On the Interactions Between Narrative Puzzles and Navigation Aids in Open World Games

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Abstract. Narrative puzzles feature prominently in story-based open world video games where they form part of the progression of a narrative and require exploration and logical and creative thinking to solve. Open world games use navigation aids to help players solve narrative puzzles located across the vast worlds they provide. Narrative puzzles offer designers one of the most interactive methods of conveying a game's narrative, particularly in the action-adventure focused genre of open-world games. In this paper we discuss the interaction between narrative puzzles and navigation aids in open world games, highlighting in case studies of three different games how the amount of information a navigation aid provides impacts the intricacy and expansiveness of puzzles. Finally, we discuss the design implications of these interactions and suggest potential future analytical uses of the discussed framework.

Keywords: Navigation Aids · Narrative Puzzles · Open World · Video Games

1 Introduction

Open world games have emerged as one of the most popular forms of story-based video games over the last 20 years, such that open world video game franchises like *Assassin's Creed*, *Grand Theft Auto*, and *The Elder Scrolls* are some of the most successful franchises on the market. Moreover, video games are the most common and most popular medium for interactive storytelling, as reflected in the vast revenue generated by story-based games like *Grand Theft Auto V* [12] and in their significant cultural impact [19].

Open world games have previously been defined by Squire [35] (summarised by Min et al. [20]) as games that "enable players to explore and pursue gameplay objectives within expansive virtual worlds" (p. 2590). However this definition lacks precision and can also include games that are not typically considered to be open world such as The Legend of Zelda: Link's Awakening [25] (a fantasy action game), Sekiro: Shadows Die Twice [15] (a samurai action game) or games in the 'Metroidvania' genre. These games gradually grant access to their full worlds by gating this access behind narrative progression. Once the player has

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progressed through most of the narrative, they are free to traverse and explore the world at their leisure. The world is only truly open in the latter stages of the narrative, meaning that the majority of the game is spent in a world that is not freely explorable. Similarly, Aung and colleagues' [2] characterisation of open world games as "featuring large virtual worlds that can span hundreds of square kilometres of virtual real estate, with very few restrictions on the freedom of the player to go where they please; and a corresponding range of affordances" (p. 1) fails to account for game mechanics that are common across all open world games. As such, we will briefly discuss the core mechanics, design tenets, and narrative structure of open world games and arrive at a new definition.

In open world games, players typically have access to the game's entire world from the beginning (or after completing a short tutorial section) though it is also possible that access to a very limited number of large areas is only provided after completing key narrative content. While many open world games are also classified as role-playing games (RPGs) that focus on player customisation, a wide variety of other game genres have adopted the open world format such as racing games like *Forza Horizon 5* [29], survival games like *Subnautica* [38], 3D platformers like *Bowser's Fury* [27], and narrative adventure games like *Outer Wilds* [21]. Even though these genres of open world games can differ greatly from each other, they all focus on three key elements: exploration, autonomy and traversal. Exploration can be rewarded with narrative clues like records of conversations from lost ships in *Outer Wilds*, or collectable items like Korok seeds in *The Legend of Zelda: Breath of the Wild* (BOTW) [26] while autonomy rewards players' intrinsic motivation by allowing them to problem solve and choose how they want to play the game. Given that open world games contain large spaces to explore, most of them feature a variety of traversal mechanics. BOTW gives players a paraglider, horses, boats and a motorbike while also allowing players to climb almost every surface in the game. *Red Dead Redemption 2* [31] (an action game set in the 'Wild West') provides players with horses, boats, trains and carriages, while *Elden Ring* [16] (a fantasy RPG) has a 'spectral steed', fast travel points that allow players to respawn in a new location, and a number of portals scattered throughout the world.

