Formal Organization and Complex Responses to Video Games Narratives

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The application of complex systems theories to the study of narratives proved able to offer a high heuristic value for the analysis of movies [24,26], TV series [35,36], music [45] and different other media with narrative capacity [cf. 20]. However, they were not yet thoroughly employed for the study of video game narratives. To address the relation between formal complexity and the complexity of response in video games, this paper conducts a contrastive analysis of two games of the Halo series, namely Halo 3 [6] and Halo 3 ODST [7]. Formal complexity is analyzed by applying Cutting's [13] approach for counting (narratorial) complexity. The evaluation of the responses to the narratives of these games is based on crowdsourced data, through Hven's [24] and Kiss and Willemsen's [26] understanding of audience response. The findings reveal that a complex response is at least partly predictable through an analysis of the formal quantitative and qualitative/organizational aspects of narratives, and, ultimately, that narrative complexity is a factor in the appreciation of games by the audience. The paper also poses the basis for the identification of a 'Goldilocks level of complexity', which can maximize the appreciation of video games stories.

CCS Concepts: • **Applied computing~Arts and humanities** • Human-centered computing~Human computer interaction (HCI)~Empirical studies in HCI • **Applied computing~Computers in other domains~Personal computers and PC applications~Computer games** • General and reference~Cross-computing tools and techniques~Empirical studies

KEYWORDS: Narrative complexity; Video game players responses; Complex systems theory; Formal complexity; Complexity of response

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1 INTRODUCTION

In recent years, researchers opened the way to a new paradigm in the analysis of narratives by applying complex system theories to different aspects of storytelling, narrative organization, and cognitive reception. The implications and outcomes of this new perspective have been recently significantly analyzed in works like [20] and [55]. However, listening to the words of Magliano and colleagues [32], it should be clear that the kind of complexity encoded and presented to the

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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 interactive digital narratives, of which video games are one of the manifestations [30,31].

Narrative complexity is being addressed by scholars using sometimes inconsistent terminology. As a consequence, this can lead to equivocation and incomprehension, also because complexity is "one of those ideas whose definition is an integral part of the problems that it raises" [38:38 and 232]. In order to reduce the risk of ambiguity in the current work, and as a first step towards a shared vocabulary in the study of narrative complexity, I should mention what Grishakova and Poulaki noted in the introduction to their recently edited book [20]. They argue that narrative complexity can assume three forms, or can be conceived at three levels, namely: at the systemic level, at the formal level, and at the level of the response of the audience. Notwithstanding the claim of Ryan [46], who supports the possibility of treating narratives exactly as complex dynamical systems, I believe the notion of 'complex system' applies only metaphorically to narratives. This is mainly due to the strong presence of authorial control, necessary for the very existence of stories [cf. also 19]. Therefore, the discussion on the systemic level of complexity in video game narratives will not be discussed in this contribution. On the other hand, however, the formal level of complexity and the complexity of response are concepts readily employable also to the study of video game narratives, and constitutes the focus of the current analysis.

My intent is indeed to achieve an initial understanding of the correlation between formal complexity and the complexity of the response of the audience, and possibly to identify feasible strategies to manipulate the latter through the former. The effort is justified by a relatively simple understanding: narratives are an important factor in the appreciation of games. This understanding is grounded in conceptual models like MDA theory [23] and has been recently demonstrated by Wang and Goh, who sum up their findings by stating that "[achievements] and narrative in games are more important for user satisfaction than other components" [56]. Therefore, more interesting narratives likely heighten the appreciation of those games that include them. According to Sternberg [48,49,cf. also 22], informational gaps heightened by curiosity, suspense and surprise rend stories more interesting. In a similar fashion, Willemsen [58, moving from 59] recently showed evidences proving that narratives can elicit interest in the audience through complex formal organizations of information, and that this interest is correlated with the confusion they generate.

