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EDITED BY
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**Interdisciplinary journal
on image, imagery and imagination**

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EDITORIAL

ISSUE 09 OCTOBER 2023 Metaverse Dilemma

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The *Gartner Hype Cycle* describes
the typical trajectory of emerging
technologies and predicts that, after
the Peak of Inflated Expectations,
when interest and excitement for a
technology are at their highest levels,
a phase of disillusionment will follow,
when expectations are not met and
interest in the technology decreases.
Although at this moment the
Metaverse-related technologies are at
the point where they are ready to roll
down, the intention of this issue of the
journal is not supporting the defeatist
thesis that technologies related to
metaverse and to virtual and mixed
realities have already reached the apex
of their creative potential. However,
it is true that in the very last few years
—compared to the 'hype' of even just
three years ago— the overall interest

>

(both academic and cultural industry investment) has shifted decisively toward artificial intelligence and its many areas of application.

Then again, this is typical about the diffusion phase of any fledgling technology: at the moment of its creation and large-scale adoption, there is a generalized confidence in it, the hope that the new medium can contribute to the improvement of human life on this planet or amplify its capabilities. So, it was with television technology (Marshall McLuhan in 1960s and 1970s), so it has been in more recent times with Internet (Manuel Castells in 1990s).

Same fate, we might say, concerned the technology of the metaverse. Moreover, the demise of utopian dimension always coincides, in each of these examples, with the advent of multinational capital that imposes its rules on the new invention in order to convert it exclusively into profit and in instrument of social control.

The critical thinking offered in this issue of the journal is intended to shake off the triumphalist naiveté that the metaverse expressed, in order to offer a more effective vision of the phenomenon and its experimental implications in creative languages. Often art is able to perceive not only the aesthetic and expressive opportunities, but above all the problematic implications and paradoxes concerning the relationship between technology and society. The metaverse spread widely among the various expressive sectors, both in arts and in entertainment and cultural industries. Even in these areas, the initial enthusiasm generated paradoxes as well as profound disappointments due to the disruption in the field of creative research.

With the advent of the fledgling technology of the metaverse, the artist was tasked with probing the changes it would and was making in everyday life and in the various dimensions of human experience. In fact, only the artist, according to McLuhan's theory, is able to consciously apprehend the change, the effects that run underground in the individual and collective dimensions. Art becomes 'anti-environment' because it embraces the technological and cultural challenge before it transforms men and society. 'Anti' precisely because art questions the present world, problematizes it, with a view to future change. Its prophetic capacity makes the artist the man of 'integral awareness' the only one who grasps the implications of his time. This is the reason why are included in this issue two 'artist's contributions' as first-person accounts of whom adopted the metaverse as an expressive strategy some years ago, before it became 'mainstream' through the imposition of digital capitalism. If the breaking point in the process of renewal of the artistic form is always determined by the advent of a new medium (artistic or nonartistic), precisely with the spread of metaverse we can argue that it becomes even more evident that 'the medium is the message': the specific content is nothing more than a kind of 'meatball for the watchdog' (watchdog is represented by our subconscious mind). An element that serves to distract the viewer by convincing him or her that the important part is the one that is revealed to his or her vision and consciousness, when in fact something much deeper and decisive is acting or has already acted by redefining his or her sensibility.

The relationship between medium and message is re-proposed by McLuhan in the dichotomy of 'figure' and 'ground': the figure is the content on which Western culture has always fixed its attention, perceived as the essential protagonist, while the ground is the environment on which the figures are placed. In the perpetuated dominance of the left hemisphere, the background has always been subordinate to happenings and content. The background is at once both that which acts decisively in the rearrangement of the anthropological horizon and the concrete and tangible emanation of the upheavals due to the advent of a new technology.

When a given ground becomes content and figure, becoming clear to rational analysis, then we are witnessing the entrenchment of a new ground, but configurations and characterizations still elude us: this is exactly what happened in recent times through the rhetoric about metaverse, an enthusiasm that has swelled out of all proportion in a 'bubble' of expectations and ambitions that then, however, soon deflated. This is precisely because, even with the metaverse, the focus was on the 'figure' and not on the 'ground': the entertainment, commercial, playfulness principle and not the anthropological implications that such technology expresses and that the artists involved know well. Understanding the world and the way it is transformed by media dynamics is possible only focusing precisely on the ground by bringing it to level of awareness, thus coming to perceive our own modes of perception. In this process, the only one able to intuit and understand a ground before it becomes a figure is precisely

the artist as creative spirit: in fact, when an old ground is displaced by the content, it finally appears in our eyes as a figure. At the same time, a new nostalgia is born, and the artist's task is to report on the nature of the background by analyzing the forms of sensibility triggered by each new ground, or cultural mode, long before man has the suspicion that anything has changed. Even when grappling with media revolutions such as the spread of the metaverse and 'extended reality' formulas, art must renew itself to redefine its status and reestablish its value as a manifestation of sensibility, a way of 'feeling,' a reflection on how one is and how one experiences the world.

As we have argued, in McLuhan's theory the artist is the individual with integral awareness, capable of grounding the anti-environment in the dynamics of renewal of existing world. The question we should be able to ask is what typology af art could serve today to probe and reveal the hidden dimensions of the world dominated by artificial intelligences and algorithms. The answer is electronic image or digital technology, or even art forms such as Net art that exploit Web technology? For McLuhan, the real medium is not the tool used, but the mode of artistic expression, the stylistic technique 'full of theory'. The critical and conceptual significance of the metaverse must be recovered in its meta-textual dimension, in its ability to reflect on the typical dynamics of the current mass media sphere: 'form as medium' means returning to reflect on the medium precisely as message embodied. If the medium is a prosthesis that determines physiological functions and augments as an extension our anatomical characterizations, this means that our attention

to the methodology of analyzing the phenomena must be directed to 'how' a product is made, distributed and disseminated – because by focusing on the 'figure' we are able to grasp and understand the 'ground'.

About metaverse, often device of creation, medium of the work and even conceptual and thematic content coincide: it is a creative horizon that gtoes far beyond the concept of 'image'. As philosopher Martin Heidegger argued already in the early 20th century, image implies a clear separation between a subject and an object placed before it. Indeed, making 'an image of the world' means to impose control over the world itself. But when the image principle is overcome thanks to immersive environments, then two positions arise: the more progressive one, which frames such an overcoming of the dichotomy between subject and object as a positive emancipation, whereby the subject flows into the object and vice versa (after all, what hermeneutics has always advocated and what evidently happens with architecture and design); the more regressive one, which instead sees in the metaverse nothing more than an absolute entrenchment of the principle of the image of the world, since the viewer represents a rejection of the external world and a radical subjectification of the exteriority itself.

As an expression of the postmodern spirit of algorithmic-digital culture, we are probably going to a new phase of experimentation, where new proposals will be affirmed to recover the original impulse of the *liveness* of exclusivity of the event. The metaverse is in fact a decisive episode of the user's 'active participation' in an environment (not an image) that he himself contributes to

build because it develops in *real time*. As Byung-Chul Han argued, it's a form to neutralize any otherness and to get 'everything and immediately' without waste or expectations. Creating a world outside the subject's reach, so that he can assert his control. Reconstructing the story of *liveness* in an approximate way, we could say that in a primitive and original phase, without the aid of the means of reproduction and reproducing media, the only real and pure *liveness* was the live show, authentic 'event' not replicable. In this first phase, *liveness* is the only condition of possibility of use of performative and musical materials. The purest and absolute form of *liveness* is that of the theatrical *hic et nunc*, which is repeated on the occasion of live sets and concerts that we define, in fact, 'live'.

By the 2000s, there are several surrogates for liveness. It is no coincidence that the principle of *liveness* has moved and updated in contemporary mass media horizon: the same principle characterizes the effectiveness of digital communication of influencers when they adopt tools such as *direct stories*. The metaverse has been configured in recent years as the most effective horizon of the universe of mass culture with excellent results, but it is also true that the experimental value of this technology has been exhausted in a short time, leaving space to a dimension often reduced to the playful field.

In this operating framework, the current critical debate about the Metaverse as a new cultural, expressive, and existential horizon highlights all of the ambitions and concerns that this technology and its developers have for the future.

This issue of the journal focused on the Metaverse aims to offer a broader and different perspective on the topic. The dilemma mentioned in the title is intended to relate different theoretical visions, research experiences and approaches to scientific inquiry that are united by a rejection of the uncritical acceptance of the new technological frontier. Rather than recognizing this frontier as something that can only be 'suffered,' the authors, from their own specific field of expertise, offered their own contribution to understanding its opportunities, but also its limitations. If the metaverse is understood as an aesthetic strategy able to complicate and open the world, and not to solve, facilitate and close it, then in the coming years we could still witness the 'dilemma' referred to here: if the dilemma were to be solved, then it would mean that technology no longer 'makes a problem', it would be either totally assimilated uncritically, or even it would be disappeared and replaced by other inventions.

Starting from these assumptions, the contributions gathered from the call for papers explore various emerging perspectives.

In the first keynote essay, the An-Icon Team, headed by Andrea Pinotti, outlines some of their key research directions. It explores a variety of topics that blend archaeological, historical, cultural, architectural, educational, and therapeutic viewpoints to delve into immersive and emersive technologies such as VR and AR. The discussion extends to a media-archaeological examination of VR, the interaction between VR and urban space design, the new capabilities of technological telepresence for studying

digital memory, and the use of immersive technologies in therapeutic and educational settings.

The keynote by Simone Arcagni is an excerpt from his book entitled *La zona oscura, filosofia del metaverso: la logica culturale della società algoritmica*. It provides a comprehensive retrospective on the technological conditions that have shaped the metaverse as we know it today, or more precisely, the multiverse—a situation in which multiple proprietary metaverses coexist, each with its own rules and specifications. From a sociocultural perspective, he emphasizes how the metaverse emerges as an ideological framework developed within immersive technologies, placing individuals in a communication space primarily defined by elements such as immersion, engagement, collaboration, and interaction.

Cultural heritage is the focal point for Fabrizio Banfi, Davide Mezzino, Nicola Dell'Aquila, and Federico Taverni. They specifically investigate how virtual reality, whether image-based or model-based, can facilitate new methods of interaction and immersion, offering a deeper understanding of cultural contexts. Their research assesses the potential of these technologies to enhance visitor experiences and promote knowledge sharing.

In her essay, Pia Davico describes the use of videomapping to enhance cultural events by blending reality and imagination. Two parallel events, an exhibition on grotesques and a magic festival, were interconnected and enriched through videomapping, creating a spectacle that merges the architecture of the place with imaginary worlds. This approach transformed the perception of the spaces,

providing an immersive experience that transcends the boundaries of reality to venture into a space suspended between reality and fiction.

Romano Fistola and Ida Zingariello, noting the growing interest from the business sector in the metaverse, highlight its increasing importance and the potential impact it could have on society, with a particular focus on urban planning. They explore whether technology simply replicates cities or transcends them, advocating for technology that enriches human spaces instead of merely duplicating them.

Margherita Fontana establishes a connection between the architectural form of bunkers and the evolving narratives of the metaverse. This study investigates various bunkers and subterranean homes within both institutional frameworks and subversive cultural settings, highlighting the bunkers' innate virtual qualities as symbols of possibility and endurance. She also explores how the concealed spaces of bunkers and the conceptual sphere of the metaverse share a common theme of escapism, offering a viable means of survival amidst global threats, be they nuclear, martial, or ecological.

Marco Proietti and Fabio Zollo explore the perception of space in the Metaverse, highlighting the importance of 'presence' and applying Marc Augé's concepts of 'places' and 'non-places' to virtual architecture. They critique the creation of virtual 'non-places' that erode the sense of community and advocate against 'skeuomorphism,' proposing new graphic codes for meaningful virtual environments.

Maurizio Unali and Giovanni Caffio present a study that features an interactive atlas of the metaverse in architecture

and design, spanning from 1980 to 2023. Designed as an online conceptual map, this atlas catalogs the main ideas of 'virtual living' along with key conceptual and visual references. It explores the evolution of the metaverse through applications in social media, virtual worlds, video games, and beyond, including the use of artificial intelligence and NFTs.

In conclusion, as mentioned above, two contributions are deliberately written in the first person to emphasize the authorial work of two artists who have conducted experiments from within their own perspective. Specifically, Marco Cadioli, through his avatar, introduces us to in-game photography as an artistic and cognitive tool to document the birth and development of the metaverse, starting from its most primitive forms such as Second Life. Chiara Passa, also speaking in the first person, presents some of her latest works, reminding us how her artistic research has consistently evolved through virtual platforms and immersive technologies, disregarding conceptual obsolescence and temporary hype.

THE DARK ZONE.
PHILOSOPHY
OF THE METAVERSE
THE CULTURAL LOGIC
OF THE ALGORITHMIC
SOCIETY

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The concept of the Metaverse, originating from Neal Stephenson's 1992 novel *Snow Crash*, has transitioned from a speculative fiction idea into a complex cultural and technological reality. This paper explores the evolution of the Metaverse as both a digital twin of the physical world and a new 'cultural logic' permeating various sectors such as gaming, education, and commerce. By integrating immersive technologies such as virtual reality, the Metaverse offers a blended "phygital" environment where users engage in activities ranging from social interactions to commercial transactions, seamlessly merging physical and digital realities. This study delves into how foremost technology leaders have influenced the Metaverse's trajectory, focusing on transforming it from a gaming interface to a broad digital ecosystem. We analyze the role of blockchain technology in facilitating a network of interconnected spaces that allow for the preservation of digital identities and assets across platforms, highlighting the challenges and potential of achieving interoperability. Ultimately, this paper presents the Metaverse as a paradigm shift in digital interaction, suggesting future directions where digital and physical realities might further converge. Through a comprehensive review of technological advancements and cultural shifts, we discuss the implications of this convergence for future digital interaction frameworks and societal norms.

ABOUT METAVERSE

The interest in the Metaverse was born at the turn of 2019 and 2020 when first the CEO of *Fornite* and then Mark Zuckerberg made several statements within a few months with the prospect of developing this technology preponderantly. At the end of 2019, *Fortnite*, the famous game, points to the Metaverse as the horizon for technological development. The idea is to turn a game into a real participatory environment where people are not just players but users who can communicate, exchange information, and participate in events such as film premieres, concerts, etc. *Fortnite* looks at the precedent of *Second Life* without, however, forgetting its gaming origin. The idea is to create a real-world where those who enter can take advantage of different functions and practices, thus customizing their presence and experience to the maximum degree.

The statements by *Fortnite*'s executives were followed by Mark Zuckerberg's now-famous press conference announcing the transformation of his holding company into Meta. Meta's goal is to create a Metaverse and, thus, a uniquely immersive, participatory, interactive, and shared environment in which *Oculus* buyers and Facebook and Instagram subscribers can be. In short, users participate in the world the young American entrepreneur created.

AT THE ORIGINS OF THE METAVERSE

The term Metaverse first appeared in 1992 in a science fiction novel attributable to the cyberpunk genre entitled *Snow Crash* (Stephenson, 1992). The author is Neal Stephenson. It is interesting to start right here, from how Stephenson describes this Metaverse: firstly, it is a sphere, and thus an apparent reference to immersive devices such as Virtual Reality that produce, precisely, 360° spherical images. Secondly, the sphere refers to the Earth and thus to the fact that

the Metaverse may represent a 'digital twin' of the physical world. It is a world of 'solid', three-dimensional images created in high-resolution computer graphics. Moreover, it also has sound. You have to use special glasses and headphones to access it.

The sphere is crossed by a vast road of lights continuously travelled by millions of people. By protocol, the length of the 'Street' is 65,536 kilometres, so it is longer than the circumference of the Earth. Constructions of different types and nature jut out onto the Street, defining the Metaverse with distinct neighbourhoods, such as the Hackers'. The model is Las Vegas, both for its glittering, phantasmagorical and spectacular appearance and for the excessive aesthetic heterogeneity of its buildings, which range in styles and ornamentation that are very different in nature and age. On average, the Street is occupied by a population roughly double that of New York City. The Street is one hundred metres wide, and a monorail passes through the middle. The people who live in the Metaverse are avatars, the product of software that generates audiovisual bodies capable of dwelling in the Metaverse. Just as one can buy objects, assets and gadgets, one can buy facial expressions and aesthetic retouches of one's avatar to look more and more like oneself, take on someone else's features, or improve one's profile. The whole world of the Metaverse revolves around gaming protocols: working, going to amusement parks, shopping, meeting people, and attending events, designed according to graphic, architectural, storytelling, and behavioural logic modelled in the world of video games. Some of the 'people' in the Metaverse are artificial intelligence programmed for different utilities but capable of learning and evolving. Every element of the Metaverse is also monitored, mapped and covered by sensors capable of perceiving and interpreting even the slightest changes in the inhabitants. It must also be said that this extraordinary construction has a 'solid' foundation in vast information and software capable of processing and controlling it. The power in the Metaverse is directly proportional to how much data

can be collected and how refined the models for processing them are.

Stephenson makes one last exciting notation about this fantastic creature: Being in the Metaverse changes and modifies cognitive processes. It assimilates software and neural structures, creating a unique environment synergistically fused with people. Moreover, it also defines a symbiotic system of human-machine relations capable of profoundly modifying people's knowledge structures. That is, it imparts a new logic.

… AND THEREFORE, THE METAVERSE

Starting from this description of the Metaverse, what is proposed here is an alternative interpretation whereby the Metaverse is not the sum of the technologies currently being developed within the so-called XR (Extended Reality) field, i.e. immersive technologies. The Metaverse is understood as a 'cultural logic', borrowing the concept from Fredric Jameson (1992/2015) and Alexander R. Galloway (2022). We can basically agree with Yuk Hui when he states that: "Scientific and technical thinking emerges under cosmological conditions that are expressed in the never-static relationships between humans and their environments" [my translation from Italian[1]] (Hui, 2021, pp. 27-28).

Relationships are never static, and thus processes, acts, actions and complex communication systems that Cybernetics had only tried to imagine. All this is 'Cosmotechnics', a system of values and relations generated in this dimension, furthermore, all the more so in the turn of the Metaverse that is rooted in action and processes involving the relationship between human beings and machines in environments that are hybrid (or augmented natural or enriched artificial). In this case, the emerging digital technology (at the intersection of XR, IoT and AI) that we can call the Metaverse represents the architecture and broader relational space within which

different uses, impacts, models and practices decline. Referring to the studies of Gilbert Simondon and Tim Ingold, Yuk Hui speaks of a theoretical field capable of reformulating the organic unity of technology and nature. Here, it is not only a matter of expressing a thought (Hui calls it philosophy) capable of realizing this task but also of identifying a panorama, a social and cultural horizon in which this unity has already been realized, basing its foundations on the sense of space and the act, action as a creative form, of thought, of communication of data generation.

Metaverse is therefore understood as a system of thought that originates within immersive technologies and that places people in a communicative dimension basically made up of certain elements and functions: immersion (being inside stories, inside communication flows, inside artificial or mixed environments), participation (the system is activated only after an evident and overt decision to enter the environment), sharing (each environment is a participatory platform), interaction (each environment adapts and reacts, not only to our actions and our crossing but also to our simple presence).

Metaverse means organizing communication by defining specific environments. They can be completely artificial environments (Myron W. Krueger's 'artificial reality' or Jaron Lanier's 'virtual reality'), usually realized in computer graphics, or rather in CGI (Computer-Generated Imagery) and developed by graphic engines such as Unreal Engine or, above all, Unity. Graphic engines have become famous for their use in the video game industry. However, little by little, they have become fundamental tools for cinema, television, and the Web, defining the most characteristic aesthetic imagery of our time (and evidence of this is the use made of them by famous contemporary artists such as Jon Rafman or Ian Cheng, or activist groups such as Total Refusal) and also the most widely used working system in the world of communication.

The first cue proposed here is that we can speak of the Metaverse as the 'Unity logic' that defines our time. In this way, we clear the field of two misunderstandings. First, the

Metaverse is not (only) the strange technological creature that Mark Zuckerberg, Apple, Microsoft and other high-tech companies are preparing. They have merely appropriated a term (circulating for a few decades) to redefine the corporate branches that deal with XR, i.e., the complex of immersive technologies such as Virtual, Augmented and Mixed Reality. Secondly, the Metaverse is not there to come; it is well present, and it already has its history made of attempts, proposals, experiments, and the use of different technologies. It has a history of its own, which was born in the world of video games and has colonized different fields over the last decades. Moreover, with the development of XR technologies, this field can (and is) define a new cultural status for contemporary technologies.

The Metaverse is thus a system of thought and relations that rests on different technologies, often used together or, at other times, hybridized with each other. It is Stefan Sonvilla-Weiss who precisely indicates the underlying communication system and social model that defines the logic of the Metaverse:

> In this global connected info space where there is no longer any ontological difference between the real and the virtual, novel forms of human-machine interaction will impact tremendously and prevasively on almost all life issues. Intelligent agensta, augmented eyewear, and virtual world avatars and habitats are only a few existing examples that signal the forthcoming changes in the networked societies. (Sonvilla-Weiss, 2008, p. 10)

Already, Alexander R. Galloway, in his systematic analysis of the gaming system (Galloway, 2022), points to a series of elements and functions capable of imposing a different cultural logic, which, from the niche of video games, has quickly colonized other media and other communication models. It invades the world of social and thus of Web 2.0, as well as that of platforms for the sharing and enjoyment of content: from music to audiovisual ones, up to new interactive applications that, freed from the explicitly playful purpose

of videogames, are called serious games and range from simulators to marketing campaigns to museum guides. For Galloway, gaming should not be studied as a media or entertainment market but rather as a new system of communication and thought, a new 'cultural logic' (Jameson, 2015) based no longer on passive enjoyment and the linear dimension of storytelling but on action. Thought ac,tion, and space are the fundamental dimensions of this praxis. Action and space become the essential functions of communication from which every other function, communicative strategy, model of fruition, storytelling, and aesthetics (with the dominance of computer graphics that, in the meantime, thanks to Pixar and its Renderman software, has invaded the imaginary of animation cinema and then moved on to action, fantasy and in short defining the aesthetic statute of Hollywood special effects of the last 30 years).

That logic, meeting the world of XR and so-called spatial computing and relying on two infrastructural pillars such as AI and 5G, may definitively become the logic of the new algorithmic paradigm.

Neal Stephenson's novel *Snow Crash* describes a dystopian near-future in which the only possible escape is into an artificial parallel universe, realized in computer graphics, accessed through an immersive helmet, and the creation of one's digital double called 'avatar'. A world also subjugated by the absolutist power of the market, by the violent logic of profit and by a social division worthy of the Middle Ages, and which is now instead becoming the model of what is being passed off as the new, irresistible and incredible technological revolution.

Behind these apparent inconsistencies of meaning lies something more profound that must be plumbed with the weapons of thought, erecting a philosophical architecture capable of reading and attempting to interpret the phenomenon, placing it in its proper context, which is the cultural one, rather than the merely technological one. Above all, subtraction and withdrawal from the communication of the sig-

nificant players and operators and relocation in the cultural sphere must be carried out. The usual hubbub, often disjointed, of the media is generating a fragmented discourse around the Metaverse and, above all, oriented towards accounting for it as a technological achievement observed solely from the point of view of the major players.

THE METAVERSE IS HERE

However, let us return to Stephenson's novel, which defines the technological horizon we move, that of immersive technologies, with virtual reality in the lead. It was 1992 when *Snow Crash* came out, and the world of digital technologies was looking at the new immersive devices that were trying (with difficulty) to enter the market. In particular, Jaron Lenier's attempts at virtual helmets are making inroads into the imagination. Lenier's idea is to create a series of devices ranging from helmets to gloves to complete suites, armed with sensors to transport the body (not just sight) into a 360°, responsive, interactive, and participatory artificial universe. It is a true digital twin that is realized with a synthetic aesthetic. Also from 1992 is Brett Leonard's *The Lawnmower Man*, the film that explores the potential of virtual reality.

Almost at the same time, Myron Krueger develops software. He makes hardware in this direction and speaks explicitly of an 'artificial reality' (Krueger, 1983/1992) of environments that video, sensors or helmets can access. It is no coincidence, therefore, that the world of literary science fiction draws on these drives and futuristic research: Stephenson, indeed, but before him also Daniel F. Galouye with *Simulacron* (Galouye, 1998), Ursula K. Le Guin with *La falce dei cieli* (Le Gui, 2005) and, again, Ernest Cline with *Ready Player One* (Cline, 2018) from which Spielberg will make his film of the same name.

However, Stephenson's novel is the primary reference for the definition of the Metaverse (anticipated only by that of

the 'database') and avatars, i.e., the digital twin that takes on the characters we wish to give it, thus defining our digital identity. It helps enter virtually infinite worlds (generated by GAN - Generative Adversarial Network), responsive, participatory, and 360°.

Krueger and Lenier, in their theoretical reflections on these artificial worlds, although they do not use the term Metaverse, are already describing it in practice, outlining its contours, architectures, practices, functions, and aesthetics. We find all of these in a series of works explicitly cited by Galloway (2022) as emblematic of this new algorithmic logic that games (in a broad sense) are defining. The examples proposed by the English philosopher are, in fact, serious games such as Sid Meier's *Civilization* (a true game-world forerunner of all meta-verses), the Machinima, and even the ARG (Alternate Reality Game, participatory and interactive storytelling that takes place alternately in the virtual and real worlds), MMOG (Massively Multiplayer Online Game) or MMORPG (Massively Multiplayer Online Role-Playing Game). What are they? These are complex, participatory (online), interactive, customizable games. Environments in which one enters a new logic where the action (as a new form of knowledge and thought) and the environment (as a new organizational structure of data and its function) dominate – an environment with non-linear and complex storytelling that defines a new communication system.

We observe an ongoing process that finds its roots in video games that subsequently colonize different forms, modes and communicative practices (including education, training, and entertainment). It is a process that scholar Stefan Sonvilla-Weiss had already observed in 2003 in his essay *(In) Visible: Learning to Act in the Metaverse* (Sonvilla-Weiss, 2008) in which he defines the Metaverse as the set of those immersive and interactive environments created by digital technologies: from Google Maps to platforms such as *Organic City*, to smart city apps. For Sonvilla-Weiss, the Metaverse also exists and has precise and delineated characteristics. What distin-

guishes it is not the use of one technology or another but the cultural logic it expresses.

The Metaverse already exists, then. So much for Zuckerberg and his disciples searching for an operating system capable of making inroads into the market. All that needs to be debated is the impact it can generate and whether it will become the primary cultural rationale of the coming years (and here we advance the hypothesis that the answer to this question is positive). The Metaverse exists independent of devices, and its logic is so imbued in our cultural system (and is so successful), especially in the last two generations of young people who are about to occupy managerial positions, that we can clearly define it as the most likely cultural logic of our time.

As mentioned earlier, we already have notable examples of successful Metaverse: from *Second Life* to all participatory games such as MMOGs and MMORPGs, starting with *The Sims* up to *Minecraft* (which are now used in various fields from education to learning to science, tourism and even online activism). Moreover, even earlier, we can cite *Habitat* from 1986, a game that is a trustworthy online virtual environment for multiple participants, as well as *EVE* or *Civilization*. To these, we should also add MUDs (Multi-User Dungeons), text-based virtual worlds based on *Dungeons and Dragons*, MUSH (Multi-User Shared Hallucinations) and MUX (Multi-User Experiences).

VR Chat is already a popular virtual reality platform for events, conferences, previews, concerts, and information exchange. The best-known platforms at the moment are *Roblox*, *Fortnite*, *Decentraland*, *Sandbox*, and the Italian The Nemesis. Metaverse and NFT marketplace platforms exist, such as Enjin, Axie Infinity, Metahero, Wilder World, and Bloktopia. SushiSwap and Render are specifically NFT markets.

By now, millions of people habitually spend time on *Roblox*, *Fortnite* and other smaller platforms such as Decentraland, especially millennials and representatives of the so-called 'Generation Z'. Not only to play games but also (and

now especially) to attend events of various kinds, to create communities, carry out actions of different kinds (including political and activism), but also to exchange digital objects, make auctions, buy, sell. Moreover, in the meantime, the most popular social network of the moment, TikTok, is preparing to land in virtual reality by purchasing Pico, one of the big players in creating virtual reality visors. The announcements and financial movements of Zuckerberg and his behemoth, with Facebook at its centre, have all come into play. A holding company that, emblematically, has taken the name Meta precisely to highlight the near future mission. Conversely, Microsoft's industrial reactions want to merge the functions of Teams with those of Mesh to produce a new, larger, and more complex version of Hololens, its holographic computer. If Meta aims at Virtual Reality, Microsoft seems primarily interested in mixed reality. So does Apple, which seems bent on following Microsoft's path, thus renewing an industrial rivalry that originates even in the clashes between young Bill Gates and Steve Jobs.

A TECHNOLOGICAL ISSUE

Logic preeminent it will become shortly, the moment these models are brought into full swing, others are joined, and above all, a minimum of interoperability is organized. Understanding by interoperability the possibility for the user to move from one environment to another, from one platform to another, taking with him his identity (the avatar), his data (photos, videos, comments, friendships, followers…), his wallet (made up of cryptocurrencies, credits, subscriptions and cards or credits of different kinds and nature). Moreover, this is an area that is particularly sensitive and emblematic at the same time: the emergence, albeit with many contrasts and jarring, of blockchain and bitcoin, intelligent contracts and NFTs that drive in the direction of the new world of the so-called Web3 of decentralized networks, DAOs.

That the 'logic' of the Metaverse is destined to become preeminent can be read in a few elements: first of all, by the amount of investment that the compartment manages to gather and that, despite some critical voices, does not seem to be diminishing. The investments of the so-called big tech companies are significant. On the other hand, the research compartment, in which private and public companies and universities are at work, also registers decidedly onerous movements and investments. It should also be said that the idea of a spatial system for the dissemination of information that is based on presence, participation and sharing has well-established roots in the past (we have already talked about the world of role-playing games, to which we can also add artistic experiments in the field of installations and expanded and augmented environments). Let us also not forget the audience factor: We are talking about at least three generations of young people who are accustomed to an algorithmic system based on immersion and participation, who are familiar with video games, who are accustomed to the systems of exchange, reward, purchase and access to information and digital objects in gaming. A digital native and immersive native audience that is comfortable with immersive environments and spatial information searches.

Suppose we dwell even on purely technological data. In that case, everything is pushing in this direction at a time when both research and market investments (and already market results) are rewarding the convergence of the XR world with the IoT world, that Internet of Things that realizes so-called spatial computing. It is basically about deploying Internet functions in space. Creating augmented environments, perhaps using QR codes or sensors (from Arduino to leaders to Kinect) or through voice command systems such as Siri, Alexa, and Cortana that already redefine the home space into a kind of intelligent city increasingly dependent on our voice paths, another form of bodily action that turns into thought/action. Moreover, in fact, it is precisely the latest generation of AI that increasingly takes on the role of

the infrastructure that ensures at least two fundamental functions of this new computing of space: on the one hand, addressing the monumental computational challenge that complex, participatory and responsive environments propose; and on the other hand a personalization of our paths in virtual and real, augmented and mixed worlds. AIs, just like voice assistants, allow our data assets to transit, to be exchanged, to swell, and above all to build increasingly personalized paths in a universe that is not only dual but complex and even ever-expanding.

For example, we are used to imagining a purely visual space. We do not necessarily. Furthermore, at the very least, it is not the only one. Intelligent voice assistants, and perhaps also oriented by geolocation data and sensor installations with which to monitor movements and the use of appliances, do indeed define sensitive, augmented, responsive, participatory, personalized environments that involve a logic that has to do with thought/action, with space as a platform for the distribution of information and correlations of different kinds (between people or between people and bots).

Sound and images imply the use of a mass of data that must be available live, precisely because we are talking about thoughts/actions. For Pedro Domingos (2018), this dimension is the natural evolution of AI, which he calls the 'ultimate algorithm'. This algorithm will combine the capabilities of evolutionary algorithms, machine and deep learning, and analogue and Bayesian learning-based methods. It will dispose itself towards us in synergistic and symbiotic ways, like a 'digital stand-in'.

