A Classification of Video Game Cartographic Maps

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ABSTRACT
Maps play discerning roles in video games as they serve multiple functions. Amongst others, they support gameplay by communicating information and acting as navigational tools. However, our body of knowledge regarding game maps, while growing, is still limited – especially from a cartographic perspective. In this paper, we contribute a classification of game maps developed from a sample of online articles and posts dedicated to video game maps. We discuss the developed categories and present examples to illustrate the varied manifestations of maps in games. Based on our review we further discuss how they can be designed and function to stimulate playfulness and present avenues for future research.

Keywords
cartography, game maps, classification, playfulness, design

INTRODUCTION
Video games and information visualisation share a long common history, among them, maps are one of the most popular representations. Maps, outside of games, have found widespread attention. For instance, Tufte (2001) discusses the value of maps for displaying information while Lewis-Jones (2018) illustrates how novelists rely on and sketch maps to help them develop their stories. Likewise, maps have long played a critical role in video games, they are used as navigational tools, reward systems, or as a reference guide (Kylie, 2019). Maps are an essential game feature that make exploring open worlds possible. Through them, players can locate treasures and plan new raids. Maps have their own aesthetics, adding a sense of wonder to the games. They build anticipation, point at mysteries, and stimulate discoveries. Game maps add texture to the game worlds, which seem more alive and vibrant. By showing contours, landscapes, landmarks, and hinting at the geopolitical system of a game world, maps are designed to engage players. Their designs, functions, and roles influence gameplay and thus change the experiences of players.

In his in-depth investigation of game maps, Thorn (2018) looked at maps according to four criteria: their interactivity, immersivity, inclusiveness, and incompleteness. Arnott (2017) investigated aspects of storytelling and narrativity in his analysis of *Metroid: Other M* (Team Ninja, 2010) while Mukherjee (2019) looked at game maps as aesthetic artefacts and affective systems influencing the players' actions. Toups et al. (2020) looked at game cartographic interfaces, describing interface properties, affordances, and functions.

Maps need to be understood critically within their cartographic perspective and how they are designed and integrated into the game world, not only with respect to their interface functions (Gekker, 2010). As can be understood, a blueprint of an indoor building is not designed nor interpreted in the same way as a world map. What players

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might be looking for in a dungeon map, is the nearest exit, or stairs to move up and down. Instead, in a world map players might, for example, select their destinations from a menu, or look for the big arrow displayed on the map to move in the right direction. World maps and minimaps can be seen as two ends of a design spectrum (e.g., very large to very small). How players interact with game maps can feel and be implemented quite differently. Thus, it can be expected that the kinds of maps embedded in a game have some implications for their functions, affordances, or uses and thus ultimately for players' experiences.

But what is a video game map and what sort of maps can be found in video games? Despite reviewing the literature on video game maps, we did not find an answer regarding the fundamental question of map design itself. Thus, we turned to the game sphere and surveyed posts and then collected twenty-three posts dedicated to video game maps. The posts discuss different aspects of maps through examples and include a high number of map designs. The range of map designs included in the post were quite striking in their quality and in their diversity.

Thus, to answer our questions and to bridge the gap between map design and map interface, we decided to focus on the map designs and develop a classification of these maps. Such classification should bring in focus map disparity and variety, and then enable map comparisons to identify patterns in their functions, affordances, gameplay styles, and resulting player experiences. Establishing the classification should let us gather further insights about maps, their designs, and uses. Resultingly, we hope to spark further research grounded in video game cartography. In the following, we first describe our methodology, steps taken to establish the classification, then present it and discuss issues related to nomenclature, categorisation, and designs.

ELABORATING THE CLASSIFICATION

To answer our question about the kinds of maps found in video games, we turned to the game sphere and looked for posts dedicated to this domain. To better understand our domain of inquiry, we looked at classifications of cartographic maps and examined related domains. Closer to video games, we looked for game map schemes, or how *Dungeon and Dragons* (*DnD*), board games, or fantasy game designers distinguish between different game maps.

Classification

Different types of maps are classified according to what they are attempting to show. Nonetheless, there are many ways to classify maps, from a geographical perspective, their content, and according to their functions. Detailed cartographic classifications have been established based on territorial coverage or scope (space, earth, continents, countries, oceans, water surfaces, etc.), content (topographic, geographic, thematic), scale (plans, large-scale, medium-scale, small-scale), and cartographic projection (Head, 1991; Schlichtmann, 2009).

