3D REPRESENTATIONS OF CITIES IN VIDEO GAMES AS DESIGNED OUTCOMES

A Critical Overview and Systematization

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Abstract. The following paper proposes a way of reading and systematizing 3D representations of cities in video games. These representations are the result of a complex design problem not solely limited to 3D graphical representations. In fact, every 3D city is a designed artefact, an outcome of a design process that shares many common points with the architectural design process. Four main characteristics of 3D cities in videogames have been identified and described, namely: interaction/gameplay, narrative, architectural and urban representations, and graphical representations. The study of 3D cities in video games can also let us reflect on and improve our real cities. This piece of writing is part of a larger project that intends to investigate aspects of video games that can bring innovative approaches and theories into architecture and related fields. A further aim of the work is to raise interest and awareness on the topic and generate further discussions.

Keywords. 3D representations; 3D cities; video games; cities in video games; interaction.

1. Introduction

In recent years, video game theories, design, art and technologies have received increasing attention from academics and professionals working in many fields such as architecture, and this trend is ever rising. Several theories and tools common in architecture have been used as inspiration and methodologies in the video game’s field and vice versa. Furthermore, real places and architecture always constitute an essential source of inspiration in the design of game environments such as the ones in Half-Life2 (Valve 2004a). By contrast, architecture and related disciplines have always limited their interest to a small number of technical aspects of the video game world. In fact, there is a number - even if still quite limited - of academics and professionals that have used game engines for visualization purposes.
However, the potential of video games does not stand solely within the technological aspects. Concepts related to game design and the creation of artistic content - in particular stories and game environments - represent relevant fields of research in architecture. For example, Di Mascio (2010) showed how the game level design process and methodologies can have an educational value for architecture students and Zarzycki (2016) described the role of narrative space in creating immersive, evocative and compelling video game experiences. A publication titled *Space Time Play.* *Computer Games, Architecture and Urbanism* by (Von Borries et al 2007) presented general reflections on computer games, architecture and urbanism but in the form of short pieces of writing such as: short essays and statements, interviews and critical reviews of commercial titles. Nonetheless, these examples still represent a minority of studies. This situation may be due to several reasons. Video games are somehow still overlooked by academics that do not have the proper knowledge to handle them. The video game world is broad, complex, multifaceted, ever-growing and changing at a fast pace, so every scholar needs to be continuously updated. Furthermore, video games need to be played in order to be understood, studied and analyzed, and this is not an insignificant detail. To study a book, it is necessary to read it; to study a movie, it is necessary to watch it; and hence, to study a video game, it is necessary to play it (even if it would be better to say “to experience it”); it is impossible to study it through videos and images, because of video game’s interactive nature that requires a more active participation. This research deals with 3d representations of cities in video games (a subject that can be significant in architecture for various reasons) from design to visualization. This topic is very wide, hence it is necessary to define some limitations. The paper focuses on 3d cities that can be found in commercial titles, hence the work does not analyze players’ own creations in games such as *Minecraft* (Mojang 2011). However, city-building games such as *SimCity 4* (Maxis 2003) will be considered because, even if players can create their own cities, the representation of each 3d building has been carefully designed by professionals. Moreover, the piece of writing will deal only with one game mode: single player. The main objective of the paper is to give an overview of the topic and propose a first way to read and systematize 3d representations of cities in video games by selecting and describing their main aspects. Each aspect will be supported by the description of characteristics of 3d cities from various video games which have been directly experienced.

