

Through the Looking Glass. Cultural Heritage Custodians to Populate the Mirrorworld

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This contribution is a wake-up call to custodians of cultural heritage to get ready and prepare for the next platform – the 3D and 4D experiences of the nascent Mirrorworld. Built upon the first generations of online experience, the sprawling communication platform of the World Wide Web, and driven by the ubiquitous reach of social networks and online gaming, the Mirrorworld will breach the glass ceiling of 2D experiences to draw us into a fully functioning 3D environment. Public institutions that manage cultural heritage for visitors, such as galleries, libraries, archives and museums (GLAMS), are ideally placed to seed the spatial communications network that will drive the new platform. Despite the formidable challenges to be surmounted, it is up to custodians of cultural heritage to become proactive in building the Mirrorworld rather than to wait for third party actors to advance commercial interests with imitation culture, simulated histories, or made-up stories. As gatekeepers of cultural artifacts, GLAMs have the capability, the experience, and even the responsibility to tell their stories forcefully, accurately and in fully-functioning 4D.

What is the Mirrorworld?

The mirrorworld doesn't yet fully exist, but it is coming. Someday soon, every place and thing in the real world – every street, lamppost, building and room – will have its full-size digital twin in the mirrorworld. For now, only tiny patches of the mirrorworld are visible through AR headsets. Piece by piece, these virtual fragments are being stitched together to form a shared, persistent place that will parallel the real world¹. According to Shoshanna Zuboff

«Among high-tech leaders, within the specialist literature, and among expert professionals there appears to be universal agreement on the idea that everything will be connected, knowable, and actionable in the near future: ubiquity and its consequences in total information are an article of faith»².

¹ Kevin Kelly, *AR Will Spark the Next Big Tech Platform - Call It Mirrorworld*, «Wired», 12 February 2019, <<https://www.wired.com/story/mirrorworld-ar-next-big-tech-platform/>>.

² Shoshanna Zuboff, *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*, New York: Public Affairs-Hachette Book Group, 2019, p. 223.

Fascinating? Yes. Scary? Very. But, while Zuboff has identified this as an unprecedented form of power which she calls “surveillance capitalism” this chapter is concerned with what this will mean for the virtual global patchwork of human creativity and for custodians of cultural heritage. How will the thousands of institutions scattered around the globe, who, together hold disconnected slivers of our shared history and globally distributed traces of our common artistic endeavor become active players? How will all these fragments come together, and how will they become accessible through the looking glass?

We already use automatic recognition systems to identify objects in the world around us as we move through our streets and visit parks, museums, and zoos. All we need to do is to download the right app and open the camera on our mobile phones. Point and shoot the plants and flowers in your garden or on an exotic island while on holiday and you can instantly identify their species and genus at the click of a button. A simple search through the many apps available will turn up several options – *FlowerChecker*, *NatureGate*, *PlantSnapp*, *Plantifier*, *LikeThat Garden*, *Leafsnap*, *iPflanzen* for starters. *NatureGate* will also help you identify birds, fish and butterflies³. The same goes for artworks – all instantly recognisable at the push of a button. It is all already at your fingertips. Even as I write this article, *Word* is analysing the illustrations in my own text and prompting me to use suggested captions. It is surprisingly accurate but actually makes me feel kind of redundant and somewhat inadequate – a taste, perhaps, of things to come. «The major difference in our lives will occur» – according to Yuval Noah Harari – «as more and more machines read our potential “when tech knows you better than you know yourself”⁴» – now that is really something to worry about! «Everything connected to the internet will be connected to the mirrorworld. And anything connected to the mirrorworld will see and be seen by everything else in this interconnected environment⁵».

We can begin to sense the nascent world when we move through Google Earth⁶. Accessible to all, we “walk” through this wallpaper-world, crisscross the digitally reincarnated streets of cities, and gaze at the facades of buildings. We “wander” the breathtaking rolling landscapes of our natural environment and “visit” places we have only dreamed of. This is just one of the stepping stones that lead us to

³ See *The Best Plant Identification Apps*, «The Plant Guide», 23 August 2017, <<https://theplant-guide.net/2017/08/23/best-plant-identification-apps/>>.

⁴ Nicholas Thompson, *When tech knows you better than you know yourself*, interview with Tristan Harris, «Wired», 10 April 2018, <<https://www.wired.com/story/artificial-intelligence-yuval-noah-harari-tristan-harris/>>.

