Virtual Immersive Models for Viewing Social Science Fiction in European Cinema

Federico O. Oppedisano, Daniele Rossi

Abstract

The paper illustrates the scientific assumptions and the results of a didactic activity aimed to explore the potential of interactive and immersive dynamic perspectives by experimenting with new virtual reality applications for the enhancement of cultural heritage. In particular the study focuses on the enhancement of some European sociological science fiction movies. In this sense, immersive virtual reality, experimentally, has been used to realize and explore models capable of representing the quality of the space and emotional conditions present in the selected movies.

Keywords: Interactive Walkthrough, 3D model, Sci-Fi movies.

Virtual reality as an "immersive" culture

Stimulated by the film and video game industry, contemporary visual culture has been enriched in recent years with new technological opportunities capable of expanding spectators'/observers' perceptual experience. The computerized three-dimensional image, with its goal of representing space precisely and reliably, generates an illusion of virtual space perceived so completely that it is experienced in a state of total cognitive immersion. What changes, therefore, is the way of viewing things: a static vision strongly conditioned by the canons of perspective has yielded to a continuous, changeable view that simultaneously makes users participants in everything that develops within the scene. The cognitive conditions change but above all the spaces of investigation and the potential of the interactive and immersive dynamic perspective change [Migliari 2009]. These potentialities, immediately intuited and presided by the video-gaming industry, now open themselves to different research fields, prefiguring different scenarios able to broaden their application horizons.
In this framework, a didactic research was started to verify new applicative declinations of immersive virtual reality to stimulate and give attention towards cultural dimensions that are alternative to the recreational ones. The aim of the experimentation was to promote, through immersive virtual reality, a cultural reality identified among those closest to the virtual dimension, namely cinematography. Indeed, the cinematography, imposing

itself through dynamic figurative levels, is able to determine, as Roland Barthes states, imaginaries in which the spectator identifies 'narcissistically'. Regarding the cinematographic image, Barthes affirms: "he catches me, he kidnaps me: I glue myself to the representation, and it is this glue to found the naturalness (the pseudo-nature) of the scene filmed […] the Real, for his part, knows only distances, the Symbolic masks; only the image (the Imaginary) is 'close', only the image is 'true' [Barthes 1994, p. 148].
Among the film genres, science fiction has been singled out to reinforce the proximity between cultural dimension and immersive scenery. It is directly linked to virtual reality, since science fiction is above all, as Lino Aldani states: "a form of representation that establishes, through the exceptionality of the situation, a different relationship with things" [Aldani 1962, p. 17]. Among the sub-genres of science fiction, the so-called sociological science fiction developed around the 60s, especially in Europe, is that which presents aspects of particular cultural importance, because it offers the possibility not only to hypothesize the shape of the future but also to reflect on the condition of present.