Within the game domain, Jorm (2018) presents fantasy maps simply as outdoor maps, blueprints (indoor maps), and battlemaps (which can be both). Jamieson (2021) in her *DnD* map overview discusses the kinds of maps by region as follows: world, kingdom, region, and town maps, as well as dungeon maps and interior maps. They differentiate maps according to scope from the largest to the smallest and if they are indoor or outdoor maps. Dungeon maps can also be described in terms of their function in the game such as battle maps or adventure maps. Distinctions and categories are not very clear or well-defined. Furthermore, there is not any information on how such categorisations might have been elaborated.

Methodology

Turning to the game sphere, we looked for posts dedicated to this domain and searched for *video game maps*, *cartography*, *computer* or *digital games*, and *in-game maps* in any combination. A clarification of terminology is necessary at this point: within the game industry, the term *game map* is often used as an equivalent to *game world* or *game environment*. This is not the usage we are referring to in this paper. Rather we use it in relation to a video game cartographic map (game map for short in the following) which takes the cartographic map as its object.

The collected posts, which also include short articles, are all dedicated and centered on game maps with a length ranging from 500 to 1,500 words. The posts have been written by enthusiastic game actors, from journalists (*retronauts.com*), game writers (*kotaku.com*, *rockpapershotgun.com*) to academics and map designers (*stamen.com)* as well as expert gamers (*ganker.com*). These posts were chosen because they contained numerous examples of maps, allowing us to explore the diversity of their design. Together, the posts included 132 maps that form our sample.[i]

We then first screened the sample and removed images, designs, or screenshots, which were not related to video game maps. The 132 game map designs come from 80 unique games. Some maps proved quite popular, but while we had few exact duplicates, e.g., *Thief: The Dark Project* (Looking Glass Studios, 1998), most related to different views (or editing) of the same map such as for *Elden Ring* (FromSoftware Inc., 2022), see Partial View below for further details. Some games also have more than one map, we had different maps from the same game, usually a world map and a minimap, such as in the case of *The Witcher 3: Wild Hunt* (CD Projekt Red, 2015) and *Ni No Kuni 2* (Level-5, 2018).

Next, to derive our classification, we established a basic anthropometric profile of the maps: map picture, post reference, game name, publisher, and date, as well as additional references so we could better understand how a map fits into its game context (e.g., YouTube game walkthroughs). Furthermore, we added keywords from posts and notes.

All the authors participated in the elaboration of the scheme and in coding the maps into categories. To elaborate our classification, we started from half the sample of maps included in the posts. We divided the maps into groups, established connections, and determined a label for that category. We looked for inclusiveness and fit, and then discussed issues and solved disagreements. Once the scheme was established, we checked if it could apply to our entire sample. Then, we coded all the maps as belonging to a unique category. In some cases, we had to refer to the game to verify if the map belonged to one category or another, e.g., a region or world map. The scheme was first established by all authors separately, and then categories were coded independently.

Classification issues: bridging map artefacts and game world

Well-known everyday maps include representations of our world, countries, or cities (such as street maps). Besides, we are familiar, for example, with hospital maps and architectural house plans. Thus, we were drawn to divide maps according to their content and known map counterparts: world maps, region maps, and so on. A game world map can be divided into continents or countries such as *Draenor* or *Azeroth* in *World of Warcraft (WoW)* (Blizzard Entertainment, 2004). Game maps can be divided first according to their territorial scope. Then, we can consider maps of towns, agglomerations of buildings, and of buildings themselves.

A map has been described as a specific kind of visual representation, whether real or imaginary, showing an area highlighting relative positions of places and landscape

features. Nonetheless, a game map unveils the created game world to their players. A map provides an overview of the game world in a simplified manner. A game world map thus includes the total playable space, an important criterion for games.

During the coding process, an issue arose between the game's notion of world map as the entire playable world, and the common usage of a world map defined through its territorial scope. They did not always align. Initial coding disagreements arose in connection with the *Grand Theft Auto* (*GTA*)*: San Andreas* (Rockstar North, 2004) map. This map shows three cities surrounded by some landscape and was classified as a city or world map. After discussion, it was decided that the map qualified as a world map, as it shows more than one city and also connections between them and the landscape. However, a few games take place entirely in one city: *Batman: Arkham Knight* (Rocksteady Studios, 2015) in Gotham City or *Infamous 2* (Sucker Punch Productions, 2011) in New Marais. The game maps then show the city. Thus, can we still talk of world maps in those cases? It seems quite counterintuitive, especially as other city maps would be given the city map label.