⁵ K. Kelly, *AR Will Spark the Next Big Tech Platform - Call It Mirrorworld*, cit.

⁶ <https://www.google.com/earth/>.

the Mirrorworld, yet, while we are still thrilled by the *smorgasbord* of virtual space – albeit in 2D – the Mirrorworld is still not quite here. We still need to make one more conceptual step – the magic leap from a 2D to 3D world in order to reach the full potential of the world that is awaiting us.

At the same time, social networks have an equally impressive global reach. The frontrunners, usually listed as Facebook, Twitter, Instagram, WeChat and Snapchat – as well as all the myriad wannabees – now connect people 24/7, usually from the palm of our hand, to a seamless, global place. While some claim this cuts out extraneous travel, thereby reducing our carbon footprint, this does give us the option to avoid unessential face-to-face meetings. At the same time, social networks are usually perceived as a celebration of social interaction, enabling online shopping, disseminating both traditional and innovative news, promoting music and sports events, as well as enticing us to travel and dine out. Sadly, especially over recent months, we are witnessing the extreme toxicity of some of these exchanges through terrorism and hate crimes down to the subversion of democracy gaining traction from social networks. In May 2019, Facebook went as far as to ban individuals deemed as “dangerous”⁷, causing vehement global discussion on whether Facebook should be classified as a platform or rather a publisher with the resulting implications, and questions about who should be responsible for identifying who is “dangerous”. The complete lack of guidelines was lamented by all, and Facebook, once again, failed to rise to the challenge of online toxicity so prevalent on its platform – even on its new, purified, “white” platform⁸.

Once the Mirrorworld has become ubiquitous (possibly even in the near future), we might also retrace its evolution as a master-platform that shared its provenance both with social networks as well as with online gaming. Since the debut of *Myst* in 1993, the first online game that shook up the world⁹, hundreds, if not thousands of games migrated from early handheld consoles or PCs to online gaming. Today, with 250 million registered players, *Fortnite*, developed by Epic Games, since it was first released in 2017, has become one of the most popular online video games ever created. Participants move through the world with four players in a squad, cooperating towards a common objective on various missions¹⁰.

⁷ Dave Lee, *Facebook bans “dangerous individuals”*, «BBC News Technology», 3 May 2019, <<https://www.bbc.com/news/technology-48142098>>.

⁸ Annie Palmer, *Facebook ditches its classic blue layout for new all-white design with a “cleaner look and feel”, as it unveils Messenger desktop app and a tool to help you flirt with your “secret crush” in “privacy focused” overhaul*, «Daily Mail Online», 30 April 2019, <<https://www.dailymail.co.uk/sciencetech/article-6975479/Zuckerberg-explain-Facebook-gets-privacy-focused.html>>.

⁹ <https://myst.com>.

¹⁰ <https://en.wikipedia.org/wiki/Fortnite>.

Anyone noticing young and not so young people spontaneously dancing “the Floss” in the real world is witnessing the impact of protracted battles in the fictitious world, laced with its oh-so-comforting dances for respite – “the Floss” has its own Wikipedia page¹¹ – and has become emblematic of the Fortnite-effect emerging from the many, many hours spent in-world to discreetly seep into real-life behaviour.

Fortnite’s developers made some strategic decisions in devising the player’s interactions that were driven by the dark clouds of social media. «For example», Fortnite’s CEO Tim Sweeney explains, «there’s only chat between you and your squadmates. There’s no proximity chat, so it’s not possible for one person to grieve another person they don’t know, out in the open world»¹². Lessons are being learned from the problematics of social networks and are influencing decisions in the development of new, more progressive experiences for players. At the same time, Fortnite’s designers were attentive to their committed players, and continued to develop new possibilities for the game. After trialing a new mode with players, they created a dedicated space where players could build their own islands – in much the same way that Second Life¹³ did when they launched their persistent virtual world in 2003. Tim Sweeney further points out:

*«Creative Mode, where players can go and create their own island and build their own work, including collaboratively with others, is now driving a large number of players. They’re building maps, they’re sharing them with friends, and we’re seeing more and more new types of gameplay emerge from that. It’s taken on a life of its own, and I think that’s going to be the driving force for Fortnite in the future»*¹⁴.