### 2. 3D Game Environments and 3D Cities in Video Games

Any video game must take place in specific virtual environments. Game-worlds constitute one of the most important aspects of the design process of a video game, as important as the design and creation of characters (Thompson et al 2007). At the beginning, game environments were just 2d pixelated representations that occupied only one single screen. First video games with smooth 3d scrolling graphics took place in indoor locations such as the dungeons in *Ultima Underworld* (Origin Systems and Electronic Arts 1992). Probably, the first video game that allowed the player to walk around a city using a smooth 3d real-time navigation system was *Legends of Valour* (U.S Gold and Strategic Simulations Inc 1992). However, in
this case the experience was also confined to one single, fantasy walled city whose complexity was limited by the available technology at that time. Technological advancements have allowed more and more complex game environments. Today’s computer technology and digital tools allow game developers to design and build extremely complex and detailed 3D game environments, and for this reason game designers and artists are increasingly looking to architecture - the term is used here in a broad sense, including both indoor and outdoor buildings and spaces - as a source of inspiration, research and study in order to create their 3D virtual places. 3D cities have been exciting and evocative settings for many video games, and the interest in these virtual urban settings seems always very high. People’s interest in the topic is demonstrated by the countless number of personal rankings of the best cities in video games that can be found on various websites. However, despite the broad number and variety of 3D representations of cities in video games, there is an almost total absence of publications that analyze and systematize them in a more structured way. For this reason, this research represents the first overview and way of systematizing 3D representations of cities in video games from an architectural point of view.

3. 3D Representations of Cities in Video Games as Designed Outcomes

3D cities have been represented in the video game media in several ways. Games such as *Half-Life 2* (figure 1 - right), *Dishonored* (Arkane Studios 2012) (figure 1 - left), and *BioShock* (2K Boston and 2K Australia 2007), all have their own cities or allow to build cities from scratch, such as in *SimCity 4*. However, after some gameplay sessions it becomes evident that their 3D representations are not simply addressed by pure aesthetical and/or technical purposes; there are several other aspects that should be considered such as: the game genre, the game storyline and the way the player interacts with the 3D virtual environment. Hence, there is enough evidence to say that 3D representations of cities in video games are the result of a complex design problem not solely limited to 3D graphic representation. In fact, every 3D city is a designed artefact, an outcome of a design process that shares many common points with the architectural design process. Every 3D city is the result of a creative process that starts with a conceptual design phase and finishes with the realization of the virtual 3D game environment. In the book titled *Half-Life 2: Raising the Bar* (Valve 2004b) - that describes the making of the award-winning video game - an entire book chapter (Chapter 05 - Welcome to City 17) is dedicated to the description of the design process of the iconic *City 17*, the dystopian city where part of the game takes place. Unsurprisingly, the role of research of references before designing and building any element of the game-world is emphasized in the design of *City 17*: the designers photographed real locations during field trips, searched material on the internet and books (ibid). Research and analysis of architectural precedents, field trips and site analysis have always had - and still have - an essential role in the architectural design process. Furthermore, both design processes are iterative and driven by conceptual drawings. The final result in both disciplines should take into account various aspects including the functional, aesthetic and emotional ones.
4. Systematization of the Main Features of 3D Cities in Video Games

What are the elements that influence the design and 3d representation of cities in video games? A possible way of reading and systematizing the 3d representations of cities is represented by the identification, selection and description of the main features that, to some extent, influence their final appearance. Obviously, the 3d representation of a city in a video game is something very different compared to a 3d city model used for urban design and planning purposes. In fact, whilst the use of the city model in this latter field is often limited to the visualization of a planning or design proposal, the final appearance of a 3d model of a city in a video game is a product aiming at providing an interactive experience that, conceptually, can be compared only with a built project in the real world. For the purpose of this study, four main features have been identified and selected, namely: interaction/gameplay, narrative, architectural and urban representations, and graphical representations. It is important to underline that each of these four categories can influence the other in many ways and by following any order; their contours are not sharp but blended. This multilayered reading has been supported by the analysis of various sources (books, magazines, websites, videos, video games) and the author’s experience in the fields of architecture and video games (both as a level designer and user). The game genre represents the first feature that characterizes a video game and it is one of the main elements that influences the 3d representations of cities and the way the player/user interacts with them. In fact, belonging to a specific game genre also influences the gameplay which is regulated by specific game mechanics.