Within our sample, we had a few maps of outer space like the World Map of *Outer Worlds* (Obsidian Entertainment, 2019). The galactic map constitutes the totality of the playable world. However, each planet can be visited and has what we would normally refer to as a world map. We decided to label those maps as world maps but introduced a specification, a subcategory *Outer Space*, to distinguish them from others. Again, the nomenclature could become quite confusing and make comparing maps within one category impossible.

An *Area*, in our classification, is not based on the whole of the playable game world but represents a part of the game world such as a continent or country, as we have seen with *WoW*. It has to be noted that some games do not have a world map as such, like in our sample *Far Cry 2* (Ubisoft Montreal, 2008). Players can interact with a segment of the map at a time, but each segment forms part of the whole map. However, it is never given to the player as part of the game. In *Assassin's Creed Valhalla* (Ubisoft Montreal, 2020), the game takes place in different independent regions like Viking England, Norway, and Asgard (one of the dwelling places of the gods). Similarly, maps of levels such as in *Super Mario Bros. 3* (Nintendo, 1988) can be considered independent regions. The player can get an overview of each level, but can only play one at a time. In rare exceptions, there can also be a map giving an overview of all the levels such as in *Super Mario Bros. 3*.

Technical developments have led to new features in game maps that reflect functionalities of other digital and Google-like maps, where players can zoom and traverse regions, towns, and so on. Our sample contains a number of area maps, few representing a specific region. Most, after verification, are zoomed-in views of a world map and thus have been labelled *Partial View*.

Understandably as our map sample originated from posts, it contained many *Partial Views*, to enable writers to emphasise a point or illustrate a map feature. However, during quests, for example, players might be focusing on a specific area of the game for a time, and thus only seeing a partial view of the world. In other words, they would then have seen a partial view of the game world in an ever-changing map.

We did not have any difficulty in categorising and differentiating between minimaps, city maps, and building maps. All three coders were almost entirely in agreement for these categories. One or two disagreements came from misinterpretations of the map designs and were quickly solved. Those came from *Hollow Knight* (Team Cherry,

2017) and *The Suffering: Ties That Bind* (Surreal Software, 2005) (each design was closer to the design of another category: city vs. area and building vs. city). *Doom* (id Software, 1993) was a little bit more difficult to classify, while the gameplay takes place mostly within the building, some parts also play outside, but in a very limited fashion. While elaborating our classification, we noticed a few issues connected to boundaries. In the case of buildings and towns, these include geo-cultural issues: landscape elements can be found inside a building (e.g., Mediterranean-like houses), or water and sea elements as well as forests can be included in a city map.

Category	Number	%	Examples
World Map Landmass Galaxy	Total: 41 36 5	31	*Grand Theft Auto: San Andreas, Tyranny, The Legend of Zelda: Breath of the Wild, PUBG: Battlegrounds*
Area Map Partial-View Region Level	Total: 47 33 10 4	36	**Partial-World:** *Ni No Kuni 2, Death Stranding, The Elder Scrolls V: Skyrim* **Region:** *Pokémon: Let's Go, Pikachu! and Let's Go, Eevee!* **Level:** *Super Mario Brothers 3, New Super Mario Bros*
City Map	Total: 15	11	*Assassin's Creed II, Mafia III, Grand Theft Auto V, Dragon Age 2*
Blueprint House Facility Dungeon	Total: 24 5 15 4	18	**House:** *Gone Home, Thief: The Dark Project* **Facility:** *Doom, Super Metroid, Soma* **Dungeon:** *Diablo 3, Etrian Odyssey, The Legend of Zelda*
Minimap	Total: 5	4	*Ni No Kuni 2, The Witcher 3: Wild Hunt, Final Fantasy VII, Far Cry 2*

Table 1. Overview of the map categories and subcategories together with the number of maps in our sample as well as examples of games using such maps.

CLASSIFICATION OF GAME MAPS

In this section, we present our classification and define and discuss each category, including examples of specific maps that were found in our sample. Table 1 shows the proportion of maps we had in our sample for each category. Our goal here is to illustrate the variety of maps that can be found in video games.

World Map – a representation of the total area within a video game that can be played, showing interconnections between its different parts (such as regions). If the complete world of the game is a city or building this was not viewed as a world map as it only shows one entity.

World Maps within games have been defined in slightly different ways such as it covers all the areas in the game, while connections are established between individual locations. World Maps are "the largest in scale and are meant to provide a general overview of your entire explorable region" (Nerurkar, 2009). Looking back, we can see that characteristics of these maps relate to territorial scope (e.g., world), scale (e.g., large) of the game, and playability. It has to be noted that in case of some world maps, not the whole map shown can be played.

