does not advance the narrative, and the fishes cover the daydreaming if not taken care of. After a while, Lewis' mind wandering becomes more and more elaborate and more invasive, growing bigger and bigger and occupying more space in the screen. The black background becomes a cave, then a city, musicians start following the oneiric Lewis, plying a tune, while other citizens start dancing. Then, oneiric Lewis embark on a ship and the player start steering the ship, eventually also deciding between alternative directions of the daydream.[167] All of this while, with the right analogue stick, grabbing the fish, cutting it, passing it on, grabbing, cutting, passing, etc.

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[165] At least by the author, but for instance no mentions of difficulty in interacting with this vignette can be found in the subreddit about the game, notwithstanding the many discussions (see r/WhatRemainsEdithFinch/).

[166] As the reader might remember, the current work adopted from the beginning Mejeur's definition of narrative in games as "the embodied cognitive process of sequencing signs drawn from a game's story (its collective possible objects, representations, and actions) into a discourse (consisting of events and chains of events) through play" (Mejeur, 2019, p. 63).

[167] These choices have little to no impact on the narrative, and therefore they have not been accounted during the analysis of the formal complexity of the game.


*Figure 5.3 – View of Lewis' workstation in the vignette. Screenshot of the game.*

Towards the end of the vignette, the wandering of Lewis' mind covers the entirety of the screen, but until the last moments before Lewis' tragic death, the player is tasked to keep cutting the fish. This repeated movement, while being slightly requiring at first, as said, becomes more and more ingrained and automatic, so much that towards the end of Lewis' vignette it is practically carried out almost subconsciously. This clever exploit of interaction mechanics has several effects that tie together closely the player and the narrative through the complex collaborative sensemaking characteristic of video games. Firstly, it allows players to focus more and more on the increasingly requiring tasks presented in the daydream. Secondly, the increasingly automatic movements mimic (and instil also in players) Lewis' growing sensations of alienation for the work in the cannery, as described by his psychiatrist. Thirdly and consequently, it brings closer to the player the desire to escape the alienating assembly line work through mind wandering, and just as the daydreaming becomes increasingly interesting for Lewis, so it does for the player. This also shows how the sensemaking adapts to the narrative content. Lewis' vignette is so powerful because it does not simply *represent* the mind and emotions of Lewis, but it *simulates* them in the mind of the player, through the mutual reinforcement between the complex narrative and the complex sensemaking. In this way, the player can say to have somehow really been in the shoes of Lewis, and therefore to have *lived* his story.

## Conclusions of Chapter 5 – Narrative complexity and complex sensemaking

In this short chapter, I have adopted in conjunction the two main conceptual perspectives discussed so far. In particular, I have demonstrated how notions and concepts on the complexity of videoludic narratives can be productively combined with the complex systemic view of game-player collaborative sensemaking. This helped shed more light on how narrative video games and their players collaborate in complex ways in constructing the complex narrative.

In the first part of the chapter, I have employed the analytical tools proposed in Chapter 1 to describe the formal complexity of narratives, discussing the narrative devices for the formal complexification in the game *What Remains of Edith Finch* (Giant Sparrow, 2017). Pervasively employing many of them, the game narrative has been described as remarkably complex. I have then provided thoughts on players response to this complex narrative, using the methodology proposed and refined in Chapter 2. Through the analysis of a set of online reviews of the game, I have demonstrated that, as expected, the game required considerable cognitive effort, and gave rise to confusion and other epistemic emotions to some of its players. This highlighted once more the connection between certain formal aspects of a narrative and certain players response to it.

In the second part of the chapter, I have employed the theoretical framework described in Chapter 3 and revised in Chapter 4, to discuss how the complex sensemaking is intertwined with the complex narrative. I have analysed two particularly insightful moments of *What Remains of Edith Finch*, namely Molly's and Lewis' vignettes, showing how the two characters' stories are presented and co-constructed with players through a game-player collaboration that entails frequent frame switching and the living the characters' life.

This chapter has shown that the narrative relevance of the sensemaking and the sensemaking relevance of the narrative are intertwined in such a way that it is almost nonsensical to disentangle. While *What Remains of Edith Finch* is particularly good at displaying this, the findings of Part I and Part II of this dissertation arguably suffice to maintain this idea for narrative video games in general. This also highlight that to a more complex narrative corresponds a more articulated sensemaking, as more and more memories and enactive attitudes and cognitions are required to ultimately allowing the game playing experience to emerge.

# Chapter 6
# Double complexity and cognitive economy

In Chapter 5, I have shown how narrative video games can be argued to present two complexities (of their narratives, and of their sensemaking) that are necessarily strictly intertwined. The complexity of video games sensemaking is at the very basis of their narratives collaborative construction and understanding, and vice versa. This means, in simplified terms, that the generally complex narrative content of a video game is represented through a quite complex sensemaking process. The question this chapter asks is therefore: how is this double complexity cognitively manageable and even enjoyable?

A first, simplistic reply to this question could be that either theory or practice are wrong. Given the numbers that game industries boast, in addition to the personal experience of whoever accessed a video game for enough time to understand what was going on, practice is unlikely to be wrong. Video games *are* enjoyable forms of entertainment that can be used as of easy escapism. For some games, this is true even in situations of scarce focus, when players cannot devote full attention to the game itself. Yet, games often pose little resistance to understanding even in these situations. This is also shown by the number of portable playing devices that are gaining popularity right now (e.g. Nintendo Switch[168], Steam Deck[169], ROG Ally[170]), which presuppose players using them on the go, in situations where less movable devices would not be fitting and, therefore, where the focus cannot be entirely on the games themselves. Theory, then, could be wrong. While this possibility remains, the huge literature on the topic and the empirical demonstration provided also in this dissertation, makes this idea equally unlikely. Therefore, if one accepted the theories and their (also empirical) investigations as they have been shown until this point, the question above turns out to have not so simple answers.

My hypothesis is that the encounter between the complex sensemaking of video games and their complex narratives do not produce a cognitively unmanageable double complexity, but rather lowers the cognitive requirements for the overall understanding through cognitive economy strategies.[171]

As the reader will notice, this is a rather exploratory chapter. In an attempt to delineate at least some of the ways in which narrative video games are made cognitively manageable by players' cognition, I will outline four macro-level cognitive functions that could be said to apply when players try to make sense of video games and their narratives. These functions arguably lower the overall

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[168] Website: https://www.nintendo.com/switch/ – last accessed: 29/06/2023

[169] Website: https://www.steamdeck.com/it/ – last accessed: 29/06/2023

[170] Website: https://rog.asus.com/gaming-handhelds/rog-ally/rog-ally-2023/ – last accessed: 29/06/2023

[171] Cognitive economy is defined as "the tendency for cognitive processes to minimize processing effort and resources" (Colman, 2009).

cognitive load in different but interrelated ways. While not all of them are unique to the videoludic medium, their occurrence in combination is not pervasively found in other media as it is in video games. This is also the reason why I call them "macro-level": they do not pertain to only specific video games or video game genres, and they are functions of players' minds elicited by the characteristics of the medium itself, rather than by specific design choices. Designers can productively harness these strategies, or they can (willingly or accidentally) lower their effectiveness, but they are still to be considered as working *a priori* the specific design of the individual video game. Towards the end of the chapter, I will also discuss how and in what sense these strategies are arguably deeply ingrained in human cognition, and trained by our everyday experience with the real world.

A more economic cognition has several related advantages. If we assume that at any given moment a certain finite cognitive power is available to an individual, reducing the required cognitive effort to deal with part of the sensemaking means that the cognitive power remaining to deal with the rest of the game is necessarily higher. This is particularly relevant with regards to the narrative content of games, as 1) leaving an overall increased cognitive power free to understand a more complex narrative; and, therefore 2) enabling the representation of an overall more complex narrative without it being cognitively overwhelming. I will return on these implications in the final considerations of this dissertation.

For now, the four macro-level cognitive strategies that I am about to discuss can therefore be said to be the reasons why video games can feature complex narrative through a complex sensemaking without cognitively overwhelm their players. I will discuss these strategies one by one.

## 6.1 The four cognitive economy strategies

### 6.1.1 An image is worth a thousand words

When it comes to computer hardware, it is a common tenet that Graphic Processing Units (GPUs) present better performances in terms of speed of computing than Central Processing Units (CPUs), in most of cases. Similarly, a common saying in non-academic guidelines for effective communication, particularly for marketing, is that "an image is worth a thousand words". While this is clearly a simplification, there is considerable evidence supporting the idea that reality might not be as distant as it seems. This could speak words to the difficulty of cognitively processing information presented in certain ways.

While the processing times of our brains are impressively short, empirical evidence suggests that there is a significant difference of processing speed for information extraction between images and text. In particular, two studies (Potter et al., 2014; and Hauk et al., 2006) present interesting results in this sense. Both studies employed the same methodology to record the processing speed of images and text (respectively). This methodology is called "rapid serial visual presentation" (RSVP) and consists of showing information in rapid sequence to a number

of participants, before asking them specific questions regarding the shown material. Since they adopted the same methodology and a similar experiment structure, the results of the two studies are comparable at least to some extent. [172]

According to the study conducted by Potter and colleagues, our brain can recognize the conceptual information in an image in as little as 30 milliseconds, down to even 13 milliseconds in some cases and for some people (Potter et al., 2014). To test this, the researchers employed an image-based RSVP. The results were consistent in showing the impressive speed at which our brain consciously detect rapidly presented complex images. The outcomes also supported the idea that the recognition of informational content is automatic, does not require mindful attention, and does not need additional pre-established knowledge nor focal direction (i.e., indications on when, where and what to focus one's attention on). "In these conditions, even durations as short as 13 ms are clearly sufficient, on a significant proportion of trials, to drive conscious detection, identification, and immediate recognition memory" conclude the researchers (Potter et al., 2014, p. 21).

On the other hand, Haunk and colleagues report an empirical investigation involving an RSVP with text instead of images (Hauk et al., 2006). The results show a much slower processing speed compared to that of images. It appears that presenting words at a 25 to 60 milliseconds rate do not leave enough time to process, understand, and consciously identify the words. Indeed, according to Hauk and colleagues, text requires a significantly longer processing time to extract semantically relevant information, namely around 150 to 200 milliseconds. These times can increase up to 400 milliseconds when a word is inserted in a sentence (cf. Halgren et al., 2002 for more detailed chronometric measurements of the processing times of sentences). Following these studies, then, the difference in processing times appears to be in the order of the ten-times.

At least to some extent, the difference in processing times between images and text is intuitive: words, as a linear and symbolic sign system, take more time to be accessed and needs to be decoded to be cognitively graspable, while images, that could be intended as more direct perceptual stimuli[173], thus requiring less symbolic decodification, need less cognitive processing to be understandable. As supporters of the idea of mental imagery would argue (cf. Nanay, 2021 for a detailed discussion of this perspective), perceptual stimuli are more similar to our mental representations, which make them more directly available for interpretation. This is also arguably due to the reliance of image processing to faster thinking methods than text, which needs more attentive, but slower, thinking modes (see the "fast and frugal heuristics" (Gigerenzer & Todd, 1999), and the

[172] As it is expectable, differences in image size, amount and density of objects presented, in addition to several contextual elements, can also impact these recognition times. Further studies are needed to have completely comparable results, but the two studies reported, together with the additional evidence discussed below, are enough to hold my exploratory hypothesis.

[173] This is not intended as a negation of the presence of an interpretive system even for perceptual stimuli.

two Systems of thinking (Kahneman, 2013; Stanovich & West, 2000) as discussed in Chapter 2).

Compared to the textual form, information presented as an image seem therefore to have a much lighter impact on the overall cognitive load.[174] This is due to the very simple understanding that, given the same processing unit (the human brain), if one task takes less time than another, the quicker task is easier than the slower one. In addition, if a task is completed faster, it takes up the available power for less time, diminishing further the overall cognitive effort required.

Video games are inherently multimodal, and as such they rely on a system of semiotic modes that include also text (see chapter 3 and in particular Section 3.2.1 "Multimodality and multimodal systems"), alongside other visual modes. Indeed, many games present sometimes considerable portions of textual content (like *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011)).[175] However, it is relatively safe[176] to argue that game designers largely rely on images to represent a significant portions of the content of a video game (on this, cf. also the four ways of intending environmental storytelling put forward by Jenkins, 2003; and Salen and Zimmerman's 'narrative descriptors' (2004)),[177] including their variably complex narratives. This heavy reliance on images makes video games capable of representing generally more complex narratives while retaining a relatively low requirement in terms of cognitive power.[178]

Within the literature on stimuli recognition speed, there seems to be also some evidence corroborating the exact opposite argument to the one I am supporting here, i.e., that text is processed faster than images. One of the most significant counter-arguments to my hypothesis comes from the Stroop effect (Stroop, 1935). The Stroop effect is a milestone in the history of psychology and a widely known phenomenon in cognitive sciences (cf. MacLeod, 2014). According to this effect, the human brain seems to show much less difficulty in processing text rather than other visual features – and therefore, that text might require less cognitive power to be processed. The setup of Stroop's test consists of written names of colours,

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[174] This is not to say that the difference in cognitive load is proportional to the difference in processing times, as it is likely that many factors can be said to influence the cognitive power requirements.

[175] See Chapter 1, Section 1.3.2 "The Elder Scrolls V: Skyrim" for more details on the game and on its textual content.

[176] Exception to this general provision are those games mainly developed for visually-impaired players, like audio-games (Fiadotau, 2018), and strictly text-only interactive fictions like the classic *Colossal Cave Adventure* (Crowther & Woods, 1976).

[177] This understanding is also in accordance with the argument that humans rely on vision as their main sense (Enoch et al., 2019). In the end, they are called *video* games for a reason.

[178] When looking at these kinds of cognitive functions, however, one is also bound to consider that very rarely (outside of controlled situations such as those created for specific tests) an individual stimulus is present at each time. Much more often, video games present several visual stimuli, combined with audio ones and sometimes even with haptics. If processed in sequence, so many simultaneous stimuli would be impossible to manage. This is a first, intuitive motivation for investigating parallel processing.

with the words themselves coloured with coherent colours (e.g. the writing "blue" written in blue colour) or incoherent ones (e.g. "blue" written in red).


*Figure 6.1 – Example of the setup for a Stroop effect test. This is a case of incongruent name-colour.*

When people are presented with incoherently coloured text as the one in Figure 6.1, much less time is required to name the colour spelled by the word (in our case, "blue"), than to name the colour in which they are written (in our case, "red"). Similar tests have been investigating different sets of incongruent word-visual pairs. Among these is the word-picture interference (Rosinski et al., 1975), in which text is written inside stylized pictures both coherent (e.g. the word "dog" inside the picture of a dog, or inside the picture of a duck). Another similar test is the word-direction interference (Shor et al., 1972), in which arrows pointing at four directions (up, down, left, right) were mix-and-matched with the four words both coherently and incoherently. The results to these tests are similar to the results of the original Stroop effect test: participants could name the word faster than the other visual features. One of the main theory advocated to explain the Stroop effect is the speed of processing theory, hinted initially by Stroop himself and accepted as generally valid for several years (cf. Dyer, 1973). According to it, faster processes fill up the cognitive capacity before slower processes can be run, leaving less cognitive power available to the latter. This allegedly explains why it is more difficult to name the incongruent word-colour pairs: because words are processed faster, and interfere with our processing of the colours. As such, the Stroop effect seems to invalidate my claims.

However, as MacLeod maintains, "the speed of processing account does not provide a sufficient explanation of Stroop interference" (MacLeod, 2014, p. 4). A more convincing justification of this effect that has been advocated in literature is the psycholinguistic explanation, according to which colours, not being directly connected to their names, require an extra step to be "translated", to connect the visual feature colour to its conventionalized nomenclature. Words, on the other hand, spell out the name of the colour directly, and it is therefore only necessary to read the word to get the correct answer (cf. Roelofs, 2003). Following this explanation, then, the Stroop effect would not entail that text are processed faster, but rather that the information presented by words in the specific setting of the Stroop effect test are more directly available to be cognitively managed for the task at hand (similar conclusions were drawn through empirical analyses, e.g. by McBride & Anne Dosher, 2002). Thus, the Stroop effect says little about processing speed of different kinds of stimuli. An additional explanation that has been proposed is that of the saliency criterium, according to which we have been trained to regard text as more informationally rich than other kinds of visual stimuli (in this case, of colours). Therefore, when it comes to extracting relevant

information from coloured words, text is automatically processed first (Melara & Algom, 2003). This explanation can also be combined with the psycholinguistic one, as the saliency is partly dictated by the very requirements of the experiment. This means that if one is required to say the name of the colour, more saliency is assigned to linguistic content. On the contrary, saliency might be shifted towards colour if one would be required to associate two words with the same colour, where linguistic content could be neglected.

Therefore, two of the main counterarguments that could be advocated to confute the hypothesis of a faster and lighter processing of images compared to text, the Stroop effect and the connected speed of processing theory, are most likely only apparently invalidating my proposition, as there is little and very debated evidence that text is processed faster than other visual features. On this, MacLeod ultimately states that the Stroop effect "reveals little about color processing" (MacLeod, 2014, p. 5).

To the best of my knowledge, there is little empirical data on the processing times of other kinds of stimuli. While Lindström and colleagues refer to an overall rapid processing of audiovisual events (Lindström et al., 2012), most of the literature on cognitive aural processing focus on sound recognition and on the discerning of known sounds from noise (cf. e.g. Isnard et al., 2019). An interesting aspect that emerges from such studies is that human voice is processed faster than other kinds of sounds. The reasons given to explain this phenomenon are related to a saliency criterium and to our training in quickly identifying the most useful information – and possibly to the evolutionary advantages of doing so. Yet, it is quite difficult to confidently state the overall weight of audio in terms of human cognitive requirements due to this lack of data. Audio is a powerful means of communicating information (semantically, contextually, and emotionally), but more research is needed to back my beliefs. Similarly, almost no research exists on the cognitive power required for processing haptic sensations.

To summarize, there is considerable empirical evidence supporting the idea that images are faster to process and cognitively lighter than text. This, in turn, means that more complex representations can still be cognitively manageable if presented via images than via text. As it could be already apparent, additional research is needed to measure the exact difference in processing speed and the resulting cognitive requirements for processing images and text. In addition, this difference must be more thoroughly identified regarding moving images, which are closer to the visual presentation of video games. Lowering the cognitive power necessary for initial information extraction means that more power is left free for the interpretation and sensemaking of the resultant information. This lowered cognitive power enabled by the not-only-textual presentation of videoludic narratives is also linked to other cognitive economy strategies.

### 6.1.2 Multimodality as parallel computing

Parallel computing is a time- and power-efficient paradigm for machine computation, where multiple calculations are carried out simultaneously (Rauber & Rünger, 2013). The idea behind parallel computing is that dividing a task in a number of smaller sub-tasks and executing these sub-tasks simultaneously rather than in series can significantly increase efficiency in terms of time and power required.[179] To make a simple case (and a simplified one, as much more factors impact actual performances), if a computer is tasked to calculate the length in characters of a sentence of 10 words, it is cheaper (in terms of both time and power) to divide the task in 10 parallel processes, each calculating the length of a single word before eventually get to the sum, rather than to calculate each word one after the other. According to several studies on human perception and cognition, the human mind is capable of performing parallel computing, too. Many empirical studies (discussed below) show that different areas of the brain activate in parallel while engaging in a task. In my view, this capability allows us, as humans, to process multiple stimuli simultaneously in a time- and power-efficient way. This appears to be true at multiple levels of observation, as I am going to discuss.

At an overall perceptual level, research in the cognitive theory of multimedia learning supports a vision of human cognitive computation as working through two parallel channels, one related to visual stimuli and one related to aural ones. One of the most influential research in this direction has been initiated by Richard E. Mayer's influential book *Multimedia Learning* with his "dual-channel assumption" (Mayer, 2001/2009).[180] While Mayer himself notes that more research is necessary to clarify the nature of the differences between the two channels, a specific discussion of the status of them is beyond the scopes of this work. What is interesting for the current effort is that the idea of a separation in different channels processed parallelly is widely accepted in the scientific community following Mayer's seminal contribution. In this regard, empirical research shows that aural and visual stimuli activate different cortical areas. Besle and colleagues locate the sensory memory representation of auditory and visual features of an audiovisual event in the temporal and occipital cortex, respectively (Besle et al., 2007), while several studies show the location of auditory and visual short-term

[179] In serial processing stimuli are processed sequentially, without any overlap of processing times.