Many open world games are designed for player autonomy by allowing players to complete certain key sections of the main narrative in whatever order they want; BOTW is a good example of this where the player can complete the four 'Divine Beast' dungeons in any order, or even not at all. However, while this feature is common in open world games, it is not universal. Story-based action games like *Grand Theft Auto V* [30] and *Red Dead Redemption 2* have linear main narratives that are supplemented by ancillary but ultimately optional side narrative content that can be completed in any order. Therefore, it cannot be said that a non-linear main narrative is a key feature of open world games but it can be said that smaller ancillary non-linear narratives that can be completed in any order are a very common feature. Whereas the main narrative can be linear or non-linear, optional ancillary narrative content is inherently non-linear. With

the above in mind, we propose the following working definition of an open world game:

> "A game that takes place in a large, freely traversable world, rewards exploration, affords significant player autonomy, and can include non-linear ancillary narrative content."

This definition allows for flexibility in the structure and core mechanics of any type of open world game, not just story-based ones and is applicable to even the earliest open world games like *Hydlide* [36], *Ultima I* [17], and *Courageous Perseus* [8], all of which are fantasy RPGs that employ mechanics from tabletop RPGs like Dungeons & Dragons.

Players can progress through the core narrative and other optional narrative content by reaching particular milestones, watching animated cut-scenes, and completing narrative puzzles. As Murray [24] states, interactive digital narratives (IDN) exhibit both spatial and encyclopedic affordances, which open world games take full advantage of. When considering narrative puzzles specifically, the large size of game worlds in open world games requires that exploration and traversal be incorporated into a game's narrative and by extension are often instrumental in the solution of narrative puzzles in open world games. Designers of open world games can take advantage of their expansive landscapes to create narrative puzzles that span large sections of the world. However, if they are to do this successfully, they will need to take into account how navigation aids interact with narrative puzzles.

2 Narrative Puzzles

Puzzles in games refer to tasks that "provide the player with a challenge that has one solution, and requires thinking rather than skills" [13]. By extension, narrative puzzles have been defined as:

> "puzzles that form part of the progression of the narrative, whose solutions involve exploration and logical as well as creative thinking" (p. 1) [11].

Narrative puzzles represent one of the most interactive means of delivering narrative content given that they require players' actions to be the driving force behind a the progression of a narrative. In focusing on narrative puzzles forming part of the progression of the narrative rather than simply being a narrative event, the definition provided by De Kegel and Haahr [11] can be interpreted as narrative puzzles needing to be part of the main narrative of a game to be considered to be a narrative puzzle. In the case of story-based open world games, narrative puzzles can be used to progress *a* narrative rather than *the* narrative. Ancillary narrative content in particular is often experienced through narrative puzzles. Therefore, we will update this definition such that a narrative puzzles are puzzles that form part of the progression of a narrative, whose solutions involve exploration and logical as well as creative thinking. The concept of

Fig. 1. A screen from *The Case of the Golden Idol*.

narrative puzzles is closely tied to Bogost's theory of procedural rhetoric wherein an idea is conveyed effectively through computational processes rather than audiovisual means [3]. Narrative puzzles challenge the player to understand a game's systems, how these systems interact with each other and how they can be manipulated by the player to create a desirable outcome. Bogost relates interactivity in the context of procedural rhetoric to the Arsitotelian enthymeme where a proposition in a logical argument is omitted and it is the responsibility of the listener (or player in the case of a game) to intuit this proposition and complete the argument. With regards to narrative puzzles, puzzles must be designed such that a player can intuit the solution based on their understanding of what the game's systems afford, i.e., the game's procedural rhetoric. A key must open a lock, water must quench a fire, a healing potion must heal, and so on.

Narrative puzzles have most commonly been found in the adventure game genre, dating back to *Colossal Cave Adventure* [9,10]. Adventure games are games wherein the player assumes the role of a character in a fantasy world and engages in exploration and puzzle solving to progress the narrative [32]. Fernández-Vara and Thomson [14] provide examples of the types of narrative puzzles found in adventure games; these include receiving a reward for giving someone an object, creating a new object by combining other objects, altering the state of an object, convincing characters to help the player, and finding keys to access new areas.