Figure 1. World Map of *The Banner Saga* (Stoic Studio, 2013)

Figure 2. World Map of *The Legend of Zelda: Ocarina of Time* (Nintendo, 1998)

Figure 3. *World Map* of *OuterWorlds* (Obsidian Entertainment, 2019)

Moreover, we can distinguish between two subcategories namely, *Landmass* (map of a specific world) and *Outer Space* (galaxies, clusters of planets, etc.). However, it is anticipated that world maps be used as such for the first sub-category (without connoting landmass) while the second sub-category would be referred to as *Outer Space* world map.

For example, Figure 1 shows the World Map (Landmass) of the game *The Banner Saga* (Stoic Studio, 2013), a fantasy role-playing game (RPG). In this example, within the game, the impressionistic map is seen within a frame of the world's warlords. Moreover, the map has details such as ornaments and constellations relating to the game's theme. By clicking on cities, parts of the land, roads, etc., additional information about the places can be obtained, which constitutes important information in an RPG. On the other hand, Figure 2 shows a top-down World Map from the game *The Legend of Zelda: Ocarina of Time* (Nintendo, 1998), an action-adventure game. Like the map of *The Banner Saga*, it shows the game's complete world (*Hyrule*) with its important places to visit. Another visible aspect are the height differences between different parts of the world and the ocean. As these examples show, world maps are especially beneficial for visualising locations and relative distances between places.

In contrast, Figure 3 shows an Outer Space map, namely the one from the game O*uter Worlds* (Obsidian Entertainment, 2019), an action RPG which plays on multiple planets that can be visited. It shows the game's solar system, called *Halcyon*. *Halcyon* consists of multiple moons, two planets, and a number of asteroids. They can be explored within the many quests and the story of the game. The planets are shown with their labels in a typical but visually lush solar system view, with the sun in the middle and the other objects around it.

Area Map – a representation showing a particular part of a world map, thus of its landmass. An area map would never include the totality of a playable world.

Area includes the subcategories *Region*, *Level*, and *Partial World*. Regions include a specific and holistic part of a landmass, standing in a specific conceptual relationship to the world (e.g., continent, country). On the other hand, a *Partial World* map can include any part of the world landmass, focusing on natural landscapes (i.e., frequently zoomed-in World Map). A Level is an autonomous play area, each area being independent of the others.

Figure 4 shows a Region Map from *World of Warcraft* (Blizzard Entertainment, 2004), a massively multiplayer online RPG. The region that is shown here is *Northrend*, which is one of the continents within the game. The map also shows the individual parts of the continent such as *Zul'drak* or *Howling Fjord*. In addition, it showcases the different kinds of land types found within each area such as snow, forest, etc. This is important

information in the context of the game as depending on the land type different enemies and NPCs can be found.

Like Region maps, *Partial World* maps can be found in some games (e.g., *Hollow Knight*; Team Cherry, 2017*)*, otherwise, they are created by players during gameplay. *Partial World* maps do not always contain a variety of information but highlight specific ones such as the *Partial World* map of *The Legend of Zelda: Breath of the Wild* (Nintendo, 2017), shown in Figure 5. In general, it shows few points of interest and map labels but here also displays pathways of the areas in a quite simple and sparse manner. Its topography is, however, presented in detail (e.g., contour lines, shading indicating elevation, etc.).

Hollow Knight (Team Cherry, 2017), is a 2D side-scrolling Metroidvania. It has quite atypical maps in many respects. First, it takes place within an underground kingdom. Second, the map design is quite diagrammatical, a style usually associated with buildings, but which represents the maze-like aspect of this game. Third, the game does not contain a full map, but only shows a partial view of the area surrounding the player. Moreover, players must first locate "wandering cartographers" hidden in different areas to unlock the individual maps for navigating its enormous labyrinth.

Figure 4. Area Map (*Region*) of *World of Warcraft* (Blizzard Entertainment, 2004)

Figure 5. Area Map (*Partial World*) of *The Legend of Zelda: Breath of the Wild* (Nintendo, 2017)

City Map – a specific representation showing predominantly a built-up area or human settlement including prototypical elements such as roads and buildings.

A city map, like a tourist map or street plan, is often viewed as an external representation of a city to help users find the way from an origin to a destination (Klippel et al., 2003). Numerous maps of cities can be found in different games. Although our sample did not contain any examples, games also have maps of smaller towns and villages.