5. Video Game Genre

Each game can be classified in genres in a similar way as movies or books. However, unlike movies and books, video games’ genres are not strictly linked with their settings. For example, all video game genres can have - as a setting - a historical or modern city. Hence, it is evident that video games’ genres are more connected with the experience that they can provide and the way it is provided. Generally, a video game can fit genres such as FPS (First Person Shooter), role-playing, action adventure, strategy, and city-building game. Half-Life2 is an FPS, Assassin’s Creed (Ubisoft 2007) an action-adventure, and SimCity 4 a city-building game.
6. Interaction - Gameplay

The two words are strictly linked together because what the player can do, namely how he/she interacts with the 3d cities, defines the gameplay. The interaction/gameplay is heavily influenced by the game genre which is often connected with a specific point of view. The 3d representations of cities can be observed using three main points of view, namely: first person, third person (observing the character from a predefined distance), and views that can be defined as god-like - in games such as SimCity 4 - because they do not follow a particular character but are aimed at monitoring and managing a big area (bird’s eye). Another important element affecting the interaction/gameplay is the game-world structure. Los Santos in GTA V (Rockstar North 2013) is a good example of what is called open world, namely a game-world structure that allows the player to free roam around the city, and choose how and when to pursue specific missions. By contrast, a linear-structure constraints the player to explore limited areas that are similar to linear paths. In Half-Life2 the player is constrained to exploring different parts of City 17, following a linear-structure, whilst in Dishonored, Dunwall’s structure - although limited - allows a higher exploratory freedom because for each mission it is possible to move within an area of the city and its districts following different paths; this last game-world type can be called semi-open world. In city-building simulations such as SimCity 4, the creation of the city structure is part of the gameplay. All the above decisions are also affected by the kind of experience that the developers want to deliver to the player. Gameplay choices can be also influenced by the storyline; narrative permeates several aspects of a video game.

7. Narrative Layers: Plot, Background Setting and Main Setting

The concept of narrative in a video game is multifaceted and multi-scalar because it influences many different aspects of the game and hence it can be interpreted in many ways.

7.1. PLOT - STORYLINE

Every game has a plot/storyline that defines and justifies the player’s mission and his/her actions. In Mirror’s Edge (EA Dice 2008), the story is set in a dystopian city of the near future where everything is controlled by the government. The player plays a runner that, to avoid the surveillance, is forced to use the rooftops of buildings and all the elements that can be found in those areas such as ventilation shafts and backstairs. With this plot, it is evident that in Mirror’s Edge the gameplay emphasizes a kind of stealth action, tactics and related use of spaces that are different from a video game that presents many openly gunfights such as in Half-Life2. This is why in Mirror’s Edge, the rooftops of high-rise buildings are generally more detailed (figure 2 - right) than the urban environment located at the streets’ level (figure 2 - left). With reference to 3d cities, it is possible to group, to some extent, the main narrative elements in two main layers: a first one that includes the elements that can be considered as part of the background; a second one that includes elements that define the main setting.
7.2. BACKGROUND SETTING

Usually, 3d cities are part of bigger settings that can be shown or only mentioned. Every game has (in a similar way to movies and novels) a background setting, namely a narrative (what) - that usually explains why the player is undertaking his/her quest -, a place (where) and a time (when) that serves as a frame for the main story. Also city-building games, such as SimCity 4, have their own settings. In general, a 3d city can be set in any time period - past, present and future - and any geographic location, both real and fictional (e.g. fantasy or sci-fi). The chosen place and time can be the theater of particular narrative events, such as the Third Crusade in Assassin’s Creed; all those components create a big frame for the player’s plot. In the publication titled Dishonored: The Dunwall Archives there is even a timeline that summarizes the main events of the world of Dishonored from -3000 until 1840 (Arkane Studios and Bethesda Softworks 2014). Sometimes, the 3d city itself can act as background setting and the player is allowed to explore only part of it. In Half-Life2, Dishonored and Bioshock we can only explore specific areas of City 17, Dunwall and Rapture but we can feel that those areas are part of bigger cities.