To further prove this claim, to link it more closely to video games studies, and to reflect over the affordances of narrative complexity for the analysis of computer games, I examined the formal complexity of two games of the same franchise and juxtaposed it to the complexity of the response of their audiences as emerging from game reviews. What should be noted is that my focus is not to analyse the representation *of complexity*, as done e.g. by Wardaszko [57] and Oţoiu [39], but rather to analyse the representation *as complex* (closer, in this, to Sellers' systemic approach to game design [47]). This can give useful insights on players' cognitive reception to game design practitioners and researchers, and show possible ways to improve narrative appreciation, which was showed to be a major factor in games enjoyment.

1.1 Terminological premise

A first terminological premise necessary for the clarity of my study is the distinction between story and discourse. The long tradition of this distinction finds its roots in Chatman [9], who

developed it specifically for the study of literature. However, dealing with narratives conveyed by a number of different media, Cutting's use of the adjective 'narrative' as opposed to 'narratorial' [13] is more directly employable to my study object. Therefore, in this work narratorial regards the way in which stories are told, *i.e.* the formal level, while narrative regards stories themselves.

When talking about formal complexity of narratives, Grishakova and Poulaki [20] argued that "complexity amounts to an organization and patterning involving a multiplicity of elements and their connectivity and variety, evoking surprise and wonder" [20:2]. Following Thue's footsteps, who proposes to divide hypercomplex phenomena into less complex ones for the sake of clearer understanding [52], it is therefore possible to claim that the formal level can be further divided into two constituents, 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. Cutting claimed that "it is as if we might trust authors to mold the difficulty of their words and sentences to the overall difficulty of their narrative." [13:209]. In fact, he employs a meter to calculate formal complexity, and he fundamentally states that detecting complexity is a matter of counting, or, paraphrasing it, that there are some aspects of complexity that can be reflected by enumerable features. This also applies to narrative and narratorial complexity, as he demonstrated: the two are in a relationship of mutual reinforcement, so that we may generally assume that the more a story is narratorially complex, the more it is also narratively, and vice versa. Analyses of formal complexity have been variously conducted, also recently, *e.g.* in [34].

Considering the complexity of response as the pathognomonic sign of narrative complexity is the arrival point of many scholars. Indeed, Hven claims that "complex narratives first and foremost deserve the designation 'complex', because they make evident that 'complexity is not only a feature of the systems we study, it is also a matter of the way in which we organize our thinking about those systems'" [53,in 24:11, see also 26,27]. Similarly, Cohn supports the idea that "comprehenders do update a mental model of a scene at each image of a visual narrative" [12:191]. However, the complexity of response itself can be regarded as resulting from the interplay of two cognitive functions: the perception of complexity and its computation. The reason why we can see perception and computation as both causes of the complexity of response resides, I believe, in their location 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" [32:149], and show that mental models are updated precisely through these two aspects (perceptual and computational), thoroughly exploring them through the concepts of front-end and back-end processes. Their 'front-end processes' involve perception or, with their words, the "extraction of information from sensory input" [32:152]: these information are then used to create a "representation [...] of what is happening 'now' in the narrative world, represented in working memory" [*ibid.*]. The information extracted are then passed to 'back-end processes', which "are involved in building mental models of an experience": "Mental model construction involves the processes involved in updating episodic memory for the narrative based on the relationship of the current event to prior events" [32:151 and 154]. This mutual dependence between front- and back-end processes in understanding narratives is probably what permits author(s) to deliver complex narratives. Yet it appears that both processes can be manipulated by authors through the molding of formal complexity, as I am going to show in a moment by means of the contrastive analysis of two games.

1.2 The games

The two games I am going to compare contrastively are Halo 3 [6] and Halo 3 ODST [7]. As a first step, it is necessary to state that even if the overall average playtime of the two games is not the same (precisely, the former, with an average 9,5 hours completion time, is almost 30% longer compared to the latter, with an average 7,5 hours [60,61]), 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 length. This premise is of particular importance because, as mentioned, I intend to quantify elements: obviously, bigger pieces of representation are more likely to have quantitatively more constituents. Other contextual factors that can impact on the quantitative formal complexity of representations, and in this case of games, are genre(s), players expectations, developers' customs, publishers' demands, and hardware intended for their access. For the current analysis, to reduce the differences caused by such aspects, I deliberately selected two games from the same series and ascribable to the same genre, which justify the assumption that their respective audiences may have the same expectations. 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.