Games situated in a city, especially those that are entirely played in the city, are densely packed worlds instead of larger open-world maps. Some cities of games are based on existing ones such as New York. How close game cities are to reality varies from game to game, some accommodate the general layout and landscape features, while others adopt a more thematic standpoint. These choices impact the map design. The style of maps varies in function, the period represented (e.g., Victorian London, Prohibition New York), and based on the setting of the game (e.g., apocalyptic or horror games).

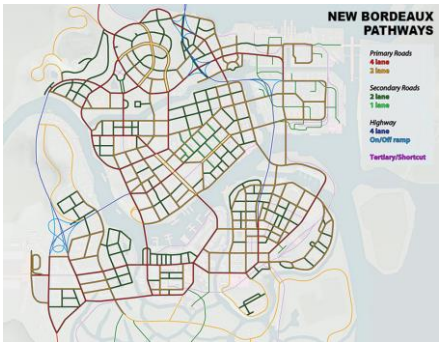

Figure 6. City Map of *Mafia III* (Hangar 13, 2016)

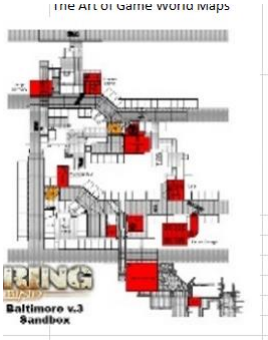

Figure 7. Excerpt from the *The Suffering: Ties That Bind* (Surreal Software, 2005) city map

Nevertheless, game city maps include basic features such as roads, buildings, as well as large establishments and landmarks. Cities are usually divided in neighbourhoods, with different characteristics and layouts. The landscape or setting also has an impact on a city's design and its map. A city can be nested in-between hills adopting a top-down structure, or areas might be divided by a river flowing through. If a town is by the seaside, docks, boats, and island chains (as, e.g., in *Dragon Age 2;* BioWare, 2011) can be included and represented. Besides geographical and architectural features, street names, landmark names, or a map legend can be added. Furthermore, additional icons and symbols are often added to facilitate or accommodate the gameplay.

In game maps, major features and landmarks serve as vantage points and aid navigation. They also indicate places that can be visited or where game events such as quests might take place. In addition to the layout of the city, key game objectives might be tracked on the map and annotations can be added. Besides, using digital map functionalities in-game maps are still evolving. Using a Google-like mapping system, the *Liberty City* map of *Grand Theft Auto IV* (Rockstar North, 2008) is supposed to function almost like Google Maps. Game cities also lend themselves to close encounters and micro-explorations. Thus, further maps of buildings and facilities, as we will see, can be found in some of those games.

As the other types of maps, city maps can vary in visual style and the information they convey. For instance, the *New Bordeaux Pathways* map (see Figure 6) of *Mafia III* (Hangar 13, 2016) – an action-adventure game – focuses strongly on the roads and their different types (e.g., highways, primary and secondary roads) as driving constitutes an important game mechanic. Specific details about buildings are left out. In a blog post (Cheever, 2018), the world designer of the game discusses how the map layout went through several iterations until they ended up with a city that feels like a real-world city but at the same time avoids large uninteresting spaces. In contrast, the city maps of *The Suffering: Ties That Bind* (Surreal Software, 2005), a third-person shooter with horror elements, also include the shape of the buildings (with important ones also being labelled and colour-coded, cf. Figure 7) in addition to streets. Due to these details the map, however, focuses on smaller areas. *The Suffering: Ties That Bind* is a rather linear game compared to *Mafia III* which offers a large city to explore freely. The map therefore rather shows the near vicinity around the player, as this is the part of immediate interest to the player.

Blueprint – a specific representation showing predominantly the indoor environment, or interior of a man-made structure (e.g., of buildings such as a house, a dungeon, or a facility, etc.).

Figure 8. Blueprint Map (House) of *Thief: The Dark Project* (Looking Glass Studios, 1998)

Figure 9. Blueprint Map (Facility) of *Metroid Prime* (Retro Studios, 2002)

Figure 10. Blueprint Map (Dungeon) of *Diablo 3* (Blizzard Team 3, 2012)

Blueprints are architectural drawings of a group of buildings, a building, or a part of it. Different types of plans are used such as a floor plan (a building level) or site plan (entire building), or groups of buildings. Floor plans show the arrangement of spaces on the floor and include elements such as openings (e.g., doors and windows), the placement of fixtures, etc. Larger plans pertain, for example, to building complexes, showing property boundaries and nearby structures, as well as the different floors, and more detailed views of infrastructures such as heating systems.