The agency that drives social networks, in which everyone can simultaneously be both a consumer and producer, is similarly driving gaming. According to young players Eviatar and Elai (age 11), «once we enjoyed running along the Temple Run¹⁵ path, jumping as we went, but that is no longer interesting. We need the space, and freedom to build our own world; invite our friends to develop our own island and know that we can return there to continue to develop it each time we log in¹⁶». They are advocating for an open-ended, non-linear persistent world, where they are assured that the fruits of their labor remain stable, even after they log out.

¹¹ [https://en.wikipedia.org/wiki/Floss_\(dance\)](https://en.wikipedia.org/wiki/Floss_(dance)).

¹² Peter Rubin, *It’s a short hop from Fortnite to AI best friend*, interview with Tim Sweeney and Kim Libreri, «Wired», 21 March 2019, <<https://www.wired.com/story/epic-games-qa/>>.

¹³ <https://secondlife.com/>.

¹⁴ P. Rubin, *It’s a short hop*, cit.

¹⁵ <<https://templerun3.co/>>. Temple Run is developed and published by Imangi Studios.

¹⁶ Eviatar Hazan and Elai Rofe



Figure 1. Eviatar and Elai's island in Fortnite

The notion of online collaboration required for a fully functional Mirrorworld demands a total global reach, in which participants are individually responsible for their own action and making their own contribution to the shared and persistent platform. The key to success here – and yet again a lesson to be learned from previous platforms – is the unequivocal rule of scalability. In the words of CTO Kim Libreri, founder of Fortnite:

«To truly see the future of collaborative gameplay and social experiences, you need a large-scale community to help that happen. This idea that a computer programmer in a basement invents the metaverse, it's just not true. We need a planet full of people to really help guide these things»¹⁷.

The vision that Libreri is suggesting here resonates with that foreseen by David Gelernter in his *Mirror Worlds* in 1992¹⁸. Over the years this vision has been called by many names: the “Metaverse”¹⁹, “Supranet”²⁰, “Matrix”²¹, and now “Mirrorworld”. “Mirror Worlds” – a term first popularized by Yale computer scien-

¹⁷ P. Rubin, *It's a short hop*, cit.

¹⁸ David Gelernter, *Mirror Worlds or the day software puts the universe in a shoebox: how it will happen and what it will mean*, e-book, New York; Oxford: Oxford University Press, 1992.

¹⁹ The term “Metaverse” was coined in Neal Stephenson's 1992 science fiction novel *Snow Crash*.

²⁰ The “Supranet” is a term coined at the turn of the 21st century by information technology analysis firm Gartner to describe the fusion of the physical and the digital (virtual) worlds, a concept that embeds the “Internet of things” as one of its elements: see <<https://en.wikipedia.org/wiki/Supranet>>.

²¹ “The Matrix” is a virtual-reality dataspace in the 1984 science-fiction novel *Neuromancer* and in the 1999 science-fiction movie entitled, indeed, *The Matrix*.

tist Gelernter – brings additional and critical dimensions into the next phase of online experience – context, meaning, and, most importantly, action.

«Mirror Worlds? What are they? They are software models of some chunk of reality, some piece of the real world going on outside your window. Oceans of information pour endlessly into the model (through a vast maze of software pipes and hoses): so much information that the model can mimic the reality's every move, moment-by-moment»²².

Each and every one of us will be able to interact in the Mirrorworld; not simply by building a map of our own island, and protecting it from marauders, and not just “wandering” around the facades that we know from Google Earth. We will still do our shopping on Amazon and all its clones and will continue to swap images and experiences as we know from social networks; the major difference is that it will all be happening in 3D. This means that daunting software and hardware solutions still need to be resolved. But they are coming. 3D technologies are emerging all around us. A compelling solution could be floating screens we evoke in the space surrounding us – the kind of interaction we watched as Tom Cruise’s iconic role as Chief John Anderton in the movie *Minority Report* (2002)²³ whose sci fi world was populated with gesture-activated screens.



Figure 2. Screenshot from the movie *Minority Report*, 2002

²² D. Gelernter, *Mirror Worlds*, cit.

²³ <https://www.imdb.com/title/tt0181689/>.

There are, in fact, impressive innovations already evolving in reality to introduce 3D worlds into our lives. Perhaps we will evoke screens to ghost-like float in the space in front of us, gesture tracking and finger recognition to drive our programs. There are already solutions that pump data directly into our eyes through retina scanners²⁴ and, of course the ultimate solution: brain-driven computer interaction²⁵. Some call this spatial computing, and, while most of the solutions are currently beyond our expertise and purse, we can buy Google Glasses, Magic Leap Goggles²⁶, and many similar products online (at a price). Be assured that within a very short time the new generation of 3D-interaction will be appearing on a screen near you.



