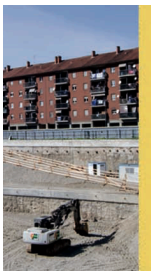

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Video Games and Urban Visions

Virtual spaces and simulated worlds

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It has been calculated that in the Renaissance, the inhabitant of a city like Florence or Venice could observe up to 500 images throughout his life. Many of these were representations of cities.
Mechanical reproduction systems, followed by photography and finally the cinema, have greatly increased the availability of images. Even in this case, the subject was often the city. With digital technology, quantity no longer poses a problem. It is rather quality that poses a problem. I am not speaking about graphic quality, which is in constant increase, but about the one which ties images to its significance. From this point of view, a parameter of judgment could be the time with which the eye can linger on a single image. Paradoxically "accessory" images (such as icons, web-banners or start up screens of software), or "container" images (such as the home page of web sites or smart devices) become important. Starting from this thought, and leveraging on the concepts of form, duration and motion, the contribution will cover the city models used as a backdrop of the video games. Images intended to influence the collective idea of urban space in a similar manner to what had been done in the past, by the seventeenth century etchings of Rome or photographs taken by the *Fratelli Alinari*.

Keywords: Virtual Space, Game Environment, Point of View, Image of the City, Gamification.

1. Introduction

This paper analyzes and evaluates how the image of the city has been represented in video games since the late seventies. Ever since their invention, video games have been undervalued, ignored and even criticized. Nevertheless, they condition the way in which one perceives and imagines urban space. Together with the visual arts (paintings, video, cinema, etc.), video games and their virtual environments, have been able to predict and foresee architectural developments and city design. As a result, video games affect and influence ones perception and sensitivity towards form, space and architecture.

2. Video games and collective imagery

The idea of the city, present in the imagination of each individual, develops progressively thanks to collective imagery. These images can be divided into three main categories:

- Direct images: urban spaces that have actually been seen, traversed and inhabited;
- Indirect images: observed representations of the city (drawings, paintings, photographs, film images, etc.);
- Verbal images: generally non-visual images, capable of stimulating the mind into producing mental images (written texts, narratives, etc).

In the past, the image of the city was formed mainly through direct images. It has been calculated that in the Renaissance period, the inhabitants of a city like Florence or Venice could observe approximately 500 representations of their city throughout their life time: in frescos, paintings, drawings and manuscripts. However, this number of representations has increased progressively over time with the development of new technologies. Today we can observe up to 500 different images in a few minutes or even a few seconds if we are at the movies, in front of the television or a computer game.

Although video games have been criticized over the years, it is important to note that they play a significant role in the formation of children and adolescents. These game players are sub-consciously storing a wealth of images that they will continue to refer to through the course of their lives. According to data published on www.gamesvillage.it and www.videogiochi.coninternet.org, 88% of Italians, between the ages of 11 and 18 use video games on a daily basis. 9% of these children spend less than an hour a day in front of a computer screen while 56% spend up to two or three hours per day. It follows that 24% of young Italians spend from 3 to 5 hours per day playing computer games, whilst the remaining 11% can spend more than five hours per day on this activity. These individuals, who may go on to govern and design urban spaces will have spent a substantial part of their lives playing video games. Furthermore, video games and architectural computer graphics have evolved simultaneously. In both cases, they have progressed from a conceptual representation in wireframe to a rudimentary attempt at shading, until finally; an increasingly realistic representation has been achieved.

3. Early non-commercial experimentations

The first video game was created by Alexander S. Douglas, in 1952, as part of his thesis on human-computer interaction. It was called *Noughts and Crosses*, a reproduction of the popular "pen and paper" game also known as *OXO* or *Tic-Tac-Toe*. *Noughts and Crosses* is a purely logical game, with no reference to an effective spatial configuration.