Typically, in a video game, a blueprint describes the interior of a built structure showing room layouts and the like. The classical dungeon map falls into this category. Blueprint maps are most often displayed from an overhead perspective where the details are shown in a flat two-dimensional plane. Most of the maps are 2D, but we found a few examples of 3D maps. The term blueprint is used generically to refer to different kinds of maps or plans of different types of buildings or infrastructures. It has to be noted that we have also included maps that do not relate strictly speaking to a building but man-made artefacts such as spaceships or space stations (e.g., *Dead Space;* EA Redwood Shores, 2008 and *Alien Isolation*; Creative Assembly, 2014).

We were quite surprised by the number and variety of examples included in our sample, by comparison to city maps or minimaps. We divided this category into three subcategories: *Facility*, *Dungeon*, and *House*. They are specific types of buildings with common design features, characteristics, and functions. The *House* as well as *Dungeon* category refer to a specific type of building. Our sample contains hand-sketched maps of houses (*Gone Home*; The Fullbright Company, 2015 and *Thief: The Dark Project*; Looking Glass Studios, 1998; see below). A *Facility* relates to a group of buildings, generally with multiple floors. Facilities usually have a specific function such as being a mall, a laboratory, or a hospital. It has to be noted that especially in the case of *Facilities*, the map can include small outdoor areas (such as in-between buildings, a garden, or a courtyard). Some facilities have a more prototypical plan such as the *Upsilon* geothermal plant in *Soma* (Frictional Games, 2015) and the *Parkview* mall in *Dead Rising* (Capcom Production Studio 1, 2006).

Quite a number of buildings in our sample have passive maps, as Thorn (2018) and Gekker (2010) called them, meaning that the player cannot interact with them. They tend to be found in the game world themselves and not as part of a game's interface. Still, this is not always the case, as with *Metroid Prime* (Retro Studios, 2002) and *Dead Space* (EA Redwood Shores, 2008) which represent the map as holographic computer displays.

Thief: The Dark Project (Looking Glass Studios, 1998) contains maps of the buildings (see Figure 8) into which the player has to break into to steal valuables. The maps make use of a hand-drawn style and show in a top-down view the size and arrangement of the rooms, with some important rooms being additionally labelled. However, in line with the theme of the game, the maps have a makeshift style, are incomplete with empty patches, and only hint at potential dangers as explained by Ganker (2017). *Metroid Prime* (Retro Studios, 2002), on the other hand, includes maps (cf. Figure 9) of the different facilities which need to be traversed by the player. *Metroid Prime*'s map is also interesting because it uses an actual 3D blueprint of the facilities which can be zoomed into or also rotated by the player. This should, according to Ganker (2017), help the player understand the complex interconnections of the labyrinthine alien facility the player needs to explore. In addition, the map uses colour coding to distinguish between different parts of the facility or to indicate opened doors which can help to see which parts have been already explored.

Another example of a Blueprint map, specifically one of a dungeon (cf. Figure 10), is the map of *Diablo 3* (Blizzard Team 3, 2012) which is a hack-and-slash role-playing game. Parra and Saga (2021) mention that if a game moves in a fast-paced way, the map should be a "tool or an element that periodically appears to be quickly consulted", especially because the player is to be fighting against NPCs in the shown dungeon. Simple in its view, it shows the shape of a specific dungeon (*Gardens of Hope 2nd Tier*) in the game.

Minimap – is a well-defined game map category. A minimap provides information on the local environment (Khan & Rahman, 2018). It is a miniature map that assists players in orienting themselves within the game world.

A minimap is nearly always visible, usually placed in the corner of the game's screen. It helps players to orient themselves by showing the near vicinity of the player or a low-detail representation of the whole environment (like in real-time strategy games). Because of its size, it is very limited in how much information can be displayed. There are different types of minimaps but in our sample only a few examples were present, for instance, *Ni No Kuni 2* (Level-5, 2018), *The Witcher 3: Wild Hunt* (CD Projekt Red, 2015), and *Final Fantasy VII* (Square, 1997). Besides more traditional minimaps, some games such as *Far Cry 2* (Ubisoft Montreal, 2008) take inspiration from technological advancements and include a GPS-style navigation system with which players should be familiar.