Social science fiction as a cultural paradigm

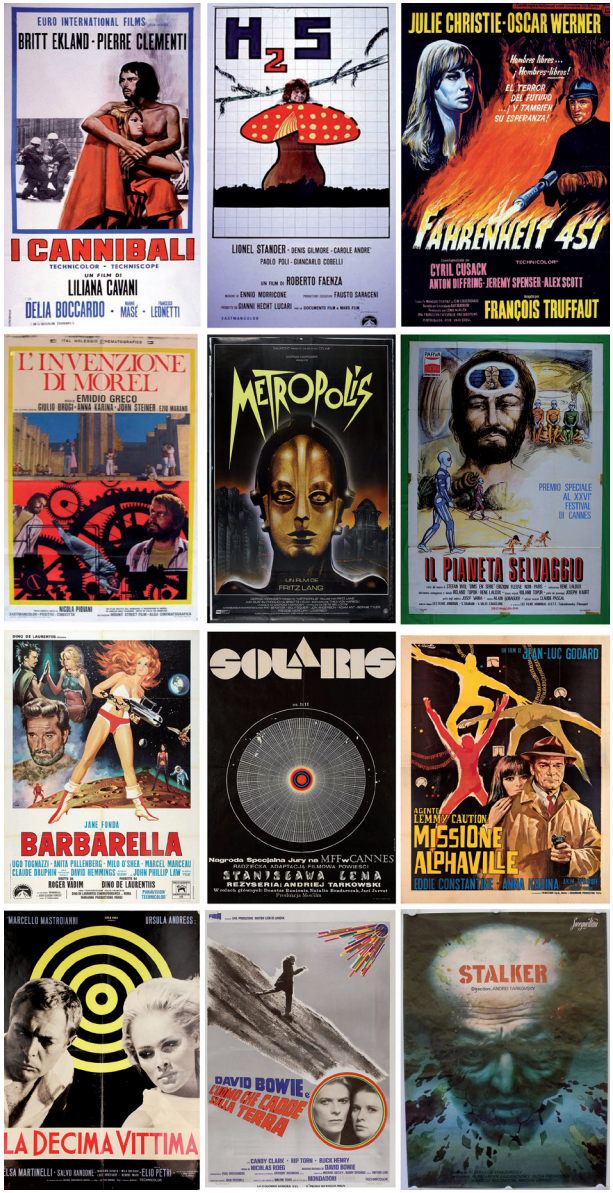
Social science fiction is largely related to science-fiction literature, which in turn grew out of utopian narratives–in large part *voyages extraordinaires*–but also the writings of Plato, Lucian of Samosata, Thomas More, Cyrano de Bergerac, and Jonathan Swift [Suvin 1985, p. 488]. Despite this, there are rare cases in which literary criticism has conferred on science-fiction novels the dignity of a work of art, both because its popular roots go back to Gothic fiction and because its spread was promoted through low-cost magazines and printing on low-quality paper [1]. The two main examples relating to scientific progress can be found in the fantasy novels of Jules Verne and H. G. Wells. The former enthusiastically gathers the possibilities of progress and introduces the scientific factor as an assumption in the fantasy and adventure narrative to make the stories more plausible [2]. Wells, on the other hand, concentrates on the theme of injustice and social inequality, proposing distorted future scenarios. In some way, the spirit of his stories reflects fears related to progress, which would be transformed into reality with the First World War, marking an end to the optimistic vision of science that had characterized the nineteenth century in Europe.
If the narrative overseas is characterized as escapist literature, the European narrative appears to adhere to the anti-utopian vein followed by Wells. The themes of the stories revolve around individual and societal problems. The narratives do not concentrate on the battle between good and evil or the description of intergalactic wars, but on the problems that progress meant for society and the individual such as pollution and overpopulation [3]. Science fiction, therefore, becomes a metaphor for life and a way of denouncing deep contradictions and social alienation [4].
The genre began to develop around the 1960s and so-called social science fiction, which, influenced by the radical changes in customs and society, proposed stories that set the technological aspect as the narrative backdrop to concentrate on investigating 'inner space' [5]. The unconscious became the terrain to experiment with new narrative models such as the characters' internal monologues, which are well suited to recounting the mental imbalances of humans in society [6]. This new dimension of science fiction in film interested various filmmakers who were not specialized in the genre, but rather used the metaphor of science fiction to denounce possible societal trends and made full-length films largely inspired by literature whose content in the cinematographic panorama of the era was innovative and particularly important. French New Wave is one example. Influential films include *Alphaville* (1965) by Jean-Luc Godard [7], *La Jetée* (1962) by Chris Marker, and *Fahrenheit 451* (1966) by François Truffaut. Other notable films include *Barbarella* (1968) by Roger Vadim, *Solaris* (1972) and *Stalker* (1979) by Andrej Tarkovskij, and *The Man Who Fell to Earth* (1976) by Nicolas Roeg, as well as animated films such as *La planète sauvage* (1973) by René Laloux.
In Italy, the social aspect of science-fiction films seemed to be a more of an underground phenomenon. It includes, in many cases, little-known works such as *Omicron* (1963) by Ugo Gregoretti, *The 10th Victim* (1965) by Elio Petri, *H2S* (1968) by Roberto Faenza, *Colpo di stato* (1968) by Luciano Salce, *The Tunnel Under the World* (1969) by Luigi Cozzi, *I Cannibali* (1970) by Liliana Cavani, *N.P. Il Segreto* (1971) by Silvano Agosti, *L'Invenzione di Morel* (1974) by Emidio Greco, *I Viaggiatori della Sera*