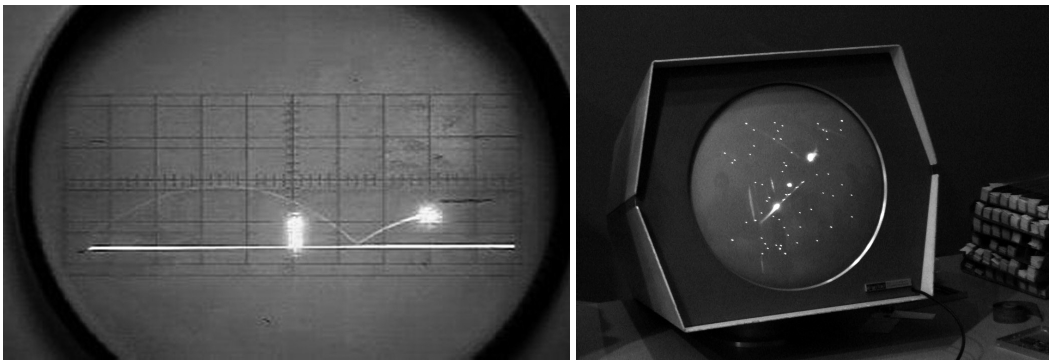


Figure 1. *Tennis for Two (1958) on the oscilloscope screen.*
Figure 2. *Spacewar! (1961) on a Programmed Data Processor-1. Spacewar! is the first video game to present a virtual environment with real-world physics and real time situations.*

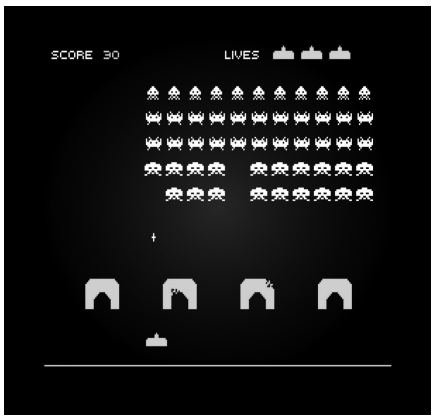
The oldest video game that simulates an actual physical place is called *Tennis for Two*. The game was created in 1958, by William Higinbotham, using an oscilloscope and a computer able to carry out ballistic trajectory calculations.

In *Tennis for Two*, the tennis court appears in a rudimentary lateral view: a horizontal line (the court), a vertical line (the net), a dot (the ball) and two invisible rackets, controlled by the players.
In 1961, Steve Russell and a group of MIT students created *Spacewar!* It was the first game to be programmed for the minicomputer *PDP 1* and was intended for market distribution. *Spacewar!* is a game for two people, each player must try to destroy their opponent's spaceship by firing missiles. The game is set in outer space and allows each player to carry out three functions: to rotate the spaceship, to accelerate and to shoot.

4. The image of space in the Arcade Era

The commercial development and distribution of video games transpired approximately a decade later when home video gaming consoles were introduced. In 1972, the *Magnavox Odyssey* console was released. The console could be connected to a standard television set and offered games essentially identical to *Tennis for Two*. Subsequently, the *Atari*, founded in the same year, also launched a clone of *Tennis for Two*, called *Pong*. Next came the growth of platform *Arcade* games thanks to home consoles and coin-operated video games found in amusement arcades. Games like *Space Invaders* (1978), *Asteroids* (1979), *Battlezone* (1980), *Defender* (1980), *Pac-Man* (1980) and *Q*Bert* (1982) marked the adolescence (and the collective imagination) of millions of teenagers. These game players, now in their 40's and 50's, occupy and will occupy influential roles in government and city design.
The aforementioned video games, were characterized by a symbolic or even abstract graphic. The only objective was human-computer interaction, where basic actions based on hand-eye coordination and reflexes were performed: moving, avoiding obstacles and shooting.

Space is purely topological in the design of these games. Here the relations of contiguity apply but there is no correlation to a real-life environment. Aside from *Battlezone* (perspective is implied in its fictitious background), the majority of games at the time, used a side or overhead view. The player is outside the virtual environment, looking in.