Adventure games' narratives are typically quite linear and progression through the narrative is only achievable by solving narrative puzzles. For example, in *The Case of the Golden Idol* [7], narrative progression is contingent on the player solving the murders of various characters that interact with the eponymous Golden Idol. Through solving the murders by exploring and manipulating

items in the murder scene vignettes presented to the player, the overarching narrative of the game can be discerned. Solving these narrative puzzles focuses heavily on exploration and environmental manipulation and the diegetic environment in which players must solve the narrative puzzles is quite small at only a few screens/vignettes per puzzle (Fig. 1).

In 3D games with larger worlds, such as the survival horror game *Resident Evil 4* (RE4) [4], the proportion of the whole puzzle space visible per frame is significantly smaller than the visible puzzle spaces in 2D games like *The Case of the Golden Idol*. The expansiveness displayed by RE4 requires the player to explore more and highlights how traversal of a 3D space is necessary to solve a narrative puzzle in 3D games. However, games with larger worlds typically feature narrative puzzles that, while not serving as a key element in the progression of the main narrative, still reveal new aspects of the game's narrative that the player can choose to engage with or not. In the remake of *Dead Space* [22], a puzzle involving locating a specific tissue sample and placing it in a medical device gives the player more information about the game's narrative. This narrative content supplements the main plot but is not required for progression, highlighting how adventure games with large, explorable worlds can use narrative puzzles to present optional narrative content. Similarly in RE4, a puzzle involving paintings of sacrificial victims does not add to the main plot but reinforces the game's tone and the nature of the threat the player character faces.

As with larger adventure games, open world games feature narrative puzzles as both a means to progress the main narrative of the game and to present ancillary narrative content. In *Red Dead Redemption 2*, exploring the city of Saint Denis to map the locations of ominous graffiti leads players to finding and fighting a Nosferatu-like vampire that has been killing victims throughout the city. Similarly, in *The Legend of Zelda: Breath of the Wild*, a character named Kass will play folkloric songs containing riddles that must be interpreted to solve nearby puzzles by performing a particular action, waiting until a particular time of day, or combining different items. In both of these games, the solution to the narrative puzzles exists within a limited distance from the onset of the puzzle. However, as open world games usually allow players to explore at their leisure, they afford puzzle designers the opportunity to distribute puzzle components across the whole open world. In order to explore the open world and find all of the puzzle components, players need systems that allow them to navigate and traverse the world.

3 Navigation Aids

As we have discussed, story-based open world games can feature large game worlds with narrative puzzles that incorporate exploration and traversal into their solutions. Given that many people use navigation aids like GPS map smartphone apps to navigate familiar and unfamiliar areas, players too need tools to help them navigate large digital open worlds. In their meta-analysis of theories of spatial knowledge acquisition, Ahmadpoor and Shahab [1] highlight how the

two external factors that influence cognitive mapping are the means/tools used in navigation, and the physical characteristics of the environment. When considering this in the context of open world games, physical characteristics of the environment can refer to the world's level design while means/tools can refer to navigation aids. For the purposes of this analysis, we will be focusing mainly on navigation aids, although the intersection between narrative puzzles and level design is also worthy of investigation.

Chittaro and Burigat [6] refer to navigation aids (NAs) in virtual environments as "electronic analogues of the tools commonly used by people to navigate unfamiliar real-world environments" (p. 2) and while this definition is applicable to video games, it does not allow for NAs that do not aim to emulate the functions of real-world navigation tools. Moura and El-Nasr [23] argue that video game navigation aids are any elements that give players directions, help them identify a location, or determine their current orientation such as maps, markers, directions from characters, GPS, a compass, and subtitles that state locations or directions. However, their definition is still limited especially when considering exploration in open world games where navigation can involve terrain assessment and the passive appraisal of players' surroundings (e.g., treacherousness of a terrain, or relative safety of a particular area).