> Within a decade each of us will probably have a 'digital stand-in,' an AI partner that will be even more indispensable than smartphones are today. Your digital stand-in will not need to physically move with you: it will most likely live somewhere in the cloud, just as much of your data already does. We see the beginnings of this in virtual assistants like Siri, Alexa and Google Assistant. [my translation from Italian [2]] (Domingo, 2018, p. 35)

The other major infrastructure needed to activate this process is the data integration network for transmission, that 5G that not only challenges the power of connection but also gives rise to next-generation platforms capable, precisely, of supporting expanding worlds participated in simultaneously by multiple people.

The technologies that determine the Metaverse are thus the complex of XR and spatial computing that defines a so-called 'phygital' (physical plus digital) universe. This definition identifies a hybridization and continuous exchange between real and virtual spaces, AIs and next-generation connections from 5G to 6G. The technologies in question can variably correlate, coexist, hybridize in depth, build platforms, and define sensitive spaces of different natures and dimensions.

THE UNDERLYING TECHNOLOGIES

As we have seen, the participation of specific technologies characterizes and substantiates the Metaverse. Specifically, infrastructural technologies, connectivity technologies such as 5G, and cloud technologies are about to become the real enablers and facilitators of the next generation of computing, which will always be experiential and immersive.

On the other hand, we have graphics engines like Unreal Engine and especially Unity (and others like Mozilla related to open logic) because they represent the scaffolding to build the virtual spatial environments on which the Metaverse experience is based.

Metaverse experience that lies within the convergence of so-called XR technologies and spatial computing. XR consists of immersive technologies such as virtual reality, augmented reality, mixed reality, video mapping, and photogrammetry.

These are, or better to say, were, while now fundamentally converging, the technologies of spatial computing

and, thus, IoT (Internet of Things). These technologies can amplify and augment physical space by making it a hybrid of physical and virtual, or by situating digital information in physical spaces or linking physical and digital spaces as in the interactive maps that underlie satellite navigation systems or the operating systems of self-driving cars. These are the complex sensor systems that redefine the boundaries of physical space by connecting to the information in the digital cloud. Emblematic is the case of voice assistants that 'fill' physical spaces with their voice and the information they derive from the Web. The Metaverse is thus substantiated by virtual environments that communicate with physical spaces and real people located in physical spaces together with natural objects, or by hybrid spaces that build a single environment and thus define a new 'chimeric' ecology, or - again - by physical spaces augmented (on demand) by virtual informational spaces.

Enabling this convergence and thus making the experience viable in the Metaverse, we find AI coming to assume two functions primarily: 1) to process data with increasing speed (and getting closer and closer to the so-called '0 latency') and 2) to provide the cues for orientation in virtual space, in 'extended' absolute space and in the transfer or overlap of the two states.

AI's role in the Metaverse is even more complex than that. We will have a chance to see how it interacts in the very construction of the Metaverse (through synthetic media and thus all the applications of so-called generative AI) and how it goes on to inhabit the Metaverse in the form of 'smart' objects (smart objects), voices and dialogue texts (chatbots) or real synthetic identities such as intelligent avatars. Nevertheless, for the moment, let us dwell on AI's role in producing the Metaverse: on the one hand, as a data processing capability. We talk about the most efficient system for processing data and meeting the need to build a credible and responsive space, enabling real-time relationships through predictive systems.

On the other hand, he performs a function very similar to that of Virgil in Dante's *Divina Commedia*, specifically in *Inferno*. Dante has to travel through a world parallel to the physical one; he has to enter the otherworld, a real immersive Metaverse, participate in it, and share, but to do so, he needs a guide who cannot only show him the way.

Ond'io per lo tuo me' penso e discerno
Che tu mi segui, e io sarò tua guida,
e trarrotti di qui per loco eterno.
(Dante, 1265-1321/1986, p.14)
But it is also capable of revealing the logic of that new world:
E poi che la sua mano a la mia puose
con lieto volto, ond'io mi confortai,
mi mise dentro a le segrete cose.
(Dante, 1265-1321/1986, p.31)

Moreover, Virgil will not only show Dante the way but will also be able to assist him in recognizing places, sins and sinners, thus revealing to him the inner logic of the 'Metaverse Inferno' but also the relationships, the threads, the connections that link the real world to the otherworldly.

The AI is thus proposed as a subject capable of guiding into another, alternative world and marking the paths within this but also marking the interferences with the real world, on the one hand highlighting the interfaces (and thus the thresholds) and, on the other hand, the correspondences. Moreover, this explains connections and identities. Furthermore, it does this by explaining secret things and thus working in the dark side, in the secret black box.

The AI stands just like Virgil for Dante. It is not a mere companion but a special guide capable of connecting and hybridizing two very different realities: the real one and the 'other' meta-real one of Hell. The two realities are evidently connected through a specific interface that is the gate to Hades. Then Virgil offers a map and a route, identifies the specifics, and allows Dante to understand the logic of the route itself.

MULTIVERSE AND METAVERSE

A maximally scalable and interoperable network of 3D virtual worlds rendered in real time, which can be experienced synchronously and persistently by an effectively unlimited number of users with an individual sense of presence within them, and which guarantee the continuity of data about identity, history, rights, objects, communications and payments. [my translation from Italian[3]] (Ball, 2022, p. 55)

What Ball describes is thus an immersive, interactive, participatory and shared space, but one that is also interoperable; that is, the user is able (made possible) to move from one space to another, from one environment to another, bringing with him or her his or her identity(s), his or her 'history' made up of texts, images, videos, pieces of communication, but also objects purchased or obtained through exchanges or challenges. For Ball (and many others), one can speak of the Metaverse only at the moment when the infrastructure is configured as a complex architecture, as a vast social that within it contains other social or other platforms and toward which all the functions at this moment delegated to media, social and platforms flow. A universe in which the experience is 3D (but not everything will be 3D), is enabled by real-time rendering and is usable in all its dimensions regardless of its origin as a proprietary system. Several immersive 'collaboration' platforms are already geared toward work and participation in real-time and presence: Virbela, Spatial, Glue, Engage, Arthur, and Horizon Workrooms, for example.

According to many observers, the Metaverse could only be called when the different immersive platforms were connected by allowing switching from one to the other as if one were within the same system. Otherwise, we would witness the coexistence of multiple metaverses (multiverses), each closed.

We are still in an indecipherable and fragmented territory where different experiences coexist, but no general

interoperability exists. 'Decentralized' platforms such as *Decentraland* or *The Sandbox* are recorded. At the same time, *OVR* and *Somnium* are actual virtual territories. *OpenSea,* on the other hand, is a transactional platform for purchasing items for environment platforms. Discord, in turn, is a platform for communicating in these metaverses. To support the economy of decentralized platforms based on blockchain technology and thus cryptocurrencies, there are real crypto wallets (wallets) such as *MetaMask* and the more famous *Ethereum. Meanwhile,* blockchain is bidding to become the technology that can authenticate digital identities, and NFTs are looking with interest at physical assets as the most promising horizon.

Web3, as a new paradigm, should realize precisely this system in which the various metaverses appear to you just as individual pages and sites present themselves to the user on the Web today simply by invoking a search. Imagine that our Google identity that superintends our browser searches and the use of the attached functions is now an avatar with which to move, no longer between pages but between immersive, interactive, participatory, and shared spaces.

If this is the Metaverse then we are still a long way from having the Metaverse. To make this possible, we need protocols, standards, conventions, new uses and technologies, different and more precise infrastructure systems, and norms of access and use. Not to mention, each proprietary system is willing to technologically, economically, and culturally enable communication with other systems. So-called 'walled garden' systems that belt out their users, actions, data, histories and assets they may have acquired are more attractive to industry groups because they allow them to hold their attention and facilitate engagement, profiling and marketing operations. Hazan points this out very well:

> Interoperability is built into platforms that use blockchain. There are other platforms, however, that have the ability to leverage walled gardens to store the value produced by users within them, and also because it is easier

to create qualitatively successful environments that way. We are probably faced with two scenarios: some will focus on interoperability, which is preferred by both users and brands; others will focus on walled gardens by offering an optimal experience in return, as was the case with iOS, for example. To be successful, however, the impact on the user must be of a similar level to that produced by, precisely, the first iPhone. [my translation from Italian[4]] (Signorelli, 2022)

Roblox, for example, contains virtual worlds but, in turn, has clear and precise boundaries of its own world. This photographs the current situation in which interoperability is still a somewhat distant and unknown horizon. However, there is already a system and a spatial logic of computing called the Metaverse. We are in a Multiverse situation, a co-presence of proprietary metaverses with different rules. Some are de-prioritizing to "federate" and constitute broader platforms of immersive experience, others are configuring themselves as specific and identity-driven, and that (at least in words) proposes to open up to forms of mutual participation (this is the case of *Horizon* by *Meta*).

ACKNOWLEDGEMENTS

NOTES

1 The Italian text of the quotation is as follows: "Il pensiero scientifico e tecnico emerge sotto condizioni cosmologiche che si esprimono nelle re-lazioni mai statiche tra gli umani e i loro ambienti" (Hui, 2021, pp, 27-28).
2 The Italian text of the quotation is as follows: "Entro un decennio probabilmente ciascuno di noi avrà una 'controfigura digitale', un partner di IA che sarà ancora più indispensabile di quanto lo siano oggi gli smartphone. La vostra controfigura digitale non avrà bisogno di muoversi fisica-mente insieme a voi: con ogni probabilità vivrà da qualche parte nel cloud,

proprio come fa già gran parte dei vostri dati. Ne vediamo i primordi
negli assistenti virtuali come Siri, Alexa e Google Assistant" (Domingo,
2008, p. 35).

3 The Italian text of the quotation is as follows: "Una rete di massima sca-
labilità e interoperabile di mondi virtuali 3D renderizzati in tempo reale,
che possono essere vissuti in modo sincrono e persistente da un numero
effettivamente illimitato di utenti con un senso individuale di presenza
al loro interno, e che garantiscono la continuità dei dati relativi a identità,
storia, diritti, oggetti, comunicazioni e pagamenti" (Ball, 2022, p. 55).

4 The Italian text of the quotation is as follows: "L'interoperabilità è inte-
grata nelle piattaforme che utilizzano la blockchain. Ci sono altre piat-
taforme che invece hanno la possibilità di sfruttare i walled garden per
conservare al loro interno il valore prodotto dagli utenti, e anche perché
in questo modo è più semplice creare degli ambienti qualitativamente riu-
sciti. Probabilmente ci troviamo di fronte a due scenari: alcuni punteranno
sull'interoperabilità, che è preferibile sia dagli utenti sia dai brand; altri
invece punteranno sui walled gar-den offrendo in cambio un'esperienza
ottimale, com'è avvenuto per esempio nel caso di iOS. Per avere successo,
l'impatto sull'utente dev'essere però di livello simile a quello prodotto, per
l'appunto, dal primo iPhone" (Signorelli, 2022).

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EXPLORING AN-ICONS, BETWEEN MEDIA ARCHAEOLOGY, CULTURAL HISTORY, MEMORY STUDIES AND CONTEMPORARY APPLICATIONS

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The ERC Advanced Grant AN-ICON, co-ordinated by Andrea Pinotti and hosted by the Department of Philosophy Piero Martinetti of the University of Milan, is cross-disciplinary project that brings together aesthetics, media theory, archaeology and various disciplines to address the complexities of contemporary mediascape, particularly in the realm of Extended Reality (XR). Within XR, which encompasses Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR), 'an-icons' emerge as self-negating images that blur iconic boundaries and promote environmental presence. This paper provides an insight into AN-ICON's diverse investigations dedicated to immersive technologies. It explores the cultural lineage of VR, AR and XR, their intersections with design and urban spaces, and the emerging prospects for digital memory studies. It also highlights the therapeutic, educational and prosocial potential of these media, informed by their historical and mediarchaeological backgrounds.

INTRODUCTION

The opportunity to intervene in this issue of the IMG journal represents for me a particularly significant occasion, not least in order to express a sincere feeling of gratitude. It was in 2017 when the notion of 'an-icon' was first introduced (Pinotti, 2017), and precisely in the proceedings of the first conference organized by IMG: the International and Interdisciplinary Conference *IMMAGINI? Image and Imagination between Representation, Communication, Education and Psychology*, hosted in Brixen, 27-28 November.

This programmatic paper, which found its way into that online publication, was the seminal stimulus for the drafting of the proposal for an ERC Advanced project, which was elaborated thanks to the intensive cooperation of Federica Cavaletti, Pietro Conte, Anna Caterina Dalmasso, Giancarlo Grossi and Giacomo Mercuriali. Once approved, the project started in the autumn of 2019 at the Department of Philosophy of the University of Milan with the title: *AN-ICON. An-Iconology: History, Theory, and Practices of Environmental Images*[1].

Since then, the project has grown excitingly, expanding into a team of more than fifteen members that I have the privilege to coordinate: four PhD students, eight post-doc researchers, four professors, all kept in line by Giulia Avanza and Irene Magrì our very efficient and resourceful project managers.

Combining a strong transdisciplinary approach (aesthetics, media theory and archaeology, history of art and cinema, history of science and technology, education and computer science), AN-ICON has being revolving around 'an-iconology' (Pinotti, 2020), which serves as a fresh framework to confront the complexities of our contemporary iconographic landscape, and especially the challenges posed by a variety of technologies which are nowadays often collected under the comprehensive term of XR – Extended Reality: immersive (Virtual Reality), emersive (Augmented Reality), and manifold Mixed-Reality hybridizations[2]. 'An-icons' are precisely self-negating images, i.e. images which tend to dissimulate

their iconic status: by virtue of their being unframed, aiming at transparency and eliciting a strong feeling of presence, they become 'environmental': they inhabit our 360-degree space offering affordances and triggering agencies. The project is structured into three interconnected research clusters, which enlighten several dimensions of an-iconology: 'history', 'theory', and 'practices'. Specifically, we aim to explore how this evolving landscape is fostering a novel interplay between the human body and technology, thereby reshaping human sensibilities in both individual and social contexts.

This paper, co-authored by several members of the team, summarizes some of the various research avenues within the project. While it presents a selection of these areas, it is not to be considered an exhaustive account of the whole *AN-ICON* field of analysis[3]. Rather, these suggestions are intended to provide a glimpse into the diverse topics under investigation: we will intricately weave together archaeological, historical, cultural, architectural, educational, and therapeutic perspectives to suggest intellectual paths into the elaborate nature of immersive and emersive technologies, encompassing both VR and AR and their intersections. As the reader will discover, the media-archaeological analysis of VR ranges from film theory to history of science. Insights into the 'astronomical' genealogy of immersive didactic devices such as the planetarium will help us to introduce some features of the cultural history of VR and its connection to American counterculture and alternative architecture. Then, it is precisely VR's productive interaction with design that enters into a dialogue with practices that augment urban spaces, paving the way for the study of AR in general. The current possibilities of technological telepresence made possible by these new media lay the foundations for new studies of digital memory. Finally, the therapeutic and educational applications of immersive technologies draw on the historical and archaeological background of these devices, opening up new perspectives for their prosocial use.

IMMERSIVE DEVICES AND SCIENCE POPULARISATION: A HISTORICAL PERSPECTIVE

In 1847, Alexander von Humboldt devoted several pages of his masterpiece, *Cosmos*, to 'panoramic buildings', stating that they would be useful and effective tools for disseminating the study of nature. Panoramas, he noted, were mostly applied to "views of cities rather than to scenes in which nature appears in its wild luxuriance and beauty." If, however, they showed "a succession of landscapes belonging to different geographical latitudes and different zones of elevation", and were "freely open to the people" like museums and galleries, they would be "a powerful means of rendering the sublime grandeur of creation" and "the feeling of the unity and harmony of the Cosmos [would] become at once more vivid and more generally diffused" (von Humboldt, 2010/1848, p. 91). Humboldt's words introduce us to a fundamental issue, namely the historical use of immersive devices in the popularisation of scientific knowledge. If it is indeed true that panoramas, cycloramas and dioramas favoured inhabited landscapes or, at most, ancient ruins, it is equally true that the history of immersive devices has at various times intersected with the history of the dissemination of science. This history, which begins long before the 19th century, has yet to be written.

Examples from different times and places reveal that immersion has been addressed by different disciplines, from optics to geology, from biology to astronomy. The latter is a good starting point: if it is easy for us today to relate immersive experiences to astronomical themes, thanks to the extraordinary proliferation of planetariums, in the past all sorts of things had to be invented to immerse the spectator under the celestial vault. Celestial (and terrestrial) globes, for the home or pocket, and mechanical orreries did indeed offer an experience of the celestial bodies that was centred on manipulation. This preamble allows us to fully grasp the significance of the *Gottorp Globe*, a gigantic walk-in globe cre-

ated in the 17th century: on the outside it represented a terrestrial globe, while on the inside one was immersed in the sky, its stars and planets. Holes in the surface, in correspondence with the stars, let in light from the outside and mapped out the constellations. The idea is very similar to another giant walk-in globe built in 1900 for the *Paris World Exhibition* (Hernandez Barbosa, 2021). Fifty years earlier, a "vertical orrery" had been projected by magic lanterns in London theatres in front of large crowds (Golinski, 2017).

But astronomy was not alone. David Brewster (1781-1868), best known as Isaac Newton's principal biographer in the 19th century, was also the inventor of the kaleidoscope and of the portable (and popular) version of the stereoscope. Brewster emphasised that these two immersive devices could be used to illustrate optics and its principles (Brewster, 1856; 1858). This was already happening when Brewster wrote, and would soon develop further, with other optical devices: magic lanterns projected microscopic images, surrounding the viewer with the infinitely small; the *London Cyclorama* staged the Lisbon earthquake (1755), allowing Victorians to feel immersed in a natural disaster, thanks to 360-degree paintings and an apparatus of *ad hoc* sounds (Hibberd, 2015). A century earlier, Martin Engelbrecht had sought the same effect with his portable theatre (or *vues à perspective*), a wonderful example of paper technology. The list could go on. What is most important here is that these case studies, when placed in their historical context and analysed, can tell us a lot about evolving ways of constructing, elaborating and communicating scientific knowledge. They do indeed share the characteristic of immersion, but this immersion has been achieved in very different ways and for different purposes over time. Moreover, if we investigate their uses in depth (in terms of places and audiences), their circulation and reception (for example, through the accounts that can be found in gazettes or in private correspondence), we can understand what it meant for laypeople to be immersed in science. The subject could not be more timely.

VR AND CINEMA: A POSSIBLE ARCHAEOLOGY

Conventionally considered the first virtual reality device in the strict sense, Morton Heilig's 1957 *Sensorama* was presented by its inventor himself as "the cinema of the future" (Heilig, 1992). Indeed, it added wind, haptic feedback and vibration to the purely audiovisual experience of cinema; vision was enhanced by the illusionistic effect of stereoscopy, sound by stereophony. What then remained of cinema, of an experience whose structural characteristics include a state of submotricity, darkness and frontality of vision? And, more generally, can we still think of VR as the cinema of the future, or is it rather a specific media experience to be considered in total autonomy?

There is thus an urgent need to investigate what relationships cinema and immersivity have historically enjoyed; to understand what survives of the largely codified language of cinema in the discursive strategies of a medium yet to be interpreted; to individuate, in the logic of remediation (Bolter & Grusin, 2000), what is the social space in which cinema and VR compete and according to what strategies the identity of one has been absorbed and translated within the other.

From a historical point of view, it is possible to consider how cinema in its origins won the social competition with immersive media in the 19th century. An outstanding example is the failure of the *Cinéorama* (Castro, 2001, pp. 44-95), patented by Raoul Grimoin-Sanson in 1897 to be presented at the 1900 *Paris World Exhibition* and which was supposed to be the natural evolution of cinema in an immersive way. While the success of the cinematograph establishes the end of the era of panoramas, dioramas, and phantasmagorias, cinema's immersive vocation has never ceased to re-emerge, as much in the enhancement of audio and video systems as in the continuous representations of imaginary media close to VR within movies.

A constant reference to cinematic language, at a citationistic and metariflexive level, is indeed often present in

numerous virtual reality narratives. In *Evolution of Verse* (Chris Milk, 2015), the founding myth of the birth of cinema is taken up in a dreamlike version: the train that hits the viewer's gaze, similar to the effect that *L'arrivée d'un train à La Ciotat* by the Lumière brothers would have on fleeing spectators in 1895. Chris Milk's VR experience thus reminds us that even cinema, though it soon lost this status, was perceived in its origins as a medium at once immersive and 'emersive'. Other experiences translate milestones of film history into VR, radically rethinking them: an example of these is ArteTV's immersive audiovisual *Caesar's Dream: In the Cabinet of Dr. Caligari* (2020) inspired by Robert Wiene's masterpiece of German expressionism, whose prototypical ambivalence between dream and reality finds new expressive force in the illusion of the head-mounted display.

It is no coincidence that filmmakers such as Alejandro González Iñárritu, Tsai Ming-Liang, and Kathryn Bigelow have resorted to VR to explore new artistic and creative stimuli. Iñárritu, in particular, with *Carne y Arena* (2017) questioned the power of the new medium to convey in a more radical form processes traditionally linked to the spectatorial relationship with the cinematic medium such as identification and empathy[4]. VR also represents fresh territory for the affirmation of new authorial identities related especially to the universe of documentary film. In the context of Italian productions, Rossella Schillaci's *Affiorare* (2022) tells the story of women convicts who live with their children in prisons. Davide Rapp's *Montegelato* (2021), on the other hand, uses the 360 degrees of the virtual image to reconstruct an imaginary archive of all the film sequences set in the waterfalls of Montegelato, near Rome. Through the multiplication and superimposition of virtual screens that appear in every direction of the immersive space, Rapp's VR experience becomes a way to rethink the very space of cinematic spectatorship by radically reinventing it.

VR is becoming increasingly aware of its ability to absorb and repurpose the cultural identities of the media which

preceded it. One of the most radical reflections that VR has offered on its connection to cinema (and immersive theatre) is represented by *The Horrifically Real Virtuality* (Marie Jourdren, 2018), which pays homage to Ed Wood's B movies, inviting the users first to create one of these films together with the legendary director and his favourite actor Bela Lugosi (played by two live performers), and then to enter the film itself (by crossing the boundaries of the film screen). This is done through a process of incorporation into avatars, which allows real-time interaction between users and performers. In fact, with the virtual helmet, we can return to the illusion depicted in an early movie such as *Uncle Josh at The Moving Picture Show* (Edwin S. Porter, 1902), depicting a countryman who, unaccustomed to the cinematic machine, converses and even argues with the characters represented on the screen. With one radical difference: now there is no mistake.

VR WITHOUT HEADSET:
A SEEMING CONTRADICTION IN TERMS

Virtual realities should not be solely equated with the use of head-mounted displays. We can therefore speak about 'VR without headset' from several significant points of view. Primarily, from a technical perspective, the immersive experience VR provides can be achieved not only by wearing helmets, both stand-alone or wired, but also by creating a simulation environment which envelops the users entirely, without totally isolating them. One such example of this immersive approach is the *CAVE*, which stands for the *Audio-Visual Experience Automatic Virtual Environment*. In the words of its creators, "the CAVE consists of a room whose walls, ceiling and floor surround a viewer with projected images" (Cruz-Neira et al. 1992, p. 65). The user wears a pair of 'distorting' goggles that allow stereoscopic and 3D vision, without occluding sight, so that "the body appears physically and does not require rendering" (Cruz-Neira et al., 1992, p. 68). This

approach to VR has gained a considerable following, and its main appeal lies in the fact that CAVEs do not require 'proper' headsets, which at the time of their invention were still very heavy and generally uncomfortable. Furthermore, because they do not obscure the user's body, they can facilitate truly collaborative experiences. Among the most recent and innovative applications of this technology, we can mention the museological designs of Sarah Kenderdine, which include, among others, domes, such as the *Cupola* or the *IDome*, and *CAVEs* such as the *0.5CAVE* (Kenderdine, 2015).

The second reason why VR cannot be reduced to the headset is genealogical. This would imply that humans have been creating virtual realities since the beginning of their artistic and intellectual journey. Here, I am referring to the cave paintings of the Upper Palaeolithic: perhaps, these representations are in fact early forms of VR, or at least have been interpreted as such (Pinotti, 2021). This is because of their 'ecological' and 'cosmological' nature, not just their environmental and cinematic aspects (Azéma, 2015). They can be, and have been, seen in this way along what I like to call the 'palaeocybernetic' (Youngblood, 2020/1970) or 'primitivist' trajectory of VR (Fontana & Pinotti, 2022), a trend that envisioned these new devices as a means of reconnecting humans with their 'primitive', thus 'true', nature. In fact, VR in its present form can be traced back to an American cultural milieu which supposed that the near future would have the same impact on human beings as the discovery of fire or the invention of writing: a new language, a new 'man', was preparing. In this respect, it is interesting to note that one of the first examples of a collision between VR and a prehistoric cave dates back to 1995, at the dawn of VR as we know it today. In fact, Benjamin Britton's *LASCAUX* project was intended to be both a reconstruction of the French site and a transformative experience that would give the user a more complete awareness of humanity's journey on planet Earth.

Lastly, there are also physical environments which are not strictly designed to be visualization devices like VR, but

which share with this medium a peculiar aspect of virtuality. I am referring to utopian, or sometimes dystopian architectures, such as the underground bunker and the geodesic dome (Fontana, 2023b). With regard to the latter, as theorised by their inventor, the American visionary Richard Buckminster Fuller (1969), geodesic domes are intended as worlds within worlds, like spaceships on our planet, defined in turn as 'Spaceship Earth'. In fact, they are a sort of virtual environment, designed as escape to the present world's social, ecological and ethical crises. Geodesic domes were seen as a valuable tool for the American counterculture of the 1960s, which discovered precise instructions on how to construct this futuristic housing solution in Stewart Brand's revolutionary periodical, the *Whole Earth Catalog*. Interestingly, the concept of the dome as a way to envision new lifestyles intersected with the life of VR pioneer Jaron Lanier, who built and resided in a dome during his teenage years, immersing himself in the values of the hippie movement which would later shape his ethical approach to technology (Lanier, 2017). A similar hypothesis can be formulated about bunker architecture, whose "aesthetics of disappearance" (Virilio, 2008/1975) make it paradoxically 'virtual'. Designed for defence and attack, solid but without foundations, liminal spaces between outside and inside, life and death, reality and non-reality, bunkers are in fact a paradoxical way of making architecture virtual. A particularly significant case in this direction is the *Underground House* (1978) in Las Vegas. It is a luxurious 1970s mansion with all the amenities, including a garden, an artificial lawn and a swimming pool, only underground. Designed as a shelter in case of nuclear fallout, the *Underground House* is an illusionistic space built to emulate 'real life' by technological means: a curious case of the offline metaverse (Fontana, 2023a). The trajectories briefly outlined here hopefully provide some indications on the cultural history of VR, while proposing alternatives to the mainstream narrative, which would link VR only to big tech companies and to dystopian scenarios of self-isolation and diffused surveillance.

VR AND AR TRANSFORMING ARCHITECTURE, URBAN DESIGN, AND CITIZEN ENGAGEMENT

VR is increasingly being used as a valuable and creative tool in architecture and urban design to simulate the environment of future buildings or the assets of new neighbourhoods (Vilar et al., 2022). The fundamental distinction between VR and other types of visual representation lies in the direct involvement of VR in experiencing space in an immersive manner. This feature stimulates a vivid feeling of presence among users, akin to the phenomenological concept of lived space (Bandi, 2021). Users are required to constantly move and look around the digital space, while changing their perspective on the surrounding image. This process generates a personalized experience which is continuously re-shaped through their gaze and bodily position.

By wearing VR headsets, architects and urban planners can step inside their designs and sketch directly in an artificial space, dynamically adjusting components, dimensions, colours and lighting. This technology also has the potential to facilitate collaborative experiences in a virtual dimension and improve communication between the various stakeholders involved in the projects. These stakeholders include architects, engineers, consultants, clients and the general public. VR is a powerful tool for creating and simulating project realities, enabling the exchange of expertise and opinions in real time, even when participants are in different geographical locations. It is also becoming an innovative and experimental teaching practice in architecture and urban planning faculties (Vegetti, 2022; Sheikh & Crolla, 2023).

This technology is especially useful in projects which emphasize participatory design, where citizens play an active role in the process, frequently in sensitive urban contexts. n situations such as these, non-expert members of the project team may find it difficult to make an effective contribution. Virtual Reality – but also Augmented Reality, and Mixed Reality – could bring about transformative changes, allow-

ing the public to experience the project first-hand, thus increasing their awareness of available input options, potential changes, and projected outcomes.

As discussed at the conference *Real Space-Virtual Space. Aesthetics, architecture and immersive environments* organized by AN-ICON and Milano Triennale, virtual realities have various objectives and types, where architecture serves distinctive purposes and manifests in diverse forms. Recently, there has been an upsurge in discourse surrounding the 'metaverse'. This lineage of cyberspace (Benedikt, 1991) has also emerged as a sphere of experimentation (Shakeri & Ornek, 2023) for renowned architectural firms realising their visionary designs, such as Zaha Hadid Architects' *Liberland* project (Schumacher, 2022). Architecture also finds a place in immersive environments to reinterpret the past, as in the case of Femme Fatale Studio's *Dream Builders VR*. This experience delves into Étienne-Louis Boullée's unrealised 1784 project for the *Cenotaph* of Isaac Newton.

Augmented reality, which will be discussed in more detail in the next section, can also serve an important purpose in smart city implementation strategies, especially in improving points of interest (POIs) such as historical sites, monuments and landmarks (Andolina et al., 2021; Yovcheva et al. 2012; Kounavis et al., 2012). It can enhance accessibility and make these places more navigable. Thus, AR acts as a powerful tool capable of interpreting the cityscape so as to create interfaces that provide quick access to visible and readily available data. In urban environments, specific forms of augmented space deliver innovative and creative functions in addition to practical applications. The integration of novel virtual objects and meanings redefines Manovich's (2006) notion of "new poetics of augmented space". *Happy Stripe* (2020), designed by Some-People, a New York-based studio, investigates the idea of reclaiming public spaces. This installation, located in a narrow alley in the Downtown area of Frederick, Maryland, consists of a red structure made of steel and nylon ropes, along with an AR application that allows for individual or group play with

spheres of different colours virtually gliding on the structure. The project aims to encourage citizens to re-appropriate certain areas by promoting interaction between public and virtual spaces.

THE EMERSIVE VIRTUAL:
AUGMENTED REALITY AND THE CONCRETE WORLD

Virtual Reality is part of a wider family of technologies, also known as Extended Reality, which includes Augmented Reality. As already mentioned, VR is mainly (albeit not exclusively) implemented by means of a headset which totally obscures the user's visual field, often combined with hand controllers, sometimes also with more sophisticated gloves or suits to track the user's entire body. When it comes to AR, things are more diffuse in a variety of tools. All those devices that involve the superimposition of digital entities (such as 3D objects, texts, images, videos, audio tracks) on the concrete environment can be regarded as Augmented Reality (Liberati, 2018). AR can be therefore considered a family within the family: it can be experienced thanks to portables such as smartphones and tablets; using wearables like smart glasses; even with VR headsets when set in the so-called 'see-through modality', which still allows to perceive the physical surroundings. More experimental instruments are on their way, especially those conceived to 'augment' touch and the smart lens. However, at the moment retail still seems very far away for this kind of product: Ultraleap, which used to produce ultrasound tablets simulating the actual texture of concrete objects, is now more concerned about creating tools for a 'no contact' touch; the same goes for Mojo Vision, which at the beginning of 2023 decided to abandon their contact lens project, just a few months after the first successful test of a prototype on a human being.

With regard to headsets and glasses, some researchers prefer to speak of Mixed Reality (MR) to emphasize that they

represent a more complex version of AR, as they permit the interaction with multisensory objects (Arcagni, 2018). However, the first AR device was actually a pair of glasses. The term 'augmented reality' was coined in 1992 by the engineers Thomas Caudell and David Mizell. They were working on a 'see-thru' VR spectacles (Caudell & Mizell, 1992, p. 660) that would let aircraft assembly workers visualize a range of practical information for performing a task alongside their usual field of vision. In this respect, a radical distinction between portable AR and wearable AR fails to reconstruct its history, together with the widespread tendency of those actually designing, marketing, and using the technology to call it AR most of the time.