[180] Mayer's theorization comes from a long history of research in cognitive psychology. Two of the main starting points of this theorization are Paivio's dual-coding theory, which makes a separation between analogue and symbolic codes (cf. Paivio, 1990), and Baddeley's model of working memory, which hypothesizes a visual and an aural component of short-term memory (cf. Baddeley, 2003). Baddeley's model of working memory proposes a three-parts model describing short-term memory. These are "a control system of limited attentional capacity, termed the central executive, which is assisted by two subsidiary storage systems: the phonological loop,which is based on sound and language, and the visuospatial sketchpad." (Baddeley, 2003, p. 830).

memory storage in, respectively, left and right tempoparietal regions (cf. Baddeley, 2003).[181] In more general terms, these findings are well in line with the idea of a simultaneous processing of aural and visual information, being somehow the condition *sine qua non* of parallel processing. If these stimuli were processed by the same parts of the brain, there would be little space for the possibility of a separation of them, prerequisite for a parallelisation. Therefore, this further supports Mayer's dual-channel assumption and my own hypothesis of a parallel processing of visual and aural stimuli.[182]

Brünken and colleagues discuss the multimodality effect in terms of cognitive processes related to its functioning. Taking the moves from Mayer's dual-channel assumption, they argue that each channel has a subsystem of the mind dedicated to its processing. These two subsystems, "have separate, limited processing capacities that cannot easily be exchanged between the systems" (Brünken et al., 2004, p. 118; see also the 'limited capacity assumption' in Mayer, 2001/2009). In simpler terms, what Brünken and colleagues suggest is that the cognitive power dedicated to the processing of visual and aural stimuli have each an allotted quantity of cognitive power. The power dedicated to vision cannot be employed by hearing, and vice versa, making them two separated processing routes. In case of a single mode of presentation (e.g. visual), the cognitive capacity dedicated to the processing of the non-employed mode (e.g. aural) is left idle. If the presentation is multimodal, the cognitive capacity allotted to the processing of both visual and aural stimuli can be employed, augmenting the overall cognitive power available.[183]

This does not mean that these two processes run completely separately from each other. Rather, they present intersections and mutual influencing. Besle and colleagues (Besle et al., 2005, 2007; cf. also Lindström et al., 2012) report evidence of interactions between audio and visual processing. They also add that even the representation in sensory memory of the two kinds of stimuli shows feature conjunctions (Besle et al., 2007).[184] Once processed in parallel, the different stimuli of a multimodal presentation obviously need to be integrated.

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[181] Gao and colleagues comment that these differences might be due to "the analytical contrast used, complexity of the stimuli, and modality within which attention was directed" (Gao et al., 2022, p. 1).

[182] The question remains whether we can even consider touch stimuli like the haptic feedback to be processed through a third, additional parallel channel. There is little to no empirical study on the matter, and I will not investigate this further in the current work.

[183] This is not to say that humans can unproblematically sustain full computing capacity for all parallel processes, but only that the parallel processing makes a fuller use of our mental capacities.

[184] Gao and colleagues note further that the ways in which the integration of these two channels work are not pre-determined but adapt to the specific circumstances. "The context-dependent neural activity related to audiovisual integration suggests a flexible rather than fixed neural pathway for audiovisual integration. Together, our findings highlight a flexible multiple pathways model for audiovisual integration", they conclude (Gao et al., 2022, p. 7). In addition, according to the parallel distributed processing theory (Rumelhart, 1987/1999), while the brain analyses the stimuli with which it is presented, specific pathways are developed or reinforced for different tasks.

This integration always uses serial processing and ultimately leads to the perception of the whole (cf. Shiffrin & Schneider, 1984; Treisman, 1986; MacLeod, 2014). This process therefore leads to "bottlenecks" in the parallel processing of multimedia content, which limit but do not invalidate the advantages of parallel processing (cf. Amdahl's law, Amdahl, 1967). Through a different set of empirical evidence, Baddeley argues that this integration happens in the frontal cortical lobes (Baddeley, 2003). These empirical findings are in line with my assumption of a parallel processing, as eventually the parallel processes necessarily have to become part of an integer, which is what informs our understanding in the very end.

The two parallel channels for processing allow a more efficient (in terms of time and cognitive power) processing of information, in a way somehow similar to that discussed above for electronic computation. This more efficient use of cognitive power, made available by our parallel processing capabilities, allows us to process complex representations rather easily. This in turn permits to represent more complex information through those artifacts which afford parallel processing, than through those which do not.

Similar considerations could be drawn at a finer granularity level. The literature on the functions related to cognitive processing reports empirical evidence supporting the idea that parallel processing works also within a single channel. Empirical studies show our capacity of processing in parallel features of visual stimuli (see Wolfe, 1992). For instance, empirical data support the idea that the brain divides what it sees into four components: colour, motion, shape, and depth, individually analysed and then compared to stored memories to identify an object (Hinton & Anderson, 1989). Eskelinen also supports a theoretical division in "interplaying channels" – parallel processed channels that show intersection with each other – of textual and other visual stimuli (Eskelinen, 2001, Section 5). Other studies show similar results with auditory stimuli (cf. Woods & Alain, 1993; Isnard et al., 2019). On this, Besle and colleagues report that distinct auditory features (such as frequency or intensity) are encoded separately in sensory memory (Besle et al., 2007).[185] This could show that even within a single channel, multiple tasks can run in parallel.[186]

These seemingly complicated considerations have rather simple manifestations in practice. An easily visible example is that of the already mentioned "Sadie's story" (see section "2.2 Formal complexity and cognitive responses – a study"). This is a second and subordinate story arc included in the game *Halo 3 ODST* (Bungie, 2009), in which the main protagonist is *the Rookie*. While playing

[185] Our brain developed "metacognitive strategies" (Mayer, 2001/2009) for discerning the most relevant information sources and focus on them (cf. also the theories of selective attention, in Johnston & Dark, 1986), which guide our perception of both images and sounds (Isnard et al., 2019; cf. the 'guided search model' discussed in Wolfe, 1992; and advanced in Wolfe & Gray, 2007)

[186] The integration of monomodal features shows that even in this case, and interplay of the parallel processes is in place.

the game, players can listen to several audio files found throughout the game world. These "audio logs" (as they are called in the game) tell the story of a girl, Sadie, who tries to flee from the city as a war breaks out. The case of Sadie's story proved to be interesting, in Part I, for discussing the complexity of the narrative of *Halo 3 ODST*, but it is particularly relevant also at this point of the discussion because of the way it is presented to the player. The recordings recounting Sadie's story are played while the user is engaged in other activities forming a normal playing session (running, shooting, jumping, etc.). At stages, Sadie's story is played while other relevant events are happening (e.g., while one of the first interstellar cruisers of the alien forces reaches the Earth). As I argued, this causes a narrative layering that fosters the complexity of the narrative of *Halo 3 ODST*. However, this also reveals the capability of our mind to process information in parallel. The very fact that designers could rely on sound (mainly voices and sound effects) to present Sadie's story, while the visuals present a largely unrelated set of stimuli, and, even more, the fact that these two sets of stimuli (aural and visual) referring to two different storyworlds (Sadie's and the Rookie's) are presented simultaneously but remain both understandable at all times, show that two cognitive processes are running in parallel. If this was not the case, the two storyworlds would collide and/or blend into each other, confusing the players and making it difficult to clearly distinguish the boundaries between one narrative and the other. If the processing of these two stories were not parallel (thus, simultaneous but distinguished), players would end up as the readers of *If on a Winter's Night a Traveler* (Calvino, 1979/1993): thrown into confusion as several narratives are juxtaposed within the same, serial cognitive process of reception.

The example of Sadie's story makes this phenomenon particularly apparent as arguably even two parallel but different sensemaking mechanisms are at play, but smaller-scale parallel processes are clearly visible for instance in the fact that it is a custom in video games to use music to set (and change) the mood of scenes presented through vision. This is the case e.g. when players are consulting a map and suddenly hear a change of music, signalling the approaching of an enemy, as it sometimes happens in *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011). If humans were not capable of processing stimuli in parallel, these effects would have not been achievable. This also means that the very existence of a multimodal system at least in video games is based on our ability to process stimuli in parallel.

As mentioned, there is empirical evidence supporting the idea that different features of the same kind of stimuli are processed in parallel. In video games, we can indeed detect parallel processing not only at the level of visual and audio stimuli, but also within only audio or only video. As Sadie's story shows, sound can convey narrative information, using a narrating voice, while, *simultaneously*, mimetically represents the happenings within the game world, e.g. with sound effects resembling the sound of characters' steps, of bombs exploding, or of the interstellar alien cruiser approaching. These two stimuli are both audio-based, but they refer to the two different narratives (Sadie's and the Rookie's). They are

both processed at the same time and identified as diverse and not directly related to one another, which supports at least at a theoretical level the idea of them being processed in parallel.[187]

To summarize: in psychology, the brain's ability to process stimuli of different quality simultaneously is known as parallel processing. Parallel processing in video games can happen both at the level of overall perception, with the simultaneous processing of visual and auditory stimuli (and, possibly, also of haptic ones) forming the multimodal (sub-)system with which video games are made perceivable. At a finer granularity level, even the processing of monomodal stimuli has been shown to work parallelly for the identification of some features. These multiple parallel processes arguably allow for a more efficient use of the overall cognitive power, easing the complex sensemaking of video games and the comprehension of their narratives, by spreading their initial processing in different tasks carried out by different cognitive functions, to which is attached dedicated and non-transferable cognitive power.

As Reinwein and Tassé argue, the advantage of multimodal over unimodal presentation increases with the increase in complexity of the presented material (Reinwein & Tassé, 2022). This suggests that this parallel processing is related to the complexity of the material presented, and therefore that the complexities of video games are particularly likely to exploit this cognitive economy strategy, and to exploit it at its fuller potential. Due to the more efficient processing of stimuli, enabled by multimodal presentation, additional effort can be put in the interpretation of the complexity of video games and of video games narratives, compared to a presentation mode that do not allow parallel processing. Furthermore, the quicker time to process images compared to text highlighted in Section 6.1.1 "An image is worth a thousand words", and the parallel processing of multimodal stimuli described here, also lead to a collateral argument, which is that videoludic worlds present a sort of lower the dissipation of cognitive power.

### 6.1.3 Lower dissipation of cognitive power

Imaginatively generating the details of a storyworld can require significant cognitive effort. This is supported by empirical data on linguistic instantiation versus referencing. Lomabardi Vallauri (2019), for instance, maintains that instantiating *ex novo* an element in memory requires more processing energy than just referencing it (that is, than retrieving it from memory).[188] If imaginatively generating

[187] On the other hand, however, it would be almost impossible to follow two narratives both told by narrating voices at the same time. This seems to highlight that parallel processing can happen only between different semiotic modes, at least for aural stimuli. The situation seems to be even more complicated for visual stimuli. More direct empirical studies are required to provide a practical validation of these theories.

[188] A similar explanation could also be taken into account to partly explain the significant difference in difficulty of understanding a representation when re-accessed after the first time (re-reading of books, re-watching o movies, or re-playing of video games): the cognitive effort

the details of a storyworld would not be cognitively requiring, this difference between instantiation and referencing would not be detectable.

My assumption is that the power required for the imaginative generation of a storyworld varies depending on the ways in which the storyworld is presented. This idea is supported by Powlesland, who similarly state that players' brain has little difficulty in constructing a credible mental model of the virtual space because "all the imaginative work has been done, freeing the player's cognitive processes to attend fully to experiencing the space." (Powlesland, 2022b, pp. 27–28). However, Powlesland does not touch on the reasons why this is so. I argue that the reasons for this lowered difficulty in understanding the storyworld can be seen in the two cognitive economy strategies I have discussed above.

A textual representation requires readers to "translate" the highly symbolic and scarcely mimetic linguistic storyworld. In a text-based narrative, in which everything is presented (and represented) through text, a significant cognitive effort is required to imaginatively generate the storyworld and its details. An audio-visually-presented storyworld is much less cognitively requiring, since it presents information in a way that is less power-consuming, as I have shown in the previous sections. The lowered power required could be due to the lesser decoding necessary to understand audiovisual narratives: if a textual representation contains the word "red", one needs to go through the convention of language and retrieve the idea of redness, and of the specific shade of redness implied. In a visual representation, there is no need to operate translations, as the colour red is simply perceived as-is, red, in all its possible nuances.[189] At the same time, the multimodal presentation, too, makes audiovisual representation more immediately understood, lowering the required cognitive effort and accelerating the imaginative generation of the storyworld.[190] Indeed, as mentioned in Section 3.2.1 "Multimodality and multimodal systems", multimodal media function as great facilitators of immersion, at least according to Steuer (1992) and Ryan (1999). The analysis conducted until this point can shed light on these claims: given the lowered cognitive power required to extract semantic content from audiovisual narratives, and their enhanced processing speed due to parallel processing, immersion is quicker and easier to arise because audiovisual

required to piece together the represented storyworld is significantly lowered by the fact that no instantiation is required, but just a reference and, at worse (i.e., if one mis-remember the details of a storyworld), a readjustment.

[189] Colour-blindness may prevent the normative perception of colour nuances, but this is irrelevant for the current discussion.

[190] Orenes provides an explanation of this, maintaining that "The theory of mental models (the 'model theory' for short; see Johnson-Laird, 2006) is consistent with the double processing […] and claims that our representations are as iconic as possible. In other words, the structure of our mental representations (mental models) is analogue to the structure of the world under description (see Peirce 1931–1958). This theory is in line with the sensorimotor representations that the embodied cognition account endorses (Barsalou, 2012; Glenberg et al., 1999), but it also allows for the use of combinations with symbolic representation […] (for a review, see Khemlani et al., 2012)" (Orenes, 2021, p. 1418).

representation come as less mediated than textual ones, and anyways necessitate fewer cognitive effort to be summoned for their fruition.[191]

We can therefore identify what can be considered a third cognitive economy strategy, which relates to the imaginative generation of the storyworld, and to the processing of all its elements. The sub-systems of information that participate in video games sensemaking seems to entail an overall lower dissipation of cognitive power. Even more, Ryan relates a lower dissipation of cognitive power to the artistic practice:

> "The ultimate goal of art is to involve the whole of the embodied mind, the intellect as well as the senses. To achieve this wholeness, sensorial art forms must be coaxed into conveying messages, while language-based art forms must be taught to appeal to the senses. Through narrativization, sensorial arts acquire a sharper mental dimension, and through collaboration with sensorial signs, language-based narrative allows a fuller experience of the storyworld. In multi-modal media, the appreciator can directly see, hear, and maybe even interact with objects, and the imagination, relieved from the cognitive burden of simulating sensory data, can more easily immerse itself in the story." (Ryan, 2012, Section 29)

This means that an increased portion of cognitive energy can be actively dedicated more specifically to the interpretation of the narrative, increasing the degree of (narrative) complexity that can be cognitively managed.

While more specific empirical data would need to be gathered to undeniably prove this more efficient use of cognitive power, several theoretical studies seem to suggest the same idea. In addition to the claims of Powelsland reported above, Jean Rousset maintains that:

> "reading, which develops over time, must, in order to be comprehensive, make the work simultaneously present in all its parts. Delacroix points out that, while a painting offers itself in its entirety to the eye, the same cannot be said of a book; a book, like a 'painting in motion', can only be discovered in successive fragments. The task of the demanding reader is to reverse this natural tendency of the book so that it presents itself in its entirety to the mind's eye. A complete reading is one that transforms the book into a simultaneous network of reciprocal relationships" (Rousset, 1989, p. xiii) [my translation from French].

This simultaneous rendering of all parts is not necessary for video game players, as the task is externalised from players' cognition, relegated to the multimodal rendering of the game – similarly to what Rousset with Delacroix attributes to painting. Through this extension of players' cognition, a considerable amount of cognitive power is left free to perform other complex tasks, like interpreting the complex narratives.

An additional effect of this cognitive economy strategy worth mentioning is that it allows a more immediate holistic view over the game- and story-world.

[191] This could also be seen as the reason why audiovisual products are so useful for persuasive purposes (as it is well known e.g. in marketing – cf. Lombardi Vallauri, 2021, 2019).

This is quite intuitive: an audiovisual (or even just visual) representation can portray in one single frame an entire landscape, while a textual representation cannot. This, while being directly related to the lower dissipation of cognitive power and to the faster processing speed of images, allows games to present information not one at a time, which would require a serial integration of information. Obtaining a holistic view in a text-based representation is much more cognitively challenging, while in the multimodal form it is direct and much less effortful.

One could argue that the three strategies discussed so far are counterbalanced, in text-based narratives, by the possibility to pace the reading at one's own comfort. This is certainly true, and it is a valid reason for the difference in manageable complexity of textual versus oral presentations. While very few video games allow for a freedom of pacing comparable to textual representations, one of their intrinsic and defining feature can be seen as allowing a midway between the fixed pacing of movies and the freedom of literature: interactivity.

### 6.1.4 Interactivity and pacing

Cinema is a dynamic medium[192] as it imposes a temporal dimension that is at least partially independent from their users: movies are perceived as "movement in time" (Domsch, 2013, p. 7). Unless behaving against the prescriptions of the medium, when one approaches a movie (or a song, or any other dynamic medium), one is forced to submit to the pacing provided by the authorial will – that of the movie director, in this case. On the other hand, text-based representations like literature, as static media (Ryan, 2006), do not inherently impose a temporal dimension. For these media, pacing therefore depends entirely on the activity of the audience/reader, who has the freedom to slow down their access to the narrative, stop to think about it, and even re-read if needed. Dynamic and static media are therefore the two extremes in a sort of spectrum of pacing freedom.[193]

Video games could be placed in a middle way of this spectrum, somewhere between cinema and literature. The exact position of each individual game in the spectrum is to be described individually as it largely depends on genre conventions and design choices, but the somehow medial position still holds, and it is afforded by the interactivity innate in video games.

Interactivity allows for slowing down in the fruition of the representation, at least to a certain extent. As most video games encompass different media like text, still images, navigable spaces and dynamic audiovisual narratives, they generally present players with both moments of control over the pace of the narrative, and moments when the control is external. As mentioned, genres customs

[192] Ryan talks of the kinetic properties of media, a medium is static when its representations stand still over time, while it is dynamic when they change (cf. Ryan, 2006).

[193] As it should be noted, most dynamic media allow an extradiegetic pausing – that is, it is possible to control pacing by forcefully suspending the fruition of the representation. However, this feature is not embedded in the representations themselves, being extradiegetic, and as such does not constitute enough ground to claim freedom of pacing.

and specific design choices can have an impact on the freedom of pacing afforded to players. An interactive fiction, rarely presenting time boundaries and often relying on text, is likely to afford much more freedom of pacing than a first-person shooter game, generally based on fast action, strict time boundaries during gameplay, and videoclips as main elements advancing the narrative. Similarly, even within the same game genre, a number of design choices can impact the afforded pacing. Within the action role-playing genre, a game like *Dark Souls* (FromSoftware, 2011) allows more freedom of pacing in accessing the narrative than, e.g., *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011). In *Dark Souls*, players have access to the story by reading snippets in the form of descriptions of the objects found in the game – this allows to re-read these snippets ideally as many times as needed, for as long as needed. In *The Elder Scrolls V: Skyrim*, on the other hand, narrative-relevant information are often presented through characters' dialogues that cannot be paused as they happen in real-time (unless one pauses the game, as discussed in footnote 193). This latter mode does not allow pacing *during* the access to the narrative, but players can still take breaks between narrative-heavy sections, e.g. between one dialogic section and the following. This possibility of breaking the flow of the narrative holds true even in the fast-paced first-person shooter genre previously discussed, and it allows players to stop and ponder over the in-game happenings at a number of moments (e.g. when no enemies are around).

Interactivity therefore allows video game players to at least partly benefit from the cognitive economy strategy of the freedom of pacing, typical of text-based narratives. At the same time, the video game multimodal system allows the employment of the other such strategies typical of audiovisual media, among which are the faster processing speed of images over text, the parallel computing of multimodal signs, and the diminished cognitive requirement for the imaginative generation of the storyworld, as discussed. Therefore, while on the one hand video games might be considered as *Gesamtkunstwerk* (Backe, 2020), as synergies of all other arts, on the other hand they also seem to make use of the most effective cognitive economy strategies that all other arts have mastered exploiting. While further multidisciplinary research on the matter is needed to obtain a clearer idea of the actual functioning of these cognitive processes, the current understanding of the working of the brain does not contradict these hypotheses.

All the considerations discussed so far could be said to have another underlining backbone, which is the fact that the cognitive economy strategies are arguably powerful because they have been thoroughly trained by real life, and they exploit this constant training due to the specific features of the digital medium.

## 6.2 Exploiting everyday training

We, as humans, are accustomed to a highly interactive and (at least) penta-sensorial reality, where vision plays a major role but is still to be integrated with other sensory stimuli, where to each action corresponds a reaction, and where we are never only and merely passive spectators. Video games can be argued to more closely mimicking these aspects of reality and, as such, they can be argued to rely on cognitive strategies that are trained on a daily basis.

It is plausible to argue that our brains are better trained to manage more efficiently sensory stimuli that resemble our reality the most. Gregersen maintain that video games rely on "core cognition", i.e., deeply-ingrained cognitive functions that are at the basis of our everyday experience in the world (Gregersen, 2014). Powlesland follows up to this claiming that "the player's cognitive functions begin to respond in the virtual world in the same way that they respond in the real world, because the well-designed game world is programmed to provide perceptually identical reciprocal feedback to her neural system to that which the real world provides" (Powlesland, 2022b, p. 19). Video games, being based on a multimodal system, can be considered a representation that at least at a sensorial level is closer to reality. As the world becomes available to us through a plethora of sensory stimuli, it is reasonable to think that the more time- and power-efficient paradigm of parallel processing is deeply ingrained in our cognitive functioning, and thoroughly trained by our everyday experience as multi-sensorial beings in the real world. Similarly, given the prominence of vision over other senses in the human sensory system (cf. the abovementioned Lombardi Vallauri, 2019), perception and computation of visual content can be argued to have been trained by everyday life to work efficiently, requiring as little cognitive power as possible. This also implies that a very well-trained reader might be able to lower significantly the cognitive effort required to deal with textual representation, but this is less immediate and less deeply ingrained in human cognitive wiring.