The choice of these games has been dictated not by their genre – First-Person Shooters (FPS) games are not traditionally story-driven – but rather by their very different approaches to narrative which, juxtaposed with the points of contact already listed, make these two games the perfect case study for a comparative analysis.

A brief summary of the stories and of the overall users' 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 [62], particularly for its multiplayer features. In this game, the player assumes the role of a cybernetically enhanced supersoldier while he fights an ally of alien races known as 'Covenant', and the semi-sentient collective-minded parasitical organisms called 'Flood'. The story of this game is quite linear, despite some turnovers. To put it very simply: for religious beliefs, the Covenants want to activate some technological artefacts (known as 'Halos', for their ring shape) which will destroy all 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.
- Halo 3 ODST, released in 2009, is generally seen as an average game. Its main strength is indeed the narrative construction [63]. 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, six 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 play 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 center and eventually flee from the city while it is being destroyed by the alien forces.

Following Cutting's line [13], not least to analyze the validity of his claim in video games, I propose here a brief analysis of a narratively and narratorially overall simple (where simple means quantitatively smaller and organizationally straightforward) game story in comparison to a more complex one. I will first analyze the formal level, proceeding from the quantitative to the qualitative/organizational perspective, and I will then compare these findings with the response of the audiences to the two games, using crowdsourced data. This approach is also built on Pianzola's claim that "the specificity of narrative should be searched in the way the discourse–audience system is organized" [41].

2 THE FORMAL ASPECTS

2.1 Method for the analysis of the Formal Complexity

For the analysis of formal aspects, I relied on the technique of close reading, and in particular on its expansion to game studies explained [4] and tested [5] by Bizzocchi and Tanenbaum. I played both games two times, at different difficulty levels. In the second iteration, due to the lower difficulty setting, I focused on noticing the storytelling strategies employed in the two games, and on the narrative organization in general. In particular, the focus of this close reading has been to: 1) note the differences in complexity of the two narratives; 2) identify the elements that could be comparable from a quantitative perspective; 3) detect the qualitative aspects of the two storytelling strategies. Both games have been tested on Xbox 360. After the two iterations, I obtained 16 pages of handwritten notes for Halo 3, and 29 for Halo 3 ODST.

2.2 Quantitative analysis and discussion

Halo 3 ODST is quantitatively richer than Halo 3. This can be subsumed by counting and comparing the number of elements forming the 'encoded storyworld' [28]. In Cutting's analysis [13], to 'count' meant to enumerate shifts in characters, locations, and time. Even though not all these criteria apply well to my test subjects, the overall concepts can be easily adjusted to be productive also in this study. The decision regarding the specific elements to list and count for this analysis is based on Cutting's reinterpretation of theatrical writing customs as summarized by Polking and colleagues [43]. These included, here, characters (playable and non-playable), timelines, plots, and synchronically represented plots. The findings are briefly summarized in Table 1.

Table 1: Results of the close reading of the two games regarding quantitative differences

Elements Counted	Halo 3	Halo 3 ODST
Plots	(2)	6 + 1*
Playable Characters	1 (main) + 1 (secondary)	1 (main) + 4 (secondary)
Timelines	1	6 + 1*
Synchronically represented plots	1	2

* The seventh plot and timeline are secondary to the main story and will be thoroughly explained in the section "Sadie's story".