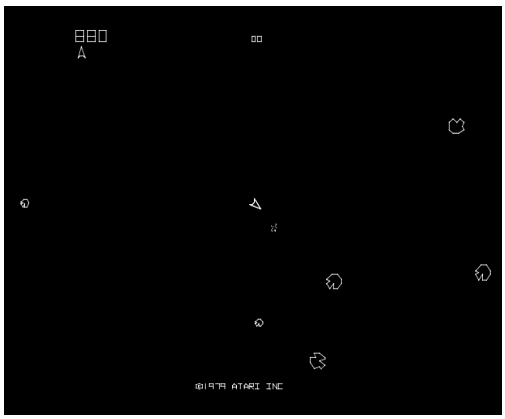


Figure 3. *Space Invaders (1978), the oldest and most famous fixed shooter.*
Figure 4. *Asteroids (1979) is a revolutionary video game. It introduces raster graphics and enables displacements, rotations and acceleration. Above all, it conceives the screen as a section of a spherical space, allowing output from one side and input from the other.*

The use of axonometrics symbolizes an important advancement in space configuration. Axonometry is widely used in games that focus on logic and spatial relationships rather than on action. The first games to use isometric orthogonal axonometry divided space into blocks that correspond to precise volumetric portions. The infinity perspective gives the player a sense of detachment from the virtual environment and total control of what happens in the game.

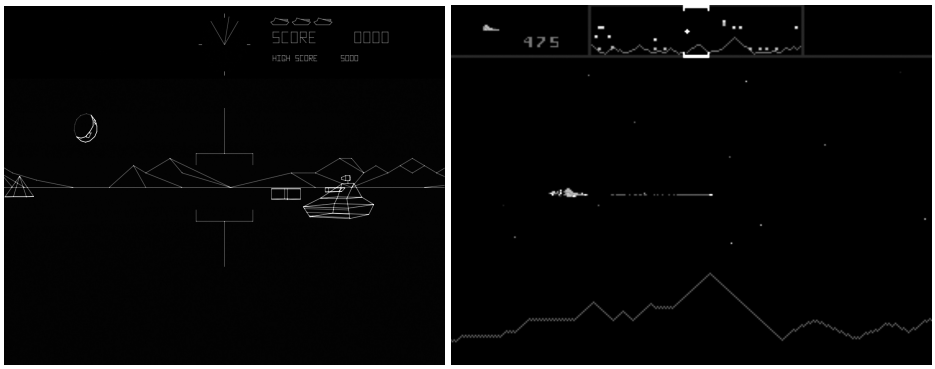


Figure 5. *Battlezone (1980) is a vectorial combat simulator. It is the first video game with a wireframe view; a first-person perspective and a color overlay (red and green) on a horizontal black and white screen.*
Figure 6. *Defender (1980) is the first two-dimensional side scrolling shoot 'em up game. The environment is toroidal: while moving in one direction for a long time you will find yourself back at the starting point.*

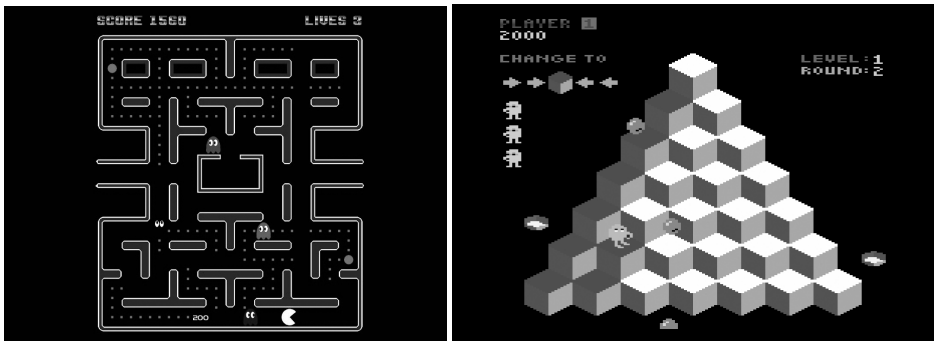


Figure 7. *Pacman (1980), the most imitated video game, represents a contemporary revival of the archetypal labyrinth.*
Figure 8. *Q*Bert (1982), based on 2D graphics, here the geometric properties of the isometric orthogonal axonometry are applied.*

5. Overcoming the fixed screen: the conquest of 3D space

The mid-eighties gave rise to innovative developments (away from the fixed screen that characterized *Arcade* style games) that established a new generation of video games. *Super Mario Bros*, a 2D platform game, was developed in 1985 for an 8-bit console. The base of the screen starts off in real time from right to left and the player moves from the left side of the screen to the right in order to reach the end of each level. This style of animation is made possible by processing individual elements called sprites. Each sprite is made up of 64 squares, formed by 8x8 pixels, reassembled in real time to obtain the various sets of images.