Figure 3. Takehiro Nakagawa, from Kusatu City (Japan) walking around the National Park in Kyoto with his family during the Saukura spring

Taking the (3D) Leap of Faith

While social networks, online gaming, and Google Earth are reaching the boundaries of 2D experiences, the true leap of faith will occur once we move into a 3D environment. Every company that builds these platforms, comprising both the software and the hardware developers that will be driving them, is already in a

²⁴ https://en.wikipedia.org/wiki/Retinal_scan.

²⁵ Brain Driven Interface, <https://en.wikipedia.org/wiki/Brain%E2%80%93computer_interface>.

²⁶ <https://www.magicleap.com/>.

fierce battle to make it all happen. While this seems very futuristic, it is actually very contemporary. We have already been there! Even if you had not downloaded Pokémon Go²⁷ yourself onto your smartphone, you probably know someone who has. Even museums were pulled into these frenetic adventures.

Pokémon Go's phenomenal success story started with Ingress²⁸, the augmented-reality multiplayer game that was launched as a beta-version by Niantic in 2011. Ingress – currently with some 7 million players actively playing around the world – is an original IP (Intellectual Property) based in a near future science-fiction setting. The backstory is almost irrelevant, but it does drive the action. Players are informed how CERN discovered the Higgs Boson; a new substance called “exotic matter” which was abruptly released into the world. This exotic matter seeps into the world through portals and has the ability to affect humans. What is interesting for custodians of cultural heritage, however, is that these portals are in fact real-life cultural and historical locations such as parks and monuments, places where people traditionally congregate. What better a way to exploit this unassuming pastime than to turn these landmarks into nodes in a global game?

There are two factions of humans in the game – the enlightened and the resistance. According to the Ingress scenario, the enlightened believe “exotic matter” will bring about the next evolutionary step for mankind. The resistance sees the matter as coming from a possible alien force and are trying to control it so that it does not find its way into the wrong hands and destroy humanity. But who cares about the backstory? The point is to get out and catch them! This app is not that kind you play while slumped on your chair at home. It requires actual movement and encourages players to get outside in order to unlock new features, weapons and challenges: for example, to capture and control “portals” which spew matter from cultural places, such as museums and libraries. You have to actually go somewhere to play this game. Once you connect three portals, you form a region and claim a territory. Winner of the Grand Prize at the 2014 Japanese Media Arts Festival, Ingress was acclaimed for «transforming the real world into the landscape for a global game of mystery, intrigue, and competition»²⁹.

Ingress's users were responsible for helping create the data pool that determined where “Pokéstops” and gyms appear in Pokémon Go. The game was first released

²⁷ <https://www.pokemongo.com/en-us>.

²⁸ <https://play.google.com/store/apps/details?id=com.nianticproject.ingress>.

²⁹ See <<https://gadgets.ndtv.com/photos/best-android-apps-of-2013-google-play-users-choice-awards-16648#7>>. About the prize-winning game Ingres see also Rene Ritchie, *Ingress, Google's augmented reality game, hits iPhone and iPad*, «iMore», 13 July 2014, <<https://www.imore.com/ingress-googles-augmented-reality-game-hits-iphone-and-ipad>>.

exclusively for Android devices on 15 November 2012 and was made available for Apple's iOS on July 14, 2014. To play, you open up the game and start walking to prominent local landmarks – represented in the game as “Pokestops” – where you can gather supplies such as “Pokeballs”. Pokeballs are what you fling at online “pocket monsters”, or Pokemon, to capture them for training. At other locations called “gyms” – which may or may not be actual gyms in the real world but included locations such as museums and libraries around the world – Pokemon battle one another for supremacy. In the early days of Ingress, Niantic formed a beginning pool of portal locations for the game based on historical markers, as well as a data set of public artwork mined from geo-tagged photos on Google. «We basically defined the kinds of places that we wanted to be part of the game», CEO of Niantic, John Hanke said. «Things that were public artwork, that were historical sites that were buildings with some unique architectural history or characteristic, or a unique local business»³⁰.