7.3. MAIN SETTING

All the elements that can be directly and closely experienced - visually and interactively - by the player can be considered to be the main setting. 3d cities - together with all their neighbourhoods and smaller areas such as alleys - are narrative virtual environments, because the way they are is the result of a series of previous fictional events that shaped the places in particular ways and the player can notice them during his/her explorations and actions. Dunwall, Rapture, City of Glass and City 17 are designed and built upon stories. All these cities have a strong narrative embedded in every detail - buildings and streets show traces of past events - and this contributes to the players’ immersion in realistic virtual cities. The idea of conveying narrative through the environment is also at the center of environmental storytelling (Smith and Worch 2010). However, architecture and places have always communicated, intentionally and unintentionally, stories and meanings.
8. Architectural and Urban Representations

All the features described in the previous paragraphs influence in a direct way the architectural and graphic representations of 3D cities in video games. Every 3D city is defined by an urban pattern, an architectural and urban representation, landmarks, and atmosphere, and all these elements can be graphically represented in several ways.

- **Urban pattern:** The urban pattern of the 3D cities in video games can be very diverse: a virtual counterpart of real cities - or at least portions of them - such as Manhattan in *The Amazing Spider-man* (Beenox 2012); fictional cities inspired by real places, such as Los Santos (Los Angeles) in *GTA V* or Dishonored’s Dunwall, inspired by London; Half-Life’s City 17 was influenced by the evolution of European Cities (Valve 2004b); completely fictional places located also in impossible locations such as the underwater city of *Rapture* in *BioShock*.

- **Architectural style:** Architecture is becoming increasingly important in supporting gameplay, settings and storylines. Also architectural styles can be influenced by real places, such as the architecture in *GTA V’s Los Santos* that are clearly inspired by the real Los Angeles. Architectural references (for example Victorian) from London and Edinburgh have being used to design Dunwall’s buildings. Art Deco architecture has been represented in a detailed and fascinating way in *BioShock’s Rapture*. The dozens of buildings that appear in *SimCity 4* have been inspired by American architecture of different cities and states.

- **Landmarks:** Every city has its own distinctive buildings that can be easily recognized by the distance. As in reality, landmarks in 3D cities are visual narrative architectural elements useful for orientation, to communicate specific meanings, reinforce the setting, and instill wonder and curiosity. In addition, in many video games, the landmarks play an active role in the gameplay and allow further levels of interaction. For example, in *Assassin’s Creed*, landmarks (such as towers and churches) are interactive distinctive features of the series. They can be climbed by the character and used as viewpoints to inspect the surroundings, orientate and admire the cityscape (figure 3).

- **Atmosphere:** Every virtual city is also designed with a character, an atmosphere that is influenced by the aspects previously described and other characteristics such as lighting and colours. The main aim of the atmosphere is to evoke emotions, increase immersion by creating a consistent and realistic world, and support a specific narrative. To achieve a mood, many concept sketches are produced at the beginning of each project, such as for *City 17* (Valve 2004b) and *Rapture* (Take-Two Interactive Software Inc 2008).
9. 3D Graphical Representations

All the previous design decisions related to gameplay, narrative and architecture affect the 3D graphical representation of the virtual cities. Digital modelling software (e.g. 3ds Max) and image editing packages (e.g. Adobe Photoshop) are the most diffused tools besides game level editors (e.g. Unreal Editor) in the creation of 3D cities. However, the same tools are being used to portray 3D cities using very diverse 3D graphic styles. Nowadays, there is an increasing interest in creating more realistic and detailed environments. Nonetheless, 3D cities have a variable level of detail (closer to reality or diagrammatic) visually represented in a realistic way - for example using textures and shaders based on pictures of real materials - or in artistic styles inspired by: comic books and cartoons, such as in SimCity 4 or Kingdom of Amalur: Reckoning (38 Studios and Big Huge Games 2012); illustrations and paintings, such as in Dishonored or Japanese anime style such as in Tales of Xillia (Namco Tales Studio 2013).