Similar considerations could be drawn regarding the highly interactive and reactive nature of our experience in the real world, where enaction is crucial. This is the very core idea of enactive views of cognition, as discussed (see Section 3.2.2 "Interactivity, enaction, and sensorimotor experiences"). The innate interactivity of video games "brings them a step closer to life than do movies and novels" (Ryan, 2006, p. 190; similar considerations are done by Aarseth, 1997). Interactivity allows for an active participation to the game (see Section 3.2.2 "Interactivity, enaction, and sensorimotor experiences"), which resembles more closely the kind of enactive attitude we are accustomed to in the real world.

It is therefore possible to claim that video games actuate a series of cognitive economy strategies also because of their increased similarity to reality with respect to both cinema and literature, at least in terms of the enactive cognitive disposition of their users. The exact extent to which this is true is to be investigated by means of empirical data. The strategies for cognitive economy discussed so far could potentially be linked even to specific evolutionary advantages. For instance, the ability to process in parallel different sensory stimuli could be

conceived as an evolutionarily selected response to the complex natural environments in which we used be required to survive for most of our history as a species. This, however, would need additional work to be claimed confidently.

Following the line of thoughts of exploiting everyday training, it might be possible to speculate that the closer a representation get to reality, the more complexity will be cognitively manageable. For instance, the one-on-one mapping of players' bodies provided by virtual reality technologies could trigger further cognitive economy strategies that are not activated by the controller- (or mouse-and-keyboard-) mediated embodiment of on-screen video games, linked for instance to proprioception and/or enhanced immersion. A similar perspective has been foreseen by Bailenson, who argues that "VR can be stored in the brain's memory center in ways that are strikingly similar to real-world physical experiences [...]. When VR is done well, the brain believes it is real"[194]. While this could be partly motivated, due to the heightened exploit of other innate cognitive processes like proprioception – similarly to what we have discussed here –, the investigation of this hypothesis, too, as well as the identification of the specific strategies and their effects for cognitive economy in virtual reality, will require further pondering beyond the scope of my current analysis.

## Conclusions of Chapter 6 – Double complexity and cognitive economy

Salen and Zimmerman regards video games as a peculiar phenomenon, stating that "games are certainly one of the best examples of how entertainment can be far from simple" (Salen & Zimmerman, 2004, Chapter 'Forewords'). In this chapter I showed some of the plausible reasons why video games ca be argued to remain cognitively manageable and even fun to deal with in practice while being impressively complex in theory. I discussed four macro-level cognitive strategies that can be said to apply when players try to make sense of video games and their narratives. These cognitive economy strategies are arguably enabled by the characteristics of the videoludic medium but deeply ingrained in our cognitive functioning and trained by everyday life, and they ultimately allow the double complexity of video games to be cognitively manageable.

The hypothesis I advanced in this chapter is that the strategies discussed here can be considered part of the reasons why video games can represent generally complex narratives exactly by relying on a complex collaborative sensemaking. Being based on the multimodal (sub-)system, on interactivity and on memory, the game-player collaboration system in video game sensemaking enables the exploit of the cognitive economy strategies by the player. The cognitive efficiency that these cognitive strategies entail allow to lower the cognitive power required by the videoludic representation. This leaves overall more cognitive power free to understand a more complex narrative and/ therefore enables the

[194] Bailensen's quotation is reported by LaMotte (2017).

representation of an overall more complex narrative without it being cognitively overwhelming. For these reasons, the encounter of complex narratives and complex sensemaking can be said to entail an improved cognitive economy.

As mentioned in the introduction to this chapter, the four strategies discussed here are functions of players' minds elicited by the characteristics of the videoludic medium itself. Designers can and often do (willingly or accidentally) manipulate these strategies through specific design choices. For instance, representing large portions of the narrative through textual content can be said to exploit more the freedom of pacing and less the benefits of multimodality.

In addition, video game designers often adhere to and exploit other deeply ingrained cognitive embodied metaphors. In *Detroit: Become Human* (Quantic Dream, 2018), the right analogue stick of the controller is associated to the focal attention of the PC through the cognitive metaphor UNDERSTANDING IS SEEING (Lakoff & Johnson, 1980/2008). This makes the interaction mechanic very intuitive notwithstanding rather intricate connection between the required real-world action and the resulting in-game movement (see Section 3.4 "Case study: the fish scene in *Detroit: Become Human*" for a more extended description). This use of cognitive metaphors is often present in interaction mechanics and is often exploited even in the design user interfaces, as I have discussed elsewhere (Bellini, 2018).

Furthermore, designers often adopt ways to help players keep the complexity of video games and of their narratives manageable. These include information design guidelines. For instance, Kuvich and Perlovsky (2013) list a number of directions to keep informational structures simple and to reduce the complexity of the representation employing them. They state that:

> "The structure must contain elements that allows [sic.] for fast decision. Fast decision means certainty."
>
> "The structure must be relational. Relation is a constraint that reduces the risk of combinatorial explosion."
>
> "The structure must be hierarchical and nested. In that case, complexity is reduced to a particular level. This also allows for using context and fast and effective navigation and search in every direction."
>
> "The model structures should have effective mechanisms for maintaining knowledge base. [sic.]" (Kuvich & Perlovsky, 2013, p. 304)

The attentive reader recognizes these guidelines as one of the starting points of this work. In Chapter 1, I have discussed how deliberately violating these prescriptions can give rise to more formally complex narratives. Therefore, a contradiction could now be detected: if games are often designed to embed complex narratives, i.e. narratives that present heightened cognitive load, why then lower the effort for what has been specifically designed to be effortful?

The answer resides in the Holy Grail of the "Goldilocks" level of complexity' that designers try to reach. One must remember that while narrative complexity is appreciated by players, it is appreciated only to a certain degree, as discussed in Chapter 2. An overwhelmingly complex narrative would be, indeed, over-

whelming. It is therefore a matter of balancing, of finding "just the right amount" of complexity, in a very *Goldilocks* sense: not too much, and not too little: "The workload that your game imposes on your audience's brain must therefore be carefully weighed (as much as it can be given that there is no precise measurement for cognitive load)" (Hodent, 2018, p. 17). In addition, often the cognitive economy that helps make complex videoludic narratives manageable comes from a different level of granularity than that of narratives themselves, and often take the form of extradiegetic elements. For instance, extradiegetic menus keep the track of the several multiple embedded stories help manage the complex nets of interrelated stories in *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011),[195] or of different branches or storylines, as in *Detroit: Become Human* (Quantic Dream, 2018).[196] Other kinds of menus help "maintaining a knowledge base", as it happens in *Hades* (Supergiant Games, 2020),[197] where at each moment the fragmented information collected are summarised per-character in an extradiegetic menu. Similarly, semi-diegetic menus like maps and mini maps are inserted to help cognitively manage the vast spaces that often cause and foster the complexity of videoludic narratives, and the self-containment of games prevent serial aspects to make the individual narrative overly complex.

These design choices, like the employment of specific cognitive/embodied metaphors and the use of information design guidelines will not be discussed in detail at this point as a more thorough analysis will require a case-by-case assessment that transcend the scope of the current work. Nonetheless, additional research in this direction could shed light on more particular but not less important reasons why video games can (seemingly paradoxically) be so complex in theory without being cognitively overwhelming. As mentioned at various stages of this chapter, further research is also needed to observe the specificities of the four macro-level cognitive economy strategies touched with regards to video game playing, and particularly interesting would be to conduct empirical tests to investigate what has been outlined in exploratory terms here.

[195] See Section 1.3.2 "The Elder Scrolls V: Skyrim".

[196] See Section 3.4 "Case study: the fish scene in Detroit: Become Human".

[197] See Section 1.3.3 "Hades".

# Conclusions of Part III
# Video games between complex narratives and complex sensemaking

In the Part on video games and narrative complexity (Part I), I showed what and in which sense video games narratives are often complex, and I discussed how the more a narrative is complex, the more it causes epistemic emotion – under the form of incomprehension, confusion and difficulty of piecing together a meaningful narrative progression. In the Part on video games and complex systems (Part II), I have postulated that video games are based on a complex collaborative sensemaking system, from which the game playing experience emerges.

In Chapter 5 of the current Part, I have adopted both these theoretical lenses to discuss a single case study, namely the game *What Remains of Edith Finch* (Giant Sparrow, 2017). The analysis has been useful to highlight not only how the two perspectives of Part I and Part II can be productively employed together to shed additional light on both the narrative and the sensemaking relating to a single game, but it has also shown how the two complexities support and foster each other.

In Chapter 6, I have explored the ways in which the encounter of their complex narratives with their complex sensemaking, does not give rise to a double complexity but actually enable an improved cognitive economy. Our everyday experience in the real world can be said to train the use of these strategies, that are therefore deeply ingrained in our cognitive functioning. In particular, I argued that at least four macro-level cognitive economy strategies can be identified. These are:

1) The faster speed of cognitively processing the semantic content of an image compared to that of text,
2) The ability to cognitively process in parallel stimuli related to different semiotic modes (in particular, aural and visual),
3) The lower dissipation of cognitive power that 1 and 2 entail, as faster and parallel processing allow a more efficient instantiation of the storyworld in the players' mind,
4) The afforded capability of deciding one own's pace in accessing the representation, which is for video games lower than for text-based representation, but higher than for dynamic media like cinema.

These strategies are pertaining the players' cognition, and are allowed specifically by the characteristics of the videoludic medium, therefore being *a priori* specific design choices. Additional research is needed on the topic, but through this chapter I hope to have highlighted at least some of the directions this further inquiry might take.

Finding the right balance of simplicity, complexity, and cognitive economy strategies, is ultimately the goal of every game and narrative designer. Reaching the Goldilocks level of complexity is a Holy Grail that is not directly available but that I hope to have pointed out the direction to.

# FINAL CONSIDERATIONS

«One of the hardest things in the world
is to convey a meaning accurately
from one mind to another»

Lewis Carroll, Letter to Dora Abdy (Collingwood, 1898/1967), chapter VIII

In this work I have investigated the complexity of narrative video games sprouting from the game-player encounter. Different notions of complexity lightened the way. With the concept of narrative complexity and with the aid of empirical findings, I have shown how a certain formal organisation of videoludic narratives produces specific responses in their players. I have proposed an account of the devices that video game narrative designers often use to make narratives formally complex, which serves not only as a description of this widespread but scarcely recognised tendency, but also as systematisation and as a possible operationalisation of it. Furthermore, I have investigated the game-player collaborative sensemaking in video games, showing how a complex-systemic account is particularly apt in describing holistically the factors from which emerges the game playing experience, also in light of empirical data. When combined, these two notions of complexity (complexity of narrative, and complexity of sensemaking) describe how generally complex videoludic narratives are collaboratively constructed by games and players, and how the two perspectives on the complexity of narrative video games can be productively adopted in conjunction, to shed light on one another. Finally, I have provided an initial exploration of the reasons why the theoretical double complexity of narrative video games can be said to improve cognitive economy by exploiting deeply ingrained cognitive strategies.

The implications of the theories presented in this dissertation are several and span across a number of domains. In the upcoming pages, some of the most important implications of my application of complexity theories to the study of video games will be foregrounded, with the hope of highlighting more clearly the contribution of this work to the different fields involved, and to outline possible future research directions for myself and other researchers. In particular, I will discuss some of the implications of my theories for narratology, media studies, game studies, and game design. I will also discuss what the findings of this work imply for the representation of complex societal issues, a direction of research carried out by the members of the COST Action 18230 – Interactive Narrative Design for Complexity Representation (INDCOR), for which I have had the honour of co-chairing the working group investigating the theoretical grounding.

## Implications for narratology and media studies

The considerations on the complexity of narrative video games have several implications for the study of different narrative media.

Firstly, video games as featuring quite complex narratives can be considered one of the reasons why, diachronically, we are seeing increasingly more narrative complexity in popular culture.[198] With the increasing commercial fortune of narrative video games and their ever more prominent position in the current mediascape, their usually complex narratives become progressively normalised. As audiences get more and more accustomed to complexity, authors can safely create more and more complex narratives. This study highlights and examines the complexity of video game narratives, but additional research is needed to understand the exact implications of this complexity for our media ecology.

Secondly, complexity is inherently artistic, and art is inherently complex. Complexity often problematizes deeply ingrained beliefs, and thus slows down cognition and activates a more attentive thinking mode that is defining also of artistic creations. With their constant subversion of patterns, their innovative organization, and their stochastic dynamics, then, complex narratives can be considered as naturally artistic. I have touched on this similarity and the relevance of complexity in artistic practice and in audience response, but this is a line of inquiry that call for further explorations.

Thirdly, the views here proposed of a complex collaborative sensemaking system seems to be applicable not only to video games. Powlesland, for instance, proposes an emergent understanding of the immersion and presence elicited by the *Divine Comedy* (Powlesland, 2022b), ultimately stating:

> "Dante has authored not only a single enunciation of the journey to the encounter with the divine, but also a system, a body of code, that the reader generatively sets into action by importing into the manifold gaps in the text her own cognitive data: her imaginative work, her thinking, her readings, her [enactive] memorial work" (Powlesland, 2022a, p. 154).

Similar considerations can be found in the work of many scholars, referring to different media. Among these are Aarseth for text,[199] Kukkonen for comics,[200]

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[198] This is not to say that it is the only reason for the increase in the popularity of complex narratives, as many others can be identified (see e.g. the discussions of the phenomenon in Mittell, 2015; Kiss & Willemsen, 2017, 2018; and Willemsen & Kiss, 2022, among others). Nonetheless, this tendency is visible and detected by the academic literature (e.g., Bordwell, 2023).

[199] "the 'text' is something more than just marks upon a surface. […] These well-known processes are not entirely trivial, however, because they remind us that a text can never be reduced to a standalone sequence of words. There will always be context, convention, contamination; sociohistorical mediation in one form or another" (Aarseth, 1997, pp. 119–120).

[200] Talking about "the dynamic nature of meaning-making" in comics, a "pragmatics of their textual effects, that is, the complex combinations of clues and gaps in the text that interface with the cognitive process our mind runs when reading fiction" (Kukkonen, 2013, p. 14) [emphasis added].

Sofia for theatre,[201] Hven for cinema,[202] and Elleström for communication in general.[203] All these works, while acknowledging the complexity and the several influences participating in the sensemaking, do not engage with a complex systemic perspective yet. The complex-systemic perspective of sensemaking that I advance here promises to be hermeneutically productive well beyond video game studies. According to the findings reported in this work, there are several reasons to believe that applying a perspective similar to mine, after having operated the due modifications, would help to better understand how also different cultural objects mean what they mean. Understanding whether my framework actually applies to different media, and which modifications would need to be enforced for its applicability, is a further direction of inquiry.

Lastly, as I have discussed, the strategies for improved cognitive economy are not characteristics to video games but can be said to work also in the reception of other media. Analysing them more in depth can be a further step towards the identification of Goldilocks' levels of complexity in different media. Analysing the differences in terms of cognitive requirements of different narrative media could shed more light on the specific representational affordances of them, and further empirical research in narratology and beyond could germinate from this starting point.

## Implications for game studies and game design

As I have discussed in Part I, narrative designers for video games have been creating generally complex narratives for a long time now – at least relatively to the age of the videoludic medium. The analysis provided here translates devices of video game narrative organisation that have been so far only employed sparsely and *ad hoc* for specific video games into a more systematic ground base on which further research and/or narrative design guidelines can sprout. Together with the discussion of the cognitive effects of narrative complexity, and

[201] "Each of our actions is guided by our sensorial descriptions that are visual, auditory, proprioceptive, and kinaesthetic in nature which, in turn, require the activation of motor programmes that modify action itself and the perceived environment at the same time. In this sense, an 'executed' action always results from sensory feedback that continues to modify that action, again in an ongoing circular process. Every single action, therefore, is not equivalent to the physical-muscular execution of mental content, but must always be regarded as a process emerging from the comparison between the individual's potential actions and the spatio-temporal dimension of the interaction with the environment" (Sofia, 2016, p. 52).

[202] "Needed is the development of a film narratology that […] understands the diegesis as *emergent on the basis of the spectator's cognitive and affective capacities for sensemaking*" (Hven, 2022, p. 3) [emphasis added].

[203] "communicative complexities" as a common practice in interpersonal interaction (Elleström, 2021, p. 26), where "the transfer of cognitive import 'through' the media product might alternatively be described as 'a chain or interactions' involving producer's mind, media product, perceiver's mind and everything in between" (*ibid.*, p. 19).

particularly of its appeal, this awareness can help creators and narrative designers to create more engrossing narrative-driven video games.

Similarly, while immersion and presence are very sought-out effects in video game design and have been studied quite extensively, conceiving them as emergent aspects and third-order-design products is a perspective largely unexplored. Yet, it helps to highlight the fact that these cognitive phenomena emerge from several factors: the multimodal system and the interaction mechanics (first-order design) afford enaction and agency (second-order), which produce in players the sense of immersion and presence (third-order). This conception promises to shed more light on how these phenomena work and how they can be effectively supported and manipulated, but further research is needed in this direction.

In general terms, the complex-systemic view of game-player collaborative sensemaking helps to discuss *how* video games afford the experiences they afford, and therefore it also helps to discuss how to create such affordances in the design phase. One of the main implications of this theoretical perspective, from the point of view of game design, is that designing elements of a video game as isolated is not productive nor justified, as everything is encapsulated into a constant feedback loop with everything else in the complex process of sensemaking in which games and players collaborate. While some elements can impact the overall sensemaking more than others (e.g. the graphic style has more impact than the single prop), all elements have the potential for systemic change (e.g., the prop being a rubber duck rather than a severed horse head). "A system-based understanding of how games function can greatly improve a game designer's ability to anticipate how changes in a game's rule-structure will ramify into a play experience" wrote Salen and Zimmerman (2004, Chapter 14), and the discussion provided here highlights the reasons why this is so.

For the same reasons, from the point of view of game analysis, it is not possible to analyse one of the aspects of the complex sensemaking in isolation (outside of extremely controlled circumstances, and sometimes not even then) as this is not the way how the sensemaking works. A more holistic view is always needed. From these premises, it comes naturally the fact that the sometimes still resonating distinction between ludic and narrative aspects of video games, and between ludological and narratological points of view in narrative video game analysis, is unjustified. It is a virtual division and a hermeneutic simplification that should be always treated as such – a virtual simplification that do not reflect actual gaming practices. At the same time, my findings also reject the need to develop completely new analytical tools specific to video game analysis, as proposed for instance by Eskelinen (2012).[204] This is not to say that specific analytical tools are not helpful in video games studies, but rather that borrowings between disciplines are useful and productive. My perspective in this sense is inclusive rather than exclusive. It does make sense to employ the knowledge developed, for instance, by film studies, to analyse video games (where and when relevant and *mutatis mutandis*, obviously, but without rejecting it in its entirety) because

[204] Not least because of the formalism of his propositions.

players *will* employ their knowledge of cinema when playing a video game – although in different ways at different stages of the gaming experiences. Rejecting this means rejecting the current neuroscientific understanding of the human mind that has been presented throughout this work.

Lastly, the strategies for lowering the required cognitive power examined can point towards a promising direction in empirical game studies. A better understanding of the reasons why narrative video games can be so complex and yet so simple can not only help in achieving the Goldilocks' level of complexity, but can also shed light on our cognitive processes when dealing with games and other media.

## Implications for the representation of complexity

In an increasingly more interconnected world, issues like climate change, situations of conflict, global pandemics, or migration crises, are progressively showing the limits of current representational customs and standards, with worrisome effects to democracies and personal and collective freedoms. Several actors at different scales are trying to address these limits. The World Economic Forum developed an interactive data visualization tool called Transformation Maps[205] to try representing in a faithful way the interconnectedness of several aspects of today's world. Needless to say, the result is a complex relational assemblage itself. The United Nations Institute for Training and Research is often tasked to develop ways to help explaining these complex topics, and possibly to foster a more systemic thinking in the audience,[206] and similar attempts (although for more smaller-scale complexities) are being done by other intergovernmental organisations Child Helpline[207] and the OSCE Office for Democratic Institutions and Human Rights.[208] The European Federation of Journalism and the New European Media Initiative are similarly looking for solutions to the issue of effectively representing complexity[209], while more and more movements of slow journalism try to fight back the loss complexity intrinsic in "fast food" journalistic reports, that have the high ground in mainstream social media. NGOs and other actors of the civil society struggle to make people understand the importance of their work, which directly

[205] https://toplink.weforum.org/knowledge/explore

[206] As reported by a representative from UNITAR in one of the meetings organized by the COST Action INDCOR (e.g., the game Mission Zhobia (&RANJ, 2013)).