Over the next decade, scrolling games became increasingly popular, especially "hack 'n slash" and "beat 'em up" formats. The perception of space within this format, is favored by a lateral pseudo-perspective. The characters can move in different directions within their virtual environment, in accordance with a set of three Cartesian axes.

These innovative design improvements increased the quality of video game graphics, but they were only applied to two-dimensional environments. Nevertheless, the revolutionary *Super Mario 64*, developed in 1996, completely changed the configuration of game play. The sequential scenes found in earlier game formats were replaced by a branched structure. The individual layers of the game consist of three-dimensional environments where the player can move around freely. Thus, the *Super Mario 64* video game realized a triumphant three-dimensional archetype.

Figure 9. *Super Mario Bros. (1985) in its characteristic environment.*
Figure 10. *Final Fight (1989) is a side-scrolling beat 'em up game set in a fictional town named Metro City.*
Figure 11. *Super Mario reaches Princess Peach's castle. Screenshot from Super Mario 64 (1996).*

6. The virtual camera and the exploration of the space in second-generation video games

The primary difference between the first-generation and the second-generation video games is that the first is based on a two-dimensional image (fixed or scrolling screen), the second explores in real time a three dimensional space using a series of virtual cameras. For example, there are three virtual cameras able to explore the world of *Super Mario 64*. The first one is the typical camera behind the avatar in semi-subjective. The second one is a fixed camera able to zoom or change the height of the point of view always in sync with Mario's movements. The third is the most innovative; it provides a view separated from the avatar and it able to supply aerial views of the surrounding space even if Mario stops.

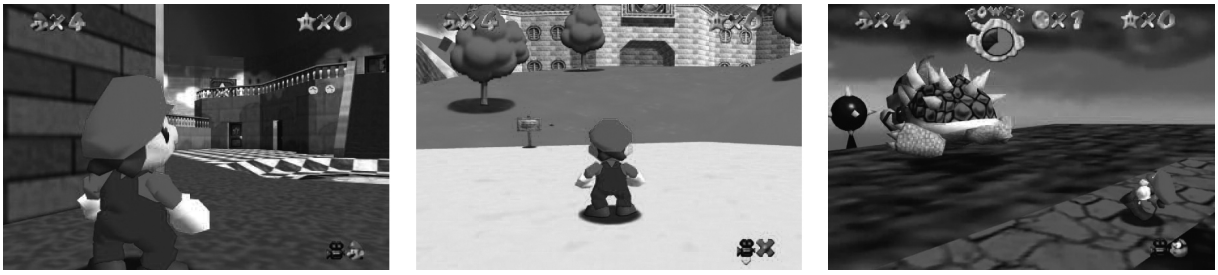


Figure 12. *The three positions of the camera in Super Mario 64: behind the avatar (following camera), longer behind and higher (predefined viewing frame) and very high up (overhead view).*

Briefly, the types of virtual camera normally used in video games are six:

- *First person point of view*, that simulates the direct vision of the avatar;
- *Following camera*, with a point of view behind the avatar;
- *Overhead view*, that allows an isometric view;
- *Predefined viewing frame*, fixed or moving;
- *Free camera*, in which the point of view can be moved freely in realtime;

Side-scrolling camera, typically used in the first games beat 'em up and hack 'n slash in the early eighties and now again popular due to the many fans of vintage style.

7. The combination Genre - Space Visualization

Although each classification into genres is reductive, we'll try to combine some different modes of space exploration with some different genres of video games (of course, as already mentioned, many video games use alternately three or more cameras).
Action video games are based on the fast-paced action, on combat, on the speed of reflexes. In this kind of game reasoning and logic may have a marginal role, or may be absent. There are several action games

subcategories. Among these: *Beat 'em up*, *Platforms*, *Maze*, *Shoot 'em up*, *Simulation* (football, boxing, racing simulator, flight simulator and many others).
As already mentioned, Beat 'em up games prefer a side-scrolling view (Fig. 10); Platform games an overhead view; Maze games a predefined viewing frame; Shoot 'em up games a first person point of view or a following camera (third person). Third person camera allows one to observe the avatar from behind the shoulder or from behind his back; this ensures a better view of the surrounding area and therefore a better control of some actions. The drawback is a lower immersion in the game world and a lower accuracy in some actions, especially the precision pointing and the shooting.