Regarding the characters: the player of Halo 3 can enact two playable characters (one main, plus one auxiliary), while in Halo 3 ODST we find five playable characters (one main, plus four auxiliary). Interestingly, in the former the main character is well-defined in psychology and traits, which are passed down since the very first instalment of the series, while in the ODST the main character (the Rookie) is almost an empty doll, who does not speak and does not have a defined personality. I would argue that this character is left blank intentionally, as a 'semantic doll' [cf. 51], to be filled by players' traits. Furthermore, Halo 3 presents two single and disentangled plots (one of which can be easily overlooked and is so distantly related to the main story that it may be considered irrelevant for the current analysis, and therefore it will be left aside from now on), while the ODST has a multiplot structure [44], with seven interwoven plots. In addition to this, the number of timelines mirrors the number of plots in both games: one in Halo 3 and seven in Halo 3 ODST, respectively. Richardson highlights that an important part of multiplot structures is the convergence of the multiple storylines – otherwise, we would merely have many single-plot structures juxtaposed, rather than a multiplot structure. In the case of Halo 3 ODST, reaching the point of convergence of the six main stories is the principal objective for the player, and it shortly leads to the end of the game. Furthermore, Halo 3 ODST is of particular interest from the point of view of the narrative because it presents a story in the background of the main events. Indeed, of the seven plots, six revolve around the ODST team members, while the seventh is generally known as Sadie's story. I will further elaborate on this latter plotline in a short while, as it provides interesting insights in many respects, not least due to the synchronic telling of the Rookie's and Sadie's stories; on the contrary, in Halo 3 there is always just one story unfolding at each one time: this represents the last major quantitative difference of the two games.

2.3 Qualitative/organizational analysis and discussion

All the mentioned quantitative features are cause of, and in direct relation with, certain organizational/qualitative constituents of complexity which, as per Clark and Phelan, are equally participating in the overall meaning-making [11]. Among these organizational features, the most noticeable aspect is probably the rhizomatic [16] organization of part of the story of Halo 3 ODST, resembling that of an hypertext (a non-sequential and non-linear writing of blocks linked by multiple path, as defined by Beltrami [3:168], on the basis of the early definition by Nelson [37]). Indeed, this game displays some elements of an open-world structure, giving the player a relative freedom of action. Together with the aforementioned multiplot structure, this produces a navigable hypertext-like storyworld through which players can access the different stages of the story in whatever order they prefer. This textual organization is made possible by the wise manipulation of time sequences, which is another important and widely accepted qualitative/organizational feature capable of generating complexity [cf. 26,42]. As noted, indeed, Halo 3 ODST features different timelines, which are connected to the Rookie's story through flashbacks. Halo 3, by contrast, presents an overall natural time flow. Similarly, also the presentation of cause-effect relations is natural in the latter game, while it is not in the former. In fact, due to 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.

For comparison purposes, I should note 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 world, as they are constrained to follow a specific and pre-determined route. A summary of the differences is available in Table 2.

Table 2: Results of the close reading of the two games regarding qualitative/organizational differences

Halo 3	Halo 3 ODST
Natural flow of time	Multiple flashbacks
Natural flow of cause-effect relationships	Effects trigger the narration of causes
Straightforward development of the story	Hypertext-like structure
One story told at each time	Layered stories

2.2.2 Sadie's story. I shall now consider in greater detail what I called '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, the player 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 the 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. Sins are presented through a figure, and therefore the representation proceeds by *exempla*, similarly to what Dante did in his poem [cf. 15]. Furthermore, and not accidentally, the artificial intelligence protecting and guiding Sadie (and later, chronologically speaking, the Rookie) through the city is named 'Vergil', which closely resembles 'Virgil', the name of the *duca* [14, Inferno, II 140, ff.] of the Italian poet.

There are several points of convergence between Sadie's story and the Rookie's story. The first convergence players can notice comes from Vergil's stated intention to tell Sadie's story to the Rookie, and make the character understand the importance of the discoveries of Sadie's father for the fates of the war. Indeed, when an interface containing an audio log is nearby, Vergil attracts the attention of the Rookie and, indirectly, of the player. These signals are shut down once the file is downloaded. Another point of convergence is bound to the last audio log, and the last 'sinner'. Sadie's father is said to be sheltered in a data hive. During the story told in the audio logs, Sadie's father is eventually killed by a corrupted policeman, who activates an emergency measure causing the data center to freeze. During the Rookie's mission in the same data hive, if all audio logs have been collected until that point, players can access the frozen room and unmask the corrupted policeman: this is the final part of Sadie's story, the last Canto and the deepest circle of Hell: it is no surprise to find here a traitor, in a frozen area which directly references the Dantesque Cocytus [14, Inferno, XXXII 16, ff.]. Here is also located the last audio log and the dead body of Sadie's father. Lastly, the most important point of convergence occurs towards the end of the game, and it