10. Final Diagram and Some Reflections

The table displayed below (figure 4) summarizes the main elements that address the representations of 3D cities in video games. It is evident that the graphic representations are tailored to interactive and narrative needs, hence these are used to support and strengthen the final interactive experience. As in any real-world design process, it is essential to have a final vision shaped by research and concept design. Furthermore, a study of 3D representations of cities in video games can also inspire alternative 3D visualizations for serious games in order to improve people’s awareness of the urban environment (e.g. for participatory design activities). Digital technologies should always support the development of a meaningful architectural and urban vision, also in reality. Studying 3D cities in video games could also improve our way of designing real cities. Nowadays in the real world, there is an emphasis on big data, quantitative analysis and efficiency, concepts, for example, close to the smart city movement that misses interesting and human-scale visions. A city can be efficient but at the same time alienating, and the projects produced during the Modern Movement have already demonstrated all the limitations of these kind of approaches. It is not a case that many new cities that are being
3D REPRESENTATIONS OF CITIES IN VIDEO GAMES AS DESIGNED

OUTCOMES

built around the world from Asia to Africa miss character and “look all the same” (Greenfield 2016). Maybe architects can learn something from the handcrafted 3D cities in video games where qualitative aspects and meaningful experiences are the final aims. The idea that 3D cities in video games can positively influence the way we look and design real places is being also discussed on popular newspapers such as The Guardian (Hoad 2014) and this interest is supposed to grow, especially with the diffusion of Virtual Reality (VR) technologies and more complex game-worlds (that will include a better artificial intelligence).

<table>
<thead>
<tr>
<th>Video Game Genre</th>
<th>FPS, action-adventure, city-building, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gameplay/Interaction</td>
<td>Interactive actions: walk, run, jump, drive, talk, fight, etc.</td>
</tr>
<tr>
<td>Player’s point of view</td>
<td>First person point of view</td>
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<tr>
<td></td>
<td>Third person point of view</td>
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<td></td>
<td>God-like view</td>
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<tr>
<td>Game-world structure</td>
<td>Open world</td>
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<td></td>
<td>Semi-open world</td>
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<td></td>
<td>Linear world</td>
</tr>
<tr>
<td>Narrative layers</td>
<td>Plot/storyline</td>
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<tr>
<td></td>
<td>Background setting</td>
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<tr>
<td></td>
<td>Narrative, Temporal, Geographical, Urban</td>
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<tr>
<td>Main setting</td>
<td>Cities, quarters, alleys</td>
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<tr>
<td>Architectural and urban</td>
<td>Urban pattern, architectural style, landmarks, atmosphere</td>
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<td>representation</td>
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<tr>
<td>Graphic Representation</td>
<td>Level of detail</td>
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<td>Reality, comic books, cartoons, illustrations, paintings, Japanese anime, etc.</td>
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Figure 4. Summary of the main elements influencing the 3D representations of cities in video games (Table source: personal archive of the author).

11. Conclusions and Future Developments

This paper dealt with 3D representations of cities in video games, and identified, described and proposed a set of concepts that can provide a way of reading and systematizing them. Despite the increasing economic, cultural, artistic, social and technological importance of video games, scholars in the architecture field are still limiting their research to game technologies applied to general visualization purposes. The main aspects that define 3D representations of cities in video games have been summarized in a table that fosters discussions and helps other scholars to explore the topic in further research. 3D representations of cities in video games are the result of a complex design problem driven by a vision that has as final aim the creation of a meaningful interactive experience. This research represents a further step of a larger and long-term project that intends to investigate aspects of video games that can bring innovative approaches, theories and reflections in architecture and related fields.

References


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