In the case of open world games, they can refer to systems a game explicitly provides players to help them navigate in the world of the game. These can include maps, character dialogue, compasses, markers, tools to assess the environment, and HUD elements like mini-maps and location names. For the purposes of this analysis, techniques used to indirectly guide players through the world (e.g., lighting and landmarks) will not be included as navigational aids because they relate more to level design than the design of systems used to aid navigation. Not only is exploration a key aspect of open world games, but it is also a key aspect of narrative puzzles [14]. Therefore, the successful implementation of narrative puzzles in open world games requires the inclusion of effective navigation aids.

4 Case Studies from Open World Games

The following section provides examples of narrative puzzles from popular open world games and their accompanying navigation aids. The games detailed in these case studies were chosen from an ongoing survey of navigation aids in open world games that the authors are conducting. These particular games were chosen due to their recency, popularity, and level of accessibility on modern platforms to ensure that the maximum number of readers will have first-hand experience with them. The games and narrative puzzles chosen, alongside their respective navigation aids, are presented in Table 1.

4.1 Elden Ring

In *Elden Ring* (ER) [16], players must traverse a dangerous, dark fantasy realm to collect pieces of the 'Elden Ring' and restore order to the world. One of the core

Table 1. Games, narrative puzzles, and navigation aids used in this analysis.

Games	Narrative Puzzles	Navigation Aids
Elden Ring	'Grand Lift of Dectus' Puzzle	Main map Custom map markers Compass Item descriptions NPC Dialogue
Assassin's Creed: Valhalla	'The Doom Book of Cats'	Main map Quest markers Compass NPC Dialogue & Actions 'Odin's Sight' filter
The Witcher 3: Wild Hunt	'Missing in Action' & 'Twisted Firestarter'	Main map Quest markers Compass NPC Dialogue & Actions 'Witcher Senses' filter

narrative puzzles in ER concerns the Grand Lift of Dectus, an enormous elevator that grants players access to the Altus Plateau, a key area in the progression of the game's main narrative. This puzzle requires the player to find and present both the left and right halves of the 'Dectus Medallion' while standing on the Grand Lift of Dectus. Doing so will operate the Lift and transport the player to the Altus Plateau. The puzzle can be initiated at three different points: at the location of each medallion half, or at the Lift itself. Should players find a medallion half first, they must use the item description ("The right half is said to reside in Fort Faroth in the Dragonbarrow, far to the east.") and limited main map to find the second half and the Lift itself. Should they first find the Lift, NPC's dialogue will hint towards the nature of the Lift and that something is needed to operate it (Fig. 2).

Regarding the first two initiation points, the player may or may not have already discovered the forts that store the medallion halves. If they have found them, they need only travel back to the location of the fort shown on their map. If they have not found them, they need to use both the map and the medallion item description to find the location of each respective fort. The item description gives them the direction they need to travel from the discovered medallion to find the undiscovered one. The hand-drawn main map (Fig. 3) features simple sketches of walls where buildings are located. To find the second half of the medallion, the player would need to locate the buildings on the map in thedirection indicated

Fig. 2. Item description for Dectus Medallion (Left) in *Elden Ring*.

Fig. 3. The main map in *Elden Ring*.

by the item description. Doing so will eventually bring them to the relevant fort. They must also find the location of the Lift, which the item description notes is used to connect the Altus Plateau to Liurnia (the only area through which the Altus Plateau is accessible). To do this, they need to explore the border of Liurnia using the map or use the map to find locations that appear to be significant and investigating them.

If the player starts the puzzle by first finding the Grand Lift of Dectus, they still need to explore, unprompted, to find the medallions (an NPC's cryptic

dialogue implies that there is some way to activate the Lift but no further information is given). It is also possible that a player may discover all three initiation points in any order through self-motivated exploration. Therefore, the potential for the player to find all components of the puzzle without realizing a puzzle exists is relatively high. However, if the player is to knowingly engage with the puzzle, they must make use of several navigation aids (e.g., the main map, the item descriptions, custom markers, compass etc.) to solve it. This puzzle spans a significant portion of the game's entire map, requiring players traverse great distances in search of the medallion halves. Conversely, while the hints provided by the item descriptions and NPC dialogue are cryptic and harder to intuit, the puzzle only requires three actions to be completed, i.e., collect each medallion half and then combine them. The mental challenge lies in finding the medallion halves using the limited amount of information that the navigation aids provide.