(1979) by Ugo Tognazzi, and *Il Seme dell'Uomo* (1969) by Marco Ferreri.
Despite being vastly different, these art films were created through experimentation. They are denoted as science fiction certainly not for their scenography, but rather for the assumptions inherent in the narrative. Due to the weakness of the production means, they present particularly original linguistic connotations in the panorama of the cinematographic culture of the time.

Experimentation. *Inside Sci-Fi*

A social science-fiction film [9] was assigned to each student [8] (fig. 1) and it was taken from a list created by the teachers. The goal was to study and develop a three-dimensional digital model that could be explored immersively. The model had to be capable of evoking the sense and most important meanings that characterize the feature film, representing the visual tone, atmosphere, and colours without yielding to hyper-realistic or imitative inclinations, which would lead to the simple realization of scenographic models.
The science fiction cinema thus becomes a cultural paradigm that can find immersive virtual reality in new forms of divulgation and knowledge in a new visual dimension. Virtual reality is able to make the atmospheres and the tone that characterize the works of this kind 'tangible', using the science-fiction metaphor, in order to urge the public to reflect on reality.
Based on these assumptions, the 3D models created by the students aimed to overcome the purely expository limits of immersive reality and the simple exploration of artificial spaces. Rather, they were designed as experimental formulas capable of stimulating users to discover the content of cinematographic works. Therefore, manneristic scenographic reconstructions were avoided. Instead a path was constructed in which users are invited to retrace and connect the elements of the work redesigned in graphical and auditory forms. These spaces condition the observer's view, which is fragmented into an infinite number of possible viewpoints, thereby contributing to the definition of a logistical dimension of the image. Walking, guiding, and looking are actions that always imply spatial measurements.
In this operational framework, the interactive and immersive dynamic perspective drew on the visual con-

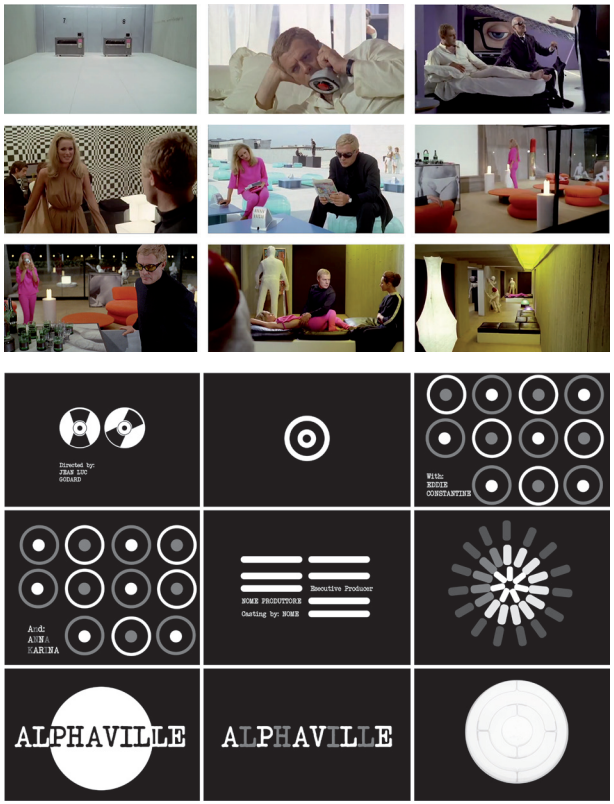
Fig. 1. Posters of the movies for which an immersive virtual model has been created.