[207] See https://childhelplineinternational.org/launching-our-first-serious-game-a-milestone-in-child-helpline-counsellor-training-in-emergencies/. This information was disclosed by a representative from Child Helpline in a COST Action INDCOR meeting.

[208] See https://www.freedomlab.io. This information was disclosed by a representative from the OSCE Office for Democratic Institutions and Human Rights in a COST Action INDCOR meeting.

[209] These efforts were reported, too, by representatives of said organizations in a meeting of the COST Action INDCOR.

deal with these complexities, while the Office of the United Nations High Commissioner for Refugees recently discussed in a management plenary session the challenge of clearly communicating complex issues to avoid political manipulation.[210]

The question of how to better represent the increasing complexity of today's world in an accessible way is therefore being asked increasingly more from many sides. Video games and interactive digital narratives have been explored as potential ways to answer this question, specifically by the members of the COST Action INDCOR. Several of the points raised in this dissertation can explain why this effort and this line of thinking is justified.

As I have demonstrated, video games allow to lower the overall cognitive effort required for their understanding by exploiting deeply ingrained cognitive strategies. I argued that this is one of the reasons why video games can present generally complex narratives without being cognitively overwhelming. In the same way, video games can represent complex societal issues, in a non-overwhelming way. In addition, the inherent complexity of the game-player collaborative sensemaking allows video games to better represent complex topics, as complexity is not *explained* but *simulated* (cf. Sicart, 2011).[211] Players can interact with these issues and learn first-hand their complexity (see Knoller, 2019). In doing so, players can also understand the ubiquitous interrelatedness of everything: they can learn *systemic thinking*.

On the other hand, complex narratives could be said to train our capability of dealing with the everyday world, which is "complex and characterized by a lack of clear order and meaning" (Kiss & Willemsen, 2018, p. 60). Complex narratives, while still having a meaning and order, can nonetheless train our capability of dealing with ambiguity, interrelatedness,[212] and uncertainty by requiring audiences to maintain multiple reasonable interpretations at the same time (see Ang, 2011). According to Mezirow, these efforts can and will lead to a transformation in the audience, that is prompted to reassess their assumptions and processes of meaning-making, even to the point of changing the spectators' world view (Mezirow, 1991) – an achievement that can be ascribed to the highest forms of art, and which can be harnessed for positive social transformation.

The unique combination of complex narratives and complex sensemaking of video games that has been described in this dissertation can be therefore assumed as the basis for maintaining an argument according to which one needs complexity to talk about complexity. This seems to be also the guiding principle of the current work.

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[210] This information was disclosed to me in a private conversation by the High Commissioner for Refugee, Mr. Filippo Grandi.

[211] It should be noted, however, that even game simulations are still *simulations*, and therefore simplifications of the complexity they are meant to represent.

[212] Even when in a game not all possibilities are explored, "you are constantly reminded of inaccessible strategies and paths not taken, voices not heard" (Aarseth, 1997, p. 3).

"One of the hardest things in the world is to convey a meaning accurately from one mind to another" wrote Lewis Carroll to Dora Abdy in 1896 (Collingwood, 1898/1967, Chapter VIII). With this work, I hope to have at least provided a glimpse on why, in video games, this is such a *complex* task.

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# Appendix I – Findings of the empirical study (Chapter 4)

This appendix contains the tables summarising the findings of the empirical study reported in Chapter 4. These tables are divided on the basis of the sub-research question(s) they address and are presented in the order they are discussed in the chapter. The findings of S-RQ1 and S-RQ2 are further divided according to the six influences described in the chapter plus the additional findings specifically related to S-RQ1. The numbering of the evidences is continuous to avoid confusion in referring to them. Evidences are therefore numbered from E1 to E169. The tables also describe (from left to right):

- the type of evidence (whether it is a statement, a behaviour, or the summary of a statement). Behavioural evidences are followed by at least one exemplary vocalisation, when appropriate;
- the participant(s) to which the evidence relate, and in which moment of the session it was collected (think-aloud or interview);
- the translation in English of the transcription constituting the evidence, done by myself;
- the original in Italian of the transcription constituting the evidence, reporting the exact statement of the participant (if the evidence is a statement);
- a brief description of the relevance of the evidence.

For evidence relating to the interview, “E” stands for “experimenter” and “P” stands for “participants”. In the transcription, curly brackets denote actions, face expressions, and other non-verbal behaviour of the participant, while square brackets provide context for the reported evidence or are meant to facilitate reading the transcript. If context is important to understand the evidence, it is provided in the square brackets.

Additional comments to individual evidences are provided in footnotes, when necessary.

# S-RQ1 & 2

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| **Multimodal system affects Interaction ($M_u \rightarrow I$)** | | | | | |
| 1 | Behaviour | **All Think-aloud** | *Avoided obstacles* | | Multimodal clues provide information for interaction |
| 2 | Statement | **P11 Think-aloud** | *[Near hanging ally] so here I'm going to try to go to the higher road because I see that there is a visual input* | *[Vicino ad amico appeso] allora qua cercherò di andare sopra perché vedo che c'è un input visivo* | Multimodal clues (visual) provide information for successful interaction (navigation) |
| 3 | Statement | **P3 Interview** | *E: Why did you try to rescue the hanging knight? P: Because I could see him dressed like me? So I said, 'well he should be a fellow, something', and I mean... well he looked allied, so…* | *E: Perché hai cercato di salvare il cavaliere appeso? P: Perché lo vedevo vestito come me? Quindi ho detto "boh sarà un compagno, qualcosa", e insomma… sembrava alleato ecco, quindi…* | Multimodal clues (visual) provide information for successful interaction (navigation) |
| 4 | Statement | **P10 Interview** | *E: Why did you try to kill the skeleton at the top? P: Because there was… because I could see that on the other side there was a… a thing to… there was a dead troop no, and so I wanted to go to… to go there to see what it was, out of curiosity let's say. And so yes I was there like {mimes the gesture of beating something with a hammer}* | *E: Perché hai cercato di uccidere lo scheletro in alto? P: Perché c'era… perché vedevo che dall'altra parte c'era un… una cosa da… c'era un una truppa morta no, e quindi volevo andare ad… andare lì a vedere che cosa fosse, per curiosità diciamo. E quindi si son stato lì {fa gesto di battere con un martello}* | Multimodal clues (visual) provide information for successful interaction (navigation) |
| 5 | Statement | **P5 Think-aloud** | *{Slowly approaches the interactivity trap} there is something on the ground here so I jump over it {jumps over interactivity trap}* | *{Si avvicina piano a interactivity trap} Qui c'è qualcosa per terra quindi lo salto {salta trappola bloccante}* | Multimodal clues (visual) provide information for successful interaction (navigation) |

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 6 | Statement | **P11 Interview** | *[Near coin] I went where I saw the visual input and eventually I saw that you could actually pick it up" [there was] "the visual input of something that you could see that was prominent... Then it was also animated, it led me to want to interact with it* | *[Vicino a monetina] sono andato dove ho visto l'input visivo e alla fine ho visto che effettivamente si poteva raccoglierlo" [c'era] "l'input visivo di qualcosa che si vedeva che era in risalto… poi era anche animato, mi ha portato a voler interagire con lui* | Multimodal clues (visual) provide information for successful interaction (navigation) |
| 7 | Behaviour | **All Think-aloud** | *Collected the golden coins* | | Multimodal clues (visual) provide information for successful interaction (navigation) |
| 8 | Statement | **P4 Think-aloud** | *I choose to go to the upper road because I saw a sword* | *Scelgo di andare di sopra perché ho visto una spada* | Multimodal clues (visual) provide information for successful interaction (navigation) |
| 9 | Statement | **P6 Think-aloud** | *Above is the sword, below is the shield {follows the road up, reaches the door, Y appears above the door, looks controller and presses Y}* | *Sopra c'è la spada, sotto c'è lo scudo {segue strada sopra, arriva alla porta, compare Y sopra la porta, guarda controller e preme Y}* | Multimodal clues (visual) provide information for successful interaction (navigation) |
| 10 | Statement | **P11 Interview** | *I chose the sword because the visual input of having a weapon in a character who only had the jump button led me to want to take a weapon* | *Ho scelto la spada perché l'input visivo di avere un'arma in un personaggio che aveva solo il tasto salto mi ha portato a voler prendere un'arma* | Multimodal clues (visual) provide information for successful interaction (interaction strategies) |
| 11 | Statement | **P2 Think-aloud** | *I see flames {stands in front of the flames} I go through {dies} I try to go through… {respawns} I try to go through when the flames are not there* | *Vedo delle fiamme {si ferma davanti alle fiamme} passo {muore} cerco di pass… {rinasce} cerco di passare quando le fiamme non ci sono* | Multimodal clues (visual) provide information for successful interaction (interaction strategies) |

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 12 | Statement | **P5 Interview** | *E: How did you figure out how to use the combo? P: Because the little symbols appeared* | *E: Come hai capito come usare la combo? P: Perché sono apparsi i simbolini* | Multimodal clues (visual) provide information for successful interaction (interaction mechanics) |
| 13 | Statement | **P9 Think-aloud** | *It's also lacking the... key thingy, to explain the keys... {jumps on platform} Maybe someone who already knows how to play already has it in mind, How to use the keys... {dies in spikes} the controller... or not {jumps on platform} But for someone who is new to the game he misses the basics of the keys* | *Manca anche il… coso dei tasti, per spiegare i tasti… {salta su piattaforma} Magari uno che sa già giocare ce l'ha già in mente, Come si usano i tasti… {muore in spine} il controller… o meno {salta su piattaforma} Ma per chi è nuovo di gioco gli mancano le basi dei tasti* | Absence of multi-modal clues to provide information for interaction (interaction mechanics) considered marked |
| 14 | Behaviour | **P1, P4, P6, P7, P9, P10, P12, P14 Think-aloud** | *Quickly stirring away when about to get hit by the fake flames* | | Automatic interaction prompted by multimodal clues |
| 15 | Behaviour | **P10, P12, P14 Interview** | *Reported to not remember the fake flames* | | Pre-conscious reaction to multimodal clues |
| **Interaction affects Multimodal system ($I \rightarrow M_u$)** | | | | | |
| 16 | Behaviour | **All Think-aloud** | *Showing or expressing satisfaction when overcoming obstacles* | | Pleasure from perception of interaction causing multimodal change |
| 17 | Behaviour | **P3 Think-aloud** | *Commenting "ok" after clearing each obstacle (trap or enemy)* | | Pleasure from perception of interaction causing multimodal change |

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 18 | Behaviour | **P1, P4, P5, P8, P9, P10, P11, P12 Think-aloud** | *Acknowledge the visible change when saving the hanging ally* | | Perception of interaction causing multimodal change (visual, auditory) |
| 19 | Statement | **P4 Think-aloud** | *Y… {press Y, hanging ally disappears] "Thank you", saved a friend* | *Y… {preme Y, alleato appeso sparisce] "Thank you", salvato un amico* | Perception of interaction causing multimodal change (visual, auditory) |
| 20 | Statement | **P1, P2, P4, P8, P9, P11, P12, P14** | *Reporting their enjoyment of candles lighting up when walking below them* | | Pleasure from perception of interaction causing multimodal change |
| 21 | Statement | **P1 Think-aloud** | *Okay, this thing is nice, nice the… the torches that light up as you pass by* | *Ok, questa cosa carina, belle le… le torce che si accendono al passaggio* | Pleasure from perception of interaction causing multimodal change (visual) |
| 22 | Statement | **P4 Think-aloud** | *Maybe it would be nice to see an increase like zero of three [...] To make it clear that I'm actually... a little satisfaction let's say in recognizing that I did a good thing* | *Magari Sarebbe bello vedere un aumento tipo zero di tre […] per far capire che sto effettivamente… una piccola soddisfazione diciamo nel riconoscere che ho fatto una cosa buona* | Multimodal change resulting from interaction considered desirable |
| 23 | Statement | **P4 Interview** | *Maybe solely because of a driver or something there was a slight delay in the movement of the character....* | *Magari solamente per un driver o qualcosa c'era un lieve ritardo nel movimento del personaggio…* | Mismatch between interaction and multimodal reaction considered marked |
| 24 | Statement | **P11 Interview** | *The hardest part [of the game] was learning the timing between the command input and the actual let's say 'scenic' output in the game* | *La parte più difficile [del gioco] è stata imparare il timing fra l'input di comando e l'effettivo output diciamo 'scenico' nel gioco* | Mismatch between interaction and multimodal reaction considered marked |

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 25 | Statement | **P1 Think-aloud** | *{Blocked by interactivity trap, looking confused} ok...? {does nothing} it stopped... Hmmm... Why? {presses all buttons, looks at me} I think it froze... I think...* | *{viene bloccato da trappola invisibile, sguardo confuso} ok…? {non fa nulla} si è fermato… hmmm… perché? {preme tutti i tasti, mi guarda} credo si sia bloccato... Credo…* | Absence of multimodal reaction to interaction considered marked |
| 26 | Statement | **P2 Think-aloud** | *{Freezes, confused, speaks immediately} and... There's something that stopped me, I don't know if it's intentional or not {he presses various keys} and... yes I'm stuck here, he doesn't answer at the moment* | *{Si blocca, confuso, parla subito} e… c'è qualcosa che mi ha fermato, non so se è voluto o meno {preme vari tasti} e… sì son fermo immobile, non risponde al momento* | Absence of multimodal reaction to interaction considered marked |
| 27 | Statement | **P7 Think-aloud** | *{Takes sword, suggestion for attack combo appears, looks at controller, moves forward, tries to attack but fails, looks at controller, moves back, tries again, moves forward again, confused, jumps, skeleton approaches, tries to attack but fails, she moves away} why doesn't it...? {looks controller} it asks to press B but nothing happens....* | *{Prende spada, compare suggerimento per combo attacco, guarda il controller, si muove in avanti, prova a fare combo ma non riesce, guarda controller, torna indietro, riprova, torna avanti, confusa, salta, scheletro si avvicina, prova ad attaccare ma fallisce, lei si allontana} perché non…? {guarda controller} chiede di premere B ma non succede niente…* | Absence of multi-modal reaction to interaction considered marked |
| 28 | Statement | **P2 Think-aloud** | *{Falls into interactivity trap} doesn't respond at the moment {keeps pressing all the keys} and... I would like to go on but I can't {keeps pressing, annoyed face, looks at me}* | *{Cade in interactivity trap} non risponde al momento {continua a premere tutti i tasti} e… vorrei andare avanti ma non posso {continua a premere, faccia infastidita, mi guarda}* | Absence of multi-modal reaction to interaction considered marked |

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| **Memories affect the Multimodal system ($M_e \rightarrow M_u$)** | | | | | |
| 29 | Statement | **P6 Interview** | *Spears are not usually a good thing {laughs} so I knew they would be harmful, that's it* | *Le lance di solito non sono una cosa che fanno bene {ride} quindi sapevo che sarebbero state dannose, ecco* | Extra-game memories (real world knowledge) explain what is presented multimodally (visual) |
| 30 | Statement | **P4 Interview** | *Being anyway a demonic-like, malignant-like form as socially considered... It made me think it was indeed a hostile form* | *Essendo comunque una forma simil demoniaca, simil maligna nel socialmente conside-rato… mi ha fatto pensare che fosse appunto una forma ostile* | Extra-game memories (cultural knowledge) explain what is presented multimodally (visual) |
| 31 | Statement | **P10 Interview** | *Or was the... It was the way they are shaped those things, that at first glance they looked hostile* | *Oppure era la… era come sono fatti quei cosi, che a primo impatto sembravano ostili* | Extra-game memories (cultural knowledge) explain what is presented multimodally (visual) |
| 32 | Statement | **P4 Interview** | *They were hostile because they were ugly {laughs}* | *Erano ostili perché erano brutti {ride}* | Extra-game memories (cultural knowledge) explain what is presented multimodally (visual) |
| 33 | Statement | **P6 Interview** | *Still the same thing, that is evil design, grunts... Background sounds* | *Sempre per lo stesso discorso, cioè design cattivo, versi… suoni di sottofondo* | Extra-game memories (cultural knowledge) explain what is presented multimodally (visual) |
| 34 | Statement | **P3 Interview** | *E: why did you think the skeleton was hostile? P: oh god… eh, by image, I don't know, it looked evil?* | *E: perché pensavi che lo scheletro fosse ostile? P: Oddio… eh, per immagine, Non lo so, sembrava cattivo?* | Extra-game memories (cultural knowledge) explain what is presented multimodally (visual) |
| 35 | Statement | **P4 Think-aloud** | *The villain [has] its usual evil laugh but it fits, it gives that classic touch* | *Il cattivo [ha] la sua solita risata malefica ma ci sta, dà quel tocco di classico* | Extra-game memories (customs of entertainment media in general) explains what is presented multimodally (aural) |

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 36 | Statement | **P10 Interview** | *They were skeletons that were coming towards you and that therefore you… I mean… at least to me, for me, in a game if you have skeletons coming at you, they are well… they are hostile* | *Erano scheletri che venivano verso di te e che quindi tu… cioè nel senso… Almeno a me, per me, in un gioco se ci sono gli scheletri che ti vengono contro, sono cioè… sono ostili* | Extra-game memories (customs of other games in general) explain what is presented multi-modally (visual) |
| 37 | Statement | **P12 Interview** | *But then, one thing I thought, and which actually later turned out to be true, is that often bosses have a life bar at least, and so maybe it could have been an enemy like many others* | *Poi però, una cosa che ho pensato, e che effettivamente poi si è rivelata vera, è che spesso i boss hanno la barra della vita perlomeno, e che quindi forse poteva essere un nemico come tanti altri* | Extra-game memories (customs of other games in general) explain what is presented multi-modally (visual) |
| 38 | Statement | **P1 Interview** | *Playing other games usually when you encounter a character in trouble two things tend to happen: either he helps you, or he is leading you to a trap. Consequently, if he helps you, most of the time he's mostly bringing you… I think I heard his voice in the headphones […] as a result, I thought maybe I'll help him, maybe I'll get an item that helps me, maybe I'll have a companion... Or maybe it's a trap, as a result I'll have to fight with the skeleton, maybe it'll drag me into the hole, I'll die as I did all the other times, or I'll be taken maybe to a secondary level, or I come back to life there* | *Giocando ad altri giochi di solito quando incontri un personaggio in difficoltà tendenzialmente le cose sono due: o ti aiuta, oppure ti sta portando ad una trappola. Di conseguenza, se ti aiuta, la maggior parte delle volte ti porta soprattutto… mi sembra di aver sentito la sua voce nelle cuffie […] di conseguenza, ho pensato magari lo aiuto, magari mi darà un oggetto che mi aiuta, magari avrò un compagno… oppure magari è una trappola, di conseguenza dovrò combattere con lo scheletro, magari mi trascinerà nel buco, morirò come sono molto tutte le altre volte, o verrò portato magari in un livello secondario, oppure ritorno in vita lì* | Extra-game memories (customs of other games in general) explain what is presented multi-modally (visual) and is used to predict possible continuation of the current situation |

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 39 | Statement | **P12 Think-aloud** | *{Defeats bat, stops and looks at the body} the thought very... Well, automatic... The fact that the bodies remain {reflects projectile from other bat and defeats it} makes me question whether they can reanimate {dodges another projectile} or something like that, in that... In some games they stay, in others they don't* | *{Sconfigge pipistrello, si ferma e guarda il corpo} il pensiero molto… così, automatico… il fatto che rimangano i cadaveri {riflette proiettile di altro pipistrello e lo sconfigge} mi fa venire un dubbio su se possano rianimarsi {schiva altro proiettile} o qualcosa del genere, in quanto… in alcuni giochi rimangono, in altri no* | Extra-game memories (customs of other games in general) explain what is presented multi-modally (visual) and is used to predict possible continuation of the current situation |
| 40 | Statement | **P10 Interview** | *In 'big' games hidden passages are, they could also be, through thorns that don't hurt you* | *Nei 'grandi' giochi i passaggi nascosti sono, potrebbero essere anche per delle spine che non ti feriscono* | Extra-game memories (customs of other games in general) explain what is presented multi-modally (visual) and is used to predict possible continuation of the current situation |
| 41 | Statement | **P4 Think-aloud** | *{Arrives in front of floating platform, sees boss arena} Aaah! Like Bowser-style*[213] | *{Arriva davanti a piattaforma, vede arena boss} Aaah! Tipo stile Bowser* | Extra-game memories (reference to one specific game/genre) explain what is presented multimodally (visual) |
| 42 | Statement | **P7 Interview** | *Usually when you have something that... That looks evil like a skeleton, in theory it's an enemy* | *Di solito quando c'hai qualcosa di… che sembra cattivo come uno scheletro, in teoria è un nemico* | Extra-game memories (unclear knowledge) explain what is presented multimodally (visual) |
| 43 | Statement | **P1 Interview** | *Because these tend to be traps designed to eliminate an enemy* | *Perché tendenzialmente queste sono trappole atte ad eliminare un nemico* | Extra-game memories (unclear knowledge) explain what is presented multimodally (visual) |

[213] Here the reference is specifically to *Super Mario Bros.* (Nintendo R&D4, 1985), as originally expected, where Bowser is waiting for the player character across a lava lake.