4.2 Assassin's Creed: Valhalla

In *Assassin's Creed: Valhalla* (ACV) [37], players play as Eivor, a Viking leader who invades and pillages England in the 9th Century and interacts with various historical figures from the period. A large number of small narrative puzzles are present throughout the game's world. They are labelled as 'World Events' and the initiation point of the puzzle is marked on the map with a blue rune quest marker. Players typically interact with an NPC and complete a small number of tasks that require logical reasoning, before returning to the NPC to conclude the puzzle. For instance, in the "The Doom Book of Cats" world event, the player meets a farmer who is trying to rid his fields of rats but has no effective means to do so. Further along the road, a woman is tending to a large number of cats. It is up to the player to deduce that the cats can be used to kill the rats and that the woman must be convinced to allow the player to use the cats for this purpose through the selection of specific dialogue options. Once the player has sent the cats to kill the rats, the farmer grants the player access to his home to take some valuable materials as thanks. All elements of the puzzle are located within a very small area (it only takes a matter of seconds to reach the house with the cats from the farmer's house) and scanning the environment with 'Odin's Sight' will place a filter over the world that highlights the location of interactable NPCs (Fig. 4). Similarly, the NPCs involved in the puzzle have a text box icon hovering above them when the player is within a close range. This formula is mirrored in most other 'World Events': the solution to the puzzle, or at least the area that contains the solution, is visible from the location of the puzzle's initiation. As players need only survey their immediate environment (sometimes with the aid of Odin's Sight or the presence of NPC icons) to find the solution to the puzzle, there is little need for any other navigation aids.

4.3 The Witcher 3: Wild Hunt

In *The Witcher 3: Wild Hunt* (TW3) [5], players take on the role of monster hunter-for-hire Geralt of Rivia as he travels across the fantasy world of the

Fig. 4. The Doom Book of Cats puzzle space; the farmer is in the middle ground and the woman is in the background. From *Assassin's Creed: Valhalla.*

Continent. One of the game's optional narrative puzzles involves finding a soldier who is missing in action. Players take on the request at a noticeboard in a village, track the puzzle in the HUD, and travel to the location marked on the mini-map. They will meet the brother of the missing soldier who will tell the player that solider was last seen on a nearby battlefield. A new quest marker directs the player towards the battlefield where the brother asks the player to find shields with the soldier's insignia on them. The player must use their Witcher Senses to find the shields. These 'Witcher Senses' constitute a filter placed over the world that highlights important interactable elements with a red glow. The map displays the area within which all the shields are located. Once the correct shield is found, the brother's dog catches the soldier's scent and guides the player to him. In this puzzle, all relevant areas, even the approximate location of the solution (the correct shield) are shown on the main map and mini-map. The maps also plot a route to each key location. The navigation aids direct the player to both the battlefield and the correct shield, reducing the difficulty of the puzzle. Another puzzle involves the player locating the arsonist who burned down the local blacksmith's workshop. After using the Geralt's Witcher Senses to follow the arsonist's footprints to a river (Fig. 5), it is discovered that the arsonist was attacked by a monster and lost his shoes in the struggle. The player must then follow the trail of blood to a house where they must look for an injured, barefoot man. In this instance, the main navigation aid used is the Witcher Senses ability that highlights the footprints and blood on the ground. The player must use these to solve the puzzle as opposed to travelling to a pre-determined location marked on the map. In both of these puzzles, the navigation aids provide players

with enough information such that while they require more actions to solve than the puzzle in ER, the mental challenge presented is minimal.

Fig. 5. Footprints visible in the mud through use of the Witcher Senses. From *The Witcher 3: Wild Hunt*.