is the very reason why the happenings of this game are relevant in the overall storyworld [21]: the ODST team is in charge of retrieving and bringing to safety the discovery of Sadie's father (under the form of an alien entity with vital information), guided by the AI Vergil. These multiple points of convergence are what justify my understanding of the two storylines as multiplots [44], rather than mere juxtaposed plots – as was the case for the second plot in Halo 3. Below I further expand on the importance of this distinction.

Through this alternative story arc and thanks to Sadie's reflections on the happenings, players have the opportunity to think about the corruptness of their fellow in-game army-men, as well as about the moral misery in which fallen humanity finds itself. However, in addition to introducing some moral aspects in a genre otherwise traditionally focused on mere shooting abilities, Sadie's story is interesting also in other respects. First of all, it is a good example of intermediality, and particularly of literary embedding in the video game environment [cf. 10]. The intermedial manifestations contributes to the formal complexity of the game as a whole, as Bal [1:266] supports [cf. also 18], and therefore heightens the cognitive effort needed to properly understand it. But what is most interesting at this point is how Sadie's story is narrated, or, better, how it is presented to the audience. "To understand how digital artifacts can function as complex semiotic scaffolds for narrative meaning production (by their creators) and embodied sense making (by their users), I suggest an understanding of their textuality that incorporates not just the way they organize information but also the way they structure the processes of reception" claims Knoller [27:107]. It is indeed also the process of reception of this story (and of the audio logs telling it) to be notable, because these recordings are played while the player is engaged in other activities: running, shooting and, in general, normally playing the game and accessing its main story. The status of entangled multiplots of these two narratives and their synchronic presentation to the player is the reason why these narrative arcs can be deemed 'layered stories': similarly to some forms of ekphrastic representations, and even more to meta-narration strategies like theatre in theatre [cf. 8]. These kinds of re-representations are delivered synchronously with the representations in which they are re-represented, in the same way as Sadie's story is delivered in Halo 3 ODST. This layering of stories highly fosters the computational complexity by giving the receiver two different storyworlds – or at least two different views of a storyworld – to decode at the same time.

This phenomenon is made possible by the complex and multifaceted nature of expressivity, and by the capability of human cognition to decode synchronically a vast amount of information. As Pier supports, "complexity involves an interplay between cooperation and competition" [42]. Through the interplay of different semiotic modes and media, communication can deliver large set of messages not necessarily referring to a single narrative core, as Sadie's story shows. Even more, it seems it is not either needed that the same semiotic medium delivers unique messages at all times: in Halo 3 ODST, sound is used to tell Sadie's story, but it is also used, in the same moment, to represent what is happening to the player, with sound effects resembling explosions and gunfire. However, the clear identification of what I define as expressive complexity will be deferred to a future time, as it exiles the scope of the present work.

3 MOTIVATED HYPOTHESIS

Halo 3 ODST is more narratorially complex than its most famous sibling Halo 3. I grounded this by drawing on Cutting's approach: the complexity of the countable elements of the narration reflects the complexity of the narration itself. Consequently, my hypothesis is that Halo 3 ODST produced a more complex response in its audience compared to Halo 3.

If this hypothesis was verified, it would imply a first proof supporting the application of the method illustrated by Cutting also to the study of narrative complexity, and of its manipulation, in video games. This is because, as mentioned, the complexity of response is the pathognomonic sign of narrative complexity. In addition – and more interestingly for the industry of electronic entertainment – if further proved and accepted as valid, the application of this scheme would entail the possibility of predicting the complexity of the response of players on the basis of formal complexity, which is countable to a certain extent and, therefore, analyzable *in abstracto*. The possibility of prediction, in turn, would open the way to the (more profitable) opportunity to efficiently manipulate complexity. This would allow to find the "gratifying amount of cognitive work" [13:210], which might have a strong impact on games sales and revenues. Although this kind of conclusions lie beyond the possibilities of my study at its current stage, in the remainder of the article I lay the groundings for the type of analysis that could lead to corroborate this overall thesis.