Despite their differences, all the XRs seem to be moving in the same direction: mixing the concrete and the digital to generate virtual environments. For this reason, the trend today does not seem to make a radical distinction between AR and MR. On the contrary, producers are working on devices they describe with the wider expression 'spatial computing', which, like the Apple Vision Pro, realize both AR and VR, depending on the user's wishes. According to the famous taxonomy proposed by Paul Milgram and Fumio Kishino (1994), VR and AR would in fact occupy the poles of a continuum of virtuality: while the former allows access to a completely synthetic world, which replaces the usual physical world, the latter aims at integrating everyday life with digital objects, mostly responsive and networked. In this sense, some scholars have referred to VR as immersive and AR as emersive XR (e.g. Asselin & Grosselin, 2014, p. 139; Eugeni, 2021, p. 131; Pinotti, 2021, p. 113).

As the title *Back To The Real World* of a seminal paper by Pierre Wellner, Wendy Mackay, and Rich Gold (1993) very clearly suggests, the most important feature specific to AR is the connection to concrete reality, to which it adds new electronic functions. Furthermore, in order to work properly, AR needs to be completed by innervating itself in a given context and at least in the body of one user. The movement and be-

haviour of the individual are among the most relevant components. Some parts of the human body, such as the eyes, the hands, the voice and the skin, literally serve as the technology's surface; by performing simple but specific gestures, the user controls the device. Far from being impalpable, despite its ghostly appearance, AR is capable of very tangible consequences. Thanks to AR, some, like the inventor Steve Mann, pursued the dream of liberation from some human constraints by hacking his own body to enhance perception and cognition and become a cyborg (Mann, 2001). Some others have realized that it has great productive potential, in manufacturing, in architecture and engineering: on the one hand, by keeping the users constantly at work, it absorbs them and prevents them from being distracted (Pirandello, 2023); on the other hand, it speeds up the creative and reasoning process by working with highly modifiable digital models and allowing for collaboration with others (Chandrasekera, 2018). Google, Microsoft, Magic Leap and others are all working on patenting the best enterprise smart glasses, mainly to save time and money in the assembly line and in the inspection process. At the moment, the military (which gave birth to it) and the medical field are the areas where AR is most used: it is not difficult to see why doctors and soldiers can benefit from touching and manipulating objects at a distance, without exposing themselves (or the patients) to risks; communicating remotely with other peers; rehearsing for a mission or a procedure without wasting instruments and materials.

Finally, since the 1980s, artists have become increasingly interested in the digital augmentation of space. Looking at the example of AR videogames, such as the renowned *Pokémon Go*, also intertwining its fates with certain political protest movements and with Street Art, today AR art lends itself particularly well to the production of artworks that populate public spaces and penetrate the walls of our homes, by no means designed to remain sheltered in the rooms of a museum. AR art tries to transform AR constant movement and interaction into engaged mobilization (Pirandello, 2021; 2023).

RAISING THE DEAD THROUGH VR, AR AND (PSEUDO)HOLOGRAMS

Since presence is an essential feature of immersion, AN-ICON also focuses on how XR technology can be used to make the past present again, thus contributing to the scientific field of memory studies. VR experiences such as *The Last Goodbye* (2017), *Witness: Auschwitz* (2017) and *The Journey Back* (2022) plunge users into hyperrealistic digital replicas of concentration camps which can be explored in the company of the few who survived the Holocaust (Modena, 2022, pp. 102-106). The debate is fierce between those who enthusiastically welcome the advent of new tools to preserve memories and help educate new generations by connecting them with past events, people, and facts at a much higher level of empathy, and those who, instead, highlight the dangers of fictionalising or 'Disneyfying' the genocide of European Jews during World War II.

A similar dispute has erupted over so-called 'survivor holograms', that is, hologram-like recordings of living witnesses giving authentic answers by means of artificial intelligence systems selecting the appropriate clips to play in response to questions from people interacting. While some emphasise the crucial role they can play in keeping memory alive in the post-witness era (Soulard et al., 2023; Shandler, 2020), others draw attention to the mere 'allure' of responsiveness they can actually grant (Alexander, 2021), also underlining the real risk that the thrill of a new interactive technology may become a goal in and of itself, thus causing a 'hollow' encounter with the survivors (Frosh, 2016).

The promise of immortality which lies at the core of the increasing spread (and marketing success) of 'survivor holograms' is shared by other holographic projections that make dead singers like Maria Callas, Frank Sinatra, Whitney Houston, Amy Winehouse or Tupac Shakur perform 'live' in concert again (Ng, 2021). The same goes for the digital cloning of deceased movie stars (such as James Dean, Peter Cushing,

or Carrie Fisher) via computer-generated imagery, thanks to which on screen there appear virtual actors who are barely distinguishable from their once-living counterparts.

Seen from this perspective, the new frontiers of picture production and manipulation which AN-ICON deals with seem to be aimed at challenging the traditional interpretation of the image as a paradoxical entanglement of absence and presence: the image tends to conceal its representational nature, exhibiting transparency instead of opacity, immediacy instead of mediation, presence instead of absence. Emblematic examples are the (in)famous case of a South Korean mother 'reunited' with her deceased daughter by means of a VR simulation (Conte, 2020) or the virtual sanctuary dubbed *Project Elysium*, where clients can interact with 3D models of their deceased parents or friends and thus work through their grief. Augmented Reality, too, has provided new strategies for bringing back the dead. There is also a fast growth in the number of smartphone AR apps which allow users to 'capture' pre-recorded video messages from loved ones at their graves or to create AI-powered avatars of the deceased to interact with in a metaverse.

Notwithstanding the hype around these projects, one cannot fail to notice that their promises cannot be kept. Aspects like the lack of credible eye movement on the part of the avatars or the absence of any genuine interaction because of the technical constraints peculiar to all existing versions of virtual metaverses cannot but reveal the true nature of the simulation. Despite all the fanfare, a death-like stasis still permeates these technologies of animation.

Other strategies for preserving memory and commemorating the dead thus prefer to avoid narratives of absolute immediateness and perfect transparency and make evident from the outset the necessarily mediated nature of all XR experiences. In the domain of public art, a good case in point is *Border Memorial: Frontera de los Muertos* – an app built to celebrate the countless South American migrant workers who have died in the attempt to enter the Unit-

ed States illegally. Aiming the cameras of their devices at the landscape, people see superimposed skeleton effigies floating off into the sky at the precise GPS coordinates of each recorded death (Auchter, 2020). Rather than trying to captivate the user by giving them an illusory sense of presence, *Border Memorial* induces a strong sense of loss and absence, paradoxically eliciting higher empathy precisely when all the rhetoric surrounding the "empathy machine" (Milk, 2015) is eschewed.

Lastly, VR can also be used to make people experience their own death, inducing in them a strong feeling of having an out-of-body experience – something that previous media like cinema and television could barely achieve (Conte, 2021). In this specific case, the first-person perspective provided by the head-mounted display ends up coinciding, paradoxically enough, with a disembodied gaze: the observer finds herself gazing at her own dead (and therefore unable to gaze) body, so that she feels as if she possesses a body that is, and at the same time is not, her own. According to some recent experiments in the field of cognitive science (Bourdin et al., 2017), this can also lead to a mitigation of the fear of death.

INSIDE THE USER'S MIND:
VR IN PSYCHIATRY AND PSYCHOTHERAPY

Neglected or hidden away for a long time, mental healthcare is currently receiving increasing attention in public discussion. The World Health Organization has launched initiatives to improve treatment coverage and fight stigmatization, and representations of mental health issues proliferate in the mass media: from 'top-down' productions (TV series like *BoJack Horseman* or *Atypical*) to 'bottom-up' phenomena (memes and reels circulating on Instagram or TikTok).

Such renewed interest is accompanied by a tendency to introduce innovations in mental healthcare 'from within',

with some practitioners becoming interested in new technological resources. Among the latter is virtual reality – VR (Cavaletti & Grossi, 2020; Park et al., 2019).

One of the main properties that make this technology interesting for psychiatrists and psychotherapists is its capacity to produce simulations with a very high degree of realism – defined not necessarily as photorealism, but rather in terms of providing sensorimotor contingencies that are similar to those encountered in the actual environment (O'Regan & Noë, 2001). In this way, VR can elicit what has been named plausibility illusion: i.e., the impression that the events in the virtual world are really happening, and the subsequent propensity to react to them as in real life (Slater et al., 2022).

Highly realistic simulations in the sense specified are very useful for therapeutic approaches inspired by the principle of exposure, i.e. the idea that dysfunctional responses – like phobias – triggered by given stimuli can be improved by presenting to the subject precisely those stimuli (Foa & Kozak, 1986; Craske et al., 2008). VR allows this to be done in a way which, while preserving the substantial traits of a real-life situation, makes it safer and more bearable, as patients know that – as compelling as they may be – the stimuli they are facing cannot actually threaten them. Virtual simulations thus become a testing ground for developing coping skills to be transferred later on into real life. An example in this regard is *Khora Exposure*, an application that offers people with social anxiety a selection of 'triggering' virtual scenarios: taking part in a house party, giving a speech, or causing a delay at a supermarket check-out.

A second relevant property of VR is the fact that it can facilitate the occurrence of another illusion, that of body ownership (Kilteni et al., 2015). Occurring in the presence of a virtual representation of the user, or avatar, this phenomenon implies feeling transported into the avatar's body, to the point that the latter substitutes one's own – an extreme instantiation of embodiment. In therapeutic settings, this il-

lusion becomes fruitful in the treatment of so-called 'body image disorders': in fact, researchers are experimenting with ways to help people restructure distorted perceptions of their appearance by letting them inhabit different bodies (Riva et al., 2021; Turbyne et al., 2021).

Among the available approaches, some combine the embodiment technique with elements of exposure. In the reference frame shifting approach (Riva, 2011), for instance, patients share an episode of their life in which their body image was impacted negatively; a virtual reproduction of the episode is then created, and the patients are assisted as they go through it again while alternating first- and third-person perspectives on their body, a process that helps counter the acquired negative feelings and beliefs.

As promising as it can be in the treatment of different mental health issues, recurring to VR in therapeutic settings does not always appear fully justified.

A problematic case in this regard is the use of VR in autism interventions (Dechsling et al., 2022). VR, when experienced via headset, can be uncomfortable: the device produces a sense of pressure and heat on the user's face, and it can feel heavy. Since people with autism often experience hyper-reactivity to external stimuli (American Psychiatric Association, 2022, p. 57), the discomforts just listed are arguably accentuated in this specific population group. For this reason, it has been suggested, VR may be usefully replaced by augmented reality – AR (Liu et al., 2017; Cavaletti, 2022). Potentially as effective as the former, the latter usually proves less perceptually challenging, which could make it more tolerable for particularly sensitive users.

Assessing carefully the concrete advantages and limitations of VR in therapeutic settings, and remaining open to discard it in favour of better alternatives, appears key not only to ensuring the success of particular interventions, but also to preserving the credibility of VR itself as a reliable and effective tool, and to fostering its further growth in mental healthcare.

VR FOR TEACHING AND LEARNING

As we have just seen, VR is not a recent technology, nor is its application to education (Hamilton et al., 2021): the first recorded implementation of a digital VR system appeared in 1966, in the form of a training flight simulator for the United States air force (Page, 2000), and since then the phenomenon has become more and more debated in the scientific community and increasingly used in teaching and training practices. VR technology has emerged as a powerful and transformative tool with profound relevance for both teaching and learning paths. In this context, VR applications address several key challenges facing educators and learners, aligning seamlessly with the changing needs and learning styles of contemporary students.

In the rapidly evolving landscape of modern education, it becomes evident that this technology raises numerous issues and seems to be aligned with the needs of contemporary learners and educators. As Virtual Reality mediated through head-mounted displays (HMD) becomes more affordable, children and young people are beginning to engage with the technology during leisure and school time. For example, it is estimated that after its release in late 2015, Google Expeditions, promoted as 'field trips to anywhere' has been tried by more than two million school children (Charara, 2017).

The use of VR in schools is in its infancy (Southgate et al., 2019), even though the phenomenon of immersive learning has been studied for years. Immersive settings are exploited especially when it is advantageous to generate simulations of scenarios and places in which interactions with other objects are activated, useful for developing skills and abilities that are difficult to achieve in face-to-face settings. Through its visual and interactive representation, VR enables learners to transcend mere theoretical comprehension and actively participate in the practical facets of a learning scenario. Learners can witness correct procedures,

emulate the actions of the virtual model, and acquire a more profound grasp of the sequential steps essential for successful execution.

Contents from medical disciplines, generally designed for universities and some secondary institutions, are particularly widespread (Garavaglia & Petti, 2022). A motivation commonly cited was the potential that VR holds to facilitate personalized learning experiences, aimed at meeting the needs of individual students. Educational Virtual Reality software potentially allows students to explore and learn at their own pace. This characteristic gives rise to a self-paced learning experience: using VR, students can potentially repeat lessons as many times as they want, without the need for an instructor (Tredinnick et al., 2014).

Many studies agree that immersive technologies have broad potential for learning (Kavanagh et al., 2017): simulation and training are the two main scenarios in which VR seems to have a very high impact. On the one hand simulation VR provides the possibility for participating in the exploration of virtual environments that would otherwise be infeasible or too dangerous to undertake in reality; on the other hand, training supports the acquisition of procedural knowledge, relying on the modelling strategy and allowing students to observe particular actions, behaviours or skills that need to be learned. From this perspective, VR offers a unique solution by enabling students to step into virtual worlds and engage with realistic scenarios. This not only enhances their understanding of complex concepts but also allows them to apply theoretical knowledge in practical settings. Fields such as medicine, engineering, and aviation have embraced VR simulations to provide students with invaluable hands-on experiences, enabling them to practice complex procedures and situations before encountering them in real-world contexts.

In terms of learning outcomes, the adoption of VR as a pedagogical tool is certainly challenging but it appears to be useful and effective as well. A recent study (Jensen &

Konradsen, 2018) confirms that learners who used an immersive HMD were more engaged, spent more time on the learning tasks and acquired better cognitive, psychomotor and affective skills.

In 2003, Burdea and colleagues showed that the frequent use of interactive VR can both improve student motivation and retention; other studies described either novelty or the increased interactivity typically provided by educational VR systems as an explanation for why their system would result in increased student enjoyment (Fabola & Miller, 2016). Many studies have also shown that the use of immersive technologies supports the students' sense of presence (Makransky & Mayer, 2022) and the memorisation and execution of procedural knowledge, rather than theoretical knowledge (Makransky, et al., 2021).

Considering the concrete use of immersive technology in schools, it is often hindered by different factors. Students frequently reported issues with the lack of realism provided by the educational VR implementations, and this could potentially detract from the learning experience (Le et al., 2014). Secondly, it is crucial to consider the high costs of these devices, often prohibitive for state schools, and also the preparedness of teachers, who are often inadequate to offer an effective immersive experience. However it is useful to remember that affordable solutions have been available on the market for years, such as the Google *Cardboard* system. Google *Cardboard* is a VR headset made, as the name suggests, of cardboard or other low-cost materials. It was first introduced by Google in 2014 as an open-source VR platform. The design is straightforward: it consists of a cardboard frame which holds a smartphone in front of the user's eyes. The smartphone acts as the display and computing unit for the VR experience. Lenses inside the Cardboard headset help create a 3D stereoscopic effect, making virtual environments appear immersive when viewed through the lenses. Plenty of immersive content is also available for free online: on Google Play Store there are many downloadable experiences, the

Google *Expedition and Sites in VR* offers several 360-degree tours, and YouTube makes available a channel specifically for 360 videos as well. There are also some immersive platforms for schools, where students and teachers are provided with different 3D environments or layouts that are easy to build (*CospaceEdu*, *Spatial* or *Verse*). In all these cases it is essential to remember to design VR experiences thoughtfully, considering the specific learning objectives, target audience, and educational context to maximize the benefits of this technology. Teachers have to consider that the immersive experience should be short (Jensen & Konradsen, 2018), situated (Mei & Sheng, 2011) and interactive, giving students the opportunity to engage with objects and/or classmates and carry out functional tasks (Hamilton et al., 2021).

Thinking about the characteristics of the didactic experience, teachers should consider the importance of both a preparatory (Cavaletti & Terrenghi, 2023) and debriefing phase. In addition to the attention mentioned above, it is important for teachers to monitor motion sickness, a temporary discomfort due to sensory misalignment and which can present in different forms depending on the subjects (Khalid et al., 2023). This phenomenon can be significantly reduced by using devices with high definition and refresh rate; there are also very recent studies showing that certain electrical stimulation goes a long way toward reducing these physical problems (Benelli et al., 2023). In conclusion, we know that research in the educational field is therefore still very intense and constantly being updated, showing rapidly evolving scenarios.

Design, and Citizen Engagement' by Fabrizia Bandi, 'The Emersive Virtual: Augmented Reality and the Concrete World' by Sofia Pirandello, 'Raising the dead through VR, AR, and (pseudo)holograms' by Pietro Conte, 'Inside the User's Mind: VR in Psychiatry and Psychotherapy' by Federica Cavaletti, 'VR for teaching and learning' by Ilaria Terrenghi.

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NOTES

1 https://an-icon.unimi.it/

2 In the following pages we will refer to the latter by the abbreviations XR, MR, VR and AR.

3 The project also includes research on gestures and interfaces in VR by Barbara Grespi (2021), on the phenomenology of the corporeality of the virtual avatar by Anna Caterina Dalmasso (2019; 2022), on contemporary art and immersive storytelling by Elisabetta Modena (2022; 2023), on the new truth paradigms of immersive journalism and forensic photography by Rosa Cinelli, on immersive devices and their relationship with erotic-pornographic material by Roberto Paolo Malaspina (2023; Malaspina, Pinotti & Pirandello 2022), on funeral practices and rituals in digital and virtual environments by Maria Serafini, and a feminist theory of horror cinema that includes contemporary immersive media by Rossana Galimi. Last but not least, within the project Alessandro Costella is working on the design for a prosthetic system for people with disabilities.

4 For the a neuroscientific analysis of the empathic relationship toward movies, see Gallese & Guerra, 2019.

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VR APPLICATIONS FOR CULTURAL HERITAGE:

HARNESSING PROXEMICS AND INTERACTIVITY FOR HERITAGE DISSEMINATION

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Recently, Virtual Reality (VR) has witnessed remarkable growth across various fields, such as education, gaming, and entertainment. In the cultural heritage domain, VR has demonstrated its significance by enabling digital reconstructions of buildings and objects. It allows the public to access virtual representations, interpreting and disseminating cultural heritage through virtual visual storytelling experiences. Despite its potential, VR remains underutilized in the cultural field.

By leveraging VR's extensive capabilities alongside on-site experiences, it offers a comprehensive exploration of architectural and museum environments, becoming a versatile tool for interpretation, learning, and knowledge dissemination. VR introduces innovative paradigms like proxemics, interactivity, and immersion in entirely new digital worlds. The study conducts an in-depth analysis of this ever-evolving technology, with a focus on its applications in two significant case studies: the *Museo Egizio* of Torino and the Basilica of Sant'Ambrogio in Milano. The investigation critically assess VR's effectiveness, highlighting its potential to implement visitors' experience and improve knowledge dissemination of both tangible and intangible aspects embedded in museums' collections and historical buildings.

INTRODUCTION

The architecture and archaeology fields have recently experienced remarkable changes, with methodologies and practices deeply rooted in the theoretical and methodological foundations of these disciplines (Smith, 2020). Globally, diverse research groups have emerged, each adopting different approaches that reflect the influence of scientific and cultural backgrounds, as well as distinct operational methods (Hou et al., 2022; Windhager et al., 2018; Schweibenz, 2019). The advent of visual interactive digital tools has enabled museums and cultural institutions to present their heritage in virtual and immersive environments, thus empowering individuals to become active participants in the cultural domain as 'cultural prosumers', who both consume and produce cultural content (Luigini & Panciroli, 2018; Lanier, 1992).

Recent research in the field of cultural heritage has focused on the design of high quality spatial experiences, with researchers seeking to develop theoretical models that optimise the combination of interaction modes and virtual reconstructions (of either objects, buildings or sites).

Particularly significant, is the work of Baradaran Rahimi, who has highlighted the transformative impact of new media and technologies on museums, transforming them into hybrid spaces where physical artifacts harmoniously coexist with virtual and augmented reality experiences (Baradaran Rahimi et al., 2022). Rahimi's cognitive theory offers a valuable reference model that encompasses key dimensions, such as duration, trigger, scope, significance, interaction, and intensity, which contribute to enhancing spatial experiences. Consequently, understanding how visitors interact with virtual activities and the essential spatial elements becomes of paramount importance.

Along with that, the emerging paradigm of digital proxemics explores the utilization of space within virtual environments and how the presence of other users influences behaviors, interactions, and movements. Thus, the

creation of hybrid spaces and the appropriate handling of digital proxemics represent novel challenges for museums and heritage sites. The concept of proxemics, introduced by American anthropologist E.T. Hall, plays a pivotal role in understanding human spatial behavior, interpersonal distance, and the communication process (Hall et al., 1968).

Hall's comprehensive exploration reveals how individuals employ space to create meaning, exchange information, and regulate social interactions. His seminal works, *The Silent Language* (1959) (Hall, 1973) and *The Hidden Dimension* (1966) (Hall, 1966), shed light on the cultural codes that underlie spatial behavior, emphasizing their significant impact on communication and mutual understanding.

Today, proxemics has become an essential field of study in communication and social psychology, providing valuable insights into the intricate interplay between individuals and their spatial environment. Hall contends that proxemics is concerned with the organization of human spaces and the analysis of relationships between individuals, thereby enhancing our understanding of group dynamics. In the realm of virtual environments, developers strive to create immersive experiences that effectively manage the spatial relationships and interactions with virtual objects. This novel area of inquiry has given rise to *digital proxemics*, a field that investigates how individuals relate to virtual spaces and objects, aiming to improve design and redefine the relationship between users and sensory experiences (Williamson et al., 2022). This paradigm opens up new possibilities for extending reality and facilitating exploration of otherwise inaccessible worlds (Mueller et al., 2014). Virtual Reality offers visitors highly immersive experiences that fully engage them with virtual environments, enabling interactions with virtual objects and artworks (Trunfio et al., 2022).

This interdisciplinary approach, incorporating digital representation, 3D modeling, digital photography, and cutting-edge software, augments interactivity and immersion in virtual environments, fostering a transformative

process that enhances accessibility and appeal to an increasingly diverse audience. According to these considerations, illustrating two VR applications, the article proposes a reflection on the role of interaction and digital proxemics for user's engagement in virtual environment.

INTERACTIVITY IN IMAGE BASED VIRTUAL APPLICATIONS: THE CASE OF THE *MUSEO EGIZIO*

Due to the Covid-19 pandemic, the sudden lack of physical interaction forced the introduction of virtual connections between people, places and objects. However, it has been shown how these virtual connections can be used productively (Greco et al., 2020). Therefore, with the aim of combining material and digital culture, the *Museo Egizio* of Torino realised a virtual tour of a part of the museum. The development of the virtual tour had the following objectives 1) to guarantee the physical accessibility (off-site) of the museum and its collections; 2) to achieve the cultural accessibility of the museum's collections by offering unprecedented learning and visualisation modalities that cannot be pursued in a real (on-site) visit. The virtual tour developed makes it possible to remotely explore and study some of the Museum's environments, allowing virtual interaction with the objects in the showcases and the multimedia content associated with them.

The virtual tour has been developed with the aim of providing the public with an easy-to-use tool available free of charge on the Museum's website.

THE GENERATIVE WORKFLOW

For the creation of the virtual tour, in the data acquisition phase, the first step consisted in taking 360° photographs. Regarding the tools, a Nikon D850, a 45,7 MPix full-

frame camera with a special lens, with the Sigma 8 mm f/3.5 circular fisheye was used to make the panoramic, 360° images. The Agnos RingT and Agnos rotator attached to the lens allowed the camera to rotate around the nodal point of the lens. The whole system is also connected to the Manfrotto 338 leveling base (which allows rotation of the above system on a level plane) and to a sturdy photographic tripod (in our case it is a carbon fiber Sirui N-3204X). This streamlined system has been chosen for its ease use and speed of action, considering the short time to produce the final outcome.

Once defined tools and methods for data acquisition, the second step consisted in the identification of the stationing points (these points correspond to the nodes through which it is possible to move within the virtual tour). Then, the panoramic photographs were shot in the planned stationing points within the selected museum indoor environments. For each stationing points four photographs, one every 90°, were taken. An f/8 aperture, constant in all the shots, was used. It provides an optimal depth of field for this type of shooting, without incurring diffraction and consequent degradation of the final image.

The circular fisheye lens used, having a very wide angle of view (slightly less than 180°) enabled to minimize the number of shots to be taken to rebuild the 360° space. Images obtained with this particular type of lens show marked curved lines as one moves away from the center and a distorted space, but for the purposes of the project this was not relevant.

THE DEVELOPMENT OF THE VR EXPERIENCE AND THE DESIGN OF THE USER INTERACTION

In the elaboration phase, the photographs taken, in .NEF format, were imported and processed in *Lightroom CC* optimizing few parameters such as: exposure, highlights and

Fig. 1 Sample of the panoramic photographs processed and optimized. Software employed: Lightroom CC. Source: authors.

shadows, and removal of chromatic aberrations (Figure 1). After that, images were exported in .jpg format, considering their use for web. The 360° space was reconstructed by joining four photographs, one every 90°. The photographs where joined (stitching process) using *PTGui*, a specialized software application for creating this type of images (Figure 2). The four images were joined according to an equirectangular projection pattern and then exported in .jpg format. Considering that the camera rotates around the nodal point of the lens[1] it has been possible to finalize the stitching process avoiding joining errors. Once all the 360 panoramic photos have been generated, the construction of the virtual tour began. For the development of the virtual tour, the software *3DVista* was adopted (Figure 3). *3DVista* is a proprietary software that allows the insertion of linked panoramic images and, most importantly, the addition of any kind of multimedia content. *3DVista* proved to be a very effective tool in the editing process as it offers a very wide range of customization options. To enrich the virtual tour experience of the museum, several multimedia contents were created ex-novo, specifically for this project.
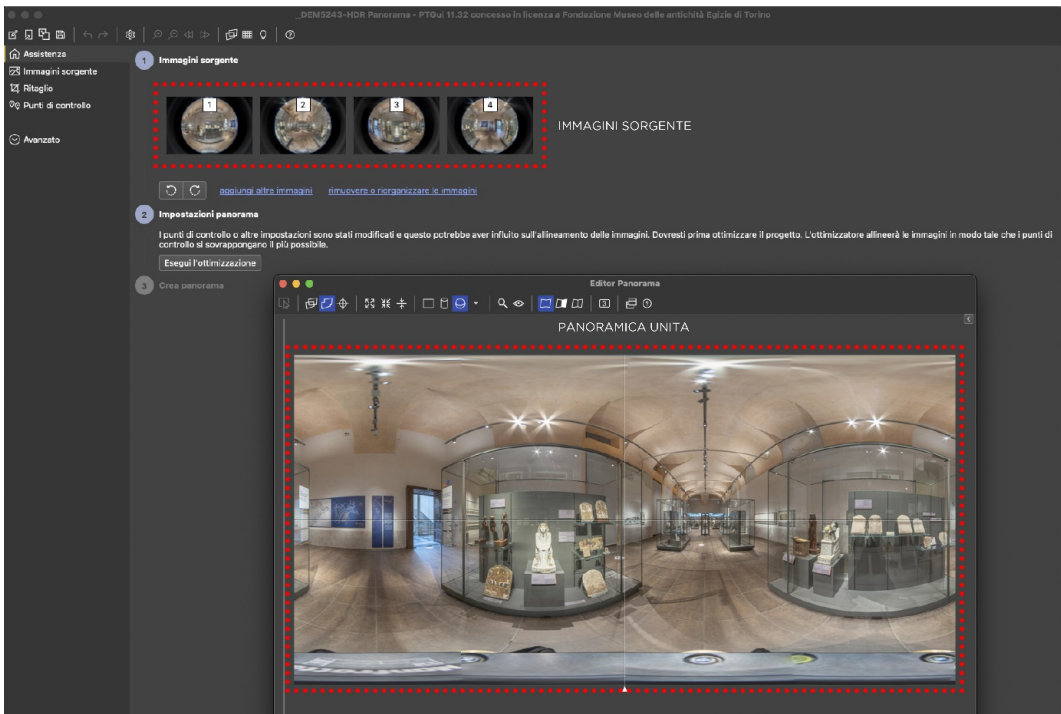
Fig. 2 Example of a 360° image generated by merging four photographs taken every 90°. This process was repeated for each environment to be recreated virtually.

Software used: *PTGui*.
Source: Authors.

For instance, videos dedicated to some of the objects hosted in the showcases, visible within the virtual tour, were created and narrated by the Museum's curators. Several 3D models have also been generated to allow the visitor a 360° appreciation of the modelled artifacts.

Additionally, image galleries have also been created, with a number of photographic campaigns specially carried out for this purpose. These images allow users to appreciate every detail of the archaeological object showed in the Museum's path, taking advantage of the high-resolution photos and the possibility to zoom in catching details otherwise invisible. Further, the historical photographs dedicated to the tomb of Kha and Merit, one of the masterpieces of the Museum's permanent collection, have been made searchable and usable in high definition directly from the virtual tour. To improve the usability of the virtual tour, for texts and videos, multilingual contents were provided.
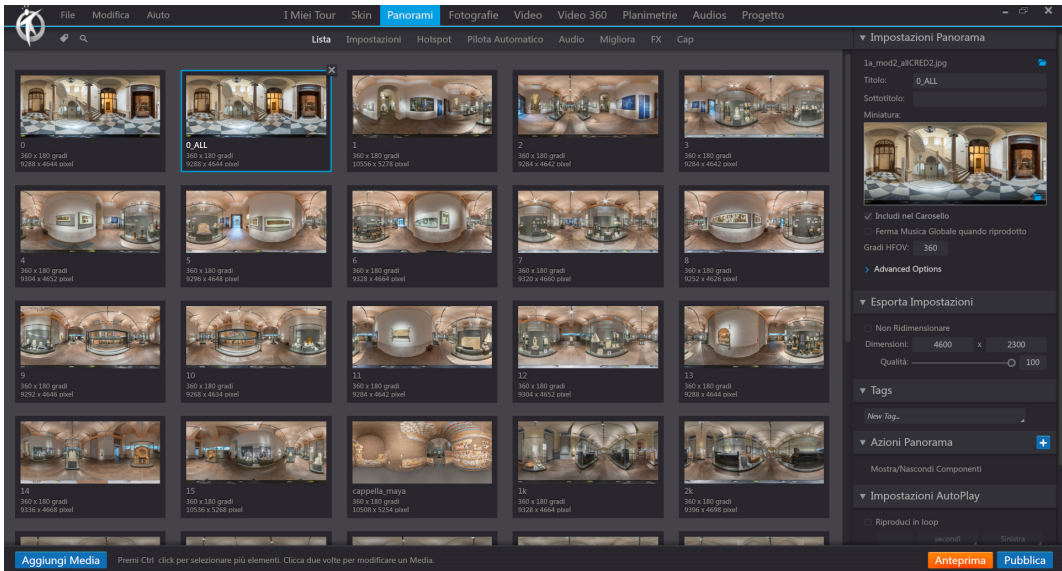
Fig. 3 3DVista software interface showing the definition process of the sequences of the panoramic images for the virtual tour. Source: authors.

More specifically, contents were made available in five languages: Italian, English, French, German and Arabic (Figure 4).

Moreover, most of the artifacts visible in the virtual tour have been linked with the Egyptian Museum's online databases. More specifically, the papyri have been linked to the TPOP *Turin Papyrus Online Platform* (https://collezionepapiri.museoegizio.it), thanks to which it is possible to visualize and consult descriptive sheets accompanied by historical and bibliographical information, high-resolution photographs, and the translation of the texts, in different languages.

The other artifacts have been linked to the Egyptian Museum's online database (https://collezioni.museoegizio.it) where it is possible to retrieve the selected artifact sheets containing basic information and a rich photographic description.