Museums soon noticed that their physical locations were getting a lot more traffic in unusual places, such as in their galleries and gardens, especially from young people who were obsessively persistent with something. Many rose to the challenge and advertised their Pokemon potential through social networks, others were less enamored with the unwelcome intrusion into their spaces.

Figure 4. Screenshot: *Pokemon comes to the Israel Museum, Jerusalem, July 2016*

³⁰ Michelle Lulic, *Are Pokemon Based On Location, in "Pokemon Go"? Traveling Is The Best Way To Catch 'Em All*, «Bustle», 12 July 2016, <<https://www.bustle.com/articles/172192-are-pokemon-based-on-location-in-pokemon-go-traveling-is-the-best-way-to-catch-em>>.



Figure 5. Screenshot, *US Holocaust Museum asks Pokemon Go players to stop*

In July 2016 the US Holocaust Museum asked Pokemon Go players to stop. A spokesman for the museum in Washington said that «playing the game inside a memorial to victims of Nazism was “extremely inappropriate”»³¹ The Arlington National Cemetery, just three miles away from the museum, had also warned off Pokemon players.

Cultural custodians must wake up to the fact that they are already identified on the map as “historical markers”. The footfall that has marked their territory for more than a decade is up for grabs, easily mined through ubiquitous geo-tags and their tradition of public welcoming easily exploited for commercial gain. The key here is not to lament the loss of agency but to step into the game and make sure the game is played by their rules.

Of course, augmented reality is not new to museums. There are several examples of excellent projects that add additional layers of interpretation for visitors.

Gallery One at the Cleveland Museum of Art launched in 2013 their ArtLens³² with several functions that interpret the collection for the visitor. “Featured Artworks” combine interpretive media (movies, comparative images, text and au-

³¹ *US Holocaust Museum asks players to stop*, «BBC News US & Canada», 13 July 2016, <<http://www.bbc.com/news/world-us-canada-36780610>>.

³² Jane Alexander Jake Barton Caroline Goeser, *Transforming the Art Museum Experience: Gallery One*, <<https://mw2013.museumsandtheweb.com/paper/transforming-the-art-museum-experience-gallery-one-2/>>.

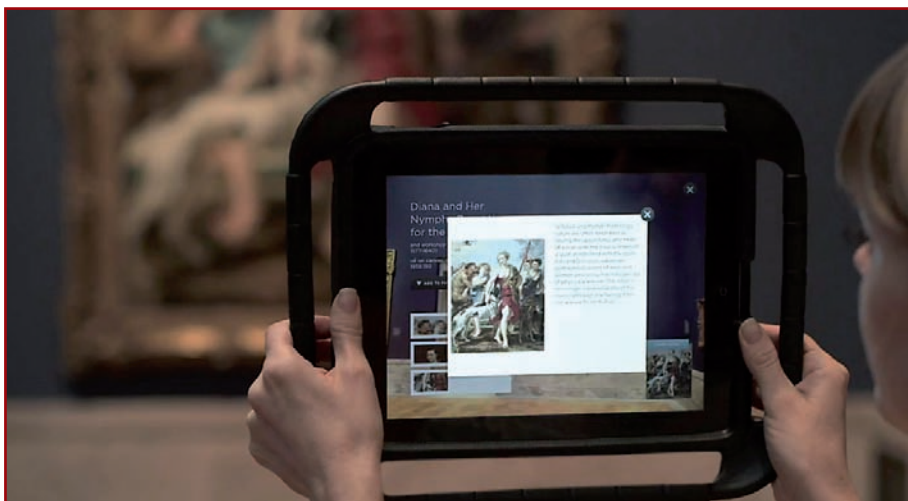


Figure 6. *ArtLens, Gallery One, Cleveland Museum of Art*

dio) with scanning image recognition, features that the curatorial team called “guided looking”. The scanning feature incorporates the device’s camera and image-recognition to provide an augmented reality experience for users on site. As visitors scan the artwork, the app recognises the object and provides context-sensitive content about the work. While the Cleveland Museum was one of the early institutions to introduce augmented reality (AR) in their galleries, many museums have followed in kind. AR apps are particularly popular in science and natural history museums, with dinosaurs and polar bears popping up all over the place to the delight of the visitors.

