

# EXPANDED WORLD

between the physical  
and the virtual

The last decade of the 20th century witnessed the birth of the internet. A network of computers, servers and telephony infrastructures covered the world and, on it, a new space was formed, a virtual environment without physical existence that some called cyberspace, where people “entered” to search for information, read the news, chat, send e-mails, and share music. In the mid-2000s, the advent of mobile phones placed access to this new world in the palm of our hands, where much of our life now takes place.

Thirty years after its appearance, the internet has completely transformed our daily lives. The term cyberspace seems to have become obsolete, unable to reflect the omnipresence of the virtual in our everyday living, and we are now talking about new, more immersive forms of digital experience that will allow us to unfold essential parts of our lives beyond the physical reality. The truth is that we are already part of an expanded world. A hybrid reality where virtual environments extend the boundaries and possibilities of the material world, raising questions of unprecedented significance. What might it mean to migrate our identity to a space where corporeality does not exist? What

impact might it have on society to be part of a community that lives between the physical and the virtual? What norms and codes should regulate digital citizenship?

For the first time in human history, the drive to generate simulated worlds has culminated in the possibility of abandoning our natural environment and living immersed in a different one. This exhibition explores the origins of this world and addresses some of its ethical and philosophical, legal, social, and economic implications.

# A hybrid reality

*10.000 Moving Cities – Same but Different* is an interactive work that recreates the buildings of a contemporary city, on whose facades the digital content generated in real time in a geographical point selected by the visitor is projected. Images and videos from social media reveal the digital life of cities that are losing their local identity and becoming more and more similar to each other. Nevertheless, the work not only explores the effects of cultural globalisation, but also puts us in a space that evokes the essence of our time, a hybrid world where two layers are superimposed — the physical materiality of reality and the virtuality of digital environments — while presenting a three-dimensional model for visualising information that invites us to imagine what the immersive internet of the future could actually look like.

# THE IMMERSIVE REVOLUTION

Producing images as true to life as reality itself, and intended to be experienced, responds to a human impulse that culminated in one of its greatest milestones with the invention of perspective in the 15th century. The architect Filippo Brunelleschi finally succeeded in representing a three-dimensional space on the surface of a painting in the same way as it is perceived by the human eye. This new system was a real revolution, as it allowed painters to realistically simulate an environment that viewers could enter with their gaze. Following Brunelleschi's discovery, the use of perspective spread throughout Europe, as the astonishing effect of three-dimensionality created a powerful immersive sensation for the public of the time.

For millennia, artists rendered reality according to their own worldview, but the introduction of perspective in the Renaissance laid the foundations of a progressive path towards the immersion of humanity in simu-

lated worlds; a path that, since then, will be marked by technological advances with the invention of peepshows, panoramas, stereoscopic photography, and cinema, all the way through to digital production, virtual reality and the long-awaited metaverse.

We refer to virtual worlds as the graphical representation of computer-generated spaces. But although it was the advent of digital technology that led to the development of these virtual recreations, the urge to immerse ourselves in simulated worlds, producing images in which to project and expand our experience of life, has its roots several centuries ago.

# Peepshows

Alongside the spread of perspective, peepshows began to emerge, becoming popular from the 17th century onwards and in use until the mid-19th century. These portable boxes were used as travelling spectacles and domestic devices, and allowed the contemplation of views of landscapes, cities and architectural interiors through a peephole with a lens that emphasised the relief and depth of the images. Some peepshow boxes — also known as “perspectives boxes” or “raree shows” — were equipped with dioramas and simple optical and lighting mechanisms that enabled a kind of special effect to be generated on the views, such as the transition from day to night.

# Panoramas

In the late 18th century, the English artist Robert Barker invented the panorama, a circular painting of enormous dimensions mounted inside a cylindrical building that could be viewed from a central platform and generated an immersive 360° view. The panoramas, which quickly spread throughout Europe, recreated distant cities, exotic landscapes and historical battles, and eventually incorporated light effects and other mechanisms that enriched the viewer's experience. The Mareorama was the main attraction at the 1900 Paris Universal Exposition; it simulated a boat trip by combining the use of moving panoramas and a moving platform that could hold more than 700 people.

# Stereoscopic photography

In the mid-19th century, the peepshow spectacle went into decline, mainly due to the advent of photography and the appearance of stereoscopic viewers. The combination of the two inventions and their presentation at the Great World Exhibition in London in 1851 brought about a real revolution after Queen Victoria tried them out at the show and was strongly impressed by the relief effect they produced. Stereoscopic cameras and viewers follow the principles of human binocular vision; each of our eyes captures images with a slightly different perspective, which our brain synthesises to form a single three-dimensional image.

# Moving images

The advent of cinema was a decisive milestone on the road to immersion in simulated worlds by placing the viewer in a darkened room in front of a large display of moving images. The Lumière brothers, inventors of the cinematograph, projected their first film in 1895. Just a few months later, they presented *The Arrival of a Train*, in which they used the technique of the fixed shot with depth of field. Legend has it that when the film — barely a minute long — was shown, some spectators got up from their seats, fearing they might be run over by the train. The kaiserpanorama, the kinora and the mutoscope were other devices developed at the same time as the cinematograph for the more or less rudimentary display of moving images.