Figure 13. *Call of Duty (2003-2013) is a first-person and third person shooter. The only goal is: shoot!, but the plausibility of the characters and the urban environment is very accurate.*
Figure 14. *Mirror's Edge (2008) is set in an alienated and exasperatingly ordered metropolis, seen through a first person point of view. The lack of head-up display makes the experience even more immersive.*

Adventure video games are based on storytelling rather than action and quickness of reflexes. Among these, the most interesting for us are the *Graphic adventure games*. Graphic adventure games, in which space exploration is performed through movement and mouse clicks; running on specific points of the screen, it allows the action to evolve. This sort of game is characterized primarily by very sophisticated 3D graphics and by the modeling of realistic three-dimensional environments. It uses mainly a first person point of view.
Action-adventure video games combine elements typical of adventure games with elements of action games. Some parts of the game are thus based on actions as: space exploration, interaction with other characters, solving puzzles; other parts are dedicated to real-time interactions based on reflexes and quick movements. The point of view is variable and depends on the game situations: it can switch from the panoramic view, the subjective, the third person, scrolling view or even axonometric.
Role-playing video games and *Strategy video games* reproduce the typical elements of classic analogical games where it is necessary to perform a task: travel, construction, exploration, solution of an enigma. The point of view is usually a subjective view or third-person view, which is often added to a bird's eye perspective or orthogonal axonometric.

Figure 15. *A screenshot from Myst (1993-2005), graphic adventure based on well groomed predefined pre-rendered viewing frames enriched by Quick Time videos.*

Figure 16:.*Following camera in Assassin's Creed (2007). It is an action-adventure game characterized by photorealistic rendering of architecture and cities actually existing.*
Figure 17. *Assassin's Creed's free camera. The game uses all visualization systems, with the prevalence of third person following camera.*

Figure 18. *Ico (2001-2006) is a refined action-adventure. Its graphic minimalistic and full of references to painting received many awards. The control of the game is with a third person fixed camera that restricts exploration but enhances the perception of the city, architectures and environments.*
Figure 19. *The screen of Warcraft II (1995). The game was created in 1993 and always keeps a steady isometric view from the top. Like nearly all strategic games, next tho the main screen appears the head-up display. It shows all the information necessary to a better development of the action and additional views of the environment.*

Figure 20. Sim City, role-playing game based on the governance of a city, was created in 1989. First using a planimetric view, after a few years it was replaced with an isometric view, increasingly rich in detail and realism.

8. Interactions between video games and architecture

The way to represent the space of the city in video games and architecture are similar. Anyone using video games is commonly accustomed to display space on a monitor in conical and cylindrical projection, to quickly change the point of view, to move interactively in the virtual space using mouse or joystick. There are many similarities between video games and various other aspects of reality. Video games affecting daily living; many of them have inspired graphic novels, movies and even romances. Of course they also involve the work of architects and city planners such as Marcos Novak, Nox or IIT Chicago Student Center by Rem Koolhaas.

Briefly, video games are increasingly taking on the physical characteristics derived from the real world: hyper realistic modeling of space, use of photographic textures, insertion of laser scanner acquired models, simulation of weather effects, touch, sound and smell sensations, interaction between corporality and software, augmented reality, and so on. At the same time, architecture is dematerialized and becomes increasingly virtual: including digital elements and effects, recreating cybernetic metaphors, mentioning the cyberspace, mixing reality and virtuality, showing the signs and the typical forms of video game's virtual world.
It starts to use the word "gamification": it is the use of games methods to improve the degree of involvement and participation of customers of a specific service or public space. Gamification is a word that comes from game theory, analyzed by the world of marketing and business; it can be applied in urban and architectonic scale and, therefore, it will involve even more the work of architects and city planners.

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