In 2016 the Seattle Art Museum took visitors out to their Olympic Sculpture Park (OSP) to visit the *Gardens of the Anthropocene*, an AR installation by Tamiko Thiel. Perhaps to the horror of the visitors, the farewell-to-spring plants had mutated to develop succulent drought-resistant leaves, as the species named there, *Clarkia irritabilis* or *Clarkia antenna*, had reacted to climate change in more than terrifying ways. According to the OSP, you could see two or three stages of development, in which the stamens and pistils had begun to fuse into an antenna-like form. In the final mutation, the flower petals had developed “marginal teeth” on their rims that detected the presence of mobile devices, and the flowers became engorged as they apparently fed off the electromagnetic emissions. The artist assured the public, however, «the behavior of the flowers is unnerving, but does not produce any known ill effects in humans»³³.

³³ Tamiko Thiel, *Gardens of the Anthropocene*, <<http://tamikothiel.com/gota/m.html>>.



Figure 7. *Gardens of the Anthropocene*, Augmented Reality Installation by Tamiko Thiel, 2016



Figure 8. *Gardens of the Anthropocene*, Augmented Reality Installation by Tamiko Thiel, 2016

Another AR project launched in 2014 took visitors outdoors again. This time the host was the Museum of London and the AR experience took place across the Streets of London³⁴. Streetmuseum 2.0, developed with creative agency Brothers and Sisters, invited visitors to visit sites across London where they could evoke

³⁴ Ellie Zolfagharifard, *Streets of London now... and then: Stand still and picture yourself in history with app that creates hybrid images of present and past*, «Daily Mail Online», 26 February 2014, <<https://www.dailymail.co.uk/sciencetech/article-2567739/Streetmuseum-app-creates-hybrid-images-London.html>>.

hidden histories of the city on the especially designed app through the geo-tagged points on the Google-map of the city. The alluring overlays of the contemporary live scene were superimposed side by side together with the historic images drawn from the Museum of London's extensive art and photographic collections. The narrative was further enhanced by the historical information form the curatorial interpretation. Sadly, Streetmuseum is no longer available at the moment but the Museum of London has several other apps for visitors³⁵.



Figure 9. Museum of London, StreetMuseum 2.0, 2014



Figure 10. Christina Broom, People and traffic in Oxford Street around the turn of the 20th century

³⁵ <https://www.museumoflondon.org.uk/discover/museum-london-apps>.

A persistent place

Our initial experience with global, digital technology was with the World Wide Web. This sprawling communication platform consists of interconnected networks, using standardised communication protocols and serves up information driven by the power of algorithms. This text-driven platform eventually became dominated by Google. The second significant platform comprised social media, distributed predominantly over mobile phones. Social networks digitised people and encapsulated human behavior; even our personal relationships became data-points to be mined and exploited. These potentially democratising networks were primed to “connect people” but were eventually dominated by Facebook, Vkontakte and WeChat, which make vast profits and exercise almost unimaginable power over information, politics and even democracy itself. According to John Kelly the third platform is just around the corner:

«We are now at the dawn of the third platform, which will digitise the rest of the world. On this platform, all things and places will be machine-readable, subject to the power of algorithms. Whoever dominates this grand third platform will become among the wealthiest and most powerful people and companies in history, just as those who now dominate the first two platforms have. Also, like its predecessors, this new platform will unleash the prosperity of thousands more companies in its ecosystem, and a million new ideas – and problems – that weren’t possible before machines could read the world»³⁶.

A machine-readable world promises a formidable reality, which at the same time is coupled with a momentous loss of human control. In essence, it will be the digital actors, the robots who will be seeing this world for us, in much the same way that self-driving cars see the world today in a combination of reality and computerised perception. When a robot looks, it will be both seeing for itself and providing a scan for other robots. The measure of success here is the way the world is modeled, the mapping of the road ahead of the vehicle, together with the on-going interpretation of real-time data that will be flooding in at speeds that humans could never dream of. This world will depend on simultaneous localisation and mapping (SLAM)³⁷, the computational challenge of constructing and constantly updating a map of the potential environment while simultaneously keeping track of an agent’s location, and movement within the potential space.

This will create a radical paradigm shift in the ways we experience the world around us. Some are calling it “XR”, a catch-all term that describes a range of visual extensions of reality, or cross reality. The evolving aesthetic is driven by com-

³⁶ K. Kelly, *AR Will Spark the Next Big Tech Platform*, cit.