In 1963, the engineer Ivan Sutherland developed a computer program that facilitated interaction between the user and the computer by using graphical elements that could be operated through a screen. Sketchpad was the first graphical interface, the kind of programmes that we still use today and which are operated by means of icons, windows, or toolbars. It is also considered the direct ancestor of computer-aided design programmes, which are essential for modelling 3D objects and configuring virtual spaces.

# Virtual Reality

In 1968, five years after designing Sketchpad, Ivan Sutherland developed what is considered to be the first virtual reality viewer in history, which he called the “Sword of Damocles”, a pair of glasses with cathode ray tubes that reproduced three-dimensional graphics. The Sword of Damocles was only a prototype that never made it out of the lab, but in 1982, engineer Tom Furness designed a flight simulator helmet for US Army pilots that projected 3D maps overlaid with aeronautical data. In the same years, NASA began to develop virtual reality devices for use in its missions, but it was the video game industry, from the 1990s onwards, that decidedly took up this technology again, and since 2015 it has been producing glasses with a wide field of vision and low latency.

# ANOTHER WORLD IN THE MAKING

Released in 1973, and inspired by the Renaissance perspective, the video game *Maze War* was a milestone. On the one hand, it featured a 3D graphical virtual world — with the use of the first-person camera, which means that the scene unfolds from the user’s point of view — and, on the other hand, it introduced the novel ability to interact with several players on a network. Since then, video games have continued to offer higher quality graphics and increasingly realistic environments, and many of them have evolved into “open world” platforms that offer users great freedom of action and movement, and even the possibility to build the spatial context in which the game itself takes place.

Video games have inspired developers and technologists in other industries and have laid the foundations for what could become the metaverse in the coming decades. But

beyond generating a parallel virtual universe, similar to our own, many artists and creators are working to imagine other possible worlds, exploring the almost infinite opportunities of environments that, due to their digital nature, can free us from the limitations — spatial, gravitational, temporal, etc.— inherent to the physical world.

More and more of our online activities are being built in simulated spaces that allow for increasingly intuitive and natural experiences. The ultimate goal seeks to generate an immersive, mass-accessible world that can be experienced in real time, from anywhere and, most importantly, that happens and lasts regardless of whether or not we are in it.

Cao Fei (China, 1978) is a multimedia artist who explores the impact that globalisation and technology are having on contemporary Chinese society. In RMB City, Fei created an avatar on the Second Life platform, which she named China Tracy and with which she spent several years developing a virtual city. The result is a space dotted with floating architectural icons and shopping centres adorned with symbols of the People's Republic of China, where social commentary, pop aesthetics and references to surrealism are mixed, and through which the artist reflects on the vertiginous, and at times chaotic, growth of Chinese mega-cities.

The aim of the game is to create a city by addressing all the details of urban growth: zoning for residential, commercial, and industrial development; construction of buildings; layout of roads and transport systems; energy supply; tax collection; environmental control, etc. The SimCity series is the type of video game where players can move freely around a virtual world, without having to fulfil predetermined objectives, and giving free rein to their creativity. These are the so-called “open world” games, which have served as inspiration and lie at the origin of what could become the metaverse.

# BREAKING THROUGH THE SCREEN

Three-dimensional scanning solutions that have enabled 3D modelling of any person, space, or object to be digitised for years, coupled with advances in supercomputing power, are making it possible to create digital replicas with astonishing detail and accuracy. These so-called “digital twins” — faithful representations of any physical entity, from a city or infrastructure to a human body — allow the exact conditions of the material world to be reproduced in the virtual one.

At the same time as these digital twins are being conceived, we are beginning to glimpse the possibility of a three-dimensional, “spatialised” internet, in which we can access information not only through our eyes — by means of a screen — but with our whole body, generating a sense of immersion and presence similar to that which we experience in the physical world.

In this case, beyond achieving plausible and attractive virtual worlds, the challenge lies in creating the means to enable a corporeal experience, so that our presence in digital environments integrates other sensations — apart from sight — and allows us to implement what some call the “internet of the senses”.

Interfaces are already being developed so that our bodies can transcend the screen and coexist in virtual worlds. Augmented reality glasses, which will need to read the user’s facial expressions, and haptic wearables that generate the sensation of touch are just some of the examples that will help us define and shape our experience within these new simulated spaces. But how will this virtual corporeality and the emergence of digital twins affect our perception of space, our sense of self and our relationship with other people?

Within a virtual environment, it is possible to know the size, position, and movements of an object by tracing around it what is known in programming as a bounding box. Based on this concept, the artist Solimán López (Spain, 1981) invites us to reflect in this interactive work upon one of the great technological challenges: to reinforce the sensation of presence in virtual environments, making the brain believe that our body is inside a space with no physical entity.

Bounding Box was conceived in 2017, as a result of a collaboration between the artist and Fito Segrera. In this new version of the work, Solimán López also introduces artificial intelligence and real-time interaction.