The adopted approach and the software employed, enabled to virtually visualize and interact with some artifacts in a way that would be impossible in a on-site visit (Figure 5). For example, through the 3D models it is possible to explore
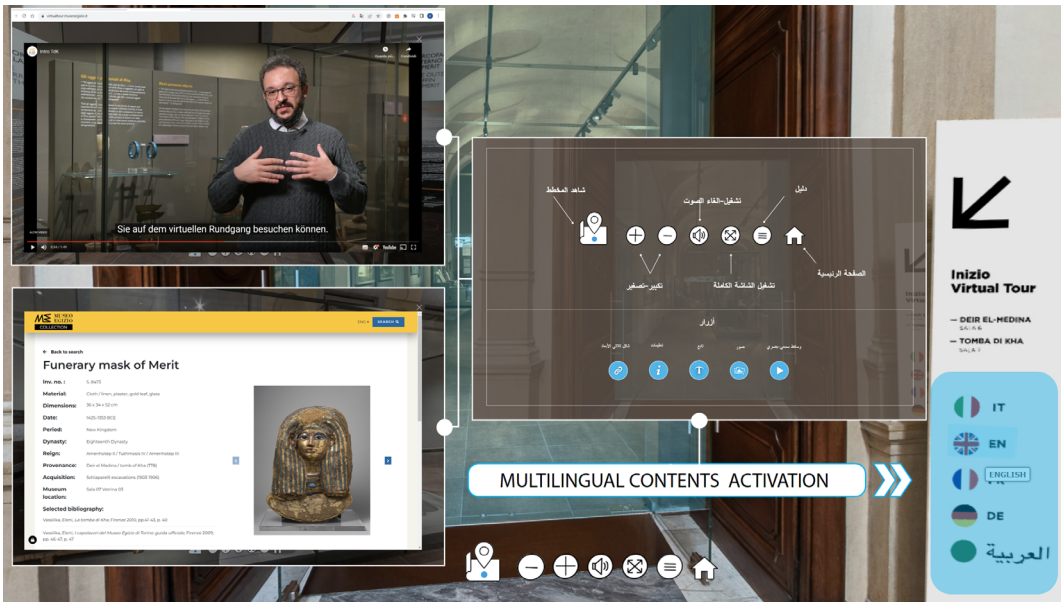
Fig. 4 Graphic interface adopted to activate the provided multilingual contents. Source: authors.

the object in 360°, having the opportunity to grasp details that are not visible when displayed in the showcase.

The possibility to virtually interact with the Museum's artifacts was allowed not only through 3D model of the displayed object but also through its photographic representation. For instance, in the case of *Maya Chapel*, the panoramic photo taken from inside the Chapel, allows to visualize, zoom in and out to appreciate all the details of the decorations of this small, fully painted funerary chapel (also considering that the access to *Maya Chapel*l is forbidden to the public) (Figure 6).

The virtual tour allows to explore its interior and appreciate, from a different perspective, the rich pictorial decoration, enjoy and interact with the numerous multimedia contents associated with it. The perceptual-motor model adopted enabled different levels of interaction within the generated virtual environment.

This approach allowed engaging users to learn through the response they receive from the interaction with digital objects and contents.
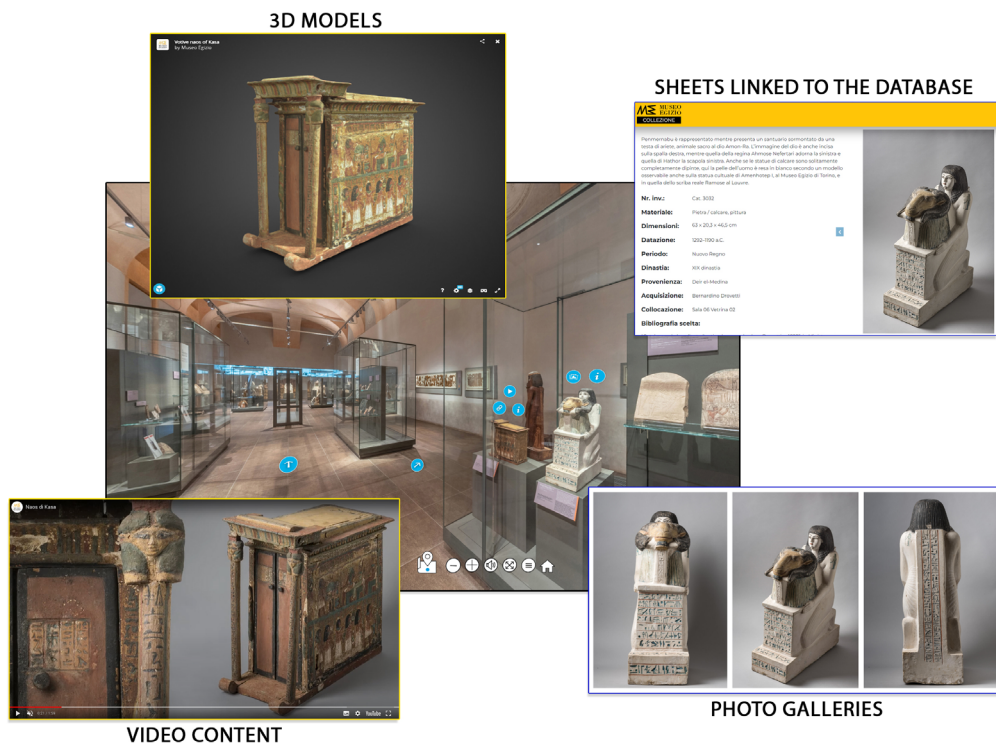
Fig. 5 Interaction available within the virtual tour. Source: authors.

DIGITAL REPRESENTATION OF THE BASILICA OF SANT'AMBROGIO: FROM ARCHIVAL RESEARCH AND 3D SURVEY TO HBIM MODEL

The case study of the Basilica of Sant'Ambrogio in Milan (Figure 7), is representative for its layered history, it complex and stratified architectures as well as for its cultural, social historical and religious relevance. During World War II, Milan was heavily hit by aerial bombings, and the Basilica of Sant'Ambrogio suffered significant damage. After the war, restoration work began immediately to preserve and restore the damaged heritage. Experts focused on repairing the damaged parts and reconstructing the colored stained glass windows. The restoration was a challenging and meticulous endeavor that took years of work (Bella, 2013). Thanks to the joint efforts of art historians,
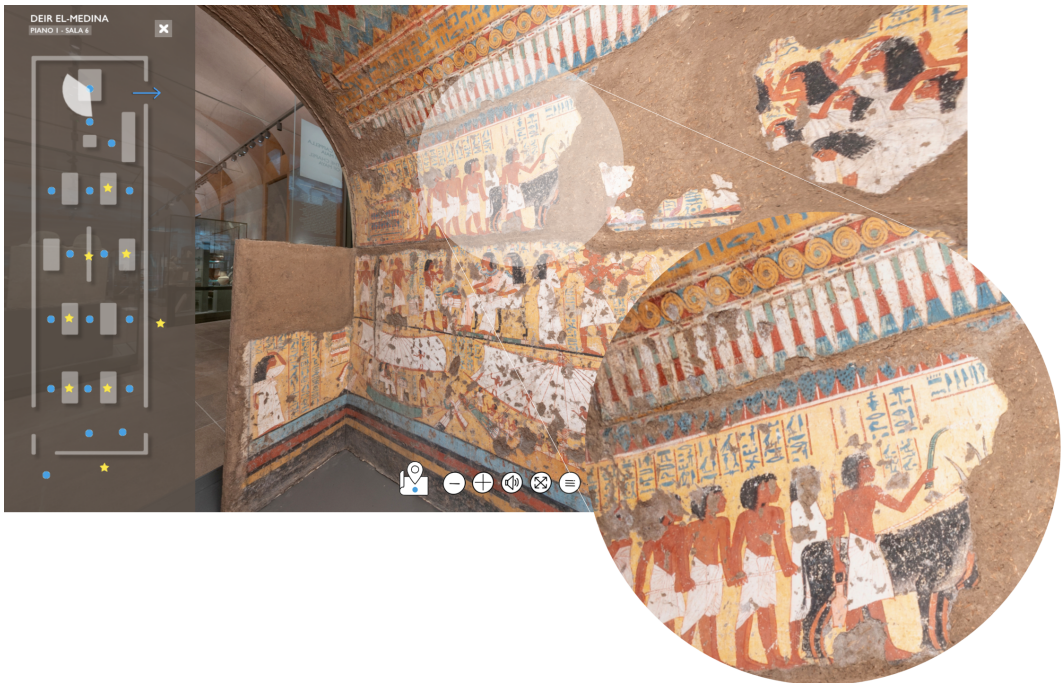
Fig. 6 Possibility to access, explore and visualize, with a high level of detail, artifacts of the *Museo Egizio* not physically accessibleb such as the Maya Chapel. Source: D. Mezzino.

architects, restorers, and local authorities, the Basilica of Sant'Ambrogio was finally restored to its ancient grandeur, preserving its historical and religious importance for future generations (Patetta, 1983). Today, visitors can admire its beauty and historical significance thanks to the subsequent restoration that has preserved this architectural gem.

Recent advancements in VR technology offer exciting opportunities to present its cultural heritage in innovative ways (Boletsis & Chasanidou, 2022). This study adopts a mixed-method approach, combining qualitative and quantitative data collection methods and multiple VR locomotion types to comprehensively assess the impact of proxemics and interactivity within the virtual environment. The study specifically concentrated on the Rectory designed by Bramante between 1492 and 1499 for the Canons of Sant'Ambrogio.

Both edifices (Basilica and rectory) held substantial historical and cultural importance, with the Rectory being promoted by Ludovico il Moro (1452-1508), the Duke of Milan.

Fig. 7 Main views of the Basilica
of Sant'Ambrogio: a) the Main
façade and Quadriportico;
b) architectural details and vaults;
c) the Rectory designed by
Bramante; d) the vault of the
chapel of San Vittore in golden sky.

These structures were chosen as compelling case studies to explore the practical application and potential implications of incorporating proxemics and interactivity in the realm of virtual architectural modeling. The creation of the model-based virtual application involved seamlessly integrating high-resolution 3D scan-to-HBIM models, historical data, and interactive elements. To evaluate the effectiveness of the model-based virtual application, a comprehensive approach was adopted, incorporating on-site observations, 3D surveys, in-depth archival research, and HBIM-to-VR developments. Additionally, spatial analysis and data visualization techniques were employed to assess the impact of interactivity and proxemics on user engagement. The interpretative complexity of the project encompassed various stages. Firstly, archival documents, written sources, historical drawings, images, past surveys, and scholars' reconstructive hypotheses were systematically organized. Secondly, the interpretation of historical transformations was developed based on data and information recorded during the reconstructive modelling process.

Lastly, a communication strategy was devised, catering to diverse audiences, including specialists and the general public. Extensive archival research, including historical documentation and publications by renowned restorers, art historians, scholars, and art critics over centuries, facilitated data collection about the Basilica and its Rectory. Scholars gained insights into its historical evolution and original architectural configuration damaged during WWII. Contributions from esteemed architects like D. Bramante, P. Tibaldi, and F. M. Richini were crucial. These scholarly investigations form the foundation of Milanese and Lombard polytechnic culture, stored at Politecnico di Milano's Historical Library, which houses notable illustrated manuals on civil and industrial construction practices. By the following structured approach, the research achieved a realistic and immersive virtual environment by combining data from different 3D survey campaigns and digital models over the course of the last years.

The workflow was structured into the following systematic steps (Figure 8):

1. Data Collection (2D,3D): Gathering data from multiple 3D survey campaigns and digital models to create a comprehensive dataset for the reconstruction process. Utilizing laser scanning, total station survey, and photogrammetry, data acquisition and processing were conducted and improved to generate a consolidated point cloud.

2. Scan-to-HBIM generation: Ensuring the collected data is accurate and removing any inconsistencies or errors to maintain the quality of the reconstruction; employing state-of-the-art reconstructive techniques to recreate the virtual environment from the compiled data. A non-parametric modelling software (*McNeel Rhinoceros*) was chosen to manage *NURBS* of the complex surveyed geometries effectively; Introducing the results of the reconstruction into a unified and coherent HBIM model.

3. Validation and HBIM Assessment: Conducting rigorous validation tests to ensure the accuracy and realism of

the reconstructed HBIM environment. The application of an automatic verification system (AVS) ensured the accuracy level and checked the modelling process results.

4. VR-Content Implementation: Integrating the virtual model into a VR environment, enhancing the user experience and interaction possibilities; continuously refining the model and implementation based on feedback and emerging technological advancements.

The primary data sources for achieving a precise scan-to-BIM model were Terrestrial Laser Scanning (*TLS*) survey and digital photogrammetry. These non-invasive techniques generated point clouds, facilitating accurate detection and measurement of the Basilica's internal and external elements (Figure 9). Digital photogrammetry addressed data gaps caused by inaccessibility due to scaffolding, barriers, or vegetation. However, some parts, like the extrados of the vaulted systems, remained inaccessible during the 3D survey. 1. *Agisoft Metashape* processed the data, and Ground Control Points (*GCPs*) and Check Points from the laser scanning survey constrained the reconstruction and verified metric accuracy. The geodetic network, measured with Total Station Leica TS30, comprised eight stations, achieving an average precision of ±1,0mm after least squares adjustment. Faro Focus3D facilitated internal

Fig. 8 *The proposed workflow: from data collection to VR implementation. Source: authors.*
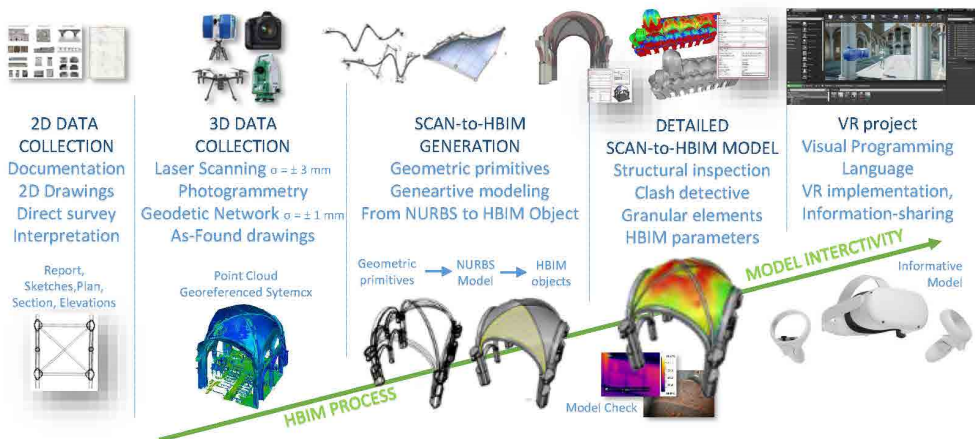
**Fig. 9** *Laser scanning data: point clouds of: a) the Quadriportico; b) the Basilica; c) the Rectory designed by Bramante.*

(3300m2) and external (4800m2) scans, with an average precision of ±3,0mm using total station measured chessboard targets and scan-to-scan spherical targets. The data collection phase included multimedia data for geometric/material analysis and enriching VR and AR projects, enhancing cultural richness representation of the Basilica of Sant'Ambrogio.

The utilization of free-form modeling based on *NURBS* geometry was pivotal in interpreting complex three-dimensional elements without the need for manual segmentation and lengthy slicing phases. Different approaches to digital modeling and information sharing were explored, incorporating modeling requirements for Historical/ Heritage Building Information Modeling (HBIM). These methods combined mathematical algorithms and *NURBS* modeling with BIM logic, leading to a more efficient and expedited modeling process for as-found-BIM projects.

The generative phase of the model involved the reprocessing of a vast amount of data obtained from laser scanning and photogrammetry. Through an extensive study of archival documents, a deeper understanding of the basilica

Fig. 10 *Model creation: from 3D drawing to NURBS model of: a) the Quadriportico; b) the Basilica; c) the Rectory designed by Bramante.*

and rectory was achieved, enabling the translation of this knowledge into an interpretive act aimed at createing lines, complex surfaces, and solids corresponding to specific architectural and structural elements (Figure 10).
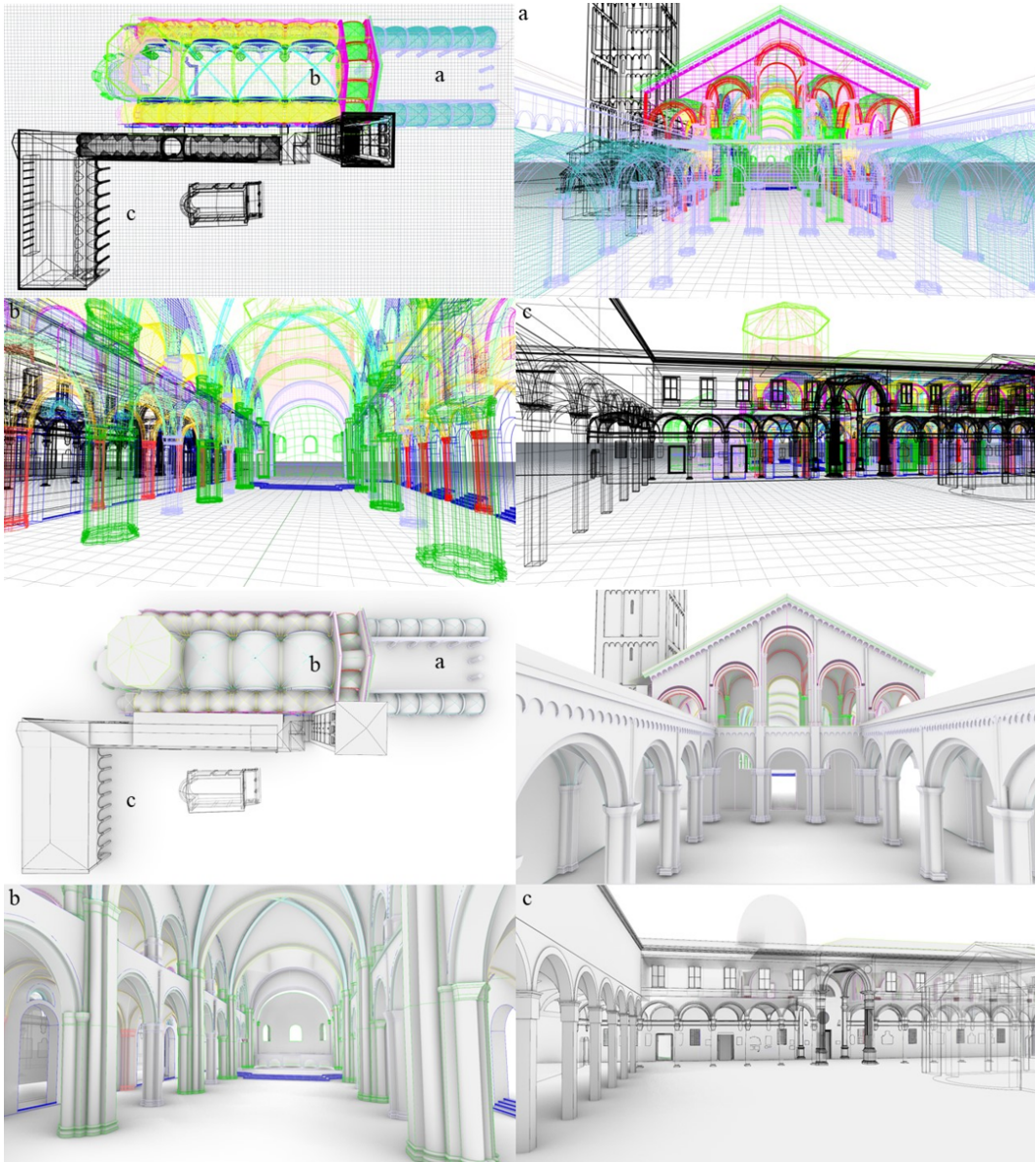
Heritage Building Information Modeling (HBIM) is a well-known process that involves creating a digital representation of historical structures, encompassing detailed information about their physical elements, materials, and historical significance. This 3D digital model serves as a valuable tool for documenting, analyzing, and preserving the unique features of the building. Moreover, it greatly facilitates researchers, conservationists, and architects in studying and planning restoration, conservation, and adaptive reuse projects.

HBIM models play a vital role in the field of heritage conservation and management, as they foster a deeper understanding of the building's history and construction techniques, thereby aiding in the development of suitable conservation strategies. By integrating historical documentation with modern Building Information Modeling (BIM) technology, HBIM models offer a comprehensive and integrated platform for research, documentation, and decision-making processes concerning the preservation and sustainable management of cultural heritage assets.

Fig. 11 *Unlocking Heritage in 3D: The bidirectional synergy of objects and information in HBIM generation. Tailored parameters ensure the accuracy and reliability of HBIM objects, blending data from historical reports, drawings, laser scans, photogrammetry outputs, and high-resolution textures.*
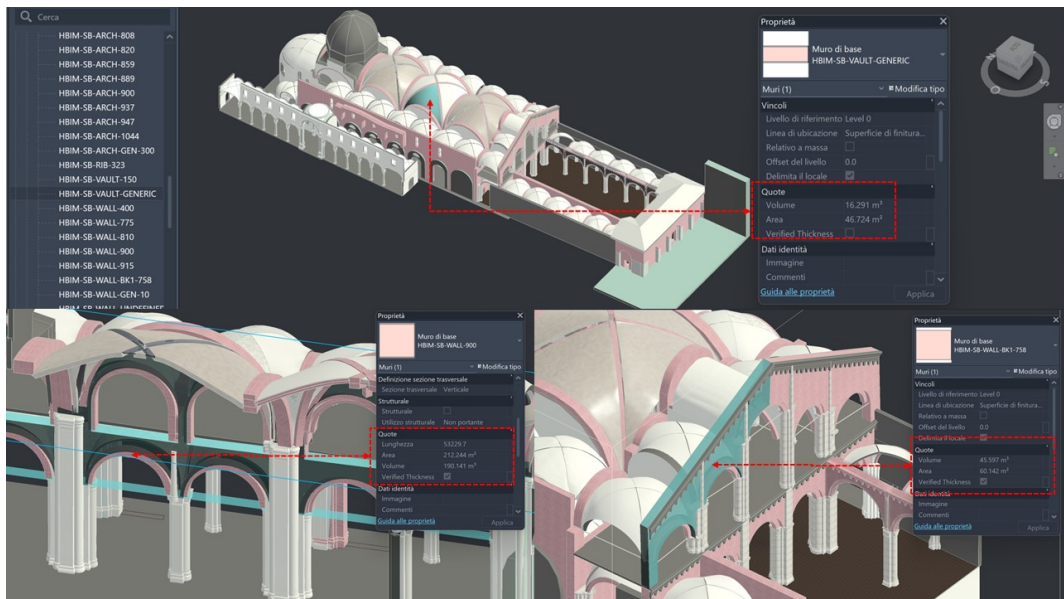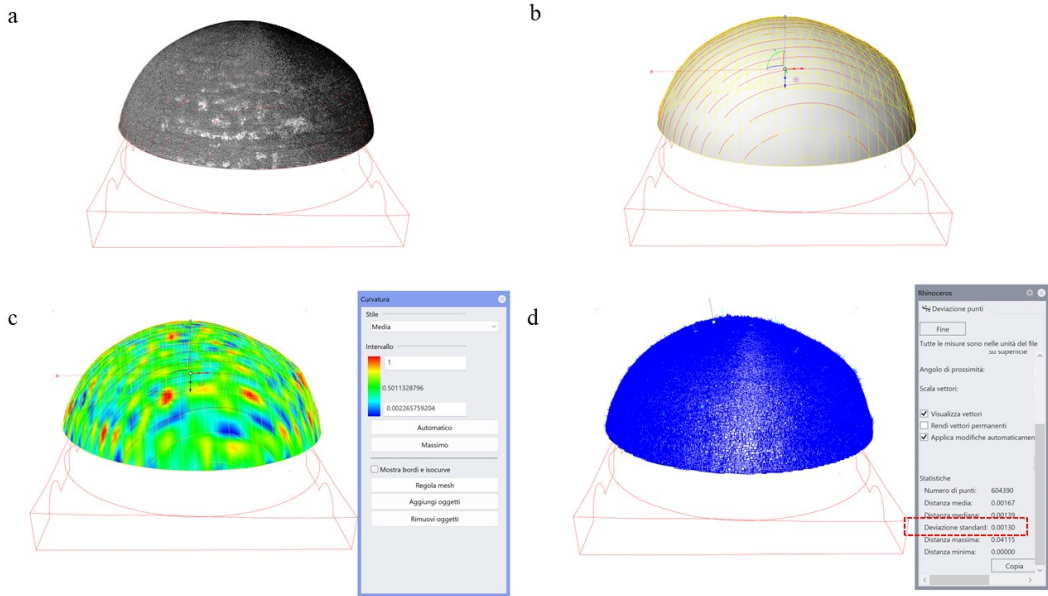
Fig. 12 *The Chapel of San Vittore
in Ciel d'Oro. The reliability and
transparency of HBIM models:
specific parameters have been
devised to convey the grade of
accuracy (GOA) achieved during the
modeling phase.*
a) point cloud and 3D drawing;
*b) NURBS model; c)curvature
analysis; d) Standard deviation:
grade of accuracy about 0,001 m.*

It's worth noting that using software like *Autodesk Revit* and
Graphisoft ArchiCAD, which were primarily developed for
managing new construction projects, can result in simpli-
fied architectural and structural elements that may not ad-
equately accommodate complex historical details. However,
by employing specific scan-to-HBIM modeling requirements,
it has become feasible to create highly detailed HBIM objects
with various types of information, such as wall stratigraphy
and materials, defined in a parametric manner.

This approach forms the foundation for a multi-level in-
formation scenario in selected case studies (Figure 11).

The bidirectional information-object relationship typi-
cal of an HBIM project is demonstrated. Each element has
been developed with parametric logic to expand the se-
mantic value of every created object. Ensuring the reliabil-
ity and transparency of HBIM models, specific parameters
have been devised to convey the accuracy achieved during
the modeling phase. For instance, the value of standard
deviation allowed for a volumetric representation within
1.5-2mm of the original survey data. Once the semantic

enrichment phase of the HBIM model was completed, 3D objects and related information were prepared for the subsequent implementation in virtual reality (VR). This seamless workflow from HBIM to VR ensures a comprehensive and immersive experience, further enhancing the exploration and understanding of the historical building's significance and characteristics (Figure 12).

EXPLORING PROXEMICS AND INTERACTIVY TROUGHT MODEL BASED VIRTUAL APPLICATIONS: THE CASE OF THE RECTORY OF BRAMANTE

The reconstructive modelling process has been adopted to develop a sustainable generative process of a digital model able to incorporate and represent the richness of the Rectory of the Basilica of Sant'Ambrogio both from the morphological and typological point of view. The VR project was developed using software applications *Twinmotion* and *Unreal Engine 5* and, enabling real-time synchronization of the 3D model generated in *McNeel Rhinoceros* and *Autodesk Revit* with the VR project. Consequently, any changes made to the model were automatically updated in the VR experience, a critical aspect considering that outcomes of the interpretative 3D reconstruction may evolve over time. Through in-depth archival research, the VR project was iteratively implemented in the last year, allowing for continuous assessment of visitor engagement and cultural understanding achieved through the model-based virtual application. Physical systems have also evolved from the use of concrete anthropometric measures to more abstract models based on VR devices such as VR headset, controllers allowing for an expansion of sensory functions. Users can immerse themselves in and freely navigate the 3D scene through a first or third-person experience, discovering content by constructing an avatar. The avatars a three-dimensional character used to represent the user and enable

Navigation refers to the ability to explore the 3D scene by conducting a true exploration using an avatar. The navigation have been directed by Virtual-Visual Storytelling (VVS) with a predefined and uniform path for all users (Figure 13). The VR project of the Basilica of Sant'Ambrogio has been enriched with an in-depth exploration that narrates the historical background of the Rectory designed by Bramante. This immersive experience conveys the historical complexity through multiple IVOs. Virtual tourists can delve into a VR environment and discover diverse content through video panels, concise descriptions, historical comparisons (from the damages of World War II to restoration efforts and the present state), moving objects, and other types of information. The virtual tourist is introduced to the history through a primary information point, which reveals that the Rectory was designed by Bramante between 1492 and 1499 for the Canons of Sant'Ambrogio, and promoted by Ludovico il Moro (1452-1508), the Duke of Milan.

A second information point describes the construction technique, detailing how the rectory was built on the

Fig. 13 *The main VR development sections. Source: authors.*
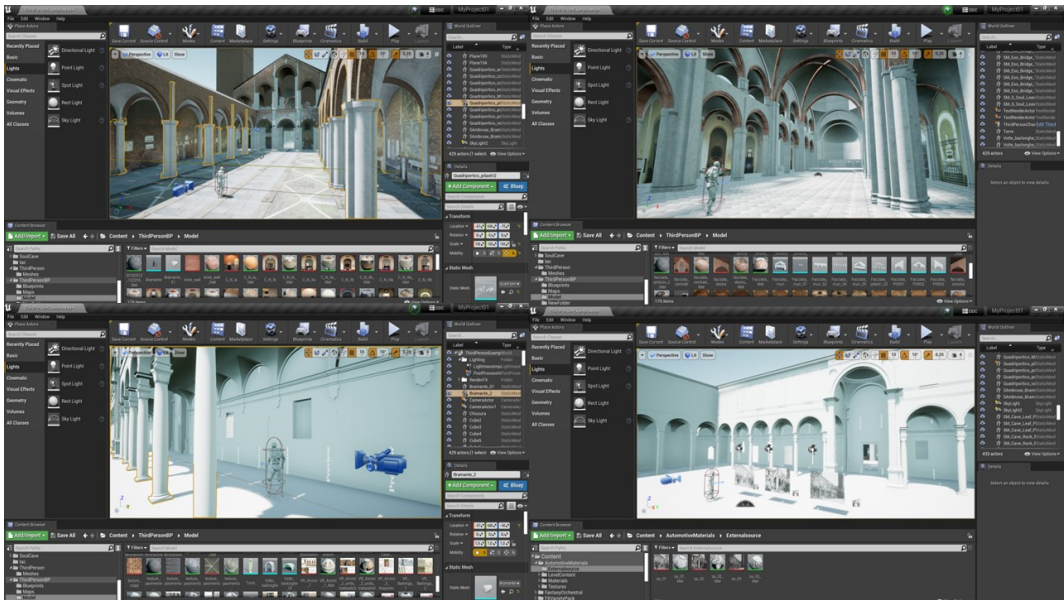
northern side of the Basilica. This arcade structure, with 13 bays supporting an unfinished first floor until the 19th century, underwent modest rearrangements in the 17th century. The main arcade, with double height, is positioned in the middle of the structure, signifying the access point to the Basilica. A third information point reports that the Rectory and part of the Basilica apse were demolished during an aerial bombing in 1943.

In the latter half of the 20th century, architect Ferdinando Reggiori was entrusted with the restoration of the building complex.

During the restoration, the foundation of an arcade structure perpendicular to Bramante's Rectory was discovered on the east side of the building. Scholars speculated that Bramante's original plan may have included constructing a cloister, where the rectory formed the northern side, and the other three sides were yet to be built. The historical complexity also involves Reggiori's additions (adding a second side to the Rectory) and the 19th-century additions that were destroyed by the 1943 bombing (fourth information point). Other information point are under developing with the main aim to improve the knowledge of this novel integration realized by Bramante (Figure 14).

Digital proxemic rules defined the interaction between the user and the scene, based on a human-centric approach that places the individual at the center of decision-making and interactive experience design, ultimately aiming to satisfy their needs and enhance their experience. In particular, from an operational perspective, the process of creating an avatar was significantly facilitated by 3D design and modeling. Various 3D modeling techniques, particularly organic modeling, offered efficient and effective ways to recreate realistic and detailed characters, streamlining the generative process. The 3D modeling process involved a series of advanced steps that required specialized skills.