sciousness of video games, a three-dimensional representative/exploratory mode by which and in which 'another' perception of space-time is reached wherein each element seems to be fluidly connected to all the others. This evolution modifies both our conceptual baggage and the experiments in application deriving from it. Our tendency towards abstraction is increased, as is the possibility of managing a new complexity linked to interaction and movement.
Each student therefore designed and developed a virtual environment in the form of a navigable 3D model based on a careful preliminary study of the director's style, the characteristics of the work and the historical moment when it was made. Each film was deconstructed to define the spatial areas and analyze the graphical apparatus.
These preliminary reflections were concretized in a series of summary graphical works such as: key frames, colour palettes, scenic objects, or artistic references. The key frames were collected on a moodboard containing visual fragments and graphical suggestions from the film. The colour palette was used to analyze the graphical spectrum and infer the chromatic code to use for the backgrounds, materials, and textures in the 3D model. Finally, the selection of props or artistic references allowed some strongly suggestive iconic objects present in the film to be included in the model (fig. 2). Indeed, as mentioned above, since they are characterized by a social connotation that does not glamorize visual effects, the selected films required some graphical references that were easily recognizable and capable, for example, of recalling a determined historical period [10].
Once the first step in graphical analysis was complete, the design and 3D modelling of the settings was addressed. Modelling techniques for real-time rendering were used, thereby favouring the use of graphical textures to add micro-geometrical data rather than weighing down the model with unnecessary polygons. Following this, the virtual environment to be explored with the interactive and immersive dynamic perspective was prepared. To this end, a hardware/software system composed of the graphical engine Unreal Engine [11] and the Oculus Rift [12] virtual-reality head mounted display was used. In this phase, the number of polygons in the 3D model was further optimized to lighten the model and guarantee fluid navigation greater than 60 fps. The setup of the scene was then finalized by adding an illumination system deriving from the preliminary analysis and prefigured in some initial concept arts (fig. 3) and using particulate systems and visual effects to simulate the atmosphere.
These environments were then validated and experimented with using the HMD device for virtual-reality vision with the Oculus Rift. The representative and narrative qualities were verified and the degree of immersion in relation to the scale of representation was measured.

Fig. 2. Board containing props and artistic references regarding La Decima Vittima (1965) by Elio Petri (student: Nicola Brucoli).

Fig. 3. Graphical element for the immersive 3D model of Alphaville (1965) by Jean-Luc Godard (student: Livia Barone).



Project methodology: the immersive virtual environment of Andrej Tarkovskij's *Stalker* film