5 Interactions Between Narrative Puzzles and Navigation Aids in the Case Studies

Based on the case studies outlined above, it can be seen that the amount of information a navigation aid provides can affect how far a player must travel to complete a puzzle, and how complex and mentally challenging a puzzle is. As such, navigation aids interact with narrative puzzles to affect puzzle design on two different continua: intricacy, and expansiveness. Below, we will take examples of narrative puzzles and navigation aids from the three case studies outlined above and discuss how an open world game's navigation aids can impact the intricacy and expansiveness of its narrative puzzles.

5.1 Intricacy

We use the term intricacy to refer to the number of components in a narrative puzzle in concert with how mentally challenging it is. A component can be an action that needs to be taken or a tool that needs to be used. Mental challenge refers to how much logical and creative thinking is required to solve the puzzle. Out of the examples above, ER presents the most intricate puzzle while ACV presents the least intricate narrative puzzles.

For the purposes of this discussion, it is assumed the player intends to pursue the Grand Lift of Dectus puzzle after reaching one of the first two initiation points discussed above. After finding the first half of the medallion, they must use the navigation aids provided to find the second half and to find the location of the Grand Lift of Dectus. The main NAs used to solve this puzzle are the main map, the HUD compass, custom map/environment markers, and item descriptions. The main map is a full-colour, hand-drawn representation of the game's world onto which players can place blue custom map markers. Once a map marker is placed, a pillar of blue light is visible in the game's world at the corresponding location, as well as a blue marker on the HUD compass. To solve the Dectus puzzle, players need to plot a course to the second half of the medallion and the Dectus Lift itself. Map markers can be used to mark a route on the map that will be visible in the world. The map itself features rough outlines of buildings along with names of each main region in the game. To find the second half of the medallion, players must find the fort specified in the item description of the discovered medallion half. To achieve this, they can use the directions in the item description; for instance "The right half is said to reside in Fort Faroth in the Dragonbarrow, far to the east". They now must locate Dragonbarrow and then locate a specific fort within it. This involves searching the far east of the map for the outline of a building and travelling to it to determine if it is the correct one. Similarly, the item description states that the Dectus Lift connects Liurnia with the Altus Plateau and as such, players need to use the map to look for structures along the borders of Liurnia and then travel to them to determine which one is correct.

The lack of explicit instruction given to the player through the navigation aids is what makes it mentally challenging, and therefore intricate. Players need to consider the clues they are given in the context of the game world and use the NAs provided to act on them. The main map is relatively abstract when compared to main maps in most modern open world games; the main map in ACV features dynamic location markers for sites of interest, shops, bars, treasure etc. as well as the inclusion of location names that increase in granularity as the player zooms in. The top-down view of the world is so detailed that it is possible to discern individual trees and fields. If the same puzzle were present in ACV, the player need only scan the map for the name of the fort to find its exact location. In this way, the puzzle is not only less mentally challenging but also has less components (e.g., players can ignore details on the map, removing the need for them to solve the puzzle). The exploration and interpretation of the navigation aids required to complete the puzzle in ER is significantly diluted in ACV.

Similarly, in TW3, navigation aids are used as a means of explicitly directing players to each successive component of certain puzzles. In the case of the "Twisted Firestarter" puzzle, the player must use their Witcher Senses to follow a trail to a river, investigate the scene of an attack, and follow a trail of blood to a house. Only then does the player need to inspect NPCs to determine who is injured. Throughout the course of this puzzle, each area containing the next

clue is highlighted on the mini map with an orange circle; each action the player needs to take is clearly signposted with the navigation aids. Guiding players in this way reduces how mentally challenging the puzzle is and in turn reduces its intricacy. The amount of information an NA gives to a player can significantly impact the intricacy of a game's narrative puzzles as engagement with and the interpretation of NAs are key elements in the solution of narrative puzzles in open world games.