The first crucial step was defining the character concept, including style, appearance, abilities, and behavior. The avatar's development starts with selecting from different templates, enabling developers to generate first or third-person experiences. The choice between first and third-person perspectives in a VR experience could significantly influence user immersion and perception of the virtual environment. In the first person, the user views the virtual world through the eyes of the character they are embodying, enhancing immersion and the feeling of being
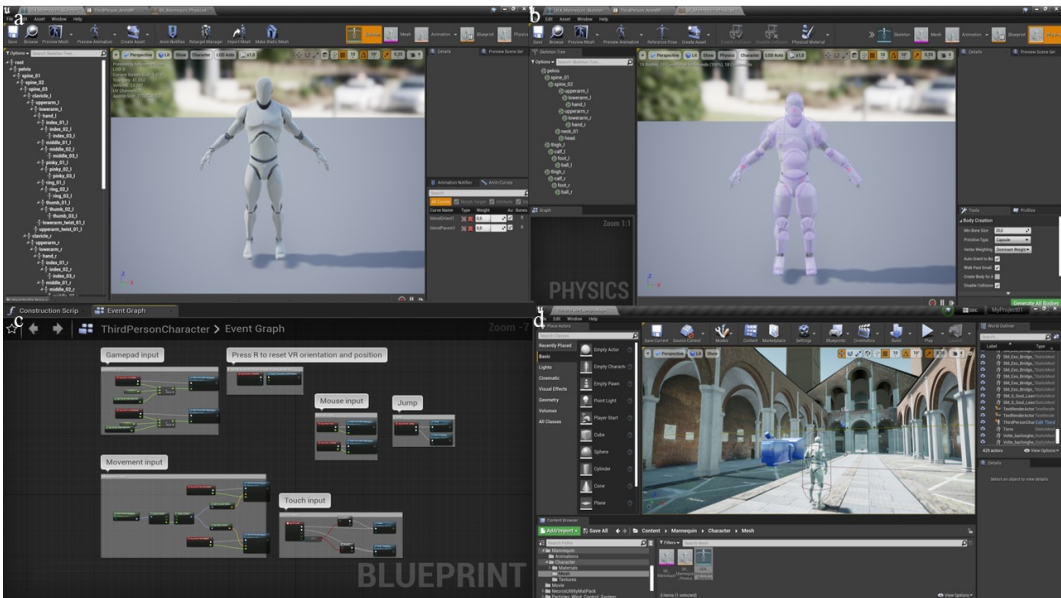
Fig. 15 *Developing third person character: from a) mesh model and b) physics skeleton model to c) VPL and d) final avatar.*

present within the virtual environment. It can also influence the sense of agency and control, as users feel more engaged and capable of directly acting within the virtual environment. On the other hand, in the third person, users see their character from an external perspective, as if watching them through a camera.

This may influence the user's perception of the virtual environment as an external representation rather than an immersive first-person experience. However, the third person perspective can also allow users to see their entire character's body, positively impacting immersion and the feeling of physical presence within the virtual environment. Character animation was achieved using *Visual Programming Language* (VPL) and animation functionality to create realistic movements like walking, running, jumping, and more in *Unreal Engine 5* (Figure 15). Thanks to the camera programming connected to the avatar and the real-time update of the corresponding blueprint, it has been possible to program and alternate the following VR locomotion modes, depending on the device used (VR headset, desktop and mobile devices):

1. Motion-based VR Locomotion: Relies on physical movements for user interaction in expansive and continuous virtual reality spaces. Techniques include walking-in-place, redirected walking, arm swinging, gesture-based locomotion, and reorientation.

2. Room Scale-based VR Locomotion: User interaction occurs through physical movement in VR environments limited by real-world dimensions. Despite spatial constraints, continuous motion is supported, and real-walking locomotion technique is included.

3. Controller-based VR Locomotion: Utilizes controllers for artificial movement in open VR spaces with continuous motion. Techniques include joystick-based, human joystick, chair-based, and head-directed locomotion approaches.

4. Teleportation-based VR Locomotion: Involves artificial interactions in open VR spaces with non-continuous movement. The user's virtual viewpoint is instantaneously teleported to predefined positions, and the point and teleport technique exemplifies this type.

5. Web-VR: Users can experience VR without dedicated hardware by connecting their mobile device to a browser and navigating using the touchscreen. This approach balances immersion and minimizes motion sickness for an optimal user experience, avoiding the installation of specific software.

Finally, to optimize proxemics, interactivity, and immersion, a final phase of research and development was oriented towards defining an Hybrid Locomotion by combining multiple locomotion techniques and hardware offering a more versatile and immersive navigation system as reported in Table 1.

CONCLUSIONS

A particularly pioneering approach in recent times has been the use of virtual reality (VR) as a novel means of disseminating

knowledge through visually immersive and interactive storytelling strategies (Cecotti, 2022; Chong, et al., 2022).

VR applications in museums and cultural sites encompass a wide range of interactive experiences, from engaging with artefacts to virtual reconstructions of archaeological sites and historical buildings, thereby increasing awareness and appreciation of cultural heritage (Theodoropoulos et al., 2022; Paladini et al., 2019).

In line with these considerations, the article illustrated two operative workflows in the development of VR experiences with different levels of interaction and digital proxemics.

The image-based and model-based approach (Rossi, 2020) adopted in the development of the two VR experiences are deeply described focusing on the integration of the software applications employed and on the narrative perspective choice, whether adopting a first-person or third-person view, including users' perception and their level of engagement. By the comparison of the two applications (Table 1), it has been possible to derive some reflections on possible implementations of digital proxemics in virtual environments, attentively considering users' spatial relationship with interactive virtual objects (*IVOs*) and the overall user experience.

The case study of the virtual tour of the *NMuseo Egizio* illustrated the methodological and operative approach adopted. The description of this image-based virtual experience focuses on the workflows and tools used as well as on the defined transmedia storytelling and on the developed level of interaction with the users. The virtual tour offers an applicative example of the opportunities of VR for a comprehensive and interactive exploration of museums' environments and collections. The presented project shows the potentials of the developed virtual experience as versatile tool for interpretation, learning, and knowledge dissemination. More specifically, the different levels of interaction enabled by the 3DVista software make it possible to virtually visualise and interact with some artefacts in a way

that would not be possible during an on-site visit. The study case describes the operational workflow adopted to build an engaging and iterative mode of edutainment (Luigini & Panciroli, 2018) within a virtual environment. The symbolic-reconstructive learning method, based on the textual component whose symbologies have to be decoded by the individual, is replaced by a new perceptual-motor model in which the user learns through the response he/she receives from the object with which he/she interacts. Additionally, the described experience illustrates the relevance of interactive elements in the design of VR projects for cultural institutions.

The second case study illustrates the model-based approach for the content and interaction implementation of the VR experience of the Basilica of Sant'Ambrogio.

The reconstructive modelling approach promoted the knowledge of the morphogenesis, topology and stereometry of the Basilica.

The virtual experience of the Basilica of Sant'Ambrogio depended significantly on the ability of digital representation techniques to faithfully simulate the real environment. However, the choice of narrative perspective, whether first or third person, had the potential to influence users' perception of the virtual encounter and their level of engagement. Furthermore, the use of avatars or virtual characters introduced the possibility of creating emotional closeness or distance between users and the virtual experience. To create a compelling virtual encounter, it was essential to design virtual environments and interfaces that maximised user interaction and immersion within the virtual realm. This human-centred approach required a thorough understanding of users' individual needs, preferences and limitations. Only through such an approach could a highly targeted and personalised design be achieved to meet the user's specific needs and deliver an exceptionally compelling virtual experience. The creation of an avatar required an in-depth knowledge of specialized techniques and tools such as organic modelling, programming and the ability to

	CASE STUDY 1 Virtual Tour of the Museo Egizio	CASE STUDY 2 VR project of Basilica of Sant'Ambrogio and Rector
TYPE OF VR APPLICATION	Image-based	Model-based
TYPE OF MOTION	Non-continous	Continuos
MOTION TECHNIQUE	Point and teleport	Controller/Joystick; Walking-in-Place; Point and teleport; Redirected Walking; Head-Directed; Arm swinging; Chair-Based; touch screen linked to web-VR
ELEMENTS OF INTERACTION	3D models; video animations; 360° photograps; text description; audios; images; websites	Avatar in first or third person template; Interactive virtual objects (IVOs); multi levels; video panels; 3D animations; images; 360° photos; moving objects, audios; text description
VISION MODES	Immersive: VR headsets, web-VR, Non immersive: desktop and mobile devices	Immersive: VR headsets, web-VR; Non immersive: desktop and mobile devices

Table 1 *Comparison of the two different VR applications, focusing on the developed interactions within the generated virtual environment. Source: D. Mezzino, F. Banfi.*

critically evaluate the results of various tests in different modelling environments.

The creation of Avatar was the culmination of a long-standing quest to create a more transparent medium that could faithfully reproduce the visual and sensory experience of the real world. This medium emphasised the importance of the human element and the experiences derived from it. The VR application also aimed at overcoming the limitations of static or moving images by providing an immersive simulation that involved not only sight, but also touch and hearing.

The VR project of the Basilica of Sant'Ambrogio involved the creation of a navigable environment that could be accessed through different devices, ranging from personal computers to mobile devices. The use of the VR headset could be intermittent, with users alternating between interactions

on mobile devices, where touchscreens facilitate navigation, and PC interactions, mainly through keyboards and controls.

The resulting VR experience allows visitors to explore the intricate architectural details, artefacts and historical narratives of the Basilica. Users are able to interact with virtual objects and take informative tours, fully immersing themselves in the atmosphere of this historic site. The VR developments were strategically aligned with the implementation of proxemics in the virtual environment, taking into account the users' spatial relationship with the interactive virtual objects (IVOs) and the overall user experience. The study evaluated how the arrangement of human spaces and interpersonal distances within the virtual environment influences the user's sense of presence and emotional connection, thereby fostering interactive environments.

The role of interaction design in guiding users through virtual-visual storytelling (VVS) has been closely examined to enable a more personalized and meaningful experience.

Notwithstanding their heterogeneous aspects, both projects highlight the key role of digital representation techniques in simulating real environments, allowing different levels of interaction with digital objects and multimedia content, with the final aim of implementing cultural and physical accessibility of cultural heritage sites and museum collections.

NOTES

1. This is the point at which the optical cone within the lens is inverted and so rotating the camera around this point is equivalent to recording images with a single point of view.

AUTHORSHIP

Despite methodology and results are shared by the authors, Davide Mezzino wrote: Abstract; Interactivity in image

based virtual applications: the case of the Museo Egizio; The generative workflow; The development of the VR experience and the design of the user interaction; Conclusions; Fabrizio Banfi wrote: Introduction, Digital representation of the Basilica of Sant'Ambrogio: from archival research and 3D survey to HBIM model; Exploring proxemics and interactivy trought model based virtual applications: the case of the Rectory of Bramante; Federico Taverni and Nicola Dell'Aquila collaborated in writing: The generative workflow.

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BACK TO THE METAVERSE

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The metaverse is not a new concept; since 2005, online platforms have been experimenting with 3D virtual worlds, which are permanent spaces built by users. The most successful experience in this regard was *Second Life*, which rekindled the previous hype around the metaverse between the end of 2006 and the beginning of 2007. Through the narrative of the reports taken with the avatar Marco Manray, the early history of *Second Life* is retraced, comparing it to recent attempts at creating a metaverse. The topic of in-game photography is also introduced.

THE WHIRLPOOL

Between the end of 2021 and the beginning of 2022, I spent numerous days at the entrance to *Decentraland*, a 3D virtual world based on the Ethereum blockchain. This is precisely where avatars would first arrive and try to figure out what to do.

If one does not already have a specific destination in mind upon entering *Decentraland*[1], they find themselves in a square with a large abyss at its center. The actual entry into the virtual world involves literally jumping into the abyss. I am unsure why this mode of entry was chosen, but it immediately struck me as having a strong symbolic value. Newcomers usually passed through here; for many, it was their first time entering the metaverse, enticed by the hype spreading through the media then. They wondered what to do and where to go; they had most likely exchanged money to obtain the local currency, *Mana*, and were now trying to figure out what to do with it. Regardless, everyone had to plunge into that abyss, and I filmed a crowd of people jumping into an abyss without knowing exactly where they were going or why.

In reality, there was a reason. Mark Zuckerberg had announced a few days earlier the company's name change from Facebook to Meta, and he did so with a *Founder's Letter*[2] that marked the birth of a new chapter for the entire internet and called it the Metaverse:

> We are at the beginning of the next chapter for the internet, and it's the next chapter for our company, too. We've gone from desktop to web to mobile, from text to photos to video. But this isn't the end of the line. The next platform will be even more immersive – an embodied internet where you're in the experience, not just looking at it. We call this the Metaverse, and it will touch every product we build. (The Founder's Letter, 2021)

This stance by Facebook suddenly put the spotlight on the metaverse; a new chapter for the internet was beginning, while there was already a lot of interest in Web 3.0, blockchain, and cryptocurrencies, and everything seemed to converge.

Figure 1 Marco Cadioli, The Whirlpool, 2022, video 5:58

One could not miss the moment. One had to enter the metaverse and jump into the abyss without asking too many questions. Thus, a small crowd of newcomers gathered at the entrance to one of the most well-known metaverses at the time, and I was shooting a video[3].

Some accidentally left their microphones open, allowing real-world sounds to enter the virtual space. Some spoke directly in their native language, transforming the square into a Tower of Babel with people speaking Russian, German, Spanish, some Italian, and, of course, many English, before plunging into the abyss.

THE PROMISE

The promise was simple: to make money. Everyone had heard of NFTs; six months prior, Beeple had sold the famous

$69 million NFT. The possession and exchange of digital assets were the new trends, and in the metaverse, NFTs also included clothing, parcels of land, and accessories for avatars. Anything could be converted into an NFT and sold; all it took was the right idea.

Entering the metaverse also required opening a digital wallet like *Metamask* and having cryptocurrencies to spend. This process was not necessarily straightforward. One could enter *Decentraland* without a digital wallet, but the experience would be limited – no purchases, no friends, and a different avatar whenever you switched devices. Essentially, you could only take a brief stroll as a guest.

Meanwhile, the hype surrounding the metaverse continued to grow through various 'firsts': the first school in the metaverse, the first wedding ceremony, a concert, the opening of a museum, and the first metaverse *Fashion Week*. This showcased the metaverse's future socio-economic benefits, images of work meetings, historical reconstructions for learning history, and doctors providing immersive training.

Many major companies were launching projects concurrently with Meta's *Horizon Worlds*. Microsoft *Mesh* was

Figure 2 People in *Decentraland*, 2021. Screenshot of the author

announced in November 2021, and Disney began developing its own metaverse strategy. In early 2022, they formed a team to envision their extended virtual parks. Nvidia's *Omniverse* provided a platform for creating applications in the metaverse, and its stock prices soared. These were just a few examples.

The metaverse was shaping up as a plurality of possible worlds. The term 'metaverse' was sometimes used to refer to the collection of all different virtual worlds and other times to indicate a single immersive environment.

Some of these platforms had been available online for years but only became popular due to the hype in early 2022. Examples include *Roblox,* founded in 2004 and popular among young gamers, and *Minecraft,* which already had over 100 million active monthly users in 2021. Blockchain-based platforms like *The Sandbox* (established in 2018) and *Decentraland* (developed in 2015 and opened to the public in 2020) were also part of this wave.

A proliferation of virtual worlds was underway, each with its own token for blockchain-based transactions. It was unclear whether new worlds were being created using their

Figure 3 Marco Cadioli, *The Promise*, 2003

own cryptocurrency or if cryptocurrencies were launched first and then associated with virtual worlds. *RedFox* (RFOX), *Alien Worlds* (TLM), *Star Atlas* (ATLAS), *Ufo Gaming* (UFO), *Axie Infinity* (AXF), *Wilder World* (WILD), and *Somnium* (CUBE) are some of the names of new platforms and their respective cryptocurrencies, forming a sector known as *Virtual Reality Crypto* present in exchanges.

Following the announcements in October 2021, there were surges in value, such as *Mana*, the currency of *Decentraland*, which went from less than a dollar in September 2021 to nearly $6 in November 2021 but has since dropped to less than $0.3 as of June 2023. The *Sand*, *The Sandbox*'s currency, now worth less than $0.5, reached over $8 in November 2021. These fluctuations were not only related to cryptocurrency speculation but also indicators of a moment of great confidence in emerging metaverses and the anticipated prospects of rapid development driven by strong hype.

The value of virtual land also experienced a surge when *Decentraland* witnessed the highest-ever land sale. The fashion industry believed in the metaverse, and in March 2022, the first *Metaverse Fashion Week* took place, featuring brands such as Dolce & Gabbana, Etro, Dundas, Estée Lauder, and Tommy Hilfiger. According to official data, it had 108,000 unique visits during the 5-day event, which included fashion shows, events, after-parties, conferences, and concerts.

I attended some fashion shows where they presented garments designed for avatars and collections connected to the real world. It was genuinely an interesting experience that showcased the potential of the metaverse. Dolce & Gabbana's 'catwalk' with models dressed as cats was quite entertaining, and after-parties featured concerts by Bob Sinclar and Grimes. However, the attempt to replicate the experience the following year was not as successful, and the 2023 *Metaverse Fashion Week* had very few participants, with the novelty factor already fading away.

In *Decentraland*, there was a significant animation for avatars that, in my opinion, captured the spirit of the hype at the

Figure 4 Dolce and Gabbana show at *Metaverse Fashion Week*, 2022. *Cat walk*, with cats walking the runway as models. Screenshot of the author

time. Avatars would throw money in the air, mimicking the gesture from the 'Money Rain' GIF[4], which had already become a meme. I filmed many avatars repeating that gesture, making it a performance in various situations and contexts.

SPACE

The network was initially built upon the concept of shared documents, a distributed hypertext whose fundamental idea is still contained in the acronym HTTP that precedes URLs.

Over time, there was a growing realization that the development of the web was constructing a space. This was expressed through metaphors of navigation, the use of the term 'website' to refer to network nodes and the creation of spatial representations of databases. Lev Manovich analyzed the aesthetics of early navigable spaces even before

Figure 5 Bob Sinclair concert at *Metaverse Fashion Week*, 2022. Screenshot of the author

the internet, starting with games like Doom (1993) and Myst (1993), in a 1998 essay where he quoted Robyn Miller, one of the co-designers of Myst, who said:

> We are creating environments to just wander around inside of. People have been calling it a game for lack of anything better, and we've called it a game at times. But that's not what it really is; it's a world. (Manovich, 1998)

A world was being constructed – a world in which one could get lost. In that same essay, Manovich introduced the figures of the *Digital Flâneur* and the *Explorer* in relation to navigable spaces. In the early years of the internet's diffusion, these concepts were naturally extended to online experiences, as expressed in the 2002 essay by artist Miltos

Manetas titled *Websites Are The Art Of Our Times*, which opens with the statement: "Because the internet is not just another 'media,' as the Old Media insists, but mostly a 'space,' similar to the American Continent immediately after it was discovered" (Manetas, 2002).

Indeed, in the following years, we witnessed the colonization of this continent, setting in motion a process that, starting in 2005, led to the increasingly social-oriented population of this space. The experience of 3D environments, already present in console video games, became enriched in online interactions with other players, and the construction of the metaverse began to be glimpsed.

BACK TO THE METAVERSE

Within this context, virtual worlds, particularly *Second Life*, experienced peak development between the end of

Figure 6 Marco Cadioli, *We are here (I am the fly)*, 2004. Screenshot @randommedia.co.uk

Figure 7 October 18, 2006
Reuters opens an office in *Second
Life*. Screenshot of the author

2006 and the beginning of 2007. One of Philip Rosedale's key insights as the founder of Linden Lab in San Francisco, the company behind *Second Life*'s software, was to free virtual worlds from the constraints of predefined fantasy environments. Instead, he provided a platform where users could create their own content. This led to a bottom-up construction that expressed trends and subcultures that users gathered around.

Philip Rosedale began working on his dream of building virtual reality environments as early as 1999. He stated that he invented *Second Life* as an evolution of the network and a place for social interaction. He was inspired by *Snow Crash* in constructing the metaverse, just as Zuckerberg would confirm more than 15 years later.

Everything that the new hype of 2021–2022 was pushing had already happened, albeit without blockchain technology. However, it had already taken place in the realm of imagination, in the myth of a possible extension of reality into the network, initially in literature and then in early immersive online experiences.

To understand today's metaverse, or at least the attempts made so far to construct it, it is important to refer to the Second Life experience, which remains the largest experimentation of a user-built permanent 3D online space. I entered *Second Life* in 2005 with the avatar Marco Manray. Initially, users could not freely choose their own names, and *Second Life* provided a list of possible names to choose from. That day, 'Manray' was available, and it became my avatar's names, which I still use.

From the very beginning, Marco Manray was a photographer. I entered *Second Life* specifically to document the birth of the metaverse through photography. When the first hype about the metaverse erupted between the end of 2006 and 2007, it seemed natural for print media outlets to have reporters from virtual worlds. Reportages by Marco Manray were published in newspapers such as Liberation

Figure 8 Headquarters of Wired Magazine in *Second Life*, October 2006. Screenshot of the author

(Paris), El Pais (Madrid), Repubblica (Milan), Elle Decor (Milan), AD Architectural Digest (Milan), and Le Temps (Geneva) in the book *Second Life, un monde possible* (De Cayeux & Guibert-Brussel, 2008). I documented Marco Manray's adventures in the book *Io, reporter in Second Life* (Cadioli, 2007).

This list intends to convey the idea of the existing interest surrounding the virtual world, with reflections that go beyond marketing announcements and immediate promises. The reportages documented some key moments, such as Reuters entering *Second Life* in October 2006, Wired magazine's presence, the construction of The Avastar headquarters, the weekly tabloid with news and gossip from within the virtual community published by Bild.T-Online in Berlin, and lasted a few months. The entry of real-world companies was also newsworthy back then: General Motors, Toyota, Nissan, Lancia, IBM, Intel, Dell, Cisco Systems, Microsoft, Harvard Law School, the University of Southern California, L'Oréal, and the list could go on. Concerts were organized, live performances took place in many venues every evening, poetry readings, book presentations, conferences, and meditation groups were held, and, during the *Burning Days*, a parallel festival was held in *Second Life.*

Figure 9 *Burning Man* in *Second Life*, 2007. Screenshot of the author
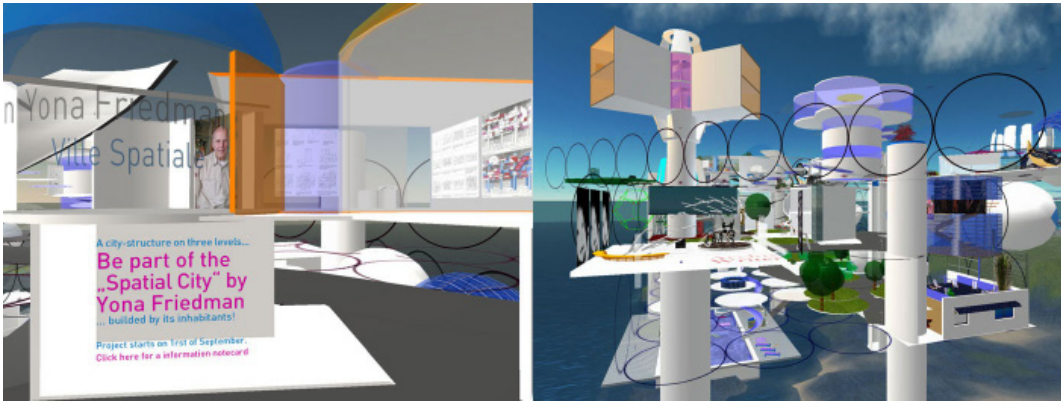
Figure 10 The reconstruction experiment of *Ville spatiale*, Yona Friedman's 1959-1960 utopian project. Screenshot of the author

Alongside the private initiatives of those who invented clothing lines, real-world brands such as Adidas entered, and American Apparel proposed cross-marketing strategies between the virtual and real worlds, selling clothing for both situations. The fashion industry spawned specialized magazines, shops, fashion shows, and collection launches. Dior launched a jewelry collection, and Lacoste presented its Spring 2007 collection with Marco Manray as the photographer.

There were reflections and experiences of democratic participation in defining internal rules, with islands based on laws freely decided by residents through a voting system. In a relatively short period, diverse advanced issues were addressed in a collective process involving residents and their expertise. Challenges included designing common spaces and developing design forms for private residences and company headquarters. The architecture of navigable spaces was explored without necessarily mimicking the real world, and designers tackled the development of objects that considered the characteristics of the metaverse and its needs and functions.

Aimee Weber was one of the greatest designers of *Second Life*. She designed the headquarters of American Apparel, created her own fashion line, and worked for the Exploratorium Museum in San Francisco. Exploring themes such as identity, body image, sex, art, and political participation deepened.

Figure 11 Aimee Weber portrayed in singer Regina Spector's studio in Second Life. 2006. Screenshot of the author

Artists played an important role in experimentation, and a community formed that constituted a recognized avant-garde, even by real-world institutions, gathering on the island of Odyssey. However, a separate essay would be needed to delve into art in virtual worlds, covering interesting contemporary experiences.

I became a special correspondent for virtual worlds for Liberation in Paris during that period. I was a reporter from a different world, treated like any other reporter. In January 2007, I covered the entry of French politicians into the metaverse during the presidential elections.

I met with the journalist who would write the piece in *Second Life*. I had never met her in person, only as an avatar. Together, we conducted interviews and visited the party headquarters. We created the service 'Votez virtuel' (vote virtual), which made the front page of the newspaper with a photo of Ségolène Royal's avatar taken at the headquarters of the Parti Socialiste in *Second Life*, with the support of the group *Désir d'avenir Comité 748*, where 748 referred to the numbering of various support committees in the real world.

The Front National of Le Pen also opened a headquarters, obviously with its symbols and values, and there was

Figure 12 *Votez Virtuel*,
Liberation cover, 20/01/2007

an island for committees supporting Sarkozy. The metaverse was being experimented with as a platform for political communication, taking advantage of the ability to organize participatory debates and create meeting places, informational points, architectural structures, and symbolic spaces. The news ended up in the political pages of newspapers, not in the gaming sections, anticipating the use of social worlds for political communication, which would later converge on much larger dimensions within Facebook. Facebook was born in those same years but would aggregate an infinitely larger number of users.

It is amusing, if not infuriating, to see how today there is a tendency to start over, narrating as something new what has already been experimented with, following the interests of a corporation to support the idea that everything is new and freshly invented, operating on a closed and corporate model. It is like those cities that are built all at once, based on a predetermined business model and idea, but then remain uninhabited. First and foremost, today's

metaverse has remained empty, without residents, real relationships, and a true emotional motivation to enter. The legless avatars in the Meta world make this ideology of teleconference meeting busts evident.

MARCO MANRAY

I had started photographing the internet in 2003, based on a series of statements collected in the *Net Photography Manifesto* (Cadioli, 2003), in which I asserted the possibility of exploring photography within the spaces of the internet and the need to capture, through photography, the construction of the world beyond the screen.

My research focused on the theme of the remediation of traditional photography within the virtual world and the possibility of giving documentary value to photographs taken in a synthetic world. A world that has its autonomy because, as Lev Manovich stated, "Synthetic computer-generated imagery is not an inferior representation of our reality but a realistic representation of a different reality" (Manovich, 2002).

In the manifesto, I referenced Susan Sontag, stating that screenshots certified that the experience had been made and the journey undertaken. "Essentially, the camera makes everyone a tourist in other people's reality and eventually in one's own" (Sontag, 1977) There was no problem in appropriating, through screenshots, creations that someone had made because, to quote Susan Sontag again, "to take a photograph is to appropriate the thing photographed" (Sontag, 1977).

That event had happened, and a device had captured it. "Has been," according to Roland Barthes' concept of the photograph, "all photography is a certificate of presence" (Barthes, 1980/81). There is a tendency to think that in a synthetic and simulated world, everything is infinitely reproducible in the same way, numerically. However, one realizes that time passes, that events belong to human time and not

Figure 13 Marco Cadioli,
ARENAE, Omaha Beach, 2005

machine time, and that synthetic representations change, age, and disappear. Photography also provides a sense of memory in the metaverse, which has often been observed by showing the images to those present at the event. They recognize their avatars in the shot and find a sense of familiarity with the places.

Forms of photography in video games have gradually gained recognition, finding theoretical support starting with Cindy Poremba's seminal essay *Point and Shot. Remediating photography in gamespace* (2007), one of the first systematic studies on in-game photography. Poremba states:

> if the process and ritual behind this image-making is similar, the players themselves are validating the reality of their subjects simply by creating a document of these experiences. In this sense, players are taking real photos, just in virtual spaces. (Poremba, 2007)

Figure 14 Marco Cadioli, *Der Neue Wanderer*, 2008
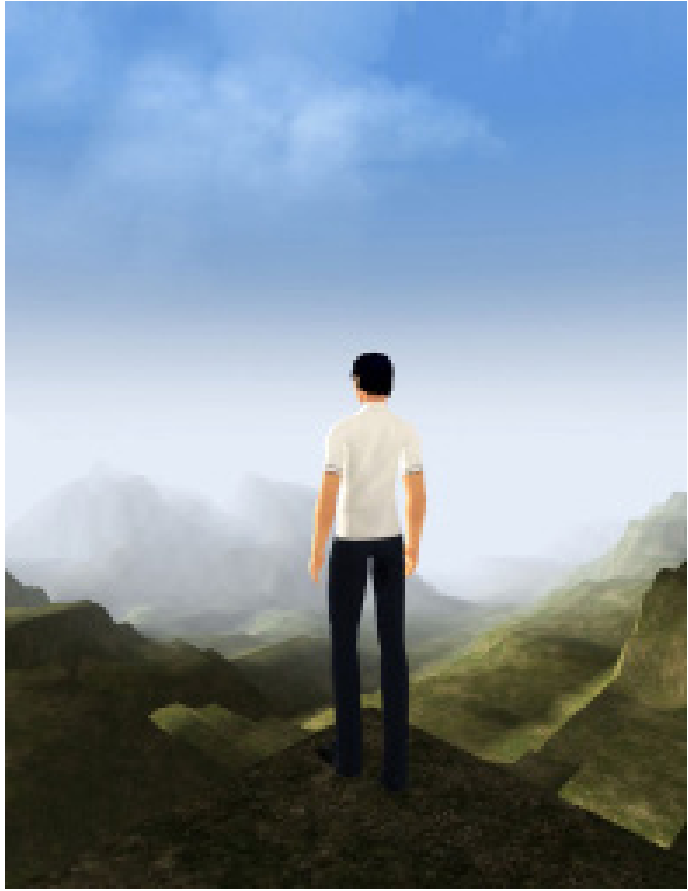
In 2005, I had already done a report on massively multiplayer online war games such as Quake3, Counter-Strike, and Wolfenstein: Enemy Territory. I photographed the Normandy landing, the D-Day, which was reenacted every day by players competing in a historically reconstructed war scenario. I moved as an 'embedded' photographer in the style of Robert Capa, escorted by professional players as I disembarked from the ship and headed towards the shore to avoid being killed immediately. This reportage was my first experience as a photographer in the virtual world and laid the foundation for many more reportages in the following years.

With Marco Manray, I explored various virtual worlds and proto-metaverse forms in their infancy, often lasting only a few years and never taking off. This was the case with the Chinese virtual world *HiPiHi*, which opened in Beijing in 2007. It had an interface with ideograms and very little documentation. In that situation, the experience of loss was strong, having crossed a border and being in the network's peripheries. It was impossible for me to communicate with the very few avatars I encountered. There were fewer than 10,000 residents, and only the predefined gestures of the avatars became a common language: waving, bowing, or simply approaching and sensing the presence of the other in an incomprehensible chat. During that journey, I took *Der Neue Wanderer*, a version of Caspar David Friedrich's painting *Der Wanderer Above The Sea Of Fog*. The world before me evoked the same sublime feeling as the painting, in a disorientation found online in the early forms of the metaverse, still exotic and remote.

This fascination has naturally been lost in these years of network development. The remote island has been discovered, and a tourist village has been built on it. Today's metaverse presents itself as a shiny product based on blockchain,

Figure 15 Marco Cadioli,
Rousseau reloaded, 2006

connected to cryptocurrencies, and attentive to the issues of digital asset ownership and business. It has moved alongside NFTs and met the same fate. It has proposed a usage model designed by big tech companies without allowing for true grassroots development or emotional investment, and as I mentioned earlier, it has remained inevitably empty.