In order to supplement my claim that Halo 3 ODST had a more complex response than Halo 3, in the next chapter I look for what is largely agreed as being the symptom of the complexity of response, which is the above-average cognitive challenge required to the player. To have more objective perspectives supporting my hypothesis, I will rely on two sets of crowdsourced data under the form of game reviews.

4 ANALYSING CROWDSOURCED DATA

4.1 Method for the analysis of the Complexity of Response

The reviews of Halo 3 ODST have been gathered from the aggregator of reviews Metacritic [63] (including reviews from Amazon.com [64], there collected) and from the digital distribution service Steam [65]. The two sources provided a total of 2044 entries, published between 2009 and 2020. A manual qualitative analysis has been conducted on this corpus. Reviews were accessed directly from the abovementioned websites.

While reading the entries forming the corpus, I looked for considerations about the story of the game, about the storytelling and about confusion and misunderstanding related to narrative comprehension. These have been considered signs of complexity by many scholars, among which Kiss and Willemsen [26] and Hven [24]. Drawing on his claim that "focal points [of complexity] are the encouragements, obstacles, resistances, or ruptures that the films [or games] in question exhibit towards particular dominant modes of organizing and comprehending experience" [24:17], I looked at comments concerning story misunderstandings, incomprehension and claiming of incoherence or fragmentation, complicatedness and confusion. The manual approach was preferred for two main reasons: 1) I expected to find a very limited number of useful reviews, and automated analyses have a higher risk of missing scarcely represented phenomena, also because 2) I could not rely on a previously explored set of keywords to confidently filter the reviews.

It should be noted that analyzing user-generated reviews can provide noisy data, due to the unfocused approach of reviewers. However, given the relatively high number of entries, a high probability of finding at least some interesting points still remained: indeed, out the relatively huge set of reviews of Halo 3 ODST, only 22 seemed to show some form of detected complexity. All the 22 reviews have been reported in the next section. Errors in spelling and grammar are in the originals.

However, in order to understand whether this handful of examples could be considered enough to prove my hypothesis, I also gathered data on Halo 3. This second set of reviews included 4833

specimens from the website Metacritic [62] (and from Amazon.com [66], there collected) and from Steam [67], 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 [33]: I focused on the keywords identified during the analysis of the first corpus. Using the internal filtering tools when possible (for Amazon.com), and browser-provided search options (for Metacritic and Steam) otherwise, I filtered the reviews on the basis of the following keywords: 'story', 'understand', 'understood' (grouped under the search term 'underst'), 'confuse', 'confusing' (grouped as 'confus'). The results of this initial filter are summarized in Table 3. The set resultant from this filtering (made of 679 entries) underwent a process similar to Halo 3 ODST reviews and have been analyzed manually.

Table 3: Results of the filtering of Halo 3 reviews based on keyword groups.

Keyword group	Metacritic	Steam	Amazon.com	Total per keyword
Story	269	130	175	574
Underst	26	19	34	79
Confus	7	4	15	26
Total per website	302	153	224	679*

* The initial filtering provided 679 reviews to be scrutinized via a manual qualitative analysis.

One should be also reminded of the fact that these games are not typically story-driven and they are, instead, highly focused on mere shooting abilities. Their target audience is thus not necessarily interested in narrative dynamics, and even semi-interested players might tend to leave aside the story elements due to the design decisions of developers, ascribable not least to the genre these games belong to. Scarce interest in narrative elements is indeed highly represented in the reviews analyzed. However, for the sake of proving my hypothesis, it is nonetheless interesting to see whether a difference between these two non-story-driven games is detectable.