5.2 Expansiveness

We use the term expansiveness to refer to the how much physical space must be traversed to complete the puzzle. From the examples, ER has the most expansive puzzle while ACV's puzzles are the least expansive. ACV provides particularly interesting examples as even though the game features very detailed navigation aids (the main map provides the locations of almost all points of interest) they are not implemented in its narrative puzzles. As such, the components of many of the game's narrative puzzles are located within a small radius of where the puzzle is initiated. In ACV, the solution to the puzzle, the woman who owns a lot of cats, is clearly visible from the location of the farmer who acts as the beginning of the puzzle (Fig. 4). Only two navigation aids can be used to aid the solution of this puzzle: floating point markers highlighting the location of interactable NPCs, and the 'Odin's Sight' ability that similarly highlights interactable NPCs. Given that this puzzle does not require the use of the more detailed navigation aids like the main map, it cannot have large distances between its components as players could easily lose track of their progress in the puzzle or lose track of the puzzle altogether due to the immense scale of the game's world. Had this puzzle, and other 'World Events' in ACV incorporated the navigation aids in the game into their solution, it would have allowed the puzzles to be more expansive and to take advantage of the affordances of the game's large explorable world. These puzzles adopt the approach taken by narrative puzzles in smaller adventure games wherein only a limited puzzle space needs to be explored to find the solution. As such, the narrative puzzles, or 'World Events', in ACV are presented as a series of small, discrete puzzle spaces dotted across a large open world. Players can find them using the blue dots that appear on the main map but once they have reached the puzzle space, the navigation aids are not required to solve the puzzle.

In contrast, the Dectus Lift puzzle in ER takes full advantage of the game's navigation aids to make the puzzle very expansive; in this instance, the puzzle space is approximately half of the game's full map. The design of this puzzle takes into account the fact that players can use the main map, custom map markers, and HUD compass to help them to interpret the clues in the medallion halves' item descriptions and aid them in exploring the world in search of the solution to the puzzle. Similarly, TW3 uses its navigation aids to make the "Twisted Firestarter" puzzle more expansive. As part of the puzzle, the player must follow tracks out of a village, across a river and back around to the village again. Throughout the course of this journey, the player is explicitly guided by

the game's navigation aids; the Witcher Senses highlight the tracks and evidence that the player needs to follow, and the mini-map displays orange circles placed on the map to indicate the approximate area of the next part of the trail to investigate. The approach taken here allows the puzzle to be more expansive but does not afford the player a great deal of autonomy in how they approach solving the puzzle. As such, incorporating, or at least accounting for, NAs when designing narrative puzzles allows them to be much more expansive and takes full advantage of the exploratory affordances of open world games.

6 Design Implications

Based on the understanding that the information navigation aids provides impact narrative puzzles on the continua of intricacy and expansiveness, we present several design implications ground in IDN theory.

Regarding the design of narrative puzzles and navigation aids for expansiveness, it is worthwhile to consider Ryan's [33] discussion of the concept of 'flânerie' in relation to the emotional and strategic experience of digital space. Ryan argues that a digital space, like physical space, can be experienced both emotionally (where traversing a space elicits emotion in the traveler) and strategically (where a traversal is viewed as a means to an end in service of a seperate goal). 'Flânerie', as Ryan describes it, encapsulates the experience of "free wandering, open to chance meetings and random discoveries" wherein a space is traversed simply for the joy of traversal and the aesthetic opportunities this affords. In the case of the most expansive puzzle from the case studies above, the 'Dectus Lift' in ER, progress in the puzzle is contingent on the player discovering at least one of the three potential initiation points. Without these, the player is not aware that this puzzle even exists and as such, must explore the world to happen upon one. Therefore, designing for flânerie is a useful of way of encouraging this exploration. ER succeeds in this respect by not only providing a large world that is well designed and aesthetically pleasing but also in its relatively limited use of navigation aids, specifically the lack of quest markers. Players must rely on flânerie, rather than quest markers as in ACV and TW3, to guide them through the world in order to find the 'Dectus Lift' puzzle. In this way, considered world design coupled with navigation aids that don't provide excessive information can promote flânerie in players, allowing the design of expansive narrative puzzles whose solutions rely less on using information rich navigation aids to direct players across vast distances, and that are more mentally challenging.