In the meantime, new devices have emerged that shift the focus to an augmented reality model, where the metaverse, if it exists, will be experienced as a digital layer superimposed on reality. It will be a mixed experience, not just immersive, where real data and objects coexist, just as bodies and avatars will coexist. Alternatively, it might be designed by an AI.

NOTES

1 https://decentraland.org/
2 https://about.fb.com/news/2021/10/founders-letter/
3 Marco Cadioli "The Whirlpool", 2022 video 5:58 https://vimeo.com/692627855
4 https://giphy.com/search/money-rain

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TOWARDS AN ATLAS OF METAVERSE IN ARCHITECTURE:
TIMELINE 1980-2023

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This study presents the latest results from a project aimed at creating an atlas of the Metaverse in architecture and design. The project is structured as an interactive conceptual map, published online, and spans from 1980-2023. It catalogs and thematically classifies some of the primary configurations of 'virtual living' and the most significant conceptual and visual references that have contributed to this idea. The subject is vast and complex, with applications in research and teaching that extend to various digital space-time applications, such as social media, virtual worlds, video games, conceptual maps, and current applications of artificial intelligence and NFTs.

This interdisciplinary project requires thematic studies and surveys primarily aimed at understanding and historicizing the phenomenon of the Metaverse. This is the main objective of the research presented here, representing the final stage of a long journey that explores the various aspects of virtual living representation history. The topic deserves further study, both in relation to the rich historical tradition that has always inspired the science and art of representation, and in relation to the techno-cultures of processing 'Virtual Living'. It encompasses various professions and languages within the expressive-communicative apparatus that characterizes the Metaverse.

INTRODUCTION

Continuing our long-standing exploration of various aspects of 'Virtual Living' through research and teaching (Caffio & Unali, 2022), we introduce a model for visualizing and processing the concept of the *Metaverse* in architecture and design, conceptualized as a thematic atlas.

This study considers the evolution of the timeline structure that has so far guided our research on the history of the *Metaverse*. It seeks to delve into and update the most notable works that have influenced the development of visual representation codes, with particular focus on 'model' projects. These projects allow us to trace an evolutionary thread through the phenomenon.

Considering the intriguing developments of the *Metaverse* concept and keeping abreast with recent techno-cultural studies on the topic, it is essential to contribute to the ongoing historicization of Virtual Living representation.

The initial step appears to involve classifying and comparing virtual spaces within a historical and authorial context, and against a backdrop of global references. From this, representations arise that can be interpreted, narrated, and 'historicized'. Emerging is a vast and complex topic, encompassing various forms of 'Virtual Living'. These range from daily interactions on social media to powerful virtual world platforms, from video games to authorial virtual cities, and from conceptual maps to artificial intelligence applications. This sphere also includes *NFTs* and the ongoing research into the new *Metaverse* in VR, forming a fascinating utopian socio-cognitive thesaurus and more.

Interdisciplinary representation projects spark creativity and advance technologies. These configurations necessitate study and thematic detection processes to historicize the phenomenon. In the following pages, a potential study model on this topic is outlined, structured like an atlas. This model is represented by an interactive conceptual map, structured by a timeline from 1980 to 2023 (Figure 1), and published online.

Fig. 1 S Graphic synthesis of the structure of the new (release 2023) concept map elaborated, titled *Towards an Atlas of Metaverse in Architecture: timeline 1980-2023*. Some of the main historical configurations of virtual living and its most vital conceptual and visual references have been cataloged and thematically classified. Highlighted is the interactive structure of the matrix and part of the timeline (at the bottom). Posted online at www. lineamenta .it/a vc22

This representation enables scholars to make a structured initial reading of the phenomenon, delve into the most significant events, stimulate debate, and trigger further thematic insights. Lastly, a caveat for researchers: mapping the evolution of the *Metaverse* and viewing the phenomenon as the result of interdisciplinary relationships means accepting that such research should be considered a 'work in progress'.

CONCEPTUAL MAP AND TIMELINE STRUCTURE:
RESEARCH METHODOLOGY AND CONTENTS

The project for the conceptual map representation is a result of a research methodology and coordinated effort. It can be summarized into four main phases.

In the first phase, we hypothesized a historical periodization based on our study of 'Virtual Living'. This timeline is divided into two macro-areas, each further divided into two homogeneous temporal areas (refer to chapters 1 and 2).

The second phase involved cataloging and classifying the primary online spaces that suggest the idea of the *Metaverse*. These were chosen based on their chronological timeline, authorship, and representational characteristics.

During the third phase, we studied the main events (projects, exhibitions, books, etc.) and the most significant conceptual and visual references that have shaped the idea of the *Metaverse*.

In the final phase, we conducted an initial experimental verification of the model (semantic order comparison and technical-perceptive compatibility test with Information and Communications Technology methods). This was followed by subsequent integrations or modifications.

THE HISTORICAL-TEMPORAL DOMAINS
OF THE TIMELINE

For Reflecting on our selected time frames for historicizing the observed phenomenon in the atlas is crucial. We must remember that the history we describe spans a broad timeframe from the 1980s to the present. This period is complex and filled with interdisciplinary references that, given the fast-paced nature of techno-cultures, underscore the laboriousness and richness of the ever-changing projects involved.

To represent these complexities, we must find conceptual syntheses that can be unified on the home page of the interactive map published online. This is a necessary step to convert the vast available information into knowledge. The periodization represented in the timeline has shaped the entire communication project. It is also important to clarify a methodological point: while the history of 'Virtual Living' seems fluid and unified, our research identified considerations that necessitated dividing the timeline into different historical-thematic moments. These divisions have shaped the map's structure. The periodization we've adopted serves the previously stated objectives and suggests preferential 'contingent' experiments to the reader. These can be modified based on subjective considerations.

After conducting a series of experimental checks, we divided the timeline of the map (refer to the x-axis, from left

to right, in figure 1 into two main historical-thematic areas. Each of these areas is further divided into two periods, as detailed below.

Towards an Atlas of the *Metaverse* in Architecture: timeline 1980-2023:

1. From radical origins to international consecration: from postmodern Cyberspace to the digital architecture of the early millennium.
    1.1. The experimental beginnings of 'Virtual Living' in the '80s: between Postmodernism, Deconstructivism, Cyberspace and the first web communities;
    1.2. The consecration of digital architecture, from the '90s to the early years of the new century.
2. Where are we going?
    2.1. From the new digital parametricism to post-digital reflection;
    2.2. From Facebook's *Metaverse* to artificial intelligence and beyond.

The first temporal area of study –1. From radical origins to international consecration: from postmodern Cyberspace to the digital architecture of the early millennium– was developed by Maurizio Unali and represents the beginnings of 'Virtual Living', from the projects of the early '80s (especially in the context of the poetics of the ephemeral in architecture) to the Venice Architecture Biennale 2000 and its subsequent influences.

The second area of study –2. Where are we going?– was developed by Giovanni Caffio and analyzes some of the most recent events of 'Virtual Living', those representations that have most shaped the idea of the *Metaverse* characterizing the beginnings of the new millennium.

From radical origins to international consecration: from postmodern Cyberspace to the digital architecture of the early millennium

The houses posed unexpected challenges for the modellerPrevious studies, such as those by Caffio and

Unali (2022), have already highlighted the history of 'Virtual Living', which we will not delve into here. These studies observed the phenomenon from the perspective of ephemeral architecture, the main relational laboratory of the various projects involved. They traced the origins of 'Virtual Living' from the early 80s to the beginning of the new millennium.

A complex time span that, especially at the educational level, we have included between two international events: from the first Venice Architecture Biennale of 1980, *The Presence of the Past*, directed by Paolo Portoghesi, to that of 2000 conceived by Massimiliano Fuksas.

In this new phase of research, this broad time span has been further specified, dividing it into two parts and expanding the projects displayed in the atlas:

1. The experimental beginnings of 'Virtual Living' in the 80s: between Postmodernism, Deconstructivism, Cyberspace and the first communities on the web;
2. The consecration of digital architecture, from the 90s to the early years of the new century.

Chapter 1.1 presents the initial projects of 'Virtual Living', which laid the foundation for digital architecture. These ideas originated from the techno-cultural experiments of the early 80s and, notably, from the invention of the concept of Cyberspace. This concept has various interpretations, ranging from punk to postmodern.

The map-timeline (www.lineamenta.it/avc22/) includes numerous examples. For instance, in the literary-cinematic dimension, it references the cyberpunk themes in William Gibson's novels, particularly the 1982 short story *Burning Chrome*, Ridley Scott's film *Blade Runner* (1982), and Robert Longo's set designs for *Johnny Mnemonic* (1995). In the fluid dimension of the web, it highlights publications such as *Cyberspace*, edited by Michael Benedikt (1991), and *City of Bits* by William J. Mitchell (1997). For the first accomplished habitable virtual spaces in the offline digital dimension, it points to *SimCity*, created by Will Wright in 1989. In the

online dimension of 'Virtual Living', *Active Worlds* (1995) and *Second Life* (2003) are featured as influential platforms for what we now generally refer to as the *Metaverse*. In terms of digital incursions into reality (and vice versa), the urban scale connectivity system *Global Village Square* by Derrick de Kerckhove (2003) and the McLuhan Program in *Culture & Technology*, first established in 1996, is noted. From the creative territories of digital art, the projects of virtual environments derived from ASCII art (from the late '70s) and Pixel Art (from the 1980s) are highlighted. Playful cityscapes, drawn in isometric axonometry by the Berlin collective eBoy, founded in 1997 by Kai Vermehr, Steffen Sauerteig, and Svend Smital, are also noteworthy.

The second time frame identified as 1.2 —The consecration of digital architecture from the '90s to the early years of the new century— shows us the international acceptance of the digital revolution in architecture at the start of the new century. This era possibly encompasses the most notable aspect of the idea of space-*Metaverse*. Many projects depicted in the atlas (see www.lineamenta.it/avc22/) include the Biennale *Less Aesthetics*, *More Ethics* by Massimiliano Fuksas in 2000, *transArchitettura* of 1992, *The Virtual House Competition* in '97, *Salt Water Pavilion* by Kas Osteruis and the *HtwoOexpo* by Nox in '97, Fumio Matsumoto's projects *Infotube* and *Ginga* from 1999, the USA pavilion at the 2000 Biennale, and *Second Life*, launched in June 2003 by the American company *Linden Lab* and its founder, physicist Philip Rosedale. Other notable works include artistic installations by Patrick Moya, the *Humble Masterpieces* exhibition curated by Paola Antonelli at MoMA, virtual architectures by Luca Lisci, *Virtual Renaissance* and studies on *Second Life* by Mario Gerosa (2007, 2008), the *Reflexive Architecture* projects, the *School of Architecture and Planning*'s educational experiments at the University of Auckland, Giorgio Armani in *Second Life*, musical events representations, the '*Metaverse* Museum' by Nicola Reinerman, and the *RMB City* designed by Chinese artist Cao Fei from 2007-2011.

Where are we going?

The To comprehend the question, 'Where are we going?' amid the swift transformation of ongoing techno-cultural and aesthetic models, we've attempted to highlight some significant ongoing changes. These changes connect economic and social revolutions to aesthetic representations within the project of virtual spaces.

The global economic crisis linked to subprime and real estate, which originated in the United States in 2006 and took place between 2007 and 2013, serves as a significant turning point. This crisis, coupled with the subsequent emergence and affirmation of hypercapitalist ideologies (Piketty, 2018), which attribute the global recession to excessive banking system regulation, has led to certain foundational themes of the post-'great recession' neoliberal economic model. These themes seem to share unique affinities with new ideas of parametricism, as presented and articulated by Patrik Schumacher on several occasions (Schumacher, 2011; 2012; 2016). The emphasis is on individualism, market efficiency, adaptability and flexibility, iconism and market competition, as well as the significance of immaterial data flows and automated mechanisms in controlling operators' choices.

Both parametricism and neoliberalism have been subject to criticism and have sparked debates that appear to be interconnected. Neoliberalism has been criticized for exacerbating socioeconomic disparities and its environmental impact (Piketty, 2020), while parametricism has been accused by some critics (Moore, 2016) of prioritizing form over functional and social considerations in architecture.

For the sake of brevity, we'll jump ahead. These profound cultural, technological, and financial transformations provide fertile ground for a new idea of virtual space that seeks to transcend the current Internet. This concept is being marketed under an appealing new brand: the *Metaverse*, a term first introduced in literature in the 90s (Stephenson, 1992).

The recent development of the 'Virtual Living' concept was initiated by Mark Zuckerberg, who rebranded his

holding company as *Meta*. This signifies his company's future association with the new idea of the *Metaverse*. According to Zuckerberg, the *Metaverse* is:

> an embodied internet where instead of just viewing content, you are immersed. And you feel present with other people as if in places, experiencing different things you couldn't do on an app or a 2D web page, like dancing, for example, or doing different kinds of fitness (Newton, 2021).

However, the concrete realization of the *Metaverse* requires a complex and synergistic blend of technological and financial systems that seem currently unavailable. In simple terms, these systems include a ubiquitous and interoperable network, an expanded version of VR and AR, and an economic-financial infrastructure based on cryptocurrencies and *NFTs*.

NFTs and cryptocurrencies are already fundamental elements in the *Metaverse*. They establish real and lasting value for digital objects, supporting a 'free' economy without apparent centralized authorization.

Starting with *Everydays: The First 5000 Days* by digital artist Beeple, which was the first digital work valued at 69 million dollars (Kastrenakes, 2021), *NFTs* have permeated various sectors, including architecture and design. Notable works include *Mars House* by Canadian artist Krista Kim (Harrouk, 2021), virtual furniture by Andrés Reisinger (Cormack, 2021), and architectural renderings by self-taught designer Alexis Christodoulou (Hahn 2021).

Even established architectural studios are creating their own virtual spaces. Noteworthy examples include the virtual gallery by Space Popular for the Spanish organization *Fundación Arquia* (Fairs, 2020); *NFTism*, a virtual gallery by Zaha Hadid Architects that explores new forms of artistic production and cultural experiences related to digital art (Niland, 2021); and *Liberland Metaverse*, a virtual city modeled after the self-proclaimed Free Republic of Liberland, designed by Zaha Hadid Architects. Other examples include *Viceverse*, a virtual office in Decentraland

for *Vice Media Group* employees, designed by BIG studio (Finney 2022); *Coral Arena*, an *NFT* artistic film created by the architecture studio OMA in New York, artist and designer Charlotte Taylor in London, and creative studio Nicholas Préaud in Paris (Wade, 2021); and *Deep Himmelblau*, a research laboratory by Coop Himmelblau that has been experimenting with digital spatiality using artificial intelligence since 2016. Lastly, *Apple*'s recent presentation of a VR viewer foreshadows exciting developments in the *Metaverse*'s uses and applications.

We invite readers to explore the *Metaverse* atlas we've created to better understand 'Where we are going', thereby deepening and expanding the various projects we're working on. You can find the atlas at www.lineamenta.it/avc22/.

CONCLUSIONS

In our current era of 'Virtual Living', some authors like Lluís Ortega, David Sax, Kim Cascone and Mario Carpo refer to it as 'post-digital' (Unali, 2019). Others see it as a 'stalemate' or a time for 'reflection'. Both research and teaching need to broaden their studies on the history of the *Metaverse* concept. This mirrors the situation from the early 21st century when we also questioned 'where are we going?'. Similar to that time, the primary action seems to be what Peter Eisenmann described as the 'late style' in relation to architecture's languages. The American architect, as early as 2008, suggested that 'this is not the time for the new'. He wrote, "While everyone wants to be at the forefront, investigating the ancient, looking inside the old, in the specific domain of their discipline and in its history, could be a way to deal with today" (Eisenmann, 2008, p. 5).

This perspective, when applied to today's techno-culture that envisions the idea of the *Metaverse*, confirms the importance of continuing to reflect on the historicization processes of 'Virtual Living' (both online and offline) in its

many forms. The exploration of ideas –utopian, radical, immaterial– can be experienced through representation projects, as 'virtual living means representing!' (Unali, 2008).

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IMAGES
AND IMAGINATION
DIALOGUES BETWEEN
ART, ARCHITECTURE
AND URBAN SPACE:
VIDEOMAPPING
AT VINOVO CASTLE

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In today's society, where images –especially if in motion or emphasized by sounds and musics– play an important role in the communication and dissemination of more or less cultured topics, there is an increasing number of projects in the territory in which videomapping is used to liven up and promote cultural events, capable of triggering interest in realities and territories that are sometimes poorly valued. This is the case proposed here, regarding the recent project wanted by the Municipality of Vinovo, that organized two parallel cultural events of different levels and interests: an exhibition about the grotesques, to appreciate the value of those ones present in its castle, and the *Festival delle Magie*, an event capable of attracting the public with the charm of its spectacularity. And the Municipality itself has asked the Carillon Theater to link the two events together and make them even more attractive through the video mappings that are presented here, which have connected aspects and characters, material and immaterial, creating a show that has also put together the architectural and environmental reality with the imaginary world, structuring an engaging journey through the continuous transformation of the forms obtained from the on-site surveys and imaginative configurations, capable of immersing the spectators within a show that goes beyond the boundaries of reality.

INTRODUCTION

In recent years, the importance of artistic interventions
on the territory has been understood, capable of
relaunching the image, and not only, of places. Indeed, the
marriage between art and urban space is more and more
frequent, as demonstrated for example by the increasingly
disruptive success of Street Art (Di Luggo & Zerlenga, 2020;
Dipartimento DIST, 2023), allowing the urban landscape to
become the scene for new visual and perceptive experiences,
able to transform the image of the environment and the
architectures themselves. The drawings and colors of
true works of art are molded with the built environment,
becoming part of it, often altering the perception of shapes
and sizes, becoming an opportunity to beautify places and
bring people closer to creative and visually captivating and
communicative events.

However, the success of the marriage between artistic
images and urban space today is not only entrusted to Street
Art, but is becoming a protagonist of many other activities
in the area proposed to become attractive occasions, not
only referring to specific cultural aspects, but often aimed
at triggering redevelopment processes of places, with
various and wide-ranging repercussions. As shown by the
"history of art, avant-garde artists have always exploited new
techniques, tools and materials to express their intuitions:
now videomapping represents one of the most innovative
techniques in the field of art and visual design" (Del Luca,
2014, p. 310). The success of videomapping is linked to its
ability to amaze, in which the combination of images, lights,
movements and sounds, defines an engaging game for the
spectators, which interprets in a modern key the success, for
example, of the illuminations of popular festivals, belonging
to the tradition, or even that of the refined "Son et lumière",
which generate "a play without actors, where light and music
act as narrators" (Del Luca, 2014, p. 311). A very fascinating
'game without actors' that has very ancient origins, and that

has been transformed over time and places by adapting to various cultures, which can already be traced back to the sinuous movements of light and shadows of antiquity, such as, for example, the Chinese shadow theatre of the Han dynasty, from 220 BC (Branchini, 2019).

Fascinating is the capability of videomapping to generate an illusory game between reality, interpretation and fiction, capable of making the viewers' imagination fly towards impossible scenarios, in which the images created 'tailor-made' for an architectural facade are able to make it change its identity through video projection. Therefore, it stems the possibility to deconstruct the identity of the built forms, connecting the references of the real aspect with the visualization of new virtual and ephemeral images, in a bond that amplifies the boundaries of the imaginary towards visions generated and conceived thanks to the artistic imagination of those who conceived and created them. And it is precisely the artistic imagination the key element for making videomapping always up-to-date, which "seems to be at a crossroads: on the one hand, exploiting new technologies to renew itself, on the other, not limiting itself to them, always putting the spotlight on the creative dimension" (Pavoni, 2017, p. 6). Actually, the rapid advancement of modern production, post-production and video projection technologies clearly influences the results, even if, as Kellner states, art and technology are two closely connected aspects, and neither of the two must prevail over the other (Pavoni, 2017).

The technological possibilities are certainly the basis of the result but it is the creative project that makes the difference, developing a sequence of images, movements and sounds, capable of leading towards an immersive experience, in which reality alternates with fantasy games in a sequence of emotions. Videomapping, generated in connection with the shapes and dimensions of the architecture onto which the projection is performed, allows in fact to create a link between reality and illusory images mainly generated by

the creative imagination, capable of creating scenographic effects that distort, and at the at the same time connect the links between architecture, urban space and artistic images, defining a sort of contemporary Quadraturism.

The effectiveness of videomapping in being attractive by proposing new sensory experiences is the basis of its use for the purpose of promoting cultural heritage and places, creating appealing opportunities useful for the enhancement of the territory, or on specific themes or aspects, as well as to bring down focus on small towns. Indeed, ever more frequent are those cases in which public institutions, or museums, or cultural events use videomapping to attract visitors, proposing new interpretative readings of the local artistic and architectural heritage. This is the case of the videomapping experience presented below, created by the Teatro Carillon[1] in occasion of the exhibition *Painted Enigmi. Dalla Domus Aurea alle Grottesche di Vinovo*, at the Della Rovere Castle in Vinovo, in the Turin province[2].


VINOVO MAPPING: THE PROJECT

The 2023 project was born to create a site-specific videomapping show in order to establish an immersive multimedial exhibition inside the wonderful historical setting of the Vinovo Castle, built at the end of the 15th century, of which some wall decorations frescoed with grotesques by one of the towers of the building have recently been restored. The Municipality of Vinovo therefore wanted to celebrate this event with an exhibition in the halls of the castle, which could divulge the grotesque style, often underestimated and little known, making this technique interactive and current. A decorative technique invented by the Etruscans to embellish the walls of their catacombs and rediscovered over the course of several centuries, especially during the Renaissance and Baroque periods. It consists in the representation of natural elements, human figures and

bizarre fantastic creatures that create a decorative texture that occupies all the spaces on the walls. Together with the exhibition, the Municipality wanted to attract the city population and other visitors with the *Festival delle Magie*, a broader and more fascinating project, which would also bring them closer to understanding the value of the castle, its park and grotesques, discovering more generally Vinovo values, often little known.

THE GROTESQUES EXPOSITION

The part of the project for the exhibition was aimed at visually enlivening the walls and vaults of the castle halls with grotesque animations, playing on the fact that spaces already existed defined by stucco decorations, in order to create astonishment and a magical atmosphere that would involve the public and make them perceive the figurative vitality of these wall paintings (Figure 1). The first phase of work included site inspections of the castle rooms, necessary

Fig. 1 Teatro Carillon, Videomapping at Vinovo Castle (inside), 2023.
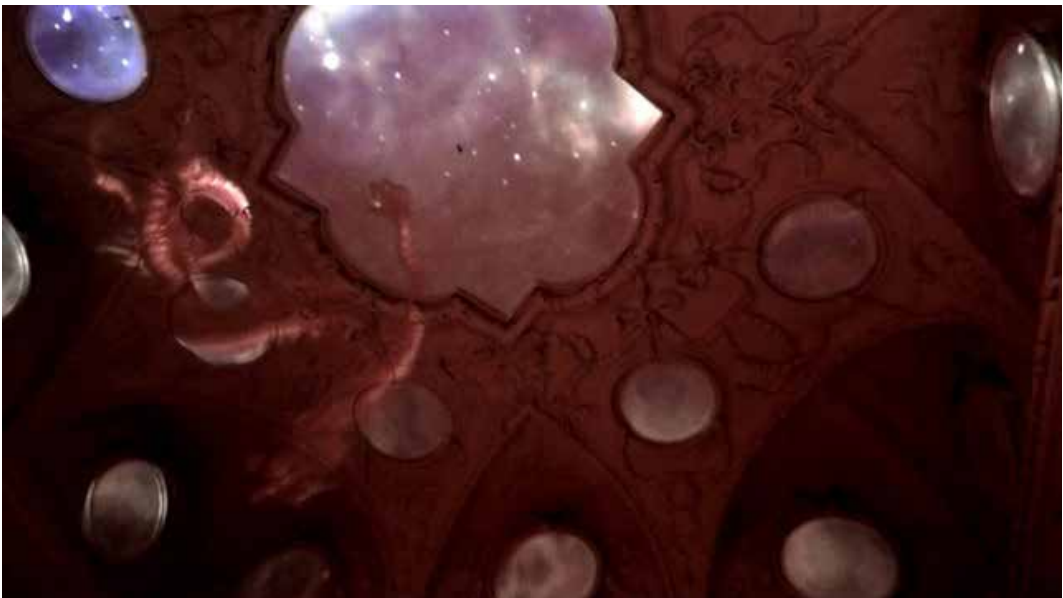
for the photographic and video documentation of the present decorations, for the design of the concepts and the planning of the type of projectors to be used and their positioning in each hall. On the basis of the characteristics of each room, in fact, in some cases ultra-short-throw or long-throw projectors were chosen to correctly adapt the virtual images to the real space.

In the exhibition space characterized by the grotesque engravings of the chandeliers with figures of dragons, it was decided to use the dragon theme as a key element of the videomapping concept. Within the circular stucco spaces of the vault, videos were made that simulated the presence of a breakthrough in the ceiling from which one could see the sky and the passage of various dragons and flying creatures, connecting the architecture with an awesome setup. In the adjoining room, however, figures taken from grotesque etchings were used, animating them one by one and creating a dynamic and entertaining general movement for the public, combined like every projection with an adequate musical production, which could support the movements and make the public perceive the right atmosphere. This project in which the imagination has overcome the constraints of the existing characteristics has been completed with the creation of a documentary to tell visitors the story of the grotesques over the centuries, with a focus on those in the castles of Piedmont, to better understand their value.

THE *FESTIVAL DELLE MAGIE* EVENING

But it is in the project for the *Festival delle Magie* that the maximum possibility of creating a fantastic place has materialized, where the imagination comes to life in the environment around the visitors, in a sort of augmented reality. In detail, along the access route to the castle, various light installations have been designed to entice people to enter its park. The first to welcome the public was a fractals morphing with the Festival logo inside, mapped on the town

Fig. 2 Teatro Carillon,
Videomapping at Vinovo Castle
(garden), 2023.

hall in the square in front of the gardens. Once through the park gate, two fairy figures welcomed visitors, appearing projected on the trunks of the two trees on either side of the central path, which with an optical illusion seemed to appear floating between the two cut trunks (Figure 2). The show of projections that brought visitors inside a fairy reality was also completed by other theatrical performances.

Indeed, at a certain point in the event, all the lights went out, leaving the bystanders waiting, when a character dressed in white appeared on stilts with a luminescent ball in his hand and a hat on the tip of which was placed a mini projector that illuminated his mask and created light refraction effects around it. This figure played the magician who would start the show; in fact, after a circle in the audience –accompanied by the song Santorini by Yanni, live at the Acropolis– he arrived in front of the main staircase and with a movement of his scepter he started the great videomapping projection on the facade of the castle.

THE MAIN SHOW: VISUAL CONFIGURATIONS BETWEEN REALITY AND IMAGINATION

In complete darkness, in which all references to the architecture and the environment are totally canceled, videomapping has created a dreamlike environment,

Fig. 3 Teatro Carillon,
Videomapping at Vinovo Castle,
2023.

Fig. 4 Teatro Carillon,
Videomapping at Vinovo Castle,
2023.

causing a full moon (Figure 3) to suddenly appear which, with
an upward movement, reaches the center of the facade and
with a he gradual opening of the perspective view is framed
by a cave overlooking a lake landscape. This immersion
in a fantastic environment, where even the movements
and sounds support the images creating expectation and
amazement in the spectators, continues with the waning
moon which becomes the nucleus of an explosion (Figure
4) that transforms into the immense eye of a flying phoenix.
This bird was chosen as a key element of the video mapping
because it is the protagonist of the frescoes found inside the
castle. In the projection, the phoenix, with a wide movement
of its wings (Figure 5), ignites a great fire (Figure 6), which
gradually goes out, still allowing the graceful movement of
the sparks to live for a few moments.

Fig. 5 Teatro Carillon, Videomapping at Vinovo Castle, 2023.

Fig. 6 Teatro Carillon, Videomapping at Vinovo Castle, 2023.

From this point begins a 'reconstruction' mechanism of the castle, which rises from the ashes like the phoenix, through the initial projection of historical views that recall its ancient image, introducing the spectators into an atmosphere of the past. The facade of the building is subsequently broken down into sectors which, through sliding movements, recompose the design of the openings, virtually enriched by grotesque decorations. The central area, in particular, is assembled by draft horses that drag the configuration of each floor up (Figure 7) to the completion of the façade (Figure 8). The overall image, which through the projection embellishes the essential forms of the front, becomes the setting for a perspective game, in which the planes are reversed, creating false settings decorated with grotesques, which transform the exteriors into interiors, and vice versa (Figure 9).

In this phase of the show, various architectural configurations follow one another, retracing the transformations that the castle has undergone over the centuries, with the element of the phoenix fluttering between the architectural elements. This perspective and three-dimensional game aimed to amaze the public through an optical illusion effect that destroyed the physicality of the building. A physicality of the castle that is redefined by the lighting, and then visually crumbles with cracks (Figure 10), until it vanishes in the dark.

Then it follows a new phase of rebirth, in which the leaves of a luminous plant (Figure 11), which burns and disappears, come out of nowhere, originating a new architectural configuration in which luminescent lines underline the openings of the castle, intersecting them and transforming

Fig. 7 Teatro Carillon,
Videomapping at Vinovo Castle,
2023.

Fig. 8 Teatro Carillon,
Videomapping at Vinovo Castle,
2023.

them with new forms of fictitious openings. The musical mood changes and after an effect that makes these lines vibrate as if they were on a liquid surface enlivened by the footsteps of a large creature, the windows gradually begin to populate with terrifying creatures taken from the grotesque frescoes. These beasts writhe in the searing flames and transport the viewer into a hellish environment to the point where a huge floating dragon comes to life and with a musical climax moves and appears to come out of the wall towards the audience and 'swallow' them.

These continuous passages between reality and the imaginary are made possible by videomapping which, thanks also to the speed granted by the projection and to the music and sounds that amplify the visual emotions, generates passages and connections that are sometimes

Fig. 9 Teatro Carillon, Videomapping at Vinovo Castle, 2023.

Fig. 10 Teatro Carillon, Videomapping at Vinovo Castle, 2023.

Fig. 11 Teatro Carillon,
Videomapping at Vinovo Castle,
2023.

even instantaneous between fantasy images, historical
quotations and configurations of architecture, which become
stimuli to approach culture in a playful way.

TECHNICALS DETAILS OF THE PROJECT

The creative videomapping work for the rooms of the
castle was planned on the CAD drawings of the survey made
using point clouds, which identified the dimensions and
shapes, particularly of the frames within which the images
were to be projected. The survey was crucial in configuring
the margins of the basic templates for the realisation of
the animations and in planning the position and type of
projectors to be used in each room.

It was selected: for the ceiling in the stucco room, an
Epson projector with 3000 lm xwga ultra Wide optics with a
ratio of 1:0.3; for the wall of the stucco room and the ceiling
of the second exhibition hall, two 2000 lm bookmaker
projectors with a protection ratio of 1:1.2; for the wall of

the second showroom, a 3000 lm Epson projector with a 1:1 protection ratio. All surfaces were videomapped with the Madmapper software and given the need to reproduce them for about two continuous months, as we were unable to make computers available, we had to find a continuous reproduction system.

The two more complex outputs were exported from the program to two Mini Mad media players of the same brand on which the program was installed. For the other two local outputs, the mapping geometries were exported from the program, animated on the final cut and reproduced in MP4 from an SD card inserted in the bookmaker projectors set up for this option.

The videomapping of the façade was designed with a different approach, starting with a photogrammetric survey, processing the photographs taken with a drone with Agisoft photoscan, in connection with some direct measurements. From the 3D model of the survey, a two-dimensional CAD drawing of the façade was obtained, which was fundamental for the creation of the images of the animation videos mapped and reproduced with Madmapper software. For the choice of the projector, a weighted research was carried out with respect to the size of the 47-metre long elevation, 50-metre projection distance, using optics with a 1:1 projection ratio and a minimum resolution of 1920x1080. Also on the basis of the budget provided, we opted for renting two 12,500 lm Panasonic projectors, mounted on cages with micro-adjustment, superimposed vertically at a height of 3.50 metres.