4.2 Results of the analysis

Firstly, I should note that many critics pointed at the carefully constructed story of Halo 3 ODST and regarded it as one of the main strengths of the title. Indeed, among the 95 reviews from critics found in Metacritic, only 2 complained about narrative construction, and one described it as 'decent', while the remaining 92 critics praised it. What is even more interesting is to notice how the narrative apparatus was 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.'
> 'Bungie's latest storytelling method in ODST is certainly unique and captivates the imagination from beginning to end'
> 'The story is more interesting and coherent than Halo's narrative has ever been'
> '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.'

This seems to mean once more, as Wang and Goh [56] demonstrated, that a well-constructed narrative may be ultimately a serious advantage. 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. But particularly significant for the current purpose are some reviews of Halo 3 ODST 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 some forms of complexity, at least to a certain extent. But 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. '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.'
7. '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 form of perceptual complexity: the author of review 3 hints at it, indirectly linking it to quantitative complexity. Review 4 seems to point at the perceptual level of the story, too: paraphrasing the metaphor, what is expressed is the sense of having to deal with something much bigger than it initially appears. This could also refer to the self-emergence of meaning, in this case of narrative deepness (complexity?). Example 5 might be intended as both related to the perceptual level, detecting the multitude of elements in which the narrative is divided, and to the organizational level, which is 'chopped', arguably due to the multiple flashbacks. But especially worth noticing is review 7 which, apart from referring to the layered stories presented in the game, shows an initial identification of the expressive complexity, or at least of some problems that might arise when it is used for layering stories, namely the difficulty that may arise from the simultaneous perception of multiple messages, in this case due to the audio settings of the game.

Another set of reviews presents interesting insights on the computational complexity:

8. 'Why people would like to see a story in mixed order is beyond me'
9. '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'
10. 'noir vibes and jazz play while you piece the story together.'
11. '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)'
12. '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.'
13. '[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.'
14. 'Bungie has delivered a good story that fills in as much as it confuses.'

15. ‘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.’
16. ‘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.’
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 computational complexity in Halo 3 ODST, which makes the story hard to understand to some players. Some attribute the overall complexity of the message to the organization of narrative, while others simply notice it with a complaint. I should note that it is seemingly easier to find mentions to complexity among negative reviews. This might be due to what Cutting explains with the Goldilocks metaphor: “Psychology 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” [13:210]. Players who like the narrative construction, like it because it meets their gratifying level of complexity, and therefore they do not see it as something other than ‘a good narrative construction’. This definition, however, is too broad and not informative enough to be of some use for my analysis and has been therefore excluded, leaving aside possible additional appreciations of the complexity from my set of reviews. On the other hand, players who struggle to understand the narrative clearly see it as a problem to be mentioned in their review, which grants a place within my set. In addition, as Wang and Goh showed, negative reviews tend to be generally more precise and punctual [56].

On the other hand, the study of the reviews of Halo 3 highlighted a number of interesting phenomena for my comparative analysis: most of the reviews mentioning ‘story’ 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, among the reviews mentioning ‘understand’, it was even possible to find a claim of the simplicity of the game story – 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 particularly interested in the narrative, the claim of its simplicity is equally evident. Lastly, among the already very limited number of reviews talking of ‘confusion’, only a handful users reported perplexity regarding the narrative itself, and in all cases the respective author admitted to not be familiar with the previous two instalments of the saga, which justify the incomprehension and exclude it from being caused by complexity. Only one review except this trend:

> ‘The game’s story was completely confusing, plot holes everywhere.’

However, due to the extremely limited representation of confusion, incomprehension, and misunderstanding generated by the game narrative – only one case – I can claim that generally no cognitive challenges in understanding the story of Halo 3 have been detected by players.

Given the more than double size of the set of reviews of Halo 3 compared to Halo 3 ODST, it is evident that my hypothesis is verified: the more formally complex organization of Halo 3 ODST provoked a more complex response of its audience in comparison with the more formally simple Halo 3.

5 LIMITATIONS OF THE ANALYSIS AND FUTURE DEVELOPMENTS

The analysis proposed here is only a preliminary study and surely requires further investigation. However, it opens a way to further employ complex system theories to examine representations in video games. Nonetheless, there are a number of directions that could be further explored to also improve the study presented here.