In order to clarify the methodological process followed for the configuration of immersive virtual environments related to selected cinematographic works, we report in this section the case study related to the film *Stalker*, directed in 1979 by Andrej A. Tarkovskij. This analysis is suitable, for poetics and contents, to describe and exemplify some of the analytical and generative processes mentioned above and to briefly illustrate the methodologies adopted in relation to the designed and prototyped artefacts.
Preliminarily, we conducted a study aimed at framing the historical-cultural context in which the movie was shot, placing it within the artistic research of the director. Synthetically, the figure of Andrej A. Tarkovskij director, screenwriter, editor and film critic, moves within different genres, proposing to the viewer his ascetic and personal vision of the world. Among his movies, recognized as masterpieces, in addition to *Stalker* we also remember another sci-fi movie: *Solaris* [13], and *The Mirror*. In these movies the director places in the foreground the profound search for the inner world of man. For Tarkovsky it is important to make a journey into psychology, the philosophy that nourishes mankind: "within the literary and cultural traditions on which his spiritual foundations rest" [Tarkovskij 1988, p. 181]. The science fiction for Tarkovsky is a pretext, it represents only the starting situation, which it helps him to "define in a more plastic and sensible way the moral conflict" [Tarkovskji 1988, p. 178] fundamental in the movie.
Stalker is based on the novel *Roadside Pic-nic* written by Boris and Arkadij Strugackij [14]. It tells about an expedition towards a post-industrial landscape in search of a mysterious Zone carried out by a writer in search of inspiration and a professor in search of scientific discovery, and led by a figure known as the *Stalker*. This figure, says the director, is apparently weak, but in reality "invincible because of his faith and his willingness to serve men" [Tarkovskij 1988, p. 166].
In the Zone there is a room in which the most intimate desires of people can be realized, a place in which the life of individuals can be radically changed [Bordwell, Thompson 1998, p. 443]. The area is a no man's land "a place where the norm, the rule that the border establishes is no longer worth, the wild land where everyone has to look after himself and everything becomes possible" [Zanini 1997, p. 15]. In this sense, for Tarkovskij, the Zone "does not symbolize anything: the Zone is the Zone, the Zone is the life: crossing it or breaking it, or resisting. If man resists it depends on his feeling of his dignity, on his ability to distinguish the fundamental from the passenger" [Tarkovskij 1988, p. 178].
Tarkovskij writes: "In *Stalker* I express my thoughts to the end: human love is the miracle that can be opposed to any arid theorization that there is no hope in the world. […] In this film I wanted to emphasize that specifically human element, which can not be dissolved and decomposed, which crystallizes in everyone's soul and constitutes its value" [Tarkovskij 1988, pp. 177-178].
The Russian musician Eduard N. Artemyev has edited the soundtrack, writing tracks that combine electronic sounds coming from a synthesizer with those of musical instruments typical of the Middle-Eastern area. In Tarkovskij's work the soundtrack has always played a fundamental role: for the director in fact "Music can be used to produce a necessary distortion of the visual material in the audience's perception, to make it heavier or lighter, more transparent, subtler, or, on the contrary, coarser. By using music, it is possible for the director to prompt the emotions of the audience in a particular direction, by widening the range of their perception of the visual image. […] Perception is deepened" [Tarkovskij 1988, p. 145].
This first phase, dedicated to the historical-cultural analysis of the movie, proved to be of fundamental importance for defining the parameters of representation of virtual environments. Subsequently, some specific analyzes of the most significant scenes of the film were conducted in order to understand the visual tone of the movie in both color and perceptive terms. From this analysis we have elaborated, on the one hand, a color palette (fig. 5) to reveal the chromatisms of dark atmospheres consisting largely of cold colors, with a dominant color that moves gradually from gray to gradations of blu and yellow; on the other hand, a moodboard was created (fig. 4) in which frames were taken with shots that use medium fields to show the external spaces and the Zone, as

Fig. 4. Moodboard regarding the movie Stalker (1979) by Andrej Tarkovskij (student: Nunzio Liso).

Fig. 5. Color palette from Stalker (1979) by Andrej Tarkovskij (student: Nunzio Liso).

well as close-ups showing the expressions of the protagonists and some of the symbolic elements in the author's poetics such as water, fire, fog, light. Similarly, the analysis of the sound landscape has allowed us to identify and sample three types of diegetic and extradiegetic sounds: those relating to the soundtrack, those relating to ambient noise, and finally the human voices of the actors.
This set of elements made up of sounds, colors and symbolic elements have become the main parameters through which to set up the construction of the immersive audiovisual experience of the virtual environment.
These analyzes have guided the definition of a spatial and emotional path in which three-dimensional geometric components, synesthetically, must be accompanied by a sequence of emotional states capable of leading the visitor into a slow wander able to evoke the sense of 'journey' of the three protagonists of the movie seeking the Zone.
The designed walkthrough, together with some other artworks (concept-art and storyboard) (figs. 6, 7) allowed to define the gameplay (fig. 8) of the immersive 3D model. In the design of a video game the gameplay represents the set of spatial and interactive conditions that influence the gaming experience of the single user. The artwork shows all the places can be visited and the systems of interaction with them. Interfaces and triggers are dislocated on a schematic representation of the model, in order to validate the possibilities of 'playing' and the appropriateness of the displacements in relation to the possible interactions. Three main places, corresponding to the levels of consciousness of the three protagonists, are organized around two distribution corridors that intersect at the land point (the spot where the user starts the immersive experience).
Within these environments, three triggers and six video outputs complete the exploration experience allowing the visitor to immerse themselves in the last environment, an unlimited space in which to let oneself fall, relaxing, releasing the accumulated emotional tension and participating in the drafting of the emotional narration necessary to make the final experience strategic and convincing.
Technically, once the gaming experience has been outlined, the use of polygonal modeling systems