As previously mentioned, the use of information rich navigation aids can reduce the mental challenge associated with a puzzle, thereby reducing its intricacy. Similarly, simply reducing the number of components of a puzzle will also reduce its intricacy. Designing for intricacy therefore requires a puzzle to not only be mentally challenging (e.g., less reliance on direct instruction from navigation aids) but to also have many components. Ensuring that players can successfully intuit or decipher the solution to a puzzle in a way that promotes agency and is

satisfying to complete is important to the design of an intricate puzzle. Considering the procedural and encyclopedic affordances of IDNs [24] alongside their ability to instantiate a narrative based on a protostory [18], a focus on systems driven gameplay in concert with effective narrative framing could be beneficial. As Spierling [34] notes, the framing narrative of a game can be employed to give players an implicit understanding of what a game's systems afford, much like creating a mental model in interaction design [28]. Players implicitly understanding a game's affordances can allow puzzle designers to greatly increase both the number of puzzle components and the mental challenge associated with narrative puzzles; the responsibility of directing the player to each puzzle component is removed from information rich navigation aids and assigned to the player's mental model of the game's affordances. As a basic example, if a potion requires a fish that lives in the dark, players should be able to intuit that they can find a cave fish in the nearby cave that they heard about from an NPC or through their own flânerie-driven exploration. Constructing both an effective framing narrative and systems that can map interactions between a wide variety of items and actions can be complex an time consuming but can also afford the design of more sophisticated and intricate narrative puzzles.

7 Conclusions and Future Work

Narrative puzzles are an integral part of story-based open world video games and the ways in which they interact with navigation aids can significantly impact their intricacy and expansiveness. When designing narrative puzzles for open world games it is important to take the design of the game's navigation aids into account as not doing so could make the puzzles boring or frustrating or could limit their scope. Designing for flânerie and placing a focus on systemic and intuitive gameplay can help prevent a game's narrative puzzles becoming trivial and unsatisfying.

The categorization of narrative puzzles according to their intricacy and expansiveness could prove to be a useful analytical tool going forward. For instance, plotting puzzles on a graph with Intricacy and Expansiveness on its axes, as in Fig. 6, would allow one to analyze the structure of puzzles in a variety of open world games, or even the structure of puzzles in a single open world game. Clusters of points on the graph could be used to differentiate and categorize puzzles in different games and aid games studies researchers and game designers in their analyses of particular games. The question of how to quantify intricacy and expansiveness such that they can be represented on a graph remains an open question (the examples in Fig. 6 are represented relative to one another) but one that could no doubt be addressed in future work. Going forward, it could be useful to analyse narrative puzzles in story-based open world games along the continua of intricacy and expansiveness both during and after a game's development.

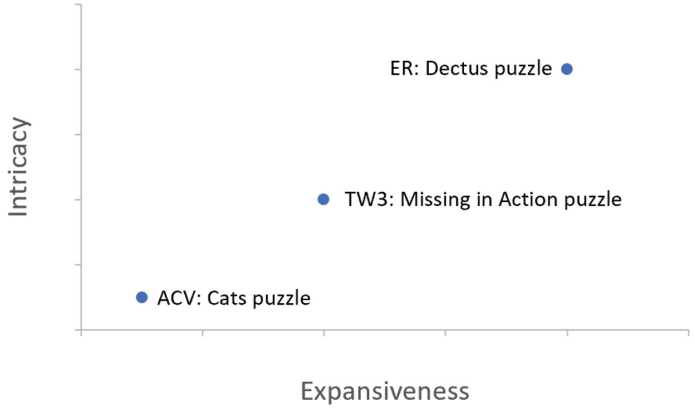

Fig. 6. Graph showing the Intricacy and Expansiveness of the puzzles outlined above.

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