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 44 | Statement | **P10 Interview** | *That's what they always make you believe: spikes are bad, spikes make people die, that's it* | *È quello che ti fanno credere sempre: le punte sono cattive, le punte fanno morire, basta* | Extra-game memories (unclear knowledge) explain what is presented multimodally (visual) |
| 45 | Statement | **P12 Interview** | *E: how did you know that skeletons were hostile? P: indicatively because traditionally the hostile enemy… well, the skeleton is used as the enemy [...] E: what about that sort of bats? P: same thing, typical monster* | *E: come hai capito che gli scheletri erano ostili? P: indicativa-mente perché tradizionalmente il nemico ostile… cioè lo scheletro viene utilizzato come nemico […] E: mentre per quella specie di pipistrelli? P: stessa cosa, tipico mostro* | Extra-game memories (unclear knowledge) explain what is presented multimodally (visual) |
| 46 | Statement | **P4 Interview** | *E: what did you think when you fell the second time into the interactivity trap? P: I thought it was the same thing as before* | *E: cos'hai pensato quando sei caduto la seconda volta nella trappola bloccante? P: Ho pensato che fosse la stessa cosa di prima* | Intra-game memories (function of a specific element) explain what is presented multi-modally (visual) |
| 47 | Statement | **P4 Think-aloud** | *Ok that little pit there {looks closely} is the thing that's blocking me I guess* | *Ok quella pozzettina lì {guarda attentamente} è la cosa che mi blocca immagino* | Intra-game memories (function of a specific element) explain what is presented multi-modally (visual) |
| 48 | Statement | **P12 Think-aloud** | *This should be the final enemy, because he was in the initial summoning scene* | *Questo dovrebbe essere il nemico finale, perché era nella scena iniziale di evocazione* | Intra-game knowl-edge (function of a specific element) explains what is presented multi-modally (visual) |
| 49 | Statement | **P1 Interview** | *They were summoned by the villain, who attacked you at the beginning, so they were definitely not your best friends* | *Erano stati nella intro evocati dal cattivo, che ti ha attaccato all'inizio, quindi sicuramente non erano i tuoi migliori amici* | Intra-game knowledge (function of a specific element) explains what is presented multimodally (visual) |

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 50 | Statement | **P8 interview** | *[Talking about head monster] I decided it was better to kill him, also because the trailer seemed to be conjured up by the villain... From the trailer it seemed to be conjured up by the villain, so eventually killing him* | *[Parlando del mostro testa] ho deciso che era meglio ucciderlo, Anche perché il trailer sembrava essere evocato dal cattivo… dal trailer sembrava che fosse evocato dal cattivo, quindi alla fine ucciderlo* | Intra-game knowledge (function of a specific element) explains what is presented multimodally (visual) |
| 51 | Statement | **P12 Think-aloud** | *{Approaching the boss at the end of the twist level} okay, this should be the final enemy... because he was in the initial summoning scene...* | *{Si avvicina al boss alla fine del livello twist} ok, questo dovrebbe essere il nemico finale… perché era nella scena iniziale di evocazione…* | Intra-game knowledge (function of a specific element) explains what is presented multimodally (visual) |
| 52 | Statement | **P13 Interview** | *E: Were you surprised to be reborn after dying? P: One thing I noticed that basically he in the game he was already dead and is resurrected so it seemed like a logical thing* | *E: ti sei sorpresa di essere rinata dopo essere morta? P: Una cosa che ho notato che di base lui nel gioco era già morto ed è resuscitato quindi mi è sembrato una cosa logica* | Intra-game knowledge (game rules) explains what is presented multimodally (visual) |
| 53 | Statement | **P2 Interview** | *[Speaking of fake spikes] I expected that maybe the spikes even in that situation were... let's say fake* | *[Parlando delle punte finte] mi aspettavo che magari le punte anche in quella situazione erano… eh, false mettiamola così* | Intra-game knowledge (function of a specific element) substitutes other intra-game knowledge very quickly |
| 54 | Statement | **P1 Think-aloud** | *{Falls into the fake spikes, very surprised} okay, this thing is not very normal I think?* | *{Cade nelle punte finte, molto stupito} ok, 'sta cosa non è molto normale credo?* | Mismatch between what is expected and what is presented considered marked. |
| 55 | Statement | **P1 Think-aloud** | *{Takes sword and shield, one at a time, stopping for a moment after each, confused look} But didn't we already have sword and shield?* | *{Prende spada e scudo, uno per volta, fermandosi un attimo dopo ognuno, sguardo confuso} Ma spada e scudo non ce l'avevamo già?* | Mismatch between what is expected and what is presented considered marked. |

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 56 | Statement | **P6 Think-aloud** | *{Goes on, gets stuck in interactivity trap} what's going on? Why did everything vibrate? What happened?* | *{Prosegue, si blocca in interactivity trap} cosa succede? Perché ha vibrato tutto? Cosa è successo?* | Mismatch between what is expected and what is presented (haptic) considered marked. |
| **Multimodal system affects Memories ($M_u \rightarrow M_e$)** | | | | | |
| 57 | Behaviour | **P1, P4, P7, P9, P11 Think-aloud** | *Stated to be studying different timings/behaviours of game elements (flames, boss)* | | Witnessing the multimodal system to memorise useful information |
| 58 | Statement | **P14 Interview** | *Then at first I didn't understand right away, but then when the blue part popped up it seems to me... Well maybe it was smoke, even grey… it meant that it was the time when it was ending and therefore I could pass* | *Dopo all'inizio non avevo capito subito, ma dopo quando spuntava la parte blu mi sembra… boh forse era fumo, anche grigia… voleva dire che era il momento in cui stava finendo e quindi sarei potuto passare* | Witnessing the multimodal system (visual) to memorise useful information (timing patterns) |
| 59 | Statement | **P9 Interview** | *So during an attack it has a skin, that is to say... The skin means the execution of the spell, or the demonstration of the spell, because it was a mage... Watching, the orbs it moved one hand, while to summon the goblins it moved the other, and completely changed form... Because one had one colour, one had the other* | *Allora durante un attacco ha una skin, ovvero… la skin si intende l'esecuzione dell'incantesimo, o la dimostrazione dell'incantesimo, siccome era un mago… vedendo, le sfere faceva muoveva una mano, mentre per evocare i goblin muoveva l'altra, e cambiava completamente forma… perché uno aveva un colore, uno aveva l'altro* | Witnessing the multimodal system (visual) to memorise useful information (attack patterns) |
| 60 | Behaviour | **P1, P4, P5, P6, P7, P9, P11 Think-aloud** | *Looking for a perceptible clue of interactivity traps to predict their presence before falling in them* | | Witnessing the multi-modal system to memorise useful information (traps patterns) |

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 61 | Statement | **P4 Think-aloud** | *What is the outline of the rock that actually gives me the malus of blocking me?* | *Qual è la sagoma della roccia che mi dà effettivamente il malus di bloccarmi?* | Witnessing the multi-modal system to memorise useful information (traps patterns) |
| 62 | Statement | **P4 Interview** | *You want to try to avoid these things in a platform game in particular, and so you try to figure out what's the pattern that applies that status to you... so it looked like it was over a rock, so at that point I'm like, it's the rock* | *Vuoi cercare di evitare queste cose in un gioco platform in particolare, e quindi cerchi di capire qual è il pattern che ti applica quello status… quindi sembrava fosse sopra una roccia, quindi a quel punto mi viene da pensare: è la roccia* | Witnessing the multimodal system to memorise useful information (traps patterns) |
| **Memories and Interaction ($M_e$ → I)** | | | | | |
| 63 | Behaviour | **P6, P8, P9, P12 Think-aloud** | *Declared to find the unexplained interaction mechanics intuitive and automatically started using the correct buttons* | | Extra-game knowledge (other games in general) provides information for successful interaction (interaction mechanics) |
| 64 | Statement | **P9 Think-aloud** | *One who already knows how to play already has in mind how to use the buttons* | *Uno che sa già giocare ce l'ha già in mente come si usano i tasti* | Extra-game knowledge (other games in general) provides information for successful interaction (interaction mechanics) |
| 65 | Statement | **P4 Interview** | *Thanks to other games I've played where there is a hit reflection system I thought there might be in this game as well* | *Grazie ad altri giochi che ho giocato in cui c'è un sistema di riflessione del colpo ho pensato che ci potesse essere anche in questo gioco* | Extra-game knowledge (other games in general) provides information for successful interaction (interaction affordances) |
| 66 | Statement | **P6 Interview** | *E: how did you know that the shield reflected projectiles? P: Eh, again prior knowledge of other video games* | *E: come sapevi che lo scudo ribatteva i colpi? P: Eh, sempre conoscenza pregressa degli altri videogiochi* | Extra-game knowledge (other games in general) provides information for successful interaction (interaction affordances) |

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 67 | Statement | **P9 Interview** | *So, sometimes there are the monsters that when they shoot the projectiles you either destroy them or send them back* | *Allora, a volte ci sono i mostri che quando sparano i proiettili o li distruggi o li rispedisci* | Extra-game knowledge (other games in general) provides information for successful interaction (interaction affordances) |
| 68 | Statement | **P4 Think-aloud** | *In a platform game as I said I preferred to rely on offense rather than defence* | *In un gioco platform come ho detto preferivo basarmi sull'attacco che sulla difesa* | Extra-game knowledge (specific game/genre) provides information for successful interaction (interaction strategies) |
| 69 | Statement | **P12 Think-aloud** | *It usually pays to always kill all enemies, from video game experience in general... so when in doubt I kill everything I find* | *Solitamente conviene sempre uccidere tutti i nemici, per esperienza di videogioco in generale… quindi nel dubbio io ammazzo tutto quello che trovo* | Extra-game knowledge (other games in general) provides information for successful interaction (interaction strategies) |
| 70 | Behaviour | **P10** | *Tried to defeat enemies by jumping on their head*[214] | | Extra-game knowledge (specific game/genre) provides information for successful interaction (interaction strategies) |
| 71 | Statement | **P9 Interview** | *Castlevania-style. In Castlevania's platform, as soon as you touch something you died* | *Stile Castlevania. Nella piattaforma di Castlevania come tocchi qualcosa morivi* | Extra-game memories (interaction mechanics of one specific game/ genre) provides information for successful interaction (interaction strategies) |
| 72 | Behaviour | **All Think-aloud** | *Collected golden coins without explicit reason – stated that it is customary to collect them* | | Extra-game knowledge (other games in general) provides information for successful interaction (interaction strategies) |

[214] This is a mechanic traditionally associated with Super Mario games, like Super Mario Bros. (Nintendo R&D4, 1985).

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 73 | Statement | **P7 Interview** | *E: Why did you immediately go and get the coin? P: Because usually in games when there is a reward it is always useful to take it, even though you may not know in the moment what it is for* | *E: Perché sei andata subito a prendere la monetina? P: Perché di solito nei giochi quando c'è una ricompensa è sempre utile prenderla, anche se magari non si sa nel momento a cosa serve* | Extra-game knowledge (other games in general) provides information for successful interaction (interaction strategies) |
| 74 | Statement | **P11 Think-aloud** | *Having the X on the right*[215] *for a PlayStation player is something you always need to learn* | *Avere la X a destra per un giocatore da PlayStation è qualcosa che devi sempre apprendere* | Mismatch between extra-game knowledge (other games in general) and in-game interaction (interaction mechanics) considered marked |
| 75 | Behaviour | **All except P3, P8, P9** | *Reported to have learned interaction mechanics of the boss from earlier in the game* | | Intra-game knowledge provides information for successful interaction (interaction strategies) |
| 76 | Statement | **P13 Interview** | *E: how did you know what to do during the boss battle? P: based on what I did before, the enemies on the ground I hit them with the sword, and the ones in the air I reflected with the shield* | *E: come facevi a sapere come comportarti durante la battaglia con il boss? P: in base a quello che ho fatto prima, i nemici a terra li colpivo con la spada e quelli in aria li respingevo con lo scudo* | Intra-game knowledge provides information for successful interaction (interaction strategies) |
| 77 | Statement | **P14 Interview** | *Having already had the experience of the enemies before, I saw that when he lowered down… I tried to attack him like the skeletons, and then from above he shot beams like eyes I tried there to parry and do the same thing* | *Avendo già avuto l'esperienza dei nemici prima, ho visto che quando si abbassava… ho provato ad attaccarlo come gli scheletri, e poi dall'alto sparava dei raggi come gli occhi ho provato lì a parare e fare la stessa cosa* | Intra-game knowledge provides information for successful interaction (interaction strategies) |

[215] The X is on the left side in the Xbox controller, and the participant must have mixed up left and right during the think-aloud session.

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 78 | Statement | **P12 Interview** | *It was quite natural for me to use what I already knew* | *Mi veniva abbastanza naturale utilizzare ciò che già sapevo* | Intra-game knowledge provides information for successful interaction (interaction strategies) |
| 79 | Behaviour | **P1, P2, P10, P13 Think-aloud** | *Willingly jumped in the spikes after having encountered fake spikes once* | | Intra-game knowledge quickly overwrites other intra-game knowledge in guiding interaction |
| 80 | Statement | **P7 Interview** | *Indeed afterwards when I moved on I continued as if it didn't... As if even the later ones didn't hurt* | *Infatti dopo quando sono andata avanti ho continuato come se non… anche quelli successivi non facessero male* | Intra-game knowledge quickly overwrites other intra-game knowledge in guiding interaction |
| 81 | Statement | **P8 Interview** | *From that moment on I started to think that maybe other things could also do me no harm* | *Da quel momento ho iniziato a pensare che forse anche altre cose potevano non farmi danno* | Intra-game knowledge quickly overwrites other intra-game knowledge in guiding interaction |
| 82 | Statement | **P11 Interview** | *E: You said you knew you would die falling into the lava but you wanted to try anyway... can you tell me why? P: […] maybe I would jump like in Super Mario the whole battle and end up in the next world* | *E: Hai detto che sapevi saresti morto cadendo nella lava ma volevi provarci lo stesso… sai dirmi perché? P: […] magari saltavo come in Super Mario l'intera battaglia e finivo nel mondo dopo* | Extra-game knowledge (specific game/ genre) prevails over intra-game knowledge in providing information for successful interaction (interaction strategies) |
| 83 | Statement | **P14 Think-aloud** | *{falls into first interactivity trap} I get stuck... Without knowing why... I see bubbles rising, gaseous clouds from below {confused, presses more buttons, then waits, presses more buttons, nothing happens} I wouldn't know how to proceed {ride}* | *{Cade in prima interactivity trap} mi ritrovo bloccato… senza sapere il motivo… vedo salire delle bollicine, nuvole gassose dal basso {confuso, preme altri bottoni, poi aspetta, preme altri bottoni, non succede nulla} non saprei come procedere {ride}* | Absence of extra- or intra-game knowledge to provide information for interaction considered marked |

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| **Interaction affects Memories (I → $M_e$)** | | | | | |
| 84 | Behaviour | **All** | *Found the combos initially confusing, but learned to use them proficiently by the end of the game* | | Interaction constructs memories (interaction strategies) |
| 85 | Statement | **P4 Interview** | *[The game seems to say:] 'test the new function, see how you like it and try it out'. Therefore I tested the shield* | *[Il gioco sembra dire:] 'testa la nuova funzione, vedi come ti trovi e provala'. Quindi ho testato lo scudo* | Intentional explorative interaction to construct memories (interaction affordances) considered supported by game design |
| 86 | Statement | **P5 Interview** | *Since I dodged the first [interactivity trap], I wanted to see what would happen if I fell in it* | *Siccome la prima [interactivity trap] l'avevo schivata, volevo vedere cosa succedeva se ci andavo sopra* | Intentional explorative interaction to construct memories (interaction affordances) |
| 87 | Statement | **P4 Think-aloud** | *But is there a double jump? {jumps several times} no, there is no double jump* | *Ma c'è un doppio salto? {salta varie volte} no, non c'è un doppio salto* | Intentional explorative interaction to construct memories (interaction affordances) |
| 88 | Statement | **P10 Think-aloud** | *[Speaking of fake spikes that do not harm] only those? {goes back, makes longer jump and dies in following spikes} only those* | *[Parlando delle punte finte che non danneggiano] solo quelle? {torna, fa salto più lungo e muore in punte più aventi} solo quelle* | Intentional explorative interaction to construct memories (interaction affordances) |
| 89 | Statement | **P12 Think-aloud** | *Unless... {presses down button} no, you can't crouch indeed* | *A meno che… {preme il tasto giù} no, non ci si può abbassare infatti* | Intentional explorative interaction to construct memories (interaction affordances) |
| 90 | Statement | **P6 Think-aloud** | *can I crouch somehow? {try pressing each button} No, so I'm sure I'll die badly here* | *mi posso abbassare in qualche modo? {prova a premere ogni tasto} No, Quindi sicuro muoio male qua* | Intentional explorative interaction to construct memories (interaction affordances) |

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 91 | Statement | **P4 Interview** | *The enemy hit is not too fast but maybe you are at the beginning so it gives you time to get used to it* | *Il colpo del nemico non è troppo veloce però magari sei all'inizio quindi ti dà modo di abituarti* | Intentional explorative interaction to construct memories (interaction strategies) considered supported by game design |
| 92 | Statement | **P5 Interview** | *I tried to make the shield when they hit me and as a result I saw that it then sent them back and killed them, so I used it then throughout the whole game in short* | *Ho provato a fare lo scudo quando mi colpivano e di consequenza ho visto che poi lo rimandava indietro e li uccideva, e quindi l'ho usato poi per tutto il gioco insomma* | Intentional explorative interaction to construct memories (interaction strategies) |
| 93 | Statement | **P11 Think-aloud** | *[Can I do the combo] even while jumping? {jumps and does attack combo} yes* | *[Posso fare la combo] anche mentre salto? {salta e fa combo attacco} sì* | Intentional explorative interaction to construct memories (interaction strategies) |
| 94 | Statement | **P4 Think-aloud** | *Let me recap the attack {does sword combo, then shield combo} and like this I defend, okay!* | *Fammi ripassare il colpo… {fa combo spada, poi fa combo scudo} e così paro, ok!* | Intentional confirmative interaction solidifies memories (interaction affordances) |
| 95 | Statement | **P11 Think-aloud** | *The fact that there are buttons for attacking and defending that are the combination of the same buttons makes it let's say necessary for me a major trial-and-error before I can learn the sequence* | *Il fatto che ci siano i tasti per colpire e difendere che sono la combinazione degli stessi tasti mi rende diciamo necessario un trial-and-error importante prima di poter imparare la sequenza* | Intentional confirmative interaction solidifies memories (interaction mechanics) |
| 96 | Statement | **P9 Think-aloud** | *I'm looking at that [interaction] is more computer-like because pressing keys quickly doesn't get it for me... unless I put two fingers on the controller*[216] | *sto guardando che [l'interazione] è più da computer perché premendo i tasti velocemente non me li prende… a meno che non metto due dita sul controller* | Intentional confirmative interaction solidifies memories (interaction mechanics) |

[216] It is unclear what exactly P9 is referring to here with "computer-like interaction", but it nonetheless appears clear that he believes he had to learn how to interact by interacting.