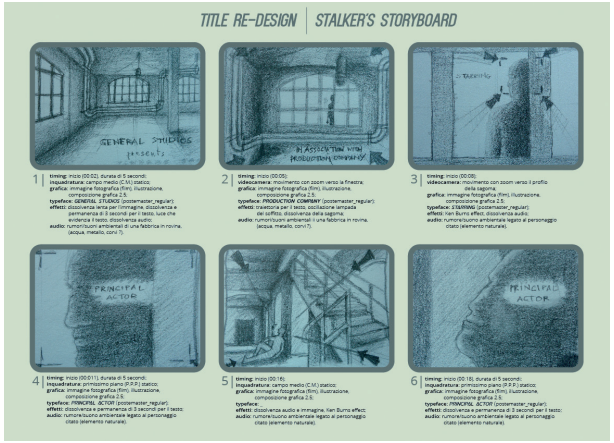


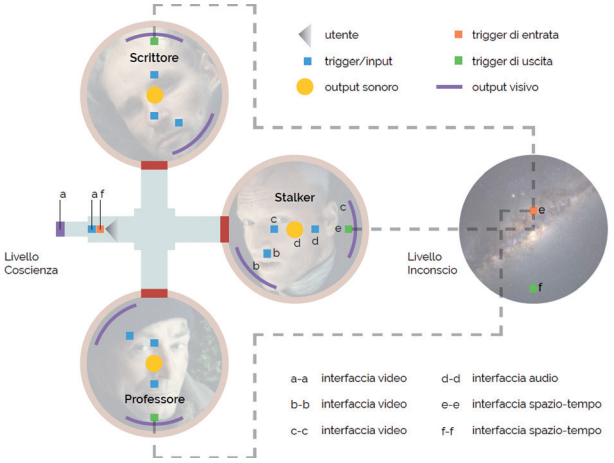
Fig. 6. Storyboard regarding the immersive 3D model of Stalker (1979) by Andrej Tarkovskij (student: Nunzio Liso).

Fig. 7. Concept-art regarding the immersive 3D model of Stalker (1979) by Andrej Tarkovskij (student: Nunzio Liso).

(*Modo*) has allowed the construction of three-dimensional models optimized to be rendered in real time on the graphic engine chosen for this experimentation (*Unreal Engine*) (fig. 9).
The texturing phase, based on the previously analyzed color sampling, has finally completed the construction of the 3D model adding micro-geometries and noise that contribute to 'stain' the polygonal mesh, dramatically increasing the spectral and narrow tone. Following these specifications, the distribution corridors were designed as if they were underground tunnels with a circular section, while the three environments were designed as three circular-shaped rooms occupied only by a well in the middle and by some wall-mounted screens. Once activated, these screens show in loop some scenes of the movie. The fourth environment, which the visitor can visit after approaching one of the wall screens, consists of a textured sphere with an image of the deep space so as not to be able to grasp the actual dimensions and in which one falls without the possibility of control. A delay triggers concludes the experience by returning the user to the initial landing point. Light sources with low emissive power and volumetric fog positioned inside the three macro-environments complete the visual set-up of the scene, contributing substantially to amplify the perceived degree of immersion. As for the sound apparatus, it is composed of a series of omnidirectional emitters inside the tunnels propagating white sounds, simulating the noise of the rain or the human steps on the floor. In the three rooms instead, music and dialogues sampled directly from the film are combined with movies projected on wall screens. Finally, in the last room, the continuous fall of the user is accompanied by a binaural audio track that acts as a further relaxing element.
The final result is an immersive experience in which three descriptive planes intersect and integrate each other. On the visual level, the photorealism of the model thus designed illudes the visitor to find himself in a real space, while the artificial lighting system and the volumetric fog signal the directions of movement in a non-invasive way. On an acoustic level, white noises and sound effects inhabit the same geometric space, guiding the user from a psycho-physical state characterized by anxiety to one characterized by relaxation. On the interactivity level, finally, triggers and video outputs, strategically placed, force the user to interact with the 3D model according to a role mechanism triggered by the curiosity to move within the Zone (fig. 10).