The investigation of the formal aspects of the two games could benefit from employing a validated list of elements or features within a game narrative to assess the complexity. At the best of my knowledge, the only effort towards the identification of such a list has been done by Knoller, Roth and Haak [29], but at this time the analysis is still in process and findings are not yet employable. Once this list will be completed and validated, it will be possible to assess more precisely the overall complexity of the games with which to compare the complexity of audiences' responses.

The complexity of the response of the audience could be further and more precisely assessed by employing games user research methods [17], and much clearer data would have been obtained, for example, through a more specifically oriented questionnaire. On the other hand, if one wants to keep investigating general game reviews as proposed here, results could be achieved in a much faster way by employing automated text analysis methods like the ones proposed, for example, by Balakrishnan & Griffiths [2, see also 25, or 50]. I have provided an initial set of keywords that could be employed for this automated scrutiny, but such a research would require a better-grounded list of terms, to be identified in advance.

Finally, in the future this investigation will be further conducted to question the validity of the current initial results for different franchises and game genres. Understanding if the same considerations will still be applicable when changing such parameters would provide a better justification for the use of complex system theories for the analysis of representations, and a much stronger indication to game design practitioners and researchers to employ this perspective. However, some initial claims could still be done at the end of the current low-scale study.

6 CONSIDERATIONS ON THE ANALYSIS AND FINAL THOUGHTS

Apparently, narratives do not normally pose cognitive challenges in popular FPS games. However, as reflected in the respective set of reviews, the responses of players to the different narrative methods implemented in my two selected games appear to preliminarily verify my hypothesis: the more formally complex narrative of Halo 3 ODST corresponded to a higher representation of cognitive dissonance, of misunderstandings and of incomprehension, all of which are symptoms of a narrative complexity, as already described, and as also Bal supports ("the complexity of narrative [...] lies in its strategies of confusion" [1]).

One could say that the same effects could be achieved by low-level or badly constructed narratives. This is surely true; however, one should be reminded that the current study is not aiming at an absolute assessment of narrative quality, but rather at contrastively juxtapose the narratives of two games. In this context, and similarly to Willemsen [58] I showed that to a more

formally complex narrative correspond a more complex audience response, and therefore that these two aspects *could be* somehow correlated.

This leads me to claim that, at least to a minimal degree, formal complexity could be manipulated by authors to provoke a certain level of complexity of response. In turn, this might mean that the complexity of response is predictable to some extent. It appears, however, that different players tolerate different degrees of complexity. If one were to further explore the relationship between players and complexity toleration to ultimately quantify the 'Goldilocks level of narrative complexity', important differences to be considered include age, cultural and social context, education, and personality traits, among other pragmatic factors. It goes without saying that these elements also impact on the reception of the story and on the cognitive effort prospectively allocated for narrative understanding and, together with customs and expectations in game design, they set the limits of how much 'beyond the limits' one can be pushed to still experience wonder: "the affective quality attached to that region just beyond the limits of understanding" [54:55].

Stepping out from considerations about my hypothesis, I should also note two more general trends: first, that narrative complexity seems to be a factor in creating engaging stories, at least for a certain part of the audience. This impact has been detected in movies and TV series (Hven [24], Mittell [35], Kiss and Willemsen [26]), and is evidently present also in digital games. This is also observed by Perlovsky, who claims that "satisfactions or dissatisfactions of the knowledge instinct are experienced as aesthetic emotions" [40:1972]. These findings, together with the discovery that narratives are one of the main factors in games appreciation [56], show that an understanding of the ways of manipulating narrative complexity could be highly rewarding not only for researchers, but also for developers and players. If my hypothesis would be further verified and validated, it could inform narrative designers on how to obtain the correct amount of cognitive challenge to maximize narrative appreciation. Furthermore, digital games scholars could employ this understanding to better understand the cognitive mechanisms in play during a games-human interaction, and, ultimately, players would be presented with more enjoyable games.

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