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 97 | Behaviour | **All except P5** | *Confused at first encounter with interactivity traps (except P5) but not at later encounters* | | Interaction unintentionally constructs memories (interaction strategies) |
| 98 | Statement | **P7 Interview** | *I saw that it [dying] didn't matter, nothing happened, so I was even a little less careful going forward* | *Ho visto che [morire] non importava, non succedeva niente, quindi sono stata anche un po' meno attenta andando avanti* | Interaction unintentionally constructs memories (interaction strategies) |
| 99 | Statement | **P12 Think-aloud** | *I have died too many times so I assume there are infinite lives* | *Sono morto fin troppe volte quindi deduco che ci siano vite infinite* | Interaction unintentionally constructs memories (interaction affordances) |
| 100 | Statement | **P8 Think-aloud** | *{Walk on fake spikes} it's strange! I mean more like you're used to thorns killing you and to see now that you can walk on them makes you rethink* | *{Cammina su punte finte} è strano! Cioè più che altro sei abituato che le spine ti ammazzano e vedere adesso che ci puoi camminare sopra ti fa ripensare* | Interaction unintentionally constructs memories (interaction strategies) overwriting other memories |
| 101 | Statement | **P1 Think-aloud** | *I still haven't learned so well how to use the commands... {tries sword combo, fails, dies}* | *Non ho ancora imparato così bene a utilizzare i comandi… {prova combo spada, non riesce, muore}* | Absence of sufficient interaction determines absence of memories (interaction mechanics) |
| 102 | Statement | **P2 Interview** | *E: Why did it not occur to you to use the shield to strike back? P: Because I lost her memory along the way* [217] | *E: Perché non ti è venuto in mente di usare lo scudo per ribattere i colpi? P: Perché l'ho persa di memoria lungo la strada* | Absence of sufficient interaction determines absence of memories (interaction affordances) |

[217] It is debatable whether this information was actually stored in P2's memory and could not be retrieved anymore, or if it was never actually stored in memory, but the two possibility are substantially interchangeable for the current discussion: whether it was not retrievable because not experienced enough, or not stored because not experienced enough, it remains that the absence of a proper amount of interaction caused an impossibility to base P2's decisions on mnemonic content.

| E | Type | Participant(s) and occasion | Evidence (EN) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| **Additional findings** | | | | | |
| 103 | Behaviour | **All but P4, P5, P11, P12 Think-aloud** | *Jumped in the portal instead of approaching and pressing Y as they did for the other doors* | | Multimodal system prevails on memories for decision-making |
| 104 | Behaviour | **P2, P5, P8, P9, P11, P13, P14 Think-aloud** | *Immediately attacked the malfunctioning skeleton* | | Memories prevail on multimodal system for decision-making |

# S-RQ3

| E | Type | Participant(s) | Evidence (ENG) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 105 | Statement | **P11 Interview** | *I went where I saw the visual input and eventually I saw that you could actually pick it up* | *Sono andato dove ho visto l'input visivo e alla fine ho visto che effettivamente si poteva raccoglierlo* | Visual semiotic mode is main influence for interaction |
| 106 | Statement | **P14 Think-aloud** | *I choose to go up because I saw a sword* | *Scelgo di andare di sopra perché ho visto una spada* | Visual semiotic mode is main influence for interaction |
| 107 | Statement | **P2 Think-aloud** | *I see flames {stands in front of the flames} I go through {dies} I try to go through {respawns} I try to go through when the flames are not there* | *Vedo delle fiamme {si ferma davanti alle fiamme} passo {muore} cerco di pass.. {rinasce} cerco di passare quando le fiamme non ci sono* | Visual semiotic mode is main influence for interaction |
| 108 | Statement | **P6 Interview** | *[Talking about the reasons why he collected the golden coins] talking about the colour palette, it didn't look like…* | *[Parlando del perché ha preso le monete] per il discorso un po' delle palette di colori non sembrava…* | Colour is main influence for interaction |
| 109 | Statement | **P4 Think-aloud** | *Ok, let's figure out what is the buttons delay* | *Ok un attimo capiamo qual è il delay dei tasti* | Pseudo-interaction mechanic requires to construct memory |
| 110 | Statement | **P11 Interview** | *The hardest part was... But it's part of the genre of game I guess, that I played, was learning the timing between the command input and the actual output... Let's say scenic output in the game* | *La parte più difficile è stata… Ma fa parte del tipo di gioco che mi sa che, a cui ho giocato, è stata imparare il timing fra l'input di comando e l'effettivo output… diciamo scenico nel gioco* | Pseudo-interaction mechanic requires to construct memory |

# S-RQ4

| E | Type | Participant(s) | Evidence (ENG) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 111 | Behaviour | **All Think-aloud and Interview** | *Talked in first person about the task they were performing* | | Illusion of first-person participation in the game world (presence) |
| 112 | Statement | **P5 Think-aloud** | *{fireball approaches, shield combo} I protect myself* | *{palla di fuoco si avvicina, combo scudo} mi proteggo* | Illusion of first-person participation in the game world (presence) |
| 113 | Statement | **P1 Think-aloud** | *Is it me or did the spears do no harm to me when they crushed me?* | *È sembrato a me oppure le lance non mi hanno fatto danno quando mi hanno schiacciato?* | Illusion of first-person participation in the game world (presence) |
| 114 | Statement | **P3 Think-aloud** | *{falls in interactivity trap} I got stuck* | *{cade nella trappola bloccante} mi sono bloccata* | Illusion of first-person participation in the game world (presence) |
| 115 | Statement | **P1 Interview** | *Fire will kill me if I get the timing wrong* | *Il fuoco mi ammazza se sbaglio il tempismo* | Illusion of first-person participation in the game world (presence) |
| 116 | Statement | **P7 Interview** | *I tried hitting it a few times but nothing happened, even when it passed through me nothing happened* | *Ho provato a colpirlo qualche volta ma non è successo niente, anche quando mi passava attraverso non succedeva niente* | Illusion of first-person participation in the game world (presence) |
| 117 | Statement | **P13 Interview** | *I noticed that it did not harm me in any way apart from the... That thing that was blocking me* | *Ho notato che non mi danneggiava in nessun modo a parte il… quella cosa che mi bloccava* | Illusion of first-person participation in the game world (presence) |
| 118 | Statement | **P1 Interview** | *Surely he didn't pull him up since he wasn't there with 'me' {mime quotation marks}* | *Sicuramente non l'ha tirato su visto che non era lì con 'me' {mima virgolette}* | Noticed the fictionality of presence, but this did not prevent it from emerging |
| 119 | Statement | **P4 Interview** | *As soon as he saw that I had approached him he thought I had fallen into the potion and turned around trying to attack me* | *Appena ha visto che mi ero avvicinato a lui pensava che fossi caduto nella pozione e si è girato cercando di attaccarmi* | Perceived intelligence and will of game characters |

| E | Type | Participant(s) | Evidence (ENG) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 120 | Statement | **P5 Interview** | *E: What did you think when you found the skeleton with his back turned? P: Erm that maybe he had made a mistake and turned around* | *E: cos'hai pensato quando hai trovato lo scheletro girato di spalle? P: Ehm che magari si era sbagliato e si era girato* | Perceived intelligence and will of game characters |
| 121 | Statement | **P4 Think-aloud** | *Take it easy champ!" [...] "quiet down champ!" [...] "no, be quiet" [...] "where are you going?* | *Stai tranquillo bomber!" […] "calmati bomber!" […] "no, sta buono" […] "dove vai?* | Addressing characters as sentient beings |
| 122 | Statement | **P5 Interview** | *E: Why did you want to save the hanging ally? P: Because maybe it was that... That knight who was also there at the beginning of the story who had died... I don't know since I was Risorta like, I mean I wasn't dead, Eh maybe I could save him too...* | *E: Perché hai voluto salvare l'amico appeso? P: Perché magari era quel… quel cavaliere che c'era anche all'inizio della storia che era morto… non lo so siccome io ero Risorta tipo, Cioè non ero morta, Eh magari potevo salvare anche lui…* | Showing empathy towards the hanging ally |
| 123 | Statement | **P7 Interview** | *E: Why did you try to save the friend hanging in trouble? P: Because anyway he looked like a comrade or something and I tried... I tried to save him rather than leave him there I mean* | *E: Perché hai cercato di salvare l'amico appeso? P: Perché comunque sembrava un compagno o qualcosa del genere e ho provato… Ho provato a salvarlo piuttosto che lasciarlo lì Insomma, pensavo potesse essere utile in qualche modo* | Showing empathy towards the hanging ally |
| 124 | Statement | **P3 Interview** | *E: Why did you try to save your friend? P: Because I saw him dressed like me? So I said dunno will he be a comrade, something, And I mean... Well he looked allied, so…* | *E: Perché hai provato a salvare l'amico? P: Perché lo vedevo vestito come me? Quindi ho detto boh sarà un compagno, qualcosa, e insomma… sembrava alleato Ecco, quindi…* | Showing empathy towards the hanging ally |

# S-RQ6

| E | Type | Participant(s) | Evidence (ENG) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 125 | Statement | **P1**<br>**Think-aloud** | *Reminds me of an old-style game for Mame32* | *Mi ricorda un gioco vecchio stile di Mame32* | One same situation prompts different frames of reference |
| 126 | Statement | **P4**<br>**Think-aloud** | *Nice reminds me of a good game that I really like, reminds me of Broforce* | *Bello mi ricorda un bel gioco che mi piace molto, mi ricorda Broforce* | One same situation prompts different frames of reference |
| 127 | Behaviour | **P4, P8, P9, P10, and P11**<br>**Think-aloud** | *Declaredly looking for easter eggs and/or secret areas* | | Unintended behaviour of players, unforeseen during the design |
| 128 | Statement | **P8**<br>**Think-aloud** | *up there seems to be... like some hidden room... but I wouldn't know how to get there* | *lì sopra sembra che ci sta… tipo qualche stanza nascosta… però non saprei come arrivarci* | Unintended behaviour of players, unforeseen during the design |
| 129 | Behaviour | **P4**<br>**Think-aloud** | *Very explorative approach* | | Players exerting their freedom to choose their own play style |
| 130 | Statement | **P4**<br>**Interview** | *I want to live the experience to the fullest* | *Voglio vivere l'esperienza al massimo* | Players exerting their freedom to choose their own play style |
| 131 | Behaviour | **P2**<br>**Think-aloud** | *Rushing through the game and missing even crucial parts of the game (e.g., crossroad)* | | Players exerting their freedom to choose their own play style |
| 132 | Behaviour | **P1** | *Playing following own's rules of "fair play"* | | Players exerting their freedom to choose their own play style by even changing the rules of their play session |
| 133 | Satement | **P1**<br>**Interview** | *There are some people who, in many games, would exploit any bug or glitch to get through more easily... I personally don't like it* | *Ci sono delle persone che in molti giochi sfrutterebbero qualsiasi bug o glitch per riuscire a passare più facilmente… a me personalmente non piace* | Players exerting their freedom to choose their own play style by even changing the rules of their play session |

# S-RQ5

| E | Type | Participant(s) | Evidence (ENG) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 134 | Statement | **P12 Think-aloud** | *{falls into fake spikes and doesn't die, confused} Ok...? I suppose there is some kind of magical effect* | *{cade in punte finte e non muore, confuso} Ok…? Suppongo ci sia un qualche tipo di effetto magico* | Looking in their memories for a piece of knowledge that can explain an otherwise inexplicable behaviour |
| 135 | Statement | **P5 Interview** | *Indeed later there were like golden sharp spikes, and I hadn't died when I went there, so maybe that [having collected the coins] was the reason... Maybe, I don't know* | *Infatti dopo c'erano tipo degli spuntoni aguzzi dorati, e non ero morta quando ero andata lì, e quindi forse mi poteva servire a quello [avere raccolto le monete] forse, non lo so* | Looking in their memories for a piece of knowledge that can explain an otherwise inexplicable behaviour |
| 136 | Statement | **P5 Think-aloud** | *{falls into fake spikes, doesn't die} here maybe I was supposed to die... Or maybe it's because I took the coin? I don't know* | *{cade in punte finte, non muore} qui forse dovevo morire… O forse è perché ho preso la moneta? Non lo so* | Looking in their memories for a piece of knowledge that can explain an otherwise inexplicable behaviour |
| 137 | Statement | **P4 Interview** | *[talking about interactivity traps] I actually had to give the blow to unlock myself from some kind of spell... I think it was* | *[parlando delle interactivity traps] dovevo effettivamente dare il colpo per sbloccarmi da una specie di incantesimo… penso fosse stato* | Looking in their memories for a piece of knowledge that can explain an otherwise inexplicable behaviour |
| 138 | Statement | **P8 Think-aloud** | *{does not die in fake flames} So the trap saved me?* | *{non muore in fiamme finte} Cioè quindi la trappola mi ha salvato?* | Looking in their memories for a piece of knowledge that can explain an otherwise inexplicable behaviour |
| 139 | Statement | **P1 Think-aloud** | *{doesn't die in fake flames, surprised} ok I didn't die...? Maybe from the purple gemstone on the ground?* | *{non muore in fiamme finte, sorpreso} ok non sono morto…? Forse per la gemmina viola per terra?* | Looking in their memories for a piece of knowledge that can explain an otherwise inexplicable behaviour |

| E | Type | Participant(s) | Evidence (ENG) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 140 | Behaviour | **All but P5 Think-aloud** | *Psychosomatic reactions of participants to the first interactivity trap characterised by confusion. Absence of such reactions from the second interactivity trap onwards.* | | Incomprehensibility of the interactivity trap neutralized by the creation of a new relation between multimodal system, interaction affordances, and memories. |
| 141 | Summary of statement | **P3, P5, P6 Interview** | *Understood the story exactly as was designed* | | Interpreted the story as intended by the design |
| 142 | Summary of statement | **P1 Interview** | *Understood the story as was designed and mentioned it being stereotypical, adding that additional twists could enliven it* | | Interpreted the story as intended by the design |
| 143 | Summary of statement | **P9 Interview** | *Understood the story as was designed (incl. Details, such as the location of the boss in a cave) but lamented the lack of further explanations* | | Interpreted the story as intended by the design |
| 144 | Summary of statement | **P11 Interview** | *Understood the story as was designed but believed that the guard was pretending to be dead to surprise the villain* | | Details of the story were changed from the design |
| 145 | Summary of statement | **P10 Interview** | *Understood the story as was designed but hypothesised the guard to be an undead* | | Details of the story were changed from the design |
| 146 | Summary of statement | **P13 Interview** | *Understood the story as one of revenge where the guard resurrected from the dead to vindicate his own death* | | The scope and point of the story were changed from the design |

| E | Type | Participant(s) | Evidence (ENG) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 147 | Summary of statement | **P4 Interview** | *Understood the story as one of revenge where the guard resurrected from the dead to vindicate his own death. Incidentally, this also saves the world* | | The scope and point of the story were changed from the design |
| 148 | Summary of statement | **P8 Interview** | *Described the story with three words: "amatorial", "rescue" and "short"*[218] | | The scope and point of the story were changed from the design |
| 149 | Summary of statement | **P2, P7 Interview** | *Stated to be unable to summarise the story* | | The scope and point of the story were not understood |
| 150 | Statement | **P13 Interview** | *Basically he in the game he was already dead and is resurrected so it seemed like a logical thing* | *Di base lui nel gioco era già morto ed è resuscitato quindi mi è sembrato una cosa logica* | Narrative sensemaking impacted the inter-pretation of the game and the gameplay experience in unforeseen ways |

[218] While these three words are not very telling about P8's narrative sensemaking, they can still tell us that the story has been interpreted as one with the ultimate goal to rescue someone.

# S-RQ7

| E | Type | Participant(s) | Evidence (ENG) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 151 | Statement | **P4 Interview** | *If instead you kind of want to do it by changing the colour, like I don't know you put yellow or whatever and then you have to use the shield, then it can be there too... it can work too, so you change the malus, which can still be nice as a thing.* | *Se invece tipo si vuole fare cambiando colore, tipo boh metti un giallo o quello che deve essere e allora devi fare lo scudo, allora può esserci anche… può starci anche così, quindi cambi il malus che può essere comunque carina come cosa.* | Suggesting to add more interactivity traps, with minor modifications (colour) to give them more diversity |
| 152 | Statement | **P11 Interview** | *[talking about the fake fire] at first I was a bit taken aback... I thought I was dead, but then I finally accepted the fact. I still don't understand why but it fits* | *[parlando del fuoco finto] all'inizio mi ha preso un po' la sprov-vista… pensavo di essere morto, invece poi alla fine ho accettato il fatto. Ancora non capisco perché però ci sta* | misbehaviours do not need to be completely understandable or explainable to be acceptable |

# S-RQ8

| E | Type | Participant(s) | Evidence (ENG) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 153 | Statement | **P1 Interview** | *at first [the interactivity traps] confused me a lot, but then knowing they were there I understood how to see them* | *All'inizio [le interactivity traps] mi hanno confuso molto, ma poi sapendo che c'erano ho capito come vederle* | Added mechanics or elements caused the entirety of the system to grow |
| 154 | Statement | **P11 Interview** | *I thought at first the angle was important but then I saw that there was simply the command input that had to be taken on screen and I saw that it worked* | *pensavo all'inizio l'angolazione fosse importante ma poi ho visto che c'era semplicemente l'input di comando che andava preso a schermo e ho visto che funzionava* | Added mechanics or elements caused the entirety of the system to grow |
| 155 | Statement | **P14 Interview** | *at first I didn't understand at first, but later when the [...] grey part popped up, it meant that it was the moment when it was finishing and then I could pass* | *All'inizio non avevo capito subito, ma dopo quando spuntava la parte [...] grigia, voleva dire che era il momento in cui stava finendo e quindi sarei potuto passare* | Added mechanics or elements caused the entirety of the system to grow |
| 156 | Statement | **All but P2, P3, P7, P12, P14 Think-aloud or interview** | *Realized that the interactivity traps were placed by the head monster* | | Growth of an already stable system by retrospectively adding information |
| 157 | Statement | **P1 Think-aloud** | *Ah, he is the one who creates those little purple things that paralyze* | *Ah, è lui che crea quei cosini viola che paralizzano* | Growth of an already stable system by retrospectively adding information |
| 158 | Statement | **P11 Think-aloud** | *{falls into interactivity trap in front of head monster} ok he is the one placing these things* | *{cade nella interactivity trap davanti al mostro testa} ok lui è quello che mette queste cose* | Growth of an already stable system by retrospectively adding information |
| 159 | Statement | **P8 Think-aloud** | *{Walk on fake spikes} it's strange! I mean more like you're used to thorns killing you and to see now that you can walk on them makes you rethink* | *{Cammina su punte finte} è strano! Cioè più che altro sei abituato che le spine ti ammazzano e vedere adesso che ci puoi camminare sopra ti fa ripensare* | Growth of an already stable system by retrospectively adding information |

# S-RQ9

| E | Type | Participant(s) | Evidence (ENG) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 160 | Statement | **P13 Think-aloud** | *{falls into fake spikes} No! ... I am not... dead... why am I not dead? {confused}* | *{cade nelle punte finte} No! ... Non sono… morta… perché non sono morta? {confusa}* | Change perceived as marked. |
| 161 | Behaviour | **P13 Think-aloud** | *Willingly jumped in (real) spikes after having encountered fake spikes once, got annoyed when the character died* | | Understanding of the function of spikes has changed, so much to consider the (previously) usual behaviour marked. This change was sudden. |

# Additional findings

| E | Type | Participant(s) | Evidence (ENG) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 162 | Statement | **P10 Interview** | *E: What did you think the first time you got stuck? P: I thought that... I don't know, I actually thought it was... it was a mistake, but then afterwards I said, 'but that's impossible, I mean. I mean, if there was a mistake, that means they should have fixed it.* | *E: Cos'hai pensato la prima volta che sei stato bloccato? P: Ho pensato che… non lo so, In realtà ho pensato che fosse… ci fosse stato un errore, ma poi dopo ho detto "ma impossibile, Cioè se c'è stato un errore vuol dire che dovrebbero averlo messo a posto* | Showing trust towards the work of the designers and developers |
| 163 | Statement | **P13 Interview** | *E: What did you think when you met the fake flames and fake tips? P: At first I thought it was a problem. Then I realised that it was actually an intended thing.* | *E: Cos'hai pensato quando hai trovato le fiamme finte e le punte finte? P: All'inizio pensavo fosse un problema. Poi ho capito che in realtà era una cosa intesa* | Showing trust towards the work of the designers and developers |
| 164 | Statement | **P10 Interview** | *[speaking of fake flames and spikes] E: And what did you think? P: Ah I thought... I thought that... that it was done on purpose Let's say, that those there were done on purpose* | *[parlando di fiamme e punte finte] E: E cosa hai pensato? P: Ah ho pensato… io ho pensato che… che era stato fatto apposta Diciamo, che quelle lì erano fatte apposta* | Showing trust towards the work of the designers and developers |
| 165 | Statement | **P6 Interview** | *E: Can you tell me what you thought when you have been blocked at one point? P: At first that it was... that you had to wait, that a cutscene had started* | *E: Sai dirmi cosa hai pensato quando a un certo punto sei stato bloccato? P: All'inizio che fosse… che dovessi aspettare, che era partita una cutscene* | Showing trust towards the work of the designers and developers |
| 166 | Statement | **P11 Interview** | *E: What did you think when you found the still skeleton? P: At first I thought that even in video games it is sometimes the case that characters are busy doing something else to give ambience* | *E: Cos'hai pensato quando hai trovato lo scheletro fermo? P: All'inizio ho pensato che anche nei videogiochi ci sta che a volte i personaggi siano occupati a fare altro per dare ambiente* | Showing trust towards the work of the designers and developers |

| E | Type | Participant(s) | Evidence (ENG) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 167 | Statement | **P9 Interview** | *E: What did you think when you saw the sword and shield in the boss level? P: Then I went in and I didn't have any more equipment, which I saw that he took out my sword and shield, and I took them back. It may mean that you choose either one way or the other not always if you pick up the corpse, OR go in the right directions, you don't have the weapons. So I deduced if I didn't pick up the two corpses at first, I would have continued like speedrun, I would have picked them up at the end* | *E: Cosa hai pensato quando hai visto spada e scudo nel livello del boss? P: Allora sono entrato e non avevo più l'equipaggiamento, che ho visto che mi ha cavato spada e scudo, e li ho ripresi. Può darsi che significa che te Scegli o una strada o l'altra non sempre se Raccogli il cadavere, O vai nelle giuste direzioni, non hai le armi. Quindi ho dedotto se all'inizio non avessi preso i due cadaveri, Avrei continuato tipo a speedrun, le avrei prese alla fine* | Showing trust towards the work of the designers and developers |
| 168 | Statement | **P12 Interview** | *E: Why did you think that the sword and shield in the boss level were power ups? P: Well, because I'd already seen, let's say, the sword and shield icon, albeit done differently, placed there like that again, very similar to the ones I already had... the only credible option I thought was something to pick up again... seeing that it didn't actually change equipment, at least it seemed to me, I suppose they were power ups to be picked up in stats, for example, instead of in actual equipment...* | *E: Perché pensavi che spada e scudo nel livello del boss fossero dei power up? P: Eh perché avendo già visto diciamo l'icona della spada e dello Scudo, pur se fatta in modo diverso, di nuovo piazzate lì così, molto simili a quelle che avevo già… l'unica opzione che ho pensato credibile fosse qualcosa da raccogliere di nuovo… vedendo che non cambiava effettivamente equipaggiamento, almeno mi è parso, suppongo che fossero stati dei power up da prendere ad esempio nelle statistiche, invece che in effettivo equipaggiamento…* | Showing trust towards the work of the designers and developers |

| E | Type | Participant(s) | Evidence (ENG) | Evidence (IT) | Description |
|---|---|---|---|---|---|
| 169 | Statement | **P1 Interview** | *E: Why were you surprised by these two things [flames and fake spikes]? P: Because these tend to be traps designed to eliminate an enemy perhaps they were an illusion simply to entice you to waste time?* | *E: Perché ti sei stupito di queste due cose [fiamme e punte finte]? P: Perché tendenzialmente queste sono trappole atte ad eliminare un nemico magari forse erano un'illusione semplicemente per invogliare a perdere tempo?* | Showing trust towards the work of the designers and developers (even when things do not work as usual) |

# Appendix II – Reported summaries of the story of the testing game

In this appendix are reported the vocalised summaries of the story of the testing game as reported by participants. In these vocalisations, E stands for "Experimenter" and P stands for "Participant". The tables report the exact questions and the exact answers in the relative rows. The vocalisations are divided per participant. Two participants (P12, P14) were not asked to summarise the story and their vocalisations are therefore missing (see Chapter 4 for additional details).