A digital twin is a virtual model that accurately reflects a living organism, object, or process. It is used to run simulations inside a computer and study the behaviour of real models, in order to adapt solutions and improvements. Although we are still far from generating the digital twin of a human being, science and supercomputing already allow us to model the cellular systems of some parts of the body and use them to develop personalised medicine, with prognoses and treatments designed for a specific patient. Located at the Barcelona Supercomputing Center, the MareNostrum 5 is one of the most powerful supercomputers in the world, with the capacity to perform more than 300 thousand trillion calculations per second. The launch of its digital simulations will be a real milestone that will strengthen research, the development of new drugs and vaccines, and the analysis of medical data through artificial intelligence.

ScanLAB is a creative studio that uses 3D scanning to produce digital replicas of landscapes and cities that explore the world around us, while reflecting on the impact that human action and technology have on our environment. In *The Dreamlife of Driverless Cars*, the scanner integrated into the vehicle moves around the streets of London, showing a captivating view of the city through the eyes of the machine; an urban map that, although rigorous and highly detailed, at times deforms depending on the speed of the vehicle, the road conditions, and the traffic.

# DIGITAL BEINGS

The term “metaverse” was coined by Neal Stephenson in 1992 in his novel *Snow Crash*. The author described the metaverse as a persistent virtual world that affected almost every aspect of human existence; a place for work, trade, and leisure where millions of people, through their “avatars”, could expand their experience of life. The novel also popularised the concept of avatar - which in the Hindu religion gives its name to the incarnation of divinity on earth - to refer to the graphical representation of a user in digital environments.

In the field of video games, the player’s virtual identity is projected by means of an avatar, which on many occasions also becomes the alter ego of the person who has chosen (or created) it, externalising the physical and psychological qualities with which the player identifies. Likewise, the constant updating of our profiles on social media, the way in which we represent ourselves

through selfies, and the identity narrative we create online, have transformed not only the way in which we are perceived by others, but also the way in which we construct our own identity.

The features that define the individual become more malleable and fluid in these virtual environments, allowing users to adopt different roles depending on their mood or context, and to expand, fragment or decentralise their identity. Reflection on the impact that technologies are having on the configuration of our psyche and on the definition of our essence as human beings, capable of extending our existence beyond the physical body, is part of an unprecedented paradigm shift.

When at the beginning of 2014 Instagram began to gain popularity, the artist Amalia Ulman (Argentina, 1989) created her own account and spent the following months posting pictures that soon garnered her thousands of followers. Images of herself posing in opulent settings, surrounded by expensive accessories, where she interspersed intimate moments and reproduced forms of consumption and canons of beauty that social media were already helping to implant. Her photographs show us a lifestyle that in the case of the artist — as in that of so many other users — turned out to be false, and invite us to reflect on the weight that the online narrative has in the construction of our identity.

In 2006 the artist couple Eva and Franco Mattes (both born in Italy in 1976) entered Second Life to make portraits of some of the avatars they found within this platform for socialisation and virtual communities. Now a classic work of Net.art — the kind of art developed from content generated on the internet —, their series Portraits presents a selection of avatar faces with flat colours and pixelated features; women of shy glances and thick lips that reveal how at times, in the industry of video games and simulated worlds, both creators and users reproduce, and even amplify, prejudices and stereotypes of real life.

# VIRTUAL COMMUNITY

The boundaries between the physical and digital worlds are becoming increasingly fluid. We work, learn, shop, and play online; we meet people and find partners on social media; we spend much of our free time on the internet and it is there that we store our memories, and show ourselves as we want to be seen. All these changes are, in turn, generating new forms of economy, labour and art — with the emergence, for example, of tokens and NFTs —, new ways of learning and relating to each other. Social media have become privileged platforms where we can collaborate with others, share our ideas and fight for them; but we have also seen how these and other technologies can be used to misinform, harass, or manipulate public opinion.

While the effects of digitalisation can be traced back more than two decades, in recent years we have witnessed a real revolution that has been accelerated by the

pandemic. During those terrible months, millions of people all over the world went massively online from their homes to continue working, studying, seeking entertainment, and meeting family and friends. In 2020, our lives became connected to the internet to an unprecedented degree.

It is clear that digitalisation is improving our lives in many ways, but we must not forget that technology also brings with it certain risks, as it can reproduce the dangers and inequalities of the real world and give rise to new ones. The challenge posed by this hybrid world — digitised and hyper-connected — will require a profound reflection on new forms of governance that will help us safeguard our humanity.

# Metaverse

Despite the expectation it has generated in the last two years, the metaverse does not yet have a single, consensual, and precise definition. In general terms, metaverse refers to a network of virtual worlds in which an unlimited number of users could share experiences and interact in real time in simulated scenarios that endure regardless of our presence. It is still very much a concept in the making, but it could transform the way people work, shop, communicate and consume content. The metaverse will be made possible by a combination of a range of next-generation technologies, from cloud computing to artificial intelligence (AI), blockchain, cryptocurrencies, cybersecurity, the internet of things (IoT), virtual reality (VR), augmented reality (AR), digital twins and more.