Figure 11. Minimap of *The Witcher 3: Wild Hunt* (CD Projekt Red, 2015)

Figure 12. Minimap of *Final Fantasy VII* (Square, 1997)

The Witcher 3: Wild Hunt (CD Projekt Red, 2015), an action open-world RPG using a third-person perspective, shows a low amount of detail information on its minimap (see Figure 11). The player can see their position and their surrounding area, depending on where they stand within the game. The chosen map also shows some points of interest using icons such as locations of city areas and islands. In contrast, the minimap of *Final Fantasy VII* (Square, 1997) provides a small-scale and simplified version of the game's complete world, only marking the player's position and the main locations of the game (see Figure 12). Minimaps are quite common, especially in some game genres. A full review would go beyond the scope of this paper.

DISCUSSION

Maps in games come in a variety of forms and functions. As shown, we have found quite a range of game maps that we classified as World maps, Area maps, City maps, and Blueprints. From the map designs in our sample, analysing and comparing them within their game context, we gained further insights on maps, and how they can be designed and function to stimulate playfulness and enhance players' experiences.A map is an abstraction of reality, it is a very specific and selective representation – for example, of the natural environment – based on a number of cartographic operations as well as design choices (Denil, 2003). In a topographic map, meaningful spatial relationships will be used to represent hills and valleys. In thematic maps, symbols, patterns, and colours are utilised to convey the message of the map. Maps are hardly neutral but persuasive (Monmonier, 2018).

Similarly, a game map is designed to fit a specific game and game experience. It has to accommodate conventions of the game's genre, and is situated in a specific historical context (e.g., in terms of game and cartography development). Arnott (2017) remarked that the salient features of a game and its virtual geography are simplified, abstracted, and distorted in representations of game maps, just as in traditional maps. This is even more so for games modelled after real countries. To make the game more engaging, different scales can be mashed up, thus cities are, for instance, displayed at a larger scale than rural areas (Kylie, 2019). Moreover, distances between locations can also be reduced to make exploration more enjoyable. The size of features might be greatly exaggerated, even in a region map, as it would otherwise be difficult to "see" castles, rivers, or in some cases even trees.

Maps are designed to be playful and delightful, to advance the game's story or reward players. The aesthetic, or style of maps is another important dimension. The emotion it creates can influence the users' perception and their behaviour (Mukherje, 2019). Indeed, some game maps are very vivid such as the ones from Total War: *Warhammer II* (Creative Assembly. 2017) or *Elden Ring* (FromSoftware Inc. 2022). As Fish (2021) discusses these kinds of maps are very good at making emotional connections with viewers and players alike. A map should fit in the context of a game and reflect its style. As Rowland (2013) remarked, the game maps of the *Dragon Age* series are akin to medieval maps and "have elaborately hand-drawn maps that are discoloured to suggest historical authenticity". The *Planescape: Torment* (Black Isle Studios, 1999) map is the most unusual example from our sample. The map is displayed as crudely stitched human skin pieces, where map features appear as tattoos.

In games, maps cannot always be taken for granted. Unlike everyday maps, to enhance playfulness and engagement, the content of game maps can be hidden, invisible, or blanked out and altered in creative ways. Players might need to seek them out or solve puzzles to find them. Finding a map can be an integral part of the gameplay necessitating exploration of hidden spaces. Games might offer maps as part of the puzzle or challenge of the game. For instance, in *Elden Ring* (FromSoftware Inc., 2022)

fragments of maps marked by little pillars have to be found to complete the maps. Finding pieces of the map throughout the game world can stimulate the interplay between the game and its map (Kowalsky & Thorn, 2022).

Maps can also become mischievous: important information is hidden purposely from the player or needs to be updated. In Thief: The Dark Project (Looking Glass Studios, 1998), the game – as mentioned above – does not have complete floor plans of the mansion. In this way, it adds tension to the game, burglaries are not as predictable as they could be. Hollow Knight (Team Cherry, 2017) also leaves some blanks within the map to stimulate players' curiosity. In other cases, like The Last of Us Part II (Naughty Dog. 2020) players are given a tourist map of Seattle and must reconstitute it in the context of the world as it is now. Using such a mechanism can facilitate exploration.

Another enjoyable driver is having an incomplete map filled out through the actions of the player's avatars. At the beginning of a game, players can only view a small portion of a map, whereas in other games the entire map is visible. When using fog of war the map is masked and slowly revealed as a player progresses. We found such an example in our map sample connected to World of Warcraft (Blizzard Entertainment, 2004). To make the discovery of the game world less overwhelming, players are guided towards the next area, and so on. They can also easily track where they have been and might want to be. Areas can be uncovered as a bonus, through collecting items or fulfilling side quests. As there are many variations of the fog of war it would be interesting to study their effects on player experience (Mason, 2018).