## P1

| | **EN** | **IT** |
|---|---|---|
| **E** | Could you summarise the story of the game you played? | Sapresti riassumermi la storia del gioco che hai giocato? |
| **P** | Yes, most of the story is in the opening cutscene where the villain gets hold of a dark power, uses a portal to enter this realm which I assume he wants to conquer for some reason that didn't seem to be explained. You are a guard along with your comrades guarding I guess the entrance to the castle... now I admit I didn't pay too much attention to the characters where they were standing when the villain arrived, you survive the villain's attack and stay I guess for your duty to do your job and try to stop him, you set off in pursuit of the villain when the villain has summoned his creatures to conquer I guess the kingdom since the creatures he summoned there and then were markedly more than the ones you eventually encountered... and as a result you leave... now I actually didn't notice at the beginning whether you were unarmed or not but I guess it wouldn't have made sense... maybe... it seems to me that they had at least the shield... they had at least the shield, and as a result there actually why abandon the shield? He was hit by the villain's ranged attack ok, but he lost his weapons and defence? I understand the shield, but I wouldn't understand losing the sword in that case. But of course there's a tutorial, that's there. And of course after that you go straight, the good guy chases the bad guy, finds the bad guy, defeats the bad guy... the end. | Sì, la maggior parte della storia è nella cutscene iniziale in cui il cattivo si impossessa di un potere oscuro, utilizza un portale per entrare in questo regno che immagino voglia conquistare per un qualche motivo che non mi sembrava venisse spiegato. Tu sei una guardia insieme ai tuoi compagni che fanno la guardia immagino all'entrata del castello… adesso ammetto di non aver fatto troppo caso ai personaggi dov'erano fermi quando è arrivato il cattivo, sopravvivi all'attacco del cattivo e rimani immagino per il tuo dovere a fare il tuo lavoro e cerchi di fermarlo, parti all'inseguimento del cattivo quando il cattivo ha evocato le sue creature per conquistare immagino il regno visto che le creature che ha evocato lì per lì erano nettamente di più rispetto a quelle che alla fine hai incontrato… e di conseguenza parti… adesso effettivamente non ho fatto caso all'inizio se eri disarmato o meno però immagino non avrebbe avuto senso… forse… mi sembra che avessero almeno lo scudo… avevano almeno lo scudo, e di conseguenza lì effettivamente perché abbandonare lo scudo? È stato colpito dall'attacco a distanza del cattivo ok, ma ha perso le armi e la difesa? Capisco lo scudo, ma non capirei la perdita della spada in quel caso. Però ovviamente ci sta un tutorial, quello ci sta. E ovviamente dopo si va dritto, il buono insegue il cattivo, trova il cattivo, sconfigge il cattivo… fine. |

## P2

| | EN | IT |
|---|---|---|
| **E** | Could you briefly summarise the story of this game? | Sapresti riassumerli brevemente la storia di questo gioco? |
| **P** | No, in the sense... the only thing I remembered was that there's a villain who turns on some crystals, something like that, at the beginning... then he runs away and you basically have to chase him | No, nel senso… l'unica cosa che mi sono ricordato è che c'è un cattivo che ha accende dei cristalli, una roba simile, all'inizio… poi scappa e tu sostanzialmente lo devi inseguire |
| **E** | And can you tell me something about your identity or something like that? | E sai dirmi qualcosa sua tua identità o qualcosa del genere? |
| **P** | No, I did not pay attention to the character | No, non ho fatto caso al personaggio |

## P3

| | EN | IT |
|---|---|---|
| **E** | Could you briefly summarise the story for me? | Sapresti riassumermi brevemente la storia? |
| **P** | So there's this knight who... you know... enters a portal created by this evil being, and on his way he finds various pitfalls, between spears, between platforms that move, monsters, and he has to defeat them all to... also to save his companion who was in trouble, and... and then defeat this final boss between... in quotes | Allora c'è questo cavaliere che… insomma… entra in un portale creato da questo essere cattivo, e nel suo percorso trova diverse insidie, tra lance, tra piattaforme che si muovono, mostri, e li deve sconfiggere tutti per… anche per salvare il suo compagno che era in difficoltà, e… e poi sconfiggere questo boss finale tra… tra virgolette |

## P4

| | EN | IT |
|---|---|---|
| **E** | Could you briefly summarise the story of this game for me? | Sapresti riassumermi brevemente la storia di questo gioco? |
| **P** | Honestly, I didn't really understand it... a medieval place where there are these two heroes who appear in front of this super... this villain... this villain... he kills these two heroes it would seem, but one comes back to life, it's not clear how... and when he comes back to life he's obviously looking for revenge, and in going to find this enemy, this villain, who seems to enter inside this castle... but first he generates monsters, he generates, so it makes you understand that his intent is to destroy a kingdom? Destroy the world? In any case, a malicious intent, that is... and so this hero, this soldier, this knight, throws himself into the quest to defeat this enemy, facing various vicissitudes, various enemies, until he arrives in front of it and manages to defeat it. | Onestamente non l'ho capita molto… un luogo medievale in cui ci sono questi Due eroi che si presentano davanti a questo super… questo cattivo… questo cattivo Ammazza questi due eroi sembrerebbe, però uno torna in vita, non si capisce bene come… e nel momento in cui torna in vita Cerca evidentemente di vendicarsi, e nell'andare a cercare questo nemico, questo cattivo, che sembra entrare appunto dentro questo castello… però prima lui genera dei mostri, genera, quindi ti fa capire che il suo intento è comunque quello di distruggere un regno? Distruggere il mondo? Comunque un intento appunto malintenzionato Ecco… e quindi questo eroe, questo soldato, questo cavaliere, si butta alla ricerca di sconfiggere questo nemico affrontando varie peripezie, vari nemici, fino a quando non arriva davanti a lui e riesce a sconfiggerlo. |

## P5

| | EN | IT |
|---|---|---|
| **E** | If I asked you to summarise the story of this game, could you do it? | Se ti chiedessi di riassumermi la storia di questo gioco, sapresti farlo? |
| **P** | At the beginning, there's this boss in a cave who's trapped, but then he's freed by some forces, I think, after which you enter the real world, where there are these two knights who try to defeat the evils, such as the boss, then the skeletons, the owls, etc. appear, but they're both killed... Then one is evidently not completely dead, and so he gets up again, and goes back into the world to try to kill the boss, the skeletons, and the owls that had attacked them earlier, and throughout the levels In fact we encounter: the owls, and the skeletons, and then at the end through the portal we arrive at the final boss, whom the knight tries to kill in order to capture him again. | Eh all'inizio c'è questo boss in una caverna e che è intrappolato, però poi viene liberato da delle forze, credo, ehm… dopodiché si entra nel mondo reale diciamo, dove ci sono questi due cavalieri che cercano di sconfiggere i mali, come ad esempio il boss, poi Appaiono gli scheletri, i gufi, eccetera, però vengono uccisi tutti e due… Dopodiché uno invece evidentemente non è morto del tutto e quindi si rialza, e torna nel mondo per cercare di uccidere il boss, gli scheletri, e i gufi che li avevano attaccati precedentemente, e durante tutti i livelli Infatti incontriamo: i gufi, e gli scheletri, e poi alla fine tramite il portale si arriva al boss finale, che il cavaliere cerca di uccidere per catturarlo di nuovo. |

## P6

| | EN | IT |
|---|---|---|
| **E** | Could you briefly tell me the story? | Sapresti dirmi brevemente la storia? |
| **P** | Ok well yes, Evil sorcerer invades the palace, attacks two guards... If I remember correctly it's one of the two guards who then goes back inside the palace... and inside which he has done a whole strange ritual and... No, whatever, yes, by creating the Portals he has gone inside the palace, and nothing so the knight tries to free the palace from the evil monsters and the evil sorcerer | Ok allora sì, stregone Cattivo che invade il palazzo, Attacca due guardie… Se non ricordo male è una delle due guardie che poi rientra dentro il palazzo… e dentro il quale ha fatto tutto un rituale strano e… No vabbè sì creando I Portali è entrato dentro il palazzo, e niente quindi il cavaliere cerca di liberare il palazzo da dai mostri cattivi e dallo stregone cattivo |

## P7

| | EN | IT |
|---|---|---|
| **E** | Could you summarise the story of this game for me very briefly? | Sapresti riassumermi molto brevemente la storia di questo gioco? |
| **P** | Eh... good question. No, not really, I don't know. | Eh… bella domanda. No, in realtà no, non lo so |

## P8

| | EN | IT |
|---|---|---|
| **E** | If I were to ask you to sum up the story in three words would you be able to do it? | Se dovessi chiederti di riassumermi la storia in tre parole riusciresti a farlo? |
| **P** | Then I think it would be like "amatorial", "rescue" and... | Allora penso che sia tipo "amatoriale", "di salvataggio" e… |
| **E** | No I meant three words figuratively, not actually three words.... | No intendevo tre parole figurativamente, non effettivamente tre parole… |
| **P** | Ah no well yeah... eh that other one I don't know, another word, maybe even "short", Yeah | Ah no beh sì… eh quell'altra Non lo so, un'altra parola, forse anche "breve", Sì |

## P9

| | EN | IT |
|---|---|---|
| **E** | If I asked you to summarise the story of this game a little bit, could you tell me something? | Se ti chiedessi di riassumermi un pochino la storia di questo gioco, Sapresti dirmi qualcosa? |
| **P** | Evil wizard got loose, goes to a castle, kills everyone except the main character, The main character chases him and has to kill him. There's no... actual seems like a one off, in the series: you free the bad guy, you have to confront him and kill him, Victory! I didn't understand why the bad guy was imprisoned, why he attacked the castle, I just knew he was laughing, the end. And the story is very... I mean either at the beginning or at the end there wasn't at least the intro to explain the story a little bit, maybe at the end the introduction of what he had... How he saved the kingdom, etc. Or at the beginning why he was trapped, because I saw at the beginning: inside a place, a cave, he frees himself, enters a portal, comes out the other side, goes to face the castle, end. I didn't really understand the meaning... because I had to face him. | Mago cattivo si è liberato, va in un castello, uccide tutti tranne il protagonista, Il protagonista lo insegue e lo deve uccidere. Non c'è… effettivo sembra un uno qualunque, della serie: si libera il cattivo, lo devi affrontare e uccidere, Vittoria! Non ho capito perché il cattivo era imprigionato, perché ha attaccato il castello, sapevo solo che rideva, fine. E la storia è molto… Cioè o all'inizio o alla fine non c'era almeno l'intro per spiegare un po' la storia, magari alla fine l'introduzione di cosa aveva… Come si è salvato il regno, eccetera. Oppure all'inizio perché è stato intrappolato lui, perché io all'inizio ho visto: dentro un luogo, una caverna, lui si libera, entra in un portale, esce dall'altra parte, va a affrontare nel castello, fine. Non ho capito molto il senso… perché dovevo affrontarlo. |

## P10

| | EN | IT |
|---|---|---|
| **E** | Could you briefly summarise for me the story of this game? | Sapresti riassumermi brevemente la storia di questo gioco? |
| **P** | So from what I've seen there's... there was this final boss, the bad guy, who was... let's say something happened that freed him, and this one here afterwards there were two troops, two troops that he... he killed them and ran away... And no... not those, no, no the two troops he didn't kill because one of... one of those You were, You were you I think, I don't know... then either you were The Chosen One, no, who had to defeat that boss there, or it was two troops and you reappeared there, that I don't know... eh And then afterwards you practically had to, from zero, practically from zero... or maybe from undead, maybe, I don't know... Well, from zero you had to take shield and sword and try to defeat the boss, to avenge yourself, tò, or to bring the world to safety, I don't know and... enough | Allora da quello che ho visto c'è… c'era questo il boss finale, il cattivo, che è stato… diciamo è successo qualcosa che l'ha liberato, e questo qui dopo c'erano due truppe, due truppe che le ha… le ha uccise ed è scappato… E no… non quelle, no, no le due truppe non le ha uccise perché una di… una di quelli Eri, Eri tu mi sembra, non so… allora o forse eri Il prescelto no, che doveva sconfiggere quel boss lì, oppure erano due truppe e tu sei riapparso lì, quello non lo so… eh E poi dopo praticamente te da, da zero, praticamente da zero… o magari da non morto, può darsi, Non lo so… Vabbè da zero dovevi prendere scudo e spada e cercare di sconfiggere il boss, di vendicarti, tò, o di portare il mondo in Salvo, non so e… basta |

## P11

| | EN | IT |
|---|---|---|
| **E** | If I asked you to briefly summarise the story, could you tell me something? | Se ti chiedessi di Riassumi brevemente la storia, sapresti dirmi qualcosa? |
| **P** | So a demon from another dimension, who may very well be the skeletor let's say from the game world, has invaded the realm of the protagonist, who initially pretends to be dead in order to... let's say... surprise the skeletor, and essentially it's about liberating a castle overrun by an evil entity. This is what I understand | Allora un demone di un'altra dimensione, che può benissimo essere lo skeletor diciamo del mondo di gioco, ha invaso il regno del protagonista, che inizialmente si finge morto per poter… diciamo… sorprendere il lo scheletro, e essenzialmente si tratta di liberare un castello invaso da un'entità maligna. Questo è quello che ho capito |

## P13

| | EN | IT |
|---|---|---|
| **E** | If I were to ask you to summarise the story of this game briefly what would you be able to tell me? | Se dovessi chiederti di riassumermi la storia di questo gioco brevemente cosa sapresti dirmi? |
| **P** | That entity at the beginning, the one who was eventually the final boss killed the protagonist who then resurrected and went to take revenge | Quell'entità all'inizio, quello che poi alla fine era il boss finale ha ucciso il protagonista che poi è risorto ed è andato a vendicarsi |

# Appendix III –
# Additional materials

Additional materials related to the experiment described in Chapter 4, including the participants' profiles (demographics and TIPI scale values), the recordings of the experiment sessions and the full transcript of them, as well as a playable version of the testing game and the full source code for it, are available at the following link:
https://drive.google.com/drive/folders/1gPCoe8CZ3b-4gUuDyWhiOH6LpC_26wCL

# SUMMARY IN ENGLISH

In this dissertation, I discuss why and how complexity and video games can be mutually illuminating. The concept of complexity is often used to talk about video games. Most frequently, complexity is intended in a strictly algorithmic sense, as a function of the rules and the intricated combinations they can give rise to (Perkis et al., 2023; Wardaszko, 2018). Elsewhere, complexity is used to talk about communities of players that gather within and outside the games themselves, giving rise to an ecology of actors and media products (Ensslin, 2022; and in part Caracciolo, 2024). In this work, I will investigate instead the complexities that are linked to the game-player encounter. My two main goals in this work are: 1) to shed light on what kind of narratives video games feature and on their formal organisation; and 2) to have a better understanding of how video games construct meaning in collaboration with their players (and vice versa).

In analysing the complexity of video games I employ a theoretical triangulation – a mixed and multimethod analysis of the same phenomenon (Denzin, 2015) – that helps elucidate nuances that would otherwise get lost. The three disciplines whose approaches, perspectives, and methods I borrow most heavily from are game studies, narratology, and cognitive sciences. These three theoretical perspectives enter different configurations throughout the text, but they are constantly at the backdrop of the discussion and always guide the argumentation.

In more specific terms, the complexity of video games will be analysed employing two notions of complexity.

The first notion of complexity I investigate in video games is the complexity of videoludic narratives – analysed in Part I. Narrative complexity is a relatively new paradigm in the analysis of narratives that apply complexity theories to different aspects of storytelling, narrative organization, and cognitive responses to them. The implications and informative value of this new perspective have been recently analysed in Grishakova and Poulaki's (2019b) and Walsh and Stepney's (2018) edited collections. However, the kind of complexity encoded and presented to the audience by different communication media is variable, and highly dependent on media affordances, customs, and expectations of their users. Despite the ever-growing importance of video games in the current cultural landscape, the heuristic value of complexity theories is still largely unexplored in the context of digital narratives. This is the first significant gap in the literature this work aims at addressing.

In Chapter 1, I discuss the formal complexity of video game narratives. I identify the narrative devices that are often used to make narratives formally complex, and I examine specifically the shape these devices take in video games. I analyse different games spanning across a large portion of the history of video games through several close readings. These readings help to support my view of video game narratives as generally complex.

In Chapter 2, I investigate the cognitive effects of formally complex narratives on their players. Epistemic emotions like confusion and cognitive dissonance

sprout from the employment of different cognitive functions and thinking styles, and they are generally considered the diagnostic sign of narrative complexity. To empirically substantiate this connection between complex narratives and specific video game players responses I report a quantitative study analysing the players' reactions to two very different narratives of two very similar games. I then discuss the appeal of the complexity of video games narratives and how this view can help designers create more intriguing videoludic narrative experiences.

The second kind of complexity I analyse in relation to video games, in Part II, is the complex system that comes into being when a game is encountered by its player, and specifically when the player engages in the active, configurative (Eskelinen, 2012) sensemaking process, distinctive of videoludic products. Here complexity refers more specifically to the notion of complex systems. Most of the studies analysing the elements that impact the game playing experience and the expressive elements that participate in its construction focus on these elements in isolation or, at best, in clusters. This perspective, while shedding light on these particulars, cannot capture the complexity of the entire experience of playing a video game. A theoretical framework that can provide a more holistic stance on this complexity is the second contribution of this dissertation to the academic discussion.

In Chapter 3, I propose my complex-systemic perspective of the game-player collaborative sensemaking. Throughout the text I discuss elements forming the collaborative sensemaking system, and the working of this system as a whole, but also introduce a mereological perspective to capture the relation among parts and between parts and the whole. I also discuss the aspects that emerge from this collaborative sensemaking, the first of which is the linear game (and narrative) experience. As I will show, this complex-systemic perspective can provide a holistic view of the ways video games co-construct meaning with their players. This flexible framework manages to accommodate and encompass the vast majority of currently existing literature on the semiotics of video games without being reduced to it. Before concluding the chapter, I investigate how this complex collaborative sensemaking system works in actual gaming practices, and highlight the ways in which the designers guide the game-player collaboration.

In Chapter 4, I report a study specifically designed for and aimed at empirically testing the complex-systemic perspective of the game-player collaborative sensemaking. I describe the object used for this study and how it has been designed on the basis of the theoretical framework outlined. After illustrating the methodology employed and the design of the testing game for the experiment, I report the findings and discuss the results in relation to my theoretical framework. In this way, the validity of the framework is supported by empirical data and the framework can be said to aptly explain the collaborative sensemaking of video games.

The two notions of complexity investigated in Part I and in Part II must necessarily come together, as they both apply to the very same objects of study – video games. In Part III, I delve deeper into what it means for video games to feature complex narratives understood through complex sensemaking. By joining

both notions of complexity, I highlight the hermeneutic potential that this junction affords and the cognitive effects it might trigger.

In Chapter 5, by employing the theoretical perspectives outlined in Part I and in Part II for the analysis of a single case study, I discuss how the two approaches can be brought together to allow a further productive scrutiny of video game experiences. I also highlight the reasons why the considerations on narrative complexity are both reinforcing and being reinforced by those on complex sensemaking, and vice versa.

In Chapter 6, I introduce the paradox of the apparent double complexity of video games. As complex narratives understood through complex sensemaking, video games might look, from a theoretical point of view, cognitively unmanageable. In this chapter, I foreground the actual improved cognitive economy that results from the encounter of the two complexities. In particular, I explore four cognitive economy strategies that make this double complexity cognitively manageable, drawing on empirical findings in cognitive psychology and neuropsychology. This gives first insights on why games can be both popular and complex forms of entertainment, being complex in theory but without causing cognitive overload.