Fig. 8. Gameplay planning (student: Nunzio Liso).

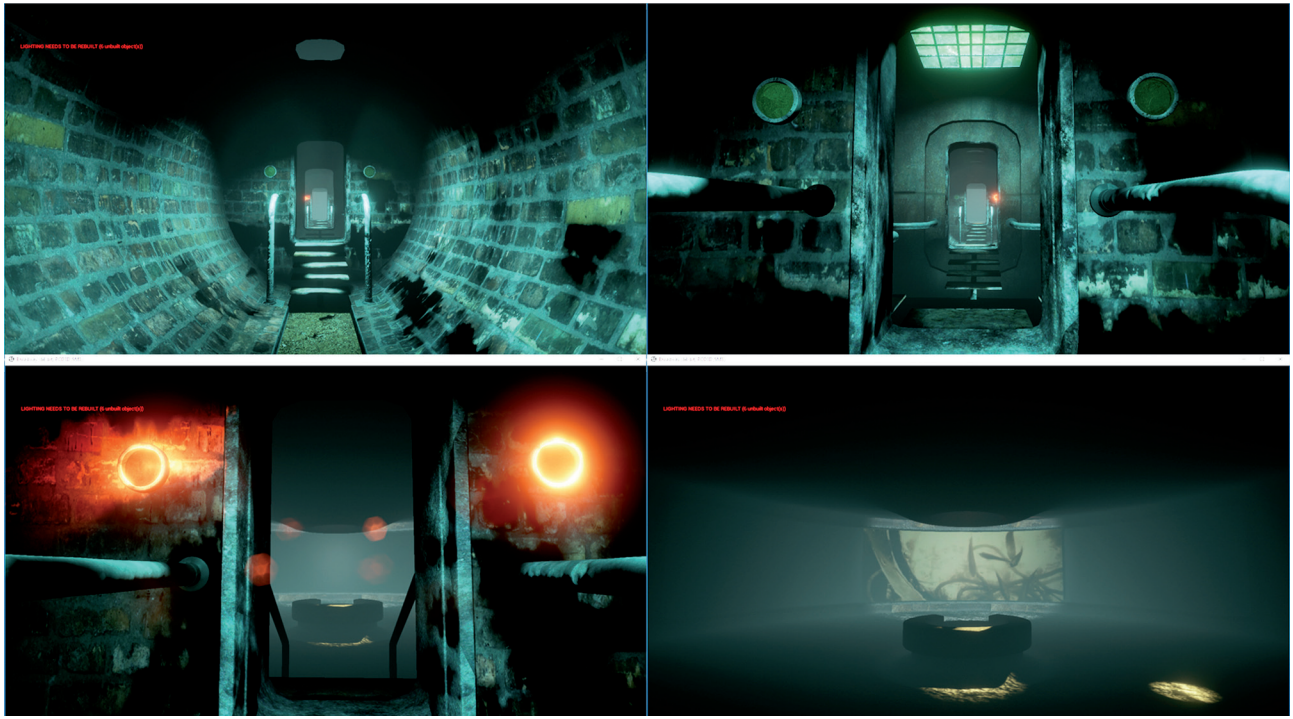
Fig. 9. The scenic layout of the 3D model in the graphic engine used for experimentation (Unreal Engine).