By contrast, some maps are always uncovered. Maps showing the entire playable world, tell players something meaningful about the game. Players get an overview of the world in its entirety and make inferences or plans. This mechanism can give players a sense of freedom and excitement: the world seems like a living and breathing entity. In Assassin's Creed Odyssey (Ubisoft Quebec, 2018), after an initial time on an island to familiarise themselves with the game, players are given access to the complete map of the world and they can explore as they wish.

Novel map designs can attract attention, and stimulate players' curiosity and engagement, as with the diegetic maps of Firewatch (Campo Santo, 2016) and Far Cry 2 (Ubisoft Montreal, 2008). Similarly to diegetic sound in film (Tan et al., 2017), these maps function and are fully integrated into the game world rather than being part of the heads-up display, where most maps are rendered. The player character gets the map in their hands without leaving the game world and breaking up immersion. In Firewatch, a walking simulator, the game characters hold an orientation map, as they were really exploring the wilderness. The map feels very tactile and is designed to galvanise exploration. These maps are remediated as mimetic objects and introduce interesting game mechanics and gameplay constraints sustaining immersion. As we have seen, in The Last of Us Part II, the diegetic map is intriguing and challenging, as well as a vehicle to the story. Other diegetic maps in our sample include a shopping mall map in Dead Rising (Capcom, 2006), the digital map of Death Stranding (Kojima Productions, 2019) and the futuristic holographic maps of Dead Space (EA Redwood Shores, 2008). They add to the atmosphere, authenticity, or naturalness of the game world. Diegetic maps open-up new creative possibilities.

Thus, beyond the "standard map" of open worlds, overcrowded by layers and layers of information, there is tremendous scope for producing more imaginative map designs and ingenious mapping systems.

CONCLUSION AND FUTURE RESEARCH

In this paper, we advance a classification of maps which highlights and can serve as a useful starting point for discussing the diversity and variety of maps found in video games. In doing so, we offer a different perspective on game maps. From a sample of map designs derived from posts dedicated to video game cartography, we developed our classification of game maps. Subsequently, we introduced each category and presented examples of maps and their designs. Most maps within our sample fell within our World Map and Area Map category (about one-third each). Area Maps mostly showed a partial view of the complete world map rather than a specific part of the game's landmass in isolation. Maps showing Blueprints of houses, facilities, or dungeons were quite frequent. Very few of the maps in our sample were City Maps while there were only five instances of Minimaps, a common type of map in video games.

There are limitations to our study and classification, as we had only investigated a small sample of maps. Moreover, our study derives from a purposive sample related to the interests and perspectives taken by the various game writers. Thus, we should highlight that the number of maps for each category is unlikely to be reflective of how ubiquitous these maps are in games in general. As with minimaps, our sample did not contain many examples of city maps. However, Dimopoulos (2020) discussed and illustrated many game cities. Thus, we might want to look at a larger sample of game maps and/or a richer sample of a specific category. Looking further into game maps should let us refine our classification.

Based on our study and classification, which took a bottom-up approach focusing first on the map design and visual representation, we found several avenues for future research. Taking into account the distinctive map categories, it can be expected that some characteristics, properties, functionalities, etc. do not apply to all categories, and that others might be specific to one category. Are affordances between minimaps and world maps the same? Is fog of war applied to city maps in games and how? Can other map formats be used to visualise game information more effectively in large open worlds? By differentiating between categories, we should be able to address issues that have been obscured by looking at maps too globally.

Hence, analysis could be expanded by also looking more closely into the different functions maps serve for gameplay, which mechanics do they enable or prohibit, how maps are used, as well as how maps help to perceive game worlds and shape spatial narratives of the players. We could study how aesthetics and emotions triggered by maps influence player experience and their actions and interactions within the game world. The review of maps could also be extended to consider more experimental forms of maps within games as well as player-generated maps. Finally, through user studies a more comprehensive understanding of maps in games should be sought.

Research about game maps has been carried out sporadically although they have received more attention recently. Thus, we hope to initiate a new research agenda in video game cartographic maps which would also encompass different game formats (e.g., mobile and indie games). Understanding the varied manifestations of maps in games can contribute to future discourse and studies on how maps should be designed to support play, players, and their experiences.

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[i] The complete sample of maps is available at: https://www.games.cg.jku.at/files/Digra-2023-mapsample.pdf