The success of the show was made possible also by the possibility of switching off the light sources around the castle, creating a darkness that made even more spectacular both the scenic effect of the videomapping and that of the stilt-walkers who, as they paraded through the crowd, activated the projection; a face-mapping helmet was created for them using a 200 lm Kodak portable projector with a 1:1 projection ratio.

CONCLUSIONS

This work shows the added value, and rather unusual, in having created a link of continuity between the environment and architecture that surrounds us every day and various art forms that, ranging from videomapping to street theatre, have created a story, which in its scenic spectacularity has highlighted the historical and artistic values of that place, connecting them to a broader cultural context.

The visual representations proposed in Vinovo fall within a general framework in which videomapping stands as an ephemeral form of contemporary art that offers great opportunities for development both in the technological field and in the more properly creative and artistic one, in constant expansion. Beyond these and other possible developments, its added value can be identified in its being an artistic creation overall, with the ability to show itself in ever new narratives and, consequently, to also attract the attention of an audience that is sometimes extraneous to the most usual cultural events proposed in museums, exhibitions, or other centers. Hence its now recognized role of being a powerful means of communication and promotion of culture and places (Zerlenga, 2022), capable of triggering processes of tourist attraction and appeal, with impacts on the local economy and employment (Khosravi & Lim, 2013), or a "bearer of territorial marketing and a new idea of promoting places through technology" (Ivona & Privitera, 2019, p.131). Indeed, as evidenced by a survey by Panasonic (Panasonic Connect, 2022), in those places where videomapping projections have been made, considerable increases in revenue have been detected by local activities, during and after each event. It is therefore highlighted how this technologically avant-garde art form, apparently marginal or extraneous to the territorial strategies, and which may appear as an artistic fact in its own right, reveals itself as an increasingly sought-after tool to trigger processes of revitalization of a place and its culture instead.

A non-invasive activity with a sustainable approach, in which the shapes of architecture and urban space are transformed by embracing images of pure fantasy, allowing each user to be enveloped by the emotions of a suspended world between reality and the imaginary.

NOTES

1 Teatro Carillon is a group of artists, consisting of Jacopo Della Rocca, Giulio Davico and Tommaso Pigliapoco, who already have various videomapping experiences to their credit, including *Aurora in Luce*, *UFO*, *Barriera Cosmica* and *Surge*.
2 The videomapping was projected on the walls of the castle on the evening of the inauguration of the exhibition – exhibited from 11 March to 14 May 2023. The project is in collaboration with and with the contribution of the Regione Piemonte and the Fondazione Cassa di Risparmio of Torino.

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METAVERSE OR URBAN DIGITAL TWIN:
THAT IS THE QUESTION

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The growing interest in the Metaverse from the business world is a testament to its increasing importance and the potential impact it could have on our society. Large companies and investors have recognized the enormous economic potential that the Metaverse can offer, prompting them to invest significant amounts of money in its growth and the development of platforms and applications. The acquisition of land and properties in the Metaverse by prominent figures in various sectors, such as finance, entertainment, and sports, reflects the rise of the Metaverse as a new form of expression, entertainment, and social interaction.

Bringing these reflections into the field of urban planning, we can say that the technological innovation behind the development of the Metaverse has dematerialised the urban object by transfiguring it into an immaterial digital content. Can new technologies merely replicate or simulate the city? Starting from this question, this paper seeks to overcome a naive fascination with the Metaverse, proposing instead a reflection on the Urban Digital Twin and the Augmented City, in the firm belief that new technological tools can redefine and develop new dimensions of humanised space rather than reproduce a *simulacrum* of the city inhabited by cyber-citizens.

TALKING (BAD) ABOUT THE METAVERSE

It often happens that innovative words become iconic in society and spread with an appeal largely attributable to the not understanding of their true meaning.

There is no doubt that the term 'Metaverse' possesses a semantic value that has contributed to its diffusion, thanks in large part to the rapid spread in the use and dependence on new technologies, and, in general, the fascination of the possibility of transferring oneself to virtual worlds where a significant portion of one's biological existence can be spent 'digitally', with much more satisfaction than what is normally obtained in real life.

Recently, the Metaverse has also attracted the interest of the business world, represented by major international companies and investors who, as reported by McKinsey's report for the first half of 2022, have invested approximately 120 billion dollars. At a lower level, there have been reports of acquisitions of land and properties in the Metaverse by well-known figures from the world of finance, entertainment, and sports, such as the footballer Verratti, who purchased one of the 25 digital islands available for sale on *The Sandbox*, one of the Metaverse platforms available online, and on which he will establish his residential settlement, complete with access infrastructure, specific commodities, sports and training spaces, etc.

What makes the Metaverse so fascinating is the ability to experience new identities, explore virtual worlds, and interact with other people in a digital context. It offers an escape from everyday reality and the opportunity to live experiences that may otherwise be inaccessible or unrealizable. This has generated strong interest among people seeking new forms of entertainment, socialization, and personal fulfillment. However, despite the growing interest and enthusiasm for the Metaverse, there are still many aspects to think about. For instance, how will we users, with our physical and corporeal nature, be able to interface with a space without a place?

And again, will we be able to strike a balance between digital and real life, so that the Metaverse can be a tool for enrichment and social connection rather than an escape from reality or a form of alienation?

DIGITAL TWIN AND METAVERSE WHAT RELATIONSHIP

Within the most recent contributions found in literature comparing Digital Twin (DT) and Metaverse, the hypothesis that they can be considered similar and sometimes coincident is often put forward. Analyzing the main characteristics of the two 'environments', it is possible to observe structurally dissimilar components. The DT, or more precisely the Urban Digital Twin (UDT), replicates a model of a specific city by building a twin based on specific data and variables derived from the real counterpart. In the Metaverse, the 'urban metaphor' is used to allow for a more familiar user experience, where users configure themselves as cyber-citizens through the transfiguration into avatars. In other words, the UDT can be seen as a digital model of a single city built using algorithms that simulate its behavior and is fed, in real-time, by packets of big data generated by sensors, control systems, traffic loops, IoT environments, etc. The Metaverse, or rather Metaverses, as it would be more accurate to say, are a semantic reconstruction of socially situated spatial organizations, namely cities. It is evident, therefore, that from an urbanistic perspective, it is not possible to claim that Digital Twin and Metaverse are closely linked.

The difference between the two becomes even more marked if we reflect on the fact that the Metaverse, at least in its current configuration, denies any mediation between the digital world and the real world, with respect to which it is completely autonomous. The UDT, on the other hand, by its very definition, could not exist without its physical twin, the variation of which automatically modifies its information content.

From a different perspective, it appears more interesting to explore the contribution that Extended Reality (XR) can provide in transforming UDTs into collaborative intelligence environments. Empowering digital twins with XR collaborations can open up new possibilities for enhancing the collaborative capabilities of UDTs. Overall, while DT and Metaverse share some similarities, they also have distinct characteristics and serve different purposes. Exploring the potential of combining Extended Reality and Digital Twins can provide valuable insights and opportunities for collaborative intelligence in urban contexts.

BEYOND THE METAVERSE: THE AUGMENTED CITY

As with the Metaverse, the UDT can also be visualised and interrogated by the XR tools. The result of the interaction between the individual instances of the UDT and the XR tools is the Augmented City (AC), a city within which it is possible to interact with "augmented urban objects" usable through XR technologies.

What substantially differentiates the AC from the Metaverse is the possibility of relating, in the same time, to both real and digital instances, in what becomes a new spatial experience that recovers the mediation between the real and digital worlds denied by the Metaverse.

Putting aside sophisticated and dedicated devices for the enjoyment of the Metaverse, through common devices such as smartphones and tablets, it is possible to visualize, live and on demand, the urban digital instances with which the citizen can dialogue in the same way as what happens with the physical instances.

In addition to being a tool at the service of citizens, the UDT, if visualised and queried by planners and decision-makers, can contribute to the governance of territorial transformations and to the redefinition of urban assets as an innovative tool for the prefiguration of planning choices.

Fig. 1 Prefiguration by LCIM app of the architectural project of the new building of the University of Sannio in Benevento.

These are the thoughts that have guided the development of the app *Live City Information Modeling -* LCIM and the app *City Augmented Reality for the Environment -* CARE, developed by the AURUS research group for urban prefiguration with the aim of simulating new design choices and testing them in terms of economic, environmental and social sustainability.

Specifically, the LCIM app allowed citizens and planners to visualise, through their smartphones, the full-scale model of the new building of the University of Sannio at Via dei Mulini in Benevento, making it possible to preview the new project within the urban context (Figure 1). Similarly, the CARE app simulates the possible tree essences that could be planted on Via Posillipo in Naples, allowing citizens to visualise the possible morphological configurations of the street to choose from, guiding the final choices of decision-makers (Figure 2).

Fig. 2 Prefiguration by CARE app of the trees that will be planted in via Posillipo in Naples.

Fig. 3 The Obama's speech in *Second Life*.

In both cases, what is generated is not a virtual urban context, but rather an augmented space born of the interaction between physical and digital entities.

CONCLUSIONS

The Metaverse or Metaverses are seeking their affirmation within individuals' existential spaces, attracting the attention of major corporations, famous brands, and innovative entrepreneurs who hope to generate new business by being among the first to enter the virtual world. There is no doubt that the digital dimension exerts a considerable charm, as was the case with *Second Life*, where even Barack Obama opened a campaign office for the 2008 presidential elections (Figure 3).

In the case of *Second Life*, its early success was also attributed to the innovation it offered by leveraging the allure of new 3D multiplayer games. However, it should be emphasized that *Second Life* was not a game with a specific goal, where players interacted to form teams dedicated to achieving an objective. Instead, it allowed the definition of a 'digital sociality' among avatars, in a way, a precursor to a significant social and economic revolution (Castronova, 2007). One of the basic challenges with *Second Life* was widespread access and effective utilization of the Virtual World's potential: knowing the technology and, to some extent, English.

Today, the Metaverse can benefit from the latest hardware and software innovations that bridge the technological gap and enable all users and their avatars to adopt 'natural' behaviors, gestures, and interactions, much like those in the real world.

The fundamental question remains: will the virtual world modify the real one? Will the digital city affect the socio-spatial structures of the physical city? Can the UDT serve as a bridge between these two dimensions, allowing new possibilities for sustainable governance of urban and territorial transformations?

The reflections proposed in this text may indicate a path for future investigations, particularly by urban planners of the 'cities of the future', but it must be explored with the full awareness that it is not the only possible way.

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THAT DIGITAL ELSEWHERE, SO IMPOSSIBLE TO IGNORE!

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MULTIMEDIA ARTS
VIRTUAL REALITY
AUGMENTED REALITY
INTERACTIVE ART
DIGITAL TRANSFORMATION

This essay presents the professional journey and philosophical underpinnings of a visual artist, Chiara Passa, who has been deeply engaged with multimedia arts since 1996. Educated at the Academy of Fine Arts in Rome, the artist has explored the interplay between physical and virtual spaces using Virtual and Augmented Reality as tools to probe architectural concepts and challenge the static nature of places. The work often transcends traditional artistic boundaries to create immersive, interactive experiences that blend real and virtual worlds, encouraging viewers to engage actively with the artwork. Significant projects utilize augmented reality and artificial intelligence to offer dynamic and unexpected artistic encounters, reflecting on emptiness and space transformation themes. The artist's work underscores a long-term commitment to integrating cutting-edge technology with artistic expression, contributing to the ongoing discourse on the role of digital technology in the evolution of art.

I am a visual artist who has been working in the field of multimedia arts since 1996. I graduated from the Academy of Fine Arts in Rome, which at the time was also the place where my experimentation with the so-called new media began. My works analyze the subtle differences between physical and virtual space through the practice of various techniques, technologies, and devices, such as virtual reality and augmented reality which I use as an artistic medium to explore architecture as a fluid and vibrant interface. I use immersive reality to question the static nature of the place, exploring the liminal duality between tangible and virtual site, obtaining in art a bizarre oscillation between spaces that generates new perceptual levels of reality around the spectators.

My artistic research fits perfectly into the renaissance of the immersive art that began around the mid-nineties. In fact, at the end of the nineties I designed video installations through virtual and augmented reality with an immersive effect, using the media of the time which were based on whole-wall Beamer projections, such as the Cave system (Cave Automatic Virtual Environment).

Inspired by Marcos Novak's writings *Liquid Architectures in Cyberspace*, after the mid-nineties, I started using the term super-place to characterize the dynamic and self-performing places in my virtual works, which appeared animated by an intrinsic metaphysics to transform in front of the spectator into something always different and unexpected. An example of a super-place is my recent interactive wall-drawing *Null Void 0*, which comes alive thanks to an application of augmented reality and artificial intelligence. The artwork explores the theme of emptiness and the related artistic-creative potential associated with it. *Null Void 0* is a sort of impossible puzzle in which the viewer is called to reconstruct the entire shape of the wall-drawing made up of more than one hundred pieces. By touching the screen, the user generates the parts of the solids that design the 3D drawing. Each piece (which can be scaled, translated, and rotated in real space) emits an artificial intelligence sentence (randomly

Fig. 1 Chiara Passa, 2017-23.
Null Void 0.

generated) that speculates on the machine learning practice inherent to the object recognition. In fact, most of the time the artificial intelligence deliberately does not recognize the part of the wall-drawing as a portion of itself, causing unexpected shifts in meaning that question the shape of the artwork. *Null Void 0* invites the public to cross the lively and unexpected border between art and game that viewers by playing create between real and virtual places.

I have been working with immersive technologies for a long time, since these artistic experiments were far from the art system and therefore referred only to very few artists who had the opportunity to experience virtual reality in the nineties, through university laboratories and specific research centers. We had to wait about twenty years to see how these technological experiences in digital art are now recon-

sidered by the art system and become the subject of numerous international studies and publications. At the end of the nineties, I developed an artistic language using the so-called new media and through the immersive technologies which currently constitute the main tools of my artistic expression. I have therefore focused my artistic research and modus operandi around virtual reality to design an artistic fruition open to multiple perceptual levels, which actively introduces the public into the vibrant context of the work of art.

Metaverse is definitely the word of the moment linked to a certain hype which, as always, will fade away from fashion. However, my artistic research has always evolved through virtual platforms and immersive technologies ignoring conceptual obsolescence and temporary hype. I would define metaverse as that sort of digital elsewhere –currently impossible to ignore– which for years now has been immersing us in online and offline multidimensional spaces, more or less complex. The metaverse has been an ongoing project since the nineties when the futurist engineer Mark Pesce created the first virtual world for the web (*Atlantis*) in the form of a 3D chat. Mark Pesce obviously also invented the VRML programming language that carried the 3D to the web through the *Cosmo Player* browser, with which

Fig. 3 Chiara Passa, 2023.
Abstract Space.

the user interacted and moved into the metaverse of the time. Later, many other virtual worlds arise, including *Second Life*, and the more recent *Mozilla Hubs*.

Within my virtual worlds the viewer can establish an intimate dimension with the artwork that can penetrate to the point of origin. The user therefore hyper-sees the work between-spaces, in that dimension suspended between the real and the intangible where everything is possible in art.

I use immersive reality to design liminal and dynamic virtual places that intersect with real space to expand the perceptive limits beyond the idea of the material body. Central to my artistic research is the theme of the involvement of the spectator who, for some time now, is no longer looking for a purely aesthetic experience, but knows that must transform into a dynamic *spett-attore* (a term already used by Augusto Boal meaning lively spectator) aware of being an active part of the process of the artwork, which is experienced through new paradigms built from unpredictable synesthetic combinations. To create new opportunities of fruition, I take art to

virtual and unexplored places such as, for example, the previously avantgardes like futurism, street art, net art, and others have done. This is precisely how non-places can become artistic spaces.

Virtual reality and augmented reality, combined with artificial intelligence, are necessary tools that I use on a wide scale to create illusory declinations of the real space where digital echoes come to life for expanding the field of sensory intuition. The theme of the self-performative space has always been very important in my artistic research since the beginning. In fact, already in 1997, I began to develop a deep interest in architectural space and how it can be transformed within the computer language. Since the creation of the *Live Architectures series*, immersive artworks of the late nineties (CAVE type), I came to fully use virtual and augmented reality when they were finally commercialized. I manipulate augmented reality to outward and animate the real space and virtual reality to explore the space from the inside and find its hidden parts. Through immersive technologies, I design mixed reality installations that connect physical and digital space with the aim of generating curious overlaps and intersections between them, often producing in the viewers the sensation to feel suspended. I use augmented reality to stretch space beyond its limit and virtual reality to penetrate it until its most recondite place of origin, achieving in situ a bizarre oscillation between virtual and real spaces. In my artworks, emerging spaces are interconnected: the imaginary space arranged by virtual effects and the spatial arrangement of the place itself. Spectators are unsettled by this double relationship, having the sensation of remaining suspended between inside and outside. The space opens up to include several dimensions, with time being just one of many that aid people's vision. Spectators walk and move as if they were in so-called 'reality', but classical space is bent, expanded, and pierced: the place itself becomes an immersive reality/non-reality to be explored. Multiplication is also created by structures enclosing virtual reality, such as

Google Cardboard geometric figures or augmented reality frescoes, further increasing multidimensionality.

For me, virtual reality has also meant getting in touch with the landscape in a concrete way, creating site-specific artworks such as, for example, *Earth Spiral*; a virtual reality installation consisting of twenty *Google Cardboards* and related smartphones that reveal twenty different immersive animations to be seen underground where the 3D viewers are well embedded. The 360° animations show to the viewers a cyclical and transformed nature through the digital manipulation of specially selected maps from *Google Earth*. The animated maps are drawn by wandering super objects and micro/macro dimensions in continuous transformation that often change in front of the users to put them confronting with a synthetic and post-organic nature.

Also in the recent artwork *Abstract Space,* the idea of a performative space is clearly evident where an imaginary and minimalist environment I created using GPT3 (Generative Pre-trained Transformer) artificial intelligence models and some GAN (Generative Adversarial Network), casually adds up, or subtract parts in order to divide and intersect with the real space. The spectator immersed in this new site experiences a sense of absence by observing the birth of a new place in constant evolution and drawn by volumes of shadow which extrude the outlines of the primitives along the direction of the light source.

Gold Environment is an artwork in the form of an augmented reality application using pre-trained artificial intelligence algorithms to recognize and interpret the real space for creating specific meshes that cover the place turning it into gold. From the meshes chunks, randomly grow up –from the walls, ceiling, and floor– a series of nomadic sculptures that move and continue growing when touched. The spectators, via tablets and smartphones, are invited to touch the screen also for generating sound effects that invite them to look beyond the real surface; where artificial intelligence incredibly transforms everything into gold and generates –all around the

Fig. 4 Chiara Passa, 2022.
Gold Environment.

viewer– a new object-oriented reality in constantly transformation. *Gold Environment* shakes up the ontological vision of the place by challenging human perception.

The dynamic space in my virtual artwork *Still Life*, transforms the past into the present and the future, redefining the concept of Cultural Heritage. Heritage that is no longer made up only of aesthetic values, but also and above all is made of shared experiential, historical and artistic values. *Still Life* reinvents aesthetics and cultural identity through virtual reality, reflecting on landscapes, paintings and history, to overthrow the space in an immersive and interactive dimension, where the spectator, walking around and

Fig. 5 Chiara Passa, 2019-23. *Still Life (sepia-gold version).*

having different experiences through the artwork with the objects, recovers cultural information by conversing in a cognitive way with the history of art. For the creation of the artwork, I designed the virtual environments using techniques such as photogrammetry and 3D scanning. Then, I worked on color mapping and texture manipulation. The result is a still life, an interactive three-dimensional painting, where objects can be unexpectedly deformed and animated. *Still Life* is finally capable of realizing (thanks to immersive reality) what the Futurist manifesto said more than a century ago: "We will bring the viewer to the center of the painting" (Boccioni et al., 1910, p. 2).

During the past pandemic, the discourse on the Metaverse exploded again, also because it was the only livable space during the lockdown. Nowadays the online and offline

exhibition possibilities have expanded –just like our reality in the metaverse –to the point of being able to build immersive shows in virtual, augmented, and mixed reality that can be enjoyed simply through a mobile browser. Technology makes it possible to overcome boundaries by imagining presence in an elastic dimension suspended between the real and the intangible, where it is possible to coexist, make art and interact on a wide-ranging basis. The metaverse must be perceived and understood as a sort of 'other' space, as a means to live artistic experiences open to multiple levels: emotional, physical, intellectual and sensorial. The metaverse for art is a space for construction and creativity, as well as an opportunity to design –using immersive technologies– something that does not exist. In fact, the beauty of art is that there are no limits, just like in virtual worlds. I believe that in the future we will be more and more immersed and that the 3D viewer, augmented glasses, will most likely be our next psychotechnology (to use De Kerckhove words), impossible not to wear!

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THE ARCHITECTURE OF THE VIRTUAL NOT-PLACE
REFLECTIONS ON DESIGN IN THE METAVERSE*

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METAVERSE
VIRTUAL PLACE
VIRTUAL ARCHITECTURE
SKEUOMORPHS

The development of new technologies in the context of the 'Metaverse' necessitates an in-depth reflection on the perception of space in the design of virtual environments. This article examines the importance of the concept of 'presence' and refers to Marc Augé's work on the distinction between 'places' and 'not-places'. It updates the same concept to virtual worlds and the design of architecture in the Metaverse. The absence of design control results in transit experiences that are more akin to virtual 'not-places', which in turn leads to a loss of a sense of community among users. Consequently, it is imperative for architecture in the metaverse to address these issues, commencing with a critique of the concept of aesthetic and functional 'skeuomorphism'. The design and modelling of architectural environments within the metaverse, conceived as virtual spaces, plays a pivotal role. The objective of this article is to stimulate reflections on the formulation of graphic codes to be used in the future design of virtual environments.

The 2021 *Facebook Connect* conference refocused attention on virtual environments, presenting plans for further development of the so-called 'Metaverse' Artificial Intelligence, 3D Digital Twins, Augmented Reality, Virtual Reality, Edge Computing, Blockchain, and Cryptocurrencies appear to be the pillars that will support the future of the digital world. Mark Zuckerberg, in his rebranding of *Facebook* to Meta, symbolized by the infinity emblem, indicates a dimension that will transcend a limit identifiable in the physicality of the real world, where the simulation of reality will appear increasingly plausible. This is a new dimension not only in terms of space and time but also experience. This multisensory universe with mobile boundaries, capable of covering every sector of life, from work to commerce and entertainment, will present opportunities as well as risks and issues, similar to those that emerged with the advent of Web 1.0, that is, the traditional web. The Metaverse is an evolution of the web that moves from 2D graphics to 3D graphics, from being viewed on a computer screen to how the user is inside a dynamic web where physical reality will attempt to merge with the digital one. It should not be forgotten that the virtual world imagined by Zuckerberg does not really exist yet, according to market analysis it will come to light in no less than five years and probably within ten. Currently, it is in the development phase, and the implemented functions are under analysis and experimentation. Matthew Ball, author of the book *Metaverse: What It Means, Who Will Control It, and Why It Is Revolutionizing Our Lives*, argues that the Metaverse is:

> A network of maximally scalable and interoperable real-time rendered 3D virtual worlds, that can be experienced synchronously and persistently by an effectively unlimited number of users with an individual sense of presence within them, and that ensure data continuity relating to identity, history, rights, objects, communications, and payments. (Ball, 2022)

In 1992, the concept of the Metaverse was introduced to the world for the first time by writer Neal Stephenson in his science fiction novel *Snow Crash* in a world not dissimilar to the one we live in today where humans interact with each other in a 3D virtual space, an evolution of the classic internet. The realization of such an online community became a reality for many people in 2003 with the introduction of *Second Life*, considered the true first application of the Metaverse concept. In this virtual world, there is no story to complete or objectives to achieve; players instead have the freedom to create their own content, interact with other users through their digital avatars, and explore the entire world that *Second Life* offers, as well as participate in the various activities that other users develop and propose. Since then, video games have expanded their presence on the Internet, creating various online communities similar to the original concept of the Metaverse where people can meet and exchange information, but also goods that correspond to real monetary values related to different economic systems. With the advent of cryptocurrencies and blockchain, these transactions have become easier and more secure, decentralizing ownership and information and thus paving the way for true expressions of metaverses online. Over the years, online video games have continuously improved, offering players more engaging graphical experiences and creating games where players are free to explore the world by interacting with various elements within it. Some of these scenarios even allow players to contribute to the construction of the world itself by providing them with building modules to assemble and create almost anything they desire, with some of these constructions being functional parts of the experience for everyone's enjoyment, as in the case of *Minecraft*. One of the most modern games that closely approaches the concept of the Metaverse is *Fortnite*, developed by Epic Games, among the most successful *Free-to-Play* multiplayer games to date. Essentially, the main game mode of *Fortnite* is the Battle Royale, but Epic Games has expanded its ecosystem with many other activities and

Fig. 1 *Decentraland Metaverse.* The user experience appears anonymous from a graphical standpoint, the architecture of the volumes lacks recognizable elements, and the places are used only as spaces for temporary transit.

features. In 2011, Ernest Cline published *Ready Player One*, a novel, which was adapted into a film by Stephen Spielberg in 2018, where one is immersed in a dystopian reality, similar to *Snow Crash* The reader is immersed in a world where humans play a virtual reality game based on the Metaverse called *OASIS*, where the main goal is to escape the chaos present on Earth. Over the last decade, due to its ever-growing popularity, it is common to find the concept of the Metaverse in pop culture, just think of films like *The Matrix* or the *Fifteen Million Merits* episode of *Black Mirror*, where citizens ride a stationary bike to earn credits to later participate in a talent show, through their personal avatars.

To date, the true Metaverse does not yet exist, because the interconnection between various virtual worlds is not yet possible. There are multiple virtual 'islands' across various sectors ranging from gaming to virtual galleries, but not within a 'unified universe'; the term is commonly used to refer to platforms where immersive experiences can be had in three-dimensional virtual environments. According to an

Fig. 2 *The Sandbox Metaverse.* The 'transitivity', or the ability to move or transition between virtual experiences, conversely, generates a sense of 'not-presence'.

analysis by the new Observatory on Augmented Reality and Metaverse at the School of Management of Politecnico of Milan, the Metaverse consists of 212 virtual worlds and only 54% are freely accessible by anyone, equipped with 3D graphics, with interoperability components that would allow the use of digital assets in a cross-platform and persistent manner, meaning they continue to exist independently of whether a person is present or not. Platforms such as *Decentraland* (Figure 1), *The Sandbox* (Figure 2), *Spatial,* and the Italian *The Nemesis* fall into this category. The 27% are *Open World,* that is, they are open, persistent, modular, and immersive virtual spaces that gather projects from every area of interest, lending themselves to both business use and social purposes, but without elements capable of supporting interoperability. Examples include *Second Life, Horizon Worlds,* and *Roblox.* The 16% belong to the Focused World category, meaning virtual worlds whose projects are focused on a particular area of interest (gaming, commerce, training, work collaboration), like *Fortnite* and Microsoft Mesh. There are also Showrooming

Fig. 3 *House of M.* The inclusion of columns, arches, or other decorative details that evoke architectural functions or styles to create a sense of realism and familiarity for the user limits the creative possibilities of a virtual place and innovation in interaction.

Worlds (3% of the total), like Musee Dezentral, virtual showcases intended for displaying, for example, artworks by artists and collectors, without the possibility of user creation and without an internal economy. The key that allows us to experience a true Metaverse is nothing but our ability to be actively involved in its creation while participating in the experience. The most compelling sensation for those approaching today's virtual places is precisely the ability to experience not just being inside them but within a digital experience. However, let's consider the concept of 'presence' in an explorable virtual place. The concept of 'being present' could completely change the current view of the Web. The correspondence between the real and the virtual could be a point where virtual and perceptive experiences meet and overlap in some way. This thought demands a sociological reflection on what is or is not 'a place' and how relationships between individuals are formed. Marc Augè, in his 1992 essay *Not-Places: Introduction to an Anthropology of Supermodernity,* theorizes the distinction between places and non-places. The former concerns a relational, identity-based, historical space, i.e., a space where relationships are solicited and are an integral part of the environment, subjects recognize themselves within it, and it is defined as identity-based and historical because the subjects have a common history or refer to it. The term not-place has opposite characteristics, often used to describe spaces

that lack a strong emotional or social connection, temporary transit spaces not tied to a community or significant relationships. Augè's analysis represents a way to understand social and cultural changes in contemporary society through the study of impersonal and standardized spaces that characterize modern life. The virtual space of the future Metaverse will be characterized by multiple explorable places, which if not adequately designed risk becoming virtual not-places. An online community lacks one of the basic characteristics that define the concept, namely being spatially proximate, that is, being in contact in the same place, so as to experience the same reality and create shared values and meanings. The main issue is that these concepts are perceived without a sense of belonging, as in reality, but only as spaces of temporary transit. The 'transitivity' or the ability to move or transition between infinite virtual experiences, could generate, on the contrary, a sense of 'non-presence'. As more human activities are transferred to 3D environments, the more these will become actual places of design within which the user-avatar can relate to others, buy intangible goods through cryptocurrencies, or hold a conference with special virtual reality headsets. It is therefore essential that in the development of Metaverse platforms, aspects related to the perception of space must be considered, since the users will always be human.

The concept of architecture within the Metaverse is a compelling idea that merges virtual reality, augmented reality, and three-dimensional architectural design to create interactive and immersive virtual environments that can be explored online by multiple users. These spaces can be designed from scratch or simulate existing real places.

Research on architectural design has included its development in cyberspace since the 1990s. Virtual architecture has been influenced by post-capitalism and globalization, with significant advances in automation, from information technology to the fourth industrial revolution. The virtual world can be considered as an extension of our real world that includes not only a physical aspect but also cultural and social interaction,

Fig. 4 Zaha Hadid Architects (2022), *Liberland*, The community features hyper-realistic neighborhoods where virtual urban planning 'enables a process of discovery'.