Conclusions. The potential of interactive and immersive dynamic perspective

The main objective of this activity was to experiment with new applications of immersive virtual reality and to understand how this could become an instrument of knowledge and dissemination of cultural contents, combining it with another reality of 'immersive' nature such as cinematography, and evaluating at the same time the expressive and revealing potentialities of the interactive dynamic perspective. Therefore, the immersive virtual reality was intended as a tool able to represent spaces and models with a strong emotional charge able to enhance the set of spatial and emotional conditions that characterize the visual tone (atmospheres, perceptions, symbols, objects and so on) of an almost unknow filmography, but nevertheless representative of some particular historical moments of our society.
The direct comparison with the language of cinema also allows us to reflect on the ways in which the environments so constructed can be narrated. Film grammar allows us to define an analogy between the dynamic interactive perspective and a film shooting technique that has become a pervasive stylistic figure in the new media: first person shot. Ruggero Eugeni defines it as a symbolic form and more precisely: "a ubiquitous and almost omnipresent figure within the intermediate and post-cinematic galaxy that characterizes contemporaneity" (Eugeni 2015, p. 53). First person shot hybridizes with areas and experiences arising from the world of video games in the first person and becomes a symbol of a visual culture characterized by perceptual habits dominated by first-person experiences.
Space can be used as if one were really within it, moving virtually through the 3D scene visualized, approaching, moving away from, or changing our direction of view, that is, using a system to simulate possible movements in space via a naturally intuitive interface. The interactive and immersive dynamic perspective holds enormous potential regarding the means of describing and discovering 3D environments. The possibility of first-person exploration improves the geometrical perception of three-dimensional models. Stereoscopic visualization using immersive virtual-reality visors, combined with the possibility of moving freely with one's own viewpoint improves the capacity to understand the spatial quality of places in which one is immersed.

Fig. 10. Some frames of the interactive dynamic perspective taken from the immersive 3D model developed for the film Stalker (1979) by Andrej Tarkovskij (student: Nunzio Liso).



Notes

[1] Hugo Gernsback founded the magazine *Amazing Stories* in the United States in 1926, which made the fantasy genre a popular phenomenon. In 1929 he founded *Science Wonder Stories* and coined the term science fiction instead of the previous term scientifiction.

[2] Verne claimed that Wells' novels lacked any plausible scientific basis.

[3] These topics were developed by Anthony Boucher, director of *The Magazine of Fantasy and Science Fiction* and Horace Gold, director of *Galaxy*. For further information cf. Asimov 1984.

[4] One of the most important authors in this period was Ray Bradbury.

[5] As defined by the writer J. G. Ballard. In this period, the magazine *New Worlds* was born in England and directed by the English writer Michael Moorcook.

[6] This notion was consolidated in the 1970s in the works of the American Philip K. Dick and the Englishman James Ballard, who inspired William Gibson. With his novel *Neuromancer* (1984), he created the manifest for the cyberpunk movement, marking the step from internal to virtual space.

[7] In various interviews, Godard stated he was not interested in the science-fiction genre.

[8] The experimentation is related to a didactic activity during the Multimedia Design Lab of the Computational Design Master Degree of the School of Architecture and Design of the University of Camerino. 2015/2016.

[9] The list includes: *Brazil* by Terry Gilliam, *Barbarella* by Roger Vadim, *The 10th Victim* by Elio Petri, *N.P. il segreto* by Silvano Agosti, *L'invenzione di Morel* by Emidio Greco, *Solaris* by Andrej Tar-

kovskij, *La planète sauvage* by René Laloux, *Alphaville, une étrange aventure de Lemmy Caution* by Jean-Luc Godard, *Metropolis* by Fritz Lang, *Zardoz* by John Boorman, *Fahrenheit 451* by François Truffaut, *H2S* by Roberto Faenza, *Stalker* by Andrej Tarkovskij, *I Cannibali* by Liliana Cavani, *The Man Who Fell to Earth* by Nicolas Roeg.

[10] In *The 10th Victim* by Elio Petri, the scenes make full reference to pop art, op art, and the boom years of Italian design in the 1960s.

[11] <www.unrealengine.com> (accessed 2018, February 3).

[12] *Oculus VR. Oculus Rift*: <http://www.oculusvr.com> (accessed 2018, February 3).

[13] Based on the novel by Stanislav Lem, *Solaris* is considered the Soviet film response of Stanley Kubrick *2001: A Space Odyssey*.

[14] The short story was published in 1971.

Authors

Federico O. Oppedisano, School of Architecture and Design of the "E. Vittoria", University of Camerino, federico.oppedisano@unicam.it
Daniele Rossi, School of Architecture and Design of the "E. Vittoria", University of Camerino, daniele.rossi@unicam.it

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