The implications of the theories presented in this dissertation are several and span across a number of domains. In the conclusions, I discuss the implications of my theories for narratology, media studies, game studies, game design, and with regards to the representation of complex societal issues.

# SUMMARY IN ESTONIAN

## Videomängud, narratiivid ja komplekssus

Käesolevas doktoritöös arutlen, miks ja kuidas komplekssus ja videomängud võivad olla vastastikku valgustavad. Videomängudest rääkides kasutatakse komplekssuse mõistet sageli. Enamasti mõeldakse seejuures komplekssust rangelt algoritmilises mõttes, reeglite ja nende põhjustatud keerukate kombinatsioonide funktsioonina (Perkis et al., 2023; Wardaszko, 2018). Komplekssust kasutatakse ka rääkides mängijate kogukondadest, mis tekivad nii mängude siseselt kui ka väljaspool, moodustades osalejate ja meediatoodete ökoloogia (Ensslin, 2022; Caracciolo, 2024). Antud töös uurin hoopis mängu ja mängija kohtumisega seotud komplekssust. Töö kaks peamist eesmärki on: 1) heita valgust sellele, millised on videomängude narratiivid ning nende formaalsed omadused; ja 2) paremini mõista, kuidas videomängud koostöös mängijatega (ja vastupidi) tähendust loovad.

Videomängude komplekssust uurides rakendan teoreetilist triangulatsiooni – ühe ja sama nähtuse sega- ja mitmemeetodilist analüüsi (Denzin, 2015), mis aitab selgitada nüansse, mis muidu kaotsi läheksid. Kolm distsipliini, mille lähenemisviise, vaatenurki ja meetodeid ma kõige rohkem kasutan, on mängu-uuringud, narratoloogia ja kognitiivteadused. Need kolm teoreetilist perspektiivi astuvad kogu diskussiooni jooksul erinevatesse konfiguratsioonidesse, kuid nad on pidevalt arutelu taustal ja suunavad argumentatsiooni.

Konkreetsemalt analüüsitakse videomängude komplekssust, kasutades kahte komplekssuse mõistet.

Esimest neist – videomängude narratiivide keerukust – analüüsin I osas. Narratiivne keerukus on suhteliselt uus paradigma narratiivide analüüsis, mis rakendab keerukuse teooriaid jutustamise, narratiivse struktuuri ja kognitiivsete reaktsioonide erinevatele aspektidele. Selle uue perspektiivi mõju ja informatiivset väärtust on hiljuti analüüsitud Grishakova ja Poulaki (2019b) ning Walshi ja Stepney (2018) toimetatud kogumikes. See, millist keerukust kodeerivad ja esitavad publikule erinevad kommunikatsioonimeediumid, on siiski varieeruv ning sõltub suuresti meedia võimalustest, tavadest ja kasutajate ootustest. Vaatamata videomängude üha kasvavale tähtsusele praegusel kultuurimaastikul on keerukuse teooriate heuristiline väärtus digitaalsete narratiivide kontekstis veel suures osas uurimata. See on esimene oluline lünk teaduskirjanduses, mida käesolev töö püüab täita.

Esimeses peatükis käsitlen videomängude narratiivide formaalset keerukust. Toon välja narratiivsed vahendid, mida sageli kasutatakse narratiivide vormilise keerukuse muutmiseks vormiliseks keerukustamiseks, ning uurin konkreetselt, millise kuju need vahendid videomängudes võtavad. Analüüsin erinevaid mänge, mis hõlmavad suurt osa videomängude ajaloost, lähilugemise kaudu. Need lugemised aitavad toetada seisukohta, et videomängude narratiivid on üldiselt keerukad.

Teises peatükis uurin vormiliselt keerukate narratiivide kognitiivset mõju mängijatele. Episteemilised emotsioonid, nagu segadus ja kognitiivne dissonants, võrsuvad erinevate kognitiivsete funktsioonide ja mõtlemisstiilide kasutamisest ning neid peetakse üldiselt narratiivse komplekssuse diagnostiliseks tunnuseks. Selle seose empiiriliseks tõestamiseks esitan kvantitatiivse uuringu, milles analüüsitakse mängijate reaktsioone kahe väga erineva narratiivi puhul kahes väga sarnases mängus. Seejärel arutlen videomängude narratiivide keerukuse atraktiivsuse ja selle üle, kuidas see vaade võib aidata disaineritel luua intrigeerivaid narratiivseid elamusi videomängudes.

II osas vaatlen teist liiki komplekssust – see on komplekssüsteem, mis tekib mängija kohtumisel mänguga, ja eriti siis, kui mängija osaleb aktiivses, konfiguratiivses (Eskelinen, 2012) tähendusloomeprotsessis, mis on iseloomulik videomängudele. Siinkohal viitab keerukus täpsemalt komplekssete süsteemide mõistele. Enamik uuringuid, milles analüüsitakse mängukogemust mõjutavaid elemente ja selle ülesehituses osalevaid väljenduslikke elemente, keskenduvad kas nendele elementidele eraldi või parimal juhul vaatlevad neid klastritena. Selline vaatenurk heidab küll valgust üksikasjadele, kuid ei suuda hõlmata kogu videomängu mängimise kogemuse komplekssust. Teoreetiline raamistik, mis võib anda selle komplekssuse kohta terviklikuma seisukoha, on selle väitekirja teine panus akadeemilisse arutellu.

Kolmandas peatükis pakun välja oma kompleks-süsteemse perspektiivi mängijate koostööl põhineva tunnetuse kohta. Arutlen koostööpõhise tunnetussüsteemi moodustavate elementide ja selle süsteemi kui terviku toimimise üle, kuid võtan kasutusele ka mereoloogilise perspektiivi, et tabada osade omavahelist ning osade ja terviku vahelist suhet. Käsitlen ka aspekte, mis tekivad taolisest ühisloomest, millest esimene on lineaarne mängu- (ja narratiivne) kogemus. Nagu ma näitan, võib see kompleks-süsteemne perspektiiv anda tervikliku ülevaate sellest, kuidas videomängud koos oma mängijatega tähendust loovad. See paindlik raamistik suudab mahutada ja hõlmata valdava osa praegu olemasolevast videomängude semiootikat käsitlevast kirjandusest, ilma et ta oleks sellele taandatud. Peatüki lõpus uurin, kuidas see keeruline koostööl põhinev mõtestamissüsteem tegelikes mängupraktikates toimib ja toon välja viisid, kuidas disainerid mängude ja mängijate koostööd suunavad.

Neljandas peatükis annan ülevaate spetsiaalselt selle töö jaoks kavandatud uuringust, mille eesmärk on empiiriliselt valideerida kompleks-süsteemset perspektiivi mängijate koostööle. Kirjeldan selle uuringu jaoks kasutatud objekti ja seda, kuidas see suhestub teoreetilise raamistikuga. Pärast kasutatud metoodika ja eksperimendi testimismängu ülesehituse tutvustamist esitan tulemused ja arutlen nende üle. Sel viisil valideeritakse teooriaraamistik ja selgitatakse näitlikult videomängude koostööl põhinevat ühistajumist.

I ja II osas uuritud kaks komplekssuse mõistet peavad tingimata kokku puutuma, sest mõlemad kehtivad samade uurimisobjektide – videomängude – suhtes. III osas süvenen põhjalikumalt sellesse, mida tähendab videomängude jaoks komplekssе tunnetuse kaudu mõistetud komplekssete narratiivide esitamine.

Ühendades mõlemad komplekssuse mõisted, rõhutan taolise ühenduse hermeneutilist potentsiaali ja kognitiivseid mõjusid, mida see võib esile kutsuda.

5. peatükis, kasutades I ja II osas kirjeldatud teoreetilisi perspektiive ühe juhtumiuuringu analüüsimiseks, arutlen selle üle, kuidas neid kahte lähenemisviisi saaks ühendada võimaldamaks videomängukogemuste edasist produktiivset uurimist. Toon välja ka põhjused, miks narratiivse komplekssusega seotud kaalutlused ühtaegu nii tugevdavad kui ka kinnistavad komplekssе tähendusloome kaalutlusi ja vastupidi.

Kuuendas peatükis tutvustan videomängude topeltkomplekssuse paradoksi. Komplekssete narratiividena, mida mõistetakse komplekssе tähendusloome kaudu, võivad videomängud teoreetilisest vaatenurgast vaadatuna näida kognitiivselt käsitlematud. Selles peatükis toon esile parendatud kognitiivse ökonoomsuse, mis tuleneb kahe komplekssuse kokkupuutest. Eelkõige uurin nelja kognitiivse ökonoomsuse strateegiat, mis muudavad selle topeltkomplekssuse kognitiivselt hallatavaks, tuginedes kognitiiv- ja neuropsühholoogia empiirilistele tulemustele. See annab esmase arusaama sellest, miks mängud võivad olla korraga nii populaarsed kui ka komplekssed meelelahutusvormid; olles teoorias komplekssed, kuid põhjustamata seejuures kognitiivset ülekoormust.

Käesolevas doktoritöös esitatud teooriate mõju on mitmetahuline ja hõlmab mitmeid valdkondi. Järeldustes arutlen oma teooriate mõju üle narratoloogiale, meedia- ja mängu-uuringutele, mängudisainile ja seostele keeruliste ühiskondlike probleemide kujutamisega.

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| 2024–... | Association for Research in Digital Interactive Narratives: General Board Member and Membership Officer |
| 2022–... | ICLA Research Committee on Literature, Arts and Media: Member |
| 2022–2024 | INDCOR – EU COST Action CA18230: Work Group 2 Vice Chair |
| 2020–2022 | INDCOR – EU COST Action CA18230: Member |
| 2020–... | Research Group on Narrative, Culture, and Cognition, University of Tartu, Institute of Cultural Research: Member |

**Events**

Co-curator of the art exhibition "Transforming Literary Places" with Dr. Francesca Arnavas. This exhibition seeks to explore the profound and imaginative connections between literature and other digital and physical arts, highlighting the way in which stories and words can shape, inspire, and transform physical spaces. The exhibition was part of the program of Tartu 2024 European Capital of Culture, and is financed by the Cultural Endowment of Estonia (Kulka)

Organising committee of the annual conference of the Science Fiction Research Association, held in Tartu in May 2024 and winning the "best event" prize of the municipality of Tartu and the Estonian Conference Bureau as and the "event of the year" award of the Faculty of Humanities and Arts, University of Tartu

Organising Committee for three INDCOR Stakeholders Event, high-profiles outreaching events for the COST Action INDCOR. It constituted a meeting point for researchers, practitioners, NGOs, IGOs, trade unions, and private companies to discuss the representation of complex societal issues (2022, 2023, 2024)

Co-chair of the track "Prosocial Interactive Digital Narratives" at two ACM International Conferences on Information Technology for Social Good (GoodIT 2023, 2024)

**Publications**

Arnavas, Francesca; Bellini, Mattia; Németh, Dezső (forthcoming 2026). Mind Wandering, Attention, and the Reception of Fictional Worlds. Routledge.

Barbara, Jonathan; Bellini, Mattia; Koenitz, Hartmut; Bakk, Ágnes Karolina (Eds.) (forthcoming 2025). INDCOR 2019-2024 – An Edited Collection of the Scholarship and Results of the COST Action 18230 – Interactive Narrative Design for Complexity Representations. Vilnius University Press.

Bellini, Mattia (2024). Narrative Strategies for Participation in Dante's 'Divine Comedy'. Italian Studies, 79 (1), 100–101. DOI: 10.1080/00751634.2024.2333129.

Bellini, Mattia (2024). Fairy-Tale Bodies and Embodying the Fairy Tale in Telltale Games' The Wolf Among Us. Marvels & Tales, 37 (2), 287–302.

Arnavas, Francesca; Bellini, Mattia (2023). Miyazaki's Hybrid Worlds and Their Riddle-Stories: Western Tropes and Kishōtenketsu. Narrative Works, 12 (1).

Perkis, Andrew; Bellini, Mattia; Nisi, Valentina; Irshad, Shafaq (Eds.) (2023). INDCOR white paper 2: Intearctive Narrative Design for Representing Complexity. DOI: 10.48550/arXiv.2305.01925.

Nack, Frank; Louchart, Sandy; Lund, Kristine; Bellini, Mattia; Georgieva, Iva; Atmaja, Pratama W.; Makai, Peter (2023). INDCOR white paper 3: Interactive Digital Narratives and Interaction.

Bellini, Mattia (2023). Validating Video Games as Complex Artifacts. Proceedings of the 2023 ACM Conference on Information Technology for Social Good. ACM Digital Library, 233–236. DOI: 10.1145/3582515.3609539.

Bellini, Mattia (2022). Interactive Digital Narratives as Complex Expressive Means. Frontiers in Virtual Reality, 3, 854960. DOI: 10.3389/frvir.2022.854960.

Barbara, Jonathan; Bellini, Mattia; Koenitz, Hartmut; Makai, Péter Kristóf; Sampatakou, Despoina; Irshad, Shafaq; (2022). The Sacra Infermeria – A Focus Group evaluation of an Augmented Reality Cultural Heritage Experience. New Review of Hypermedia and Multimedia, 28 (3–4), 143–171. DOI: 10.1080/13614568.2022.2150324.

Bellini, Mattia (2021). Formal Organization and Complex Responses to Video Games Narratives. Proceedings of the ACM on Human-Computer Interaction, 5. DOI: 10.1145/3474702.

Meier, Marie-Luise; Bellini, Mattia (2021). Framing the Dilemma – The Influence of Immersion in Ethical Choice Making. CEUR Workshop Proceedings, 2934: 4th Workshop on Games-Human Interaction Italy 2021; Bolzano, Italy; July 12th 2021. CEUR-WS.

Bellini, M. (2019). Towards a model to meet players' preferences in games. CEUR Workshop Proceedings, 2480: 3rd Workshop on Games-Human Interaction, Italy 2019; Padova; Italy; 23 September 2019. CEUR-WS, Code 152976.

Bellini, M. (2018). Impact of user interfaces for the enhancement of narrative elements of a video game. CEUR Workshop Proceedings, 2246: 2nd Workshop on Games-Human Interaction, Italy 2018; Grosseto; Italy; 29 May 2018. CEUR-WS, Code 141963.

# ELULOOKIRJELDUS


| | |
|---|---|
| Nimi: | Mattia Bellini |
| Sünniaeg: | 30.03.1993 |
| E-post: | mattia.bellini@ut.ee, bellinitia@gmail.com |


**Haritustee**

| | |
|---|---|
| 2020–2025 | Doktoriõpe, kirjandus- ja kultuuriuuringud, Tartu Ülikool |
| 2017–2019 | Magistrikraad kaasaegses filoloogias (cum laude), Milano Ülikool |
| 2012–2016 | BA humanitaarteadustes, Milano Ülikool |

**Teenistuskäik**

| | |
|---|---|
| 01.11.2024–… | Tartu Ülikool, humanitaarteaduste ja kunstide valdkond, kultuuriteaduste instituut, teadusassistent (0,50) |
| 01.10.2022–30.08.2024 | Tartu Ülikool, humanitaarteaduste ja kunstide valdkond, kultuuriteaduste instituut, võrdleva kirjanduse nooremteadur (0,50) |

**Teadusorganisatsiooniline ja -administratiivne tegevus**

| | |
|---|---|
| 2025–... | Euroopa Komisjoni sidevõrkude, sisu ja tehnoloogia peadirektoraat: Ekspertide nõukogu liige |
| 2024–... | Association for Research in Digital Interactive Narratives: Juhatuse liige ja liikmesuse eestvedaja |
| 2022–... | ICLA kirjanduse, kunsti ja meedia teaduskomitee: Liige |
| 2022–2024 | INDCOR – ELi COST meede CA18230: Töörühma 2 aseesimees |
| 2020–2022 | INDCOR – ELi COST meede CA18230: Liige |
| 2020–... | Narratiivsuse, kultuuri ja tunnetuse uurimisrühm, Tartu Ülikool, Kultuuriteaduste Instituut: Liige |

**Sündmused**

Koos dr Francesca Arnavasega kunstinäituse „Kirjanduslike kohtade ümberkujundamine“ kaaskuraator. Selle näituse eesmärk on uurida kirjanduse ja teiste digitaalsete ja füüsiliste kunstide vahelisi sügavaid ja fantaasiarikkaid seoseid, rõhutades, kuidas lood ja sõnad võivad füüsilisi ruume kujundada, inspireerida ja muuta. Näitus oli osa Euroopa kultuuripealinna Tartu 2024 programmist ja seda rahastab Eesti Kultuurkapital (Kulka).

2024. aasta mais Tartus toimuva Science Fiction Research Associationi aastakonverentsi korraldustoimkond, mis võitis Tartu linna ja Eesti Konverentsibüroo auhinna „parim üritus“ ning Tartu Ülikooli humanitaarteaduste ja kunstide teaduskonna auhinna „aasta üritus“.

Kolme INDCORi sidusrühmade ürituse korralduskomitee, mis on COST-meetme INDCORi kõrgetasemelised teavitamisüritused. See kujutas endast kohtumispaika teadlastele, praktikutele, valitsusvälistele organisatsioonidele, valitsusvälistele organisatsioonidele, ametiühingutele ja eraettevõtetele, et arutada keeruliste ühiskondlike küsimuste esindatust (2022, 2023, 2024).

Kahe ACM International Conferences on Information Technology for Social Good (GoodIT 2023, 2024) teema „Prosocial Interactive Digital Narratives“ kaasesimees.

**Publikatsioonid**

Arnavas, Francesca; Bellini, Mattia; Németh, Dezső (ilmumas 2026). Mind Wandering, Attention, and the Reception of Fictional Worlds. Routledge.

Barbara, Jonathan; Bellini, Mattia; Koenitz, Hartmut; Bakk, Ágnes Karolina (Eds.) (ilmumas 2025). INDCOR 2019–2024 – An Edited Collection of the Scholarship and Results of the COST Action 18230 – Interactive Narrative Design for Complexity Representations. Vilnius University Press.

Bellini, Mattia (2024). Narrative Strategies for Participation in Dante's 'Divine Comedy'. Italian Studies, 79 (1), 100–101.
DOI: 10.1080/00751634.2024.2333129.

Bellini, Mattia (2024). Fairy-Tale Bodies and Embodying the Fairy Tale in Telltale Games' The Wolf Among Us. Marvels & Tales, 37 (2), 287–302.

Arnavas, Francesca; Bellini, Mattia (2023). Miyazaki's Hybrid Worlds and Their Riddle-Stories: Western Tropes and Kishōtenketsu. Narrative Works, 12 (1).

Perkis, Andrew; Bellini, Mattia; Nisi, Valentina; Irshad, Shafaq (Eds.) (2023). INDCOR white paper 2: Intearctive Narrative Design for Representing Complexity. DOI: 10.48550/arXiv.2305.01925.

Nack, Frank; Louchart, Sandy; Lund, Kristine; Bellini, Mattia; Georgieva, Iva; Atmaja, Pratama W.; Makai, Peter (2023). INDCOR white paper 3: Interactive Digital Narratives and Interaction.

Bellini, Mattia (2023). Validating Video Games as Complex Artifacts. Proceedings of the 2023 ACM Conference on Information Technology for Social Good. ACM Digital Library, 233–236. DOI: 10.1145/3582515.3609539.

Bellini, Mattia (2022). Interactive Digital Narratives as Complex Expressive Means. Frontiers in Virtual Reality, 3, 854960.
DOI: 10.3389/frvir.2022.854960.

Barbara, Jonathan; Bellini, Mattia; Koenitz, Hartmut; Makai, Péter Kristóf; Sampatakou, Despoina; Irshad, Shafaq; (2022). The Sacra Infermeria – A Focus Group evaluation of an Augmented Reality Cultural Heritage Experience. New Review of Hypermedia and Multimedia, 28 (3–4), 143–171. DOI: 10.1080/13614568.2022.2150324.

Bellini, Mattia (2021). Formal Organization and Complex Responses to Video Games Narratives. Proceedings of the ACM on Human-Computer Interaction, 5. DOI: 10.1145/3474702.

Meier, Marie-Luise; Bellini, Mattia (2021). Framing the Dilemma – The Influence of Immersion in Ethical Choice Making. CEUR Workshop Proceedings, 2934: 4th Workshop on Games-Human Interaction Italy 2021; Bolzano, Italy; July 12th 2021. CEUR-WS.

Bellini, M. (2019). Towards a model to meet players' preferences in games. CEUR Workshop Proceedings, 2480: 3rd Workshop on Games-Human Interaction, Italy 2019; Padova; Italy; 23 September 2019. CEUR-WS, Code 152976.

Bellini, M. (2018). Impact of user interfaces for the enhancement of narrative elements of a video game. CEUR Workshop Proceedings, 2246: 2nd Workshop on Games-Human Interaction, Italy 2018; Grosseto; Italy; 29 May 2018. CEUR-WS, Code 141963.

# DISSERTATIONES LITTERARUM ET CONTEMPLATIONIS COMPARATIVAE UNIVERSITATIS TARTUENSIS

1. **Indrek Tart**. Eestikeelne luuleraamat 1638–2000. Tartu, 2002.
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