Fig. 5 OMA, Morphosis, UNStudio, MAD, Sou Fujimoto, & Zaha Hadid Architects (2023), *Metrotopia Metaverse* Venice, in conjunction with the 2023 Architecture Biennale, features both a physical and virtual exhibition. The virtual spaces have been designed by:
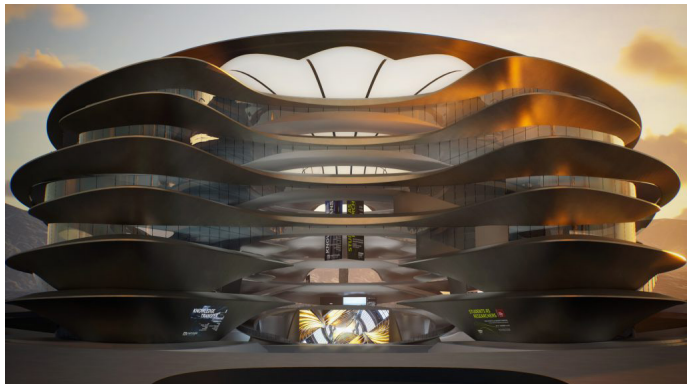
aesthetic and psychological issues. These characteristics, generally, are not included in the training of those who actually design and build virtual worlds, namely game designers, programmers, and users, and the consequence of this lack of knowledge is reflected in virtual places and architectures. The main goal is to create an immersive place where users can explore, interact, and actively participate in the design and modification of virtual environments. However, it is important to address some considerations regarding native virtual architectural design within the Metaverse. This last represents a revolution in the approach to modeling spaces, involving de-
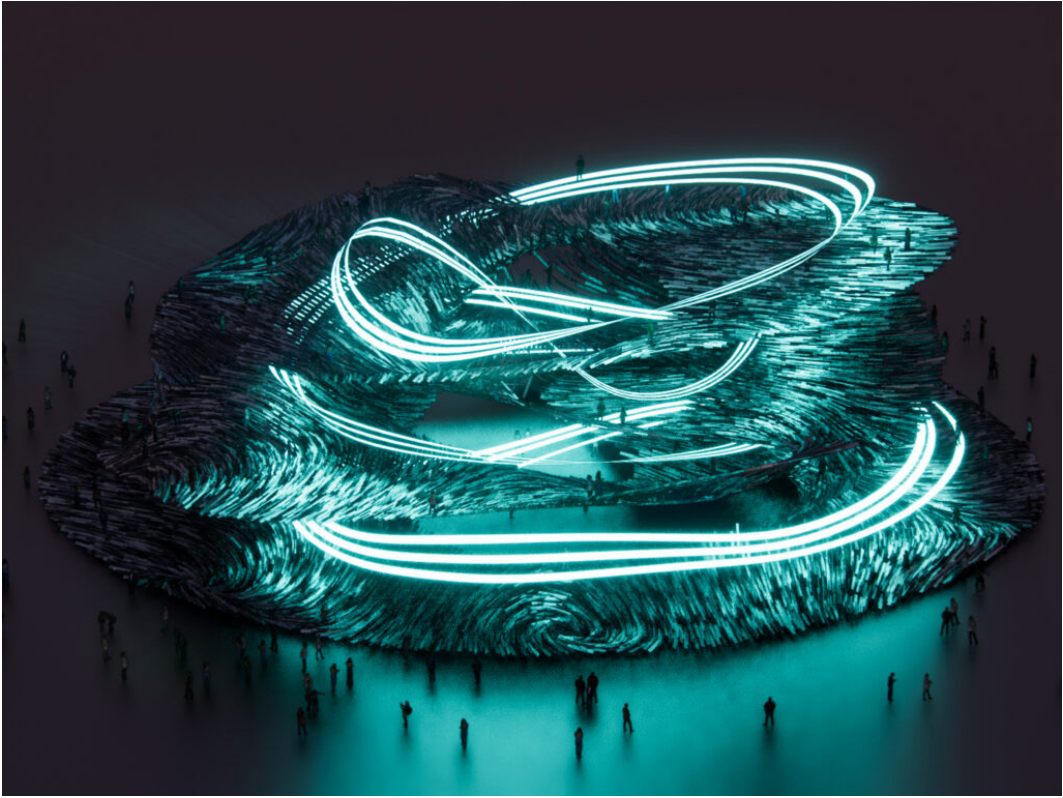
Fig. 6 Lava Architects (2023),
The First Metaverse Architecture,
Biennale, The virtual pavilion is
designed on multiple levels that
are interconnected by a single
seamless surface, like the path
on an infinite curve.

signing, visualizing, and manipulating buildings, landscapes, and environments in an immersive digital context. In this sense, the concept of skeuomorphism is introduced, referring to the use of design elements that recall or imitate the features of real buildings or environments. A common example might be the inclusion of stairs, columns, arches, or other decorative details that recall architectural functions or styles to create a sense of realism and familiarity for the user (Avatar). These elements are often used for aesthetic, functional purposes, or to help users better understand and more easily navigate a virtual environment, but it should be noted that the use of skeuomorphs in Virtual Reality and Augmented Reality contexts can also be controversial. On one hand, they can make the experience more accessible, but on the other, they can limit the creative and innovative possibilities in virtual interaction.

CONCLUSIONS

The architecture of the Metaverse does not necessarily have to be characterized by virtual elements that mimic real ones. In the virtual place, space is without natural boundaries, gravity disappears, and materiality is not constrained by the construction elements typical of reality. This new frontier offers a broad spectrum of opportunities and challenges for architects and designers. Designing architecture in the Metaverse is a challenging task even for experienced architects, as the skills of software developers, conceptual artists, 3D modelers, game designers, or sometimes even the users themselves are not sufficient because they lack a technical background in architectural composition, which could easily lead them to lose themselves in the dynamics of the digital not-place, anonymous, where everything is possible and potentially enormous. This is even more necessary when the design of the Metaverse involves the reproduction of historical environments and their contemporary architectures, which most often follows controversial philological approaches and methods.

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METAPHORICAL METAVERSES
THE CASE OF BUNKER ARCHITECTURE

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Drawing on the influential reflections of Paul Virilio and his *Bunker Archaeology*, this paper draws a parallel between the spatiality of the bunker and the cultural discourses surrounding the metaverse. Occupying a liminal position between earth and sky, life and death, the bunker is a highly symbolic space within contemporary visual culture. I will focus on a particular type of bunker that emerged during the Cold War in the United States and has regained relevance in times of ongoing crisis, namely that which mimics everyday life, but is underground. By examining various bunkers and underground dwellings in institutional and counter-cultural contexts, this analysis emphasises the inherent 'virtual' nature of bunkers, symbolising potentiality and survival. As we shall see, the affinity between the underground space of the bunker and the cultural concept of the metaverse lies in their shared promise of escapism – a humanly sustainable alternative for survival in the midst of global catastrophes, whether nuclear, war-related, or environmental.

INTRODUCTION

In this article, I will analyse a particular immersive architectural *topos*, namely the bunker, as a *metaphor* for the 'metaverse'. This singular, not to say daring, parallelism is based on the conviction that the bunker conceals within itself precisely a 'virtuality': a liminal place, situated between the surface and the depths of the earth, designed to protect and to attack, to inspire fear and to promise salvation, the bunker stands out in the panorama of contemporary visuality as a highly symbolic space, at least since the widely discussed reflections devoted to it by the French philosopher Paul Virilio (2008). In the following pages, I will first propose an analogy between the spatiality of the bunker and 'virtuality', understood as one of the cultural dimensions necessary for a full understanding of this singular artefact. I will refer to a specific anthropological and technological aspect of virtuality, namely some of the cultural discourses that have been carried out on the metaverse as an escapist fantasy in times of crisis. This reading of online life will lead me to a particular type of bunker that was first conceived in the United States during the Cold War and has now found a new moment of success as the crisis becomes permanent and structural. I am referring to bunkers which, far from evoking the brutalist forms of war architecture, are simulacra of everyday life, only transported underground. As we pass through several bunkers and underground houses, both conceived in institutional and counter-cultural contexts, we will see that the bunker is, in a sense, always 'virtual'. The bunker is a sign of potentiality: even when decommissioned, it remains as an imprint of impending disaster. It always works, even when completely useless. It is precisely in this, at times dystopian and disturbing, promise of escapism that the affinity between the underground space of the bunker and the cultural idea of the 'metaverse' lies: a simulation of offline –read 'real'– life, a humanly sustainable alternative that makes survival possible in a scenario of global collapse, be it nuclear, martial or climatic.

PAUL VIRILIO'S BUNKER AESTHETIC:
FROM DISAPPEARANCE TO VIRTUALISATION

As mentioned above, the French philosopher Paul Virilio, who published *Bunker Archéologie* in 1975, first grasped the aesthetic and political value of the bunker. This unique book was conceived as a catalogue for an exhibition of the same name, held at the *Musée des Arts Décoratifs* in Paris. The show collected photographs Virilio had taken between 1958 and 1965 of the fortifications known as the Atlantic Wall, creating an intellectual and aesthetic taxonomy that would reveal the political power of these unusual structures. Left unfinished by the Nazi regime, the Atlantic Wall would have been the largest defence apparatus built on European soil: a vast system of coastal bunkers stretching from the Scandinavian coast to France. Indeed, it was not only the Nazi occupation of the coast that aroused the philosopher's interest, but above all the architecture of the bunkers themselves, which seemed to suggest a unique overlapping of imaginaries. Virilio chose to cast an archaeological eye on them, studying them as signs of a lost civilisation, which has certainly not disappeared. In their conformation, these bunkers are traces of the war strategies and the cultural superstructures that led to the catastrophe. Actually, according to Virilio, this warfare architecture is not only shaped by the strict requirements of the conflict, but it is also a reflection of its ideology. One of the key aspects of the bunker's aesthetics, and in our analysis a prelude to the discovery of its symbolic potential, is its peculiar and dual temporality. The ruins of fortifications, oriented towards both past and future, are defenceless remains, museum exhibits, but also compendia, testimonies, manuals for constructing power, which can be repeated in the future. As we shall see, the bunkers 'work' even when they do not, just like the 'metaverse' imagery: even when non-functioning, their existence is enough to evoke scenarios and produce effects that are exquisitely ideological.

As a liminal space, the bunker is always paradoxical: indestructible but without foundations, hyper-modern but with

disturbingly primitive features. Only a few years after the end of the conflict, the Nazi bunkers began to subside, sinking into the dunes of the Normandy beaches, remaining as empty shells, ominous relics of a recent past, unwittingly monumental. In Virilio's words:

> Anachronistic in normal periods, in peacetime the bunker appears as a survival machine, as a shipwrecked submarine on a beach. It speaks to us of other elements, of terrific atmospheric pressure, of an unusual world in which science and technology have developed the possibility of final disintegration. (Virilio, 2008, p. 39)

The visual and intellectual trajectory traced by Virilio ends precisely with the presentation of an 'aesthetics of disappearance': in this category fall the bunkers designed by the Nazis to blend in with civil and even ecclesiastical architecture, but also all the structures that nature is slowly reclaiming. Let us not forget that bunkers, however resistant, are structures without foundations: here they disappear, sink under the sand, tilt like a shipwreck, or are exposed, naked, by the erosion of the dune that was supposed to hide them. Virilio's work presents reflections of extraordinary topicality, both political and ecological. On the one hand, it brings us back to the modernity of the bunker, a structure designed to ensure survival in the event of a third world war, but also in the event of an environmental catastrophe. The shift of the war scenario from the horizontality of the battlefield to the three-dimensionality of the skies, as well as outer space, leads back to the identification of the threat at the atmospheric, and therefore climatic, level[1].

THE RHETORIC OF THE METAVERSE: GOING ONLINE AND GOING UNDERGROUND

Far from being a mere military device, the bunker turns out to be an ideological instrument, almost a propaganda statement. The same can be said of the metaverse, which at present is more a chapter in recent cultural history, a declaration
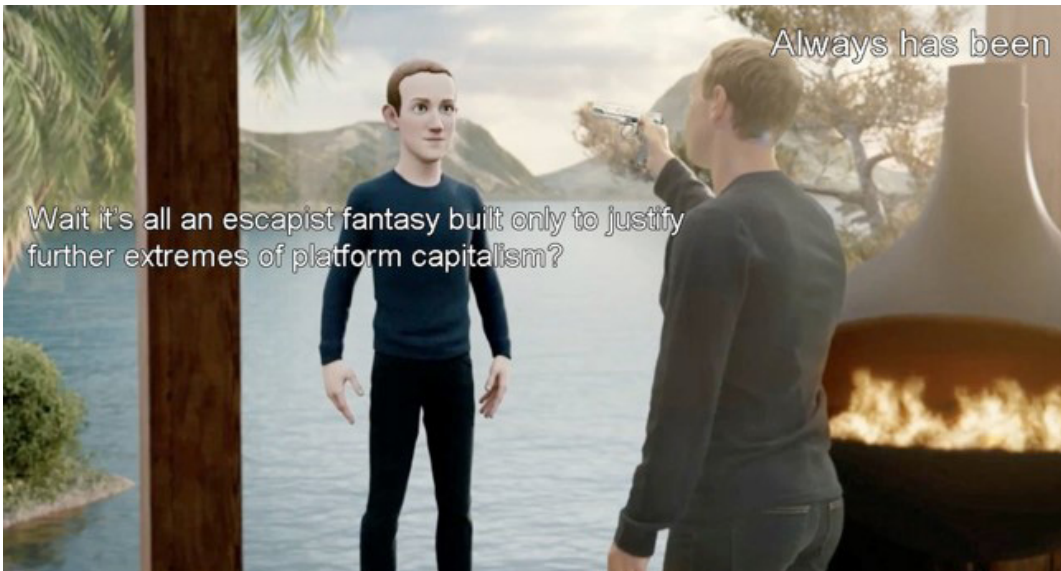
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of intent, than an actual reality. To be more precise, if we understand the metaverse as an online simulation of 'real' life, accessible simultaneously to multiple users who engage in activities comparable to those of their everyday existences, then the metaverse has already existed for decades, in the increasingly sophisticated forms of Massive Multiplayer Online Games (MMOGs). However, in this context I will focus more on what the metaverse 'could'be or 'will eventually' be in the commercial and ideological debates that surround it, as I will treat this cultural object like the bunker, as an ideological standpoint that works even when it does not.

Mark Zuckerberg's rhetoric about the metaverse seems to have come out the loser, maybe precisely for its similarity to the bunker framework. Indeed, the infamous rebranding of Facebook to Meta in October 2021 was greeted with great sarcasm. The social media giant's name change to Meta was immediately commented on by hundreds of memes online, ironically joking that the corporation had chosen to dive into the metaverse instead of addressing the numerous security and transparency issues that have dogged it in recent years. In this regard, one meme in particular strikes me: it belongs

to the 'always has been' family, which exploits the *topos* from science fiction in which the protagonist is the victim of a plot that is revealed at the end, when it is too late. In the meme, posted on the former Twitter, now X, by the account Everest-pipkin, Zuck kills his avatar, who has suddenly realized that the metaverse is nothing more than "escapist fantasy only to justify further extremes of platform capitalism" (Figure 1). Even in instant public discourse, the metaverse is hailed as an escapist, deceitful exit strategy, an elsewhere to hide in when the world as we know it is being destroyed by the same platforms that are trying to provide us with the solution[2].

This unsettling framework is echoed by Meta itself — and frankly, I cannot decide how consciously or not— in the infamous advertising for the headset Meta Quest 2 for the 2022 Super Bowl. In the one-minute advert, the main character is an animatronic dog playing in an animatronic band of animatronic pals in a pizza chain. The setting is clearly inspired by Chuck E. Cheese, an American chain of children's restaurants established in 1977 by Atari co-founder Nolan Bushnell, a pioneer of arcade games. The restaurants became famous for their animatronic shows, which were inspired by the idea, similar to that of amusement parks, of bringing the game-like experience into the real world. In recent years, since 2017, with the end of the arcade, the company has started a process of rebranding, gradually dismantling its animatronic singing bestiary: the stages give way to dance floors and the robots now seem a thing of the past, a memory for the parents and grandparents of the children who are the current customers. Let's get back to the Meta advertisement: as happened with Chuck E. Cheese 'performers', our animatronic dog is left without a reason to exist after the closing of its restaurant chain — it is not temporary, as the sign states very clearly that it is 'closing forever'. He is finally thrown away and almost on the verge of being destroyed in a scrapyard when he is narrowly rescued and transferred to a museum, where a young man who happens to be using a Meta Quest 2 headset, while leaving the facility,

has him put it on. So here is our little mechanical dog who, thanks to virtual reality and, above all, to Meta's metaverse platform, Horizon Worlds, can return to play with his friends in a digital elsewhere where everything has remained the same: the neon lights, the 1980s songs and, most importantly, his distant friends are now gathered. "Old friends. New Fun" states the slogan. The ad has generated considerable discussion, but its tone tends towards the dark rather than the alluring (Roth, 2022). From my perspective, I am interested in showing how the Meta ideology aligns seamlessly with the unsettling escapism inherent in the metaverse. The central concept is quite simple: the metaverse serves as an antidote to our nostalgia, or rather as an elixir to help us endure our bleak and lonely present. Traditional face-to-face social interactions are becoming a thing of the past, as this 'new fun' takes root elsewhere. It allows us to leave our decaying world behind and find solace in a place where we can once again indulge in our remembrances. After all, why worry about climate change or societal collapse when we can just forget about it and put our headsets on?

That the metaverse would serve as an alternative place, a refuge in the event of ecological breakdown, is a perspective that pop visual culture has already explored: an obvious case in point is Ernst Cline's novel *Ready Player One*, from which Steven Spielberg derived the film of the same name, which effectively described the metaverse as a habitat necessary for survival in a dystopian age of ecological catastrophe. In the gloomy future the novel depicts, the co-creator of the VR simulation OASIS leaves the company as his metaverse "had become a self-imposed prison for humanity", "a pleasant place for the world to hide from its problems while human civilization slowly collapses, primarily due to neglect" (Cline, 2011, p. 120). Indeed, the problem whether these dreams about the metaverse would fall into escapist fantasies was discussed in scholarly debate in the same period. In 2010, game studies scholar Gordon Calleja warned against an overly simplistic division between the real and

the virtual, particularly with regard to the alleged escapism practised by the gamer community. According to Calleja,

> Actions that take place within the marked area of the game, if this exists, are interpreted differently from actions outside that area. In digital games, the distinction is void because the only space that one can act in is traversable space. (Calleja, 2010, p. 341)

In support of his thesis, Calleja references Massive Multiplayer Online Games (MMOGs), including precursors of the current metaverses such as *Second Life* or *World of Warcraft* (Malaby, 2009; Corneliussen & Rettberg, 2011). In these simulation environments, as noted by Nick Yee (2006), players invest innumerable hours in activities that might be considered repetitive and not particularly enjoyable, resembling real work more closely. This challenges the conventional notions of the 'magic circle' theory and the rhetoric of the 'frontier', as these concepts do not seem to align with the anthropological observations of cyberspace usage. According to Calleja, it appears that online gamers do not merely seek refuge in virtuality; instead, they inhabit it in ways remarkably similar to the real ones. They actively work within it, engage in production and trade, and communicate as they would in the physical realm. "The clear demarcation of game space from non-game space becomes even more problematic when contemporary developments in digital games […] are considered" (Calleja, 2010, p. 342).

It is interesting to note how this tendency to create doubles, uncanny duplications of the actual state of things, has been at the centre of the latest and somewhat odd book by Canadian activist and thinker Naomi Klein (2023), entitled precisely *Doppelganger*. In Klein's words, "if Mark Zuckerberg's plans for the 'Metaverse' proceed as he hopes, with all of us represented by personalized animated avatars to our banks and our friends, this is only going to get more confusing". She is referring to a near future in which "this kind of live-action fakery [will be] a pillar of mass culture" (Klein, 2023, n.d.): not just digital doubles,

as they already exist, but a whole series of misrepresentations that will ultimately blind us to reality. According to Klein, a Mirror World already exists: she is alluding to the right-wing social networks, news platforms and websites that contribute to the construction of a distorted world view characterised by conspiracy theories and negationism. Again,

> When reality starts doubling, refracting off itself, it often means that something important is being ignored or denied –a part of ourselves and our world we do not want to see– and that further danger awaits if the warning is not heeded. (Klein, 2023, n.d.)

Mutatis mutandis, perhaps it is precisely through Klein's suggestion and her reading of the 'double' that we can revisit the bunker, whose aesthetic was first introduced to us, as we have noted, by Paul Virilio. In particular, I would like to focus on a specific type of bunker, built not to resemble one, but rather to provide an alternative in the event of nuclear or environmental fallout: the underground house, a *doppelgänger* of a real home. This is an architectural typology that became popular in the United States during the Cold War, permeating both the channels of institutional communication and the more unconventional counterculture. Indeed, at least as far as the Western context is concerned, the idea of the underground dwelling seems to be associated with survival strategies, both of the hippy and the rich, in case of ecological disaster.

Particularly in the United States, the trend towards bunker architecture was characterised by a certain degree of 'virtuality': designed to resemble houses on the surface, these spaces were, like aquariums or dioramas, virtual off-line reconstructions of 'idyllic' scenarios, simulations of everyday life to be activated in the event of fallout. These bunkers are different from the scary monsters and exotic creatures that Virilio captured on film. Instead, bunker houses were proposed as an attractive alternative to the dangers of the outside world. 'Reality' or 'normal life' would become something to be artificially constructed underground.

Fig. 2 Detroit Publishing Co., *Shooting from hunters' blind by shore*, 1900-1920. Library of the Congress. Retrieved from https://www.loc.gov/item/2016816199/.

VIRTUAL SPACES: THE UNDERGROUND HOME ENTERPRISE

The 1964-1965 New York World's Fair –dedicated to *Peace Through Understanding* (Cotter & Young, 2004)– was the first institutional advertisement for this particular type of bunker, perhaps the most 'virtual' or 'metaverse-like'. Planned in the second half of the 1950s and early 1960s, the fair was strongly influenced by the climate of the Cold War: there, the visitor would find the a complete display of the

Underground Home, a project to transfer all the comforts of a luxury mansion into an underground dwelling designed to survive a nuclear fallout. According to Isaac Asimov (1964), who visited the Fair and wrote an article on the New York Times imagining its 2014 edition, the "underground house […] is a sign of the future". Indeed, the fair featured a pavilion by the Underground Home Corporation, owned by Jerry Henderson, the millionaire founder of the famous Avon cosmetics company. *Underground Home* exhibited a real bunker designed by the architect and former military serviceman Jay Swayze[3] (1980), who was the creator of the Atomitat, an underground house he built for his family in Plainview, Texas, in 1962 (Figure 2). The exhibition was accompanied by a brochure which could be considered an ideological manifesto for underground living. According to Henderson, living underground was the answer not only to nuclear fallout, but also to pollution and, in general, to all the inconveniences of living 'outside': a dream of a life that could be totally controlled, a simulacrum of reality to be completely manipulated at the will of its inhabitants. The brochure explained how "a few feet underground can give man 'an island unto himself'; a place where he (sic!) controls his own world – a world of total ease and comfort, of security, safety and above all, privacy". All technical details and construction information are set out: the domestic space is enclosed in a 'shell', and "the living area is divided into 'exterior' and 'interior' areas". The external simulation becomes just another element of the 'décor', which "can be blended with a favourite 'outside' view; the time of day or night may be 'dialed' to fit any mood or occasion". The technical means to achieve this result, introduced by Swayze, are the *Murals of Light*: luminous walls which, at least in the intentions of their designers, can reproduce any lighting condition, depending on the time of day, but also on the season. "Underground, one is free of the outside climate, and health no longer depends on it" (Underground Home, 1964a).

The most famous outcome of the propositions of the Fair, is the Underground House in Las Vegas, which uses all the best practices presented in New York. It is the perfect synthesis of the dystopia of the metaverse and the imagery of the bunker. Designed as the family mansion of Jerry Henderson, who lived there with his second wife, Mary Hollingsworth, the subterranean dwelling is a lavish abode with a spacious floor area of over 15,000 square feet. Its opulent interior is meticulously decorated with simulated natural elements, such as an artificial garden, with fake trees and rocks, as well as meticulously crafted and immersive scenic embellishments. In addition, the ambient lighting is adjustable to replicate different times of day, while a constellation of twinkling stars adorns the ceiling, artfully mimicking the night sky. This subterranean sanctuary offers an array of recreational amenities, including a four-hole putting green, two hot tubs, a sauna, a sizeable dance floor, a well-stocked bar, a barbecue area and a swimming pool. The residence comprises two bedrooms and three bathrooms, supplemented by an additional *casita* to accommodate guests.

The house is now owned by a company specialising in cryonics[4] and is up for sale: its absurdity and paradoxical location, both geographical and temporal, make it a concentration of unsettling feelings. This particular ambience has been captured in a very interesting series of photographs by Juno Calypso, who has created a series of self-portraits impersonating a creepy inhabitant of this peculiar and defunctionalized house. The woman Calypso impersonates is like an ornament, a decoration in an over-decorated house that serves as a symbol of an artificial life, "a life in plastic". Her project is entitled *What To Do With A Million Years* (Calypso, 2018), with reference to the uncanny link of the U-House with cryonics, but also its peculiar time collocation: between past and present, life and death.

As mentioned earlier, at a similar time to the emergence of the Henderson project, underground living was

also being embraced in counter-cultural circles as a distinct response to the same challenges. In the event of societal collapse, caused not only by war but also by issues such as overpopulation and pollution, moving underground represented a more nature-integrated lifestyle. In this scenario, the pursuit of ideals of control gave way to a desire to break free from consumerism, enabling the creation of self-sustaining communities capable of surviving the downfall of capitalism. Among these attempts, there is Mike Oehler's 1978 self-published *The $50 and Up Underground House Book*. Oehler's manual provides practical information on how to imagine alternative housing solutions that are sustainable, affordable and long-lasting, following in the footsteps of other famous DIY manuals, such as the series of 'dome cookbooks' popularized by Stewart Brandt's *Whole Earth Catalog* (1968-1972)[5]. The book is a political statement about what a true Underground House is, according to counter-culture: definitely not a bunker. In Oehler's colourful words, if you are thinking of building a bunker:

> You won't really want to design and build a home which is integrated with nature. What you want is a concrete bomb shelter buried so that you may save your own fat ass during atomic attack. You don't want a home which is a growing, living thing, which has light and air and views. (Oehler, 1978, p. 5)

The U-House is "not a cave either" (Oehler, 1978, p. 9). In the event of nuclear war, the U-House can bear the weight of the trees and ruins that might fall on it.

> Even if a full sized tree should fall on a U house the survival chances are excellent for there are banks of solid earth on all sides to absorb the weight. If a tree falls on most conventional structures devastation is the result. (Oehler, 1978, p. 14)

Despite being underground, Oehler's project, like many others, envisions the U-House not as a dark, hyper-technological protective cavern, but rather as a human-scale dwelling, one that we might consider more sustainable today[6].

BUNKERS IN THE AGE OF THE METAVERSE

As Daniel South and Nigel South (2021) have recently pointed out, the current era of increasing crises has led to a growing interest in bunkers and underground housing among the wealthier sections of the population. These individuals are increasingly seeking out bunkers or "artificial 'clean', 'green', 'pure', and 'politically free' bubbles and domes"; following a process that has been described as an 'inverted quarantine' or aptly 'bunkerisation' (South & South, 2021, p. 134; South 2019): a process of self-isolation of the healthy and the wealthy from the ill and poor. This contemporary manifestation of bunkerisation is closely intertwined with the libertarian ideals espoused by tech luminary Peter Thiel, co-founder, alongside with Elon Musk, of the tech-giant PayPal. In a notable 2009 blog post, Thiel promptly drew a connection between the 'virtual' alternative to a faltering democratic world, symbolised by the emergence of cyberspace facilitated by cryptocurrencies on the internet, and the prospective expansion into space —ex colleague Elon Musk had founded SpaceX in 2002— as well as the controversial concept of 'seasteading', which envisions the dystopian colonisation of oceanic surfaces.

As we have just seen, the recent expansion of the metaverse is now accompanied by a renewed frenzy for bunkers and underground living among the super-rich. This has happened in the last ten years at least in the heart of the most expensive areas of European capitals, such as London, where luxury basements offer a way to expand with more security and privacy. The reasons, again, seem to lie in escapist fantasy: "Perhaps there is something about the geotropic, burrowing urge that betrays a kind of deep-seated introspection — a desire to dig, to escape further from reality, to retreat into a private fantasy world" (Wainwright, 2012).

More recently, studies have been carried out on the community of the so-called 'preppers': people whose lifestyle and beliefs are shaped by the need to prepare for disaster[7].

Bunkers, or underground houses, are an integral part, if not the heart, of these initiatives, which have been the focus of an extensive study conducted by Bradley Garrett. Among the several communities depicted by Garrett, one seems particular significant for our conceptual framework[8]: I am referring to the *Kansas Survival Condo* (Garrett, 2021a; 2021b). It is the most sophisticated private bunker in the world: a former Cold War US government missile silo transformed into an inverted skyscraper. The project is the brainchild of Larry Hall, who, like Swayze before him, is an ex-government contractor with experience in weaponry. This remarkable underground super-house, if we can call it that, is designed to ensure the survival of 75 people without any contact with the outside world for up to 5 years. The facility includes a variety of dwellings, ranging from ordinary apartments to luxurious penthouses. In this case, the windows no longer face painted murals and neon lights; they now overlook monitors controlled by a centralized electronic system, overseen by Larry Hall himself. The condo also features Kaleidoscope, a basic AI system capable of automatically sealing off sections of the bunker in the event of a fire. It is curiously described as "a secure, self-contained, sustainable architectural experiment – an underground counterpart to the University of Arizona's Biosphere project"[9]. As this brief description shows, the *Survival Condo* reflects contemporary anxieties and conveys them through an outlandish architectural design that incorporates elements of remote control and closed-circuit surveillance into the Underground House formula. In the age of the metaverse, bunkers are indeed integrated with digital devices that guarantee a superior level of control unimaginable at the time of Jerry Henderson's dreams.

CONCLUSION

I hope that the trajectory I have followed so far can make a small contribution to the cultural history of the metaverse.

It illustrates how certain discourses about online presence, ranging from utopian to dystopian, intersect in a fascinating way with the aesthetics of the bunker. In particular, the underground dwellings I have briefly described seem to suggest a departure from the crisis mentality of the Cold War era. Take the example of the *Survival Condo,* which demonstrates that the response to society's underlying crisis reflects its causes: the militarisation of security, surveillance technology and remote defence systems. It would appear that the ideological elements of the bunker identified by Virilio after the Second World War are being transformed into a new, hyper-technological and highly controlled form. Turning our attention back to the metaverse, or at least one of its potential manifestations, we find a similar future looming. It is characterised by pervasive hyper-surveillance imposed on a population that has made the choice to surrender their ability to correct their mistakes in exchange for the preservation of their lives, willingly submitting themselves to overseers capable of perpetuating the simulation. "The thing the psychologist drilled into me was that my job as the developer was to make this place as normal as possible", Larry Hall (2021b, p. 246) told Garrett, during his visit to the *Condo.* What could be less ordinary than an underground panopticon exclusively for the super-rich, designed for prolonged subterranean living? Without succumbing to technophobic fears, it is important to remain vigilant about the ways in which these military-inspired paradigms encroach on our online habitats.

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NOTE

1 Recently, the literature on the historical and ideological values of bunkers has grown (among others, see Bennett 2011; 2013; 2017), and Virilio's position has been recast as shaped by the impact of the Second World War (Garrett & Klinke, 2019). However, the French philosopher's proposals remain of great importance for the metaphorical and ideological value of these unusual structures, which are not disappearing, but are evolving in response to the features of the current crisis. As we shall see, bunkers are increasingly present in the face of contemporary threats, which, as in Virilio's time, are once again mainly ecological.

2 For a recent literature review on whether or not the metaverse platforms will contribute to carbon emissions significantly, see Kshetri & Dwivedi, 2023.

3 For a reflection on the Underground House and Cold War culture, with particular attention to Swayze contribution to the project, see Boyd & Linehan, 2018.

4 The buyer asked to remain anonymous, but is now credited to be the Stasis Foundation, specialized in Organ Donation and Transplantation, enhanced through cryonics. In the most recent video tour of the house, posted on YouTube channel "Daze with Jordan the Lion," we can see clearly the presence of a cryonics chamber of the company Alcor, alongside with many issues of Alcor's magazine *Cryonics*. See Stasis Foundation at https://www.organstasis.org; Alcor website at https://www.alcor.org/; and the "Daze with Jordan the Lion" video at https://www.youtube.com/watch?v=JqbVd7pwjVg. All links retrieved October 5, 2023. In fact, the photographer Juno Calypso, whose project will be cited in the next few lines, included in her artistic project the informative pamphlets discussing the latest developments in cryonics, immortality and the art of preserving life that she stumbled upon during her visit to the house (Warner, 2018).

5 I started addressing this issue, which is connected to other "virtual" offline architectures, in an article dedicated to U.S. geodesic architecture and its connection to the technoculture from which VR emerged (Fontana, 2023).

6 The scenarios and ideals depicted by Oehler have been reprised by Rob Roy (2006).

7 Prepper culture is an American phenomenon that combines mechanical and practical displays of masculinity with military and weaponry aspects. It has garnered increasing attention in popular culture, notably through reality shows like *Doomsday Preppers* (2012-2014), giving rise to the term 'apocotainment' (Foster, 2014) which characterizes entertainment centred around apocalyptic scenarios and death. On prepper culture see also Nguyen (2018).

8 Advertised as "The Backup Plan For Humanity," the Vivos underground shelter would also be worthy of analysis. In this case, the most striking aspect is the explicit mixture of environmental and millenarian concerns. In fact, Vivos Enterprise presents its bunker as a possible answer to *The Rapture*, Armageddon, the 'hypothesis' of the polar shift or killer planets. See the pages about *Threats*, on Vivos Enterprise website, e.g. https://www.terravivos.com/threatplanetx.php.

9 Built in Oracle, Texas, between 1987 and 1991, *Biosphere 2* –the Earth being Biosphere 1– is a giant 'greenhouse' designed to simulate the possibility of building a self-contained environment in which humanity could survive, both on Earth and on other planets, in the event of ecological collapse. The *Biosphere 2* and the *Survival Condo* share more than a casual affinity: Larry Hall built the *Survival Condo* following the advice of the same psychologist who worked on the experiments at *Biosphere 2* (Garrett, 2021b, pp. 240-241).

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