³⁷ https://en.wikipedia.org/wiki/Simultaneous_localization_and_mapping.

puter vision, machine learning, and the increasingly collaborative intersection between human and machine. This growing capacity enables us to act with digital devices in a world that blurs the digital and biological. We can call up inexhaustible data to enrich and inform the action in real time in a formidably collaborative environment. The move towards AR vision is sneaking up all around us. Google is already taking its first steps in this direction with its Google Maps augmented reality³⁸ and Minecraft Earth is currently campaigning for the summer 2019 launch of its AR version which it hopes will rival the Pokemon Go craze³⁹. Significant steps are already underway whether we notice or not. Facebook has recently announced several of its robotics projects, which explore ways for robots to teach themselves from experience rather than data prepared for training purposes – a skill Facebook believes could have implications beyond the field of robotics. «The real world is messy, it's difficult», Roberto Calandra, a research scientist in Facebook's AI division explains. «The world is not a perfect place; it's not neat. So the fact that we are trying to develop algorithms that work on real robots [will] help to create [AI] algorithms that, generally speaking, are going to be more reliable, more robust, and that are going to learn faster»⁴⁰.

At the same time, Google is frenetically engaged with Big Data, Machine Learning, Deep Learning and voluminous AR projects. Under their bespoke banner "Advancing the state of the art – We work on computer science problems that define the technology of today and tomorrow", Google is already one of harbingers of the Mirrorworld. While we are concerned with the culture values of the Mirrorworld, at this moment in time we need to pause think why Google is laying all the groundwork for the Mirrorworld and are reminded of Zuboff's insightful, and dire warning of appropriating everything for the lucrative profits inherent in surveillance capitalism.

«[...] the everywhere, always-on instrumentation, datafication, connection, communication, and computation of all things, animate and inanimate, and all processes—natural, human, physiological, chemical, machine, administrative, vehicular, financial. Real-world activity is continuously rendered from phones, cars, streets, homes, shops, bodies, trees, buildings, airports, and cities back to the digital realm, where it finds new life as data ready for transformation into predictions, all of it filling the ever-expanding pages of the shadow text»⁴¹.

³⁸ Karissa Bell, *Google Maps augmented reality directions are here (and actually useful)*, «Mashable», 7 May 2019, <<https://mashable.com/article/google-maps-augmented-reality-walking-directions/>>.

³⁹ Peter Rubin, *Minecraft Earth wants to be the Next Pokemon Go – but Bigger*, «Wired», 17 May 2019, <<https://www.wired.com/story/minecraft-earth-wants-to-be-the-next-pokemon-go-but-bigger/>>.

⁴⁰ Kristin Houser, *Facebook finally unveils secret robotics projects*, 20 May 2019, <<https://futurism.com/the-byte/facebook-robot-projects>>.

⁴¹ Shoshanna Zuboff, *The Age of Surveillance Capitalism*, cit, p. 202.

Predicting our actions is the *modus operandi* of marketing, targeting us to sell something, or even influence our political preposition for a particular political agenda. These progressions also clearly represent daunting challenges, to us as individuals, but especially to custodians of cultural heritage, those institutions who maintain historical and contemporary culture that is both tangible and intangible and is poised to flood the Mirrorworld with unique and archetypal content.

Clearly for the Mirrorworld to ripen to its full potential there are several significant, technological challenges to be surmounted, presumably by the leading companies such as Google. Ideally we will need digital prosthetics that offer six degrees of freedom (6DoF)⁴², the number of axes along which the body is able to freely move in three-dimensional space including the X, Y and Z axes as well as change orientation between those axes though rotation usually called pitch, yaw and roll. Somebody has to model the world in 3D, and, in addition, every object in this world will need a digital twin. Will consumers be doing this themselves with tiny head-mounted, phone-equipped, or street embedded cameras, or will the data be flooding in from the long-established, world-wide commercial pixel-pushers, Google, Apple, Microsoft, Ingress, Facebook and other global giants? What role will the custodians of culture be playing in this evolving matrix, and what will their responsibilities be to the public?

«History will be a verb. With a swipe of your hand, you will be able to go back in time, at any location, and see what came before. You will be able to lay a reconstructed 19th-century view right over the present reality. To visit an earlier time at a location, you simply revert to a previous version kept in the log. The entire mirror-world will be like a Word or Photoshop file that you can keep “undoing”. Or you’ll scroll in the other direction: forward. Artists might create future versions of a place, in place. The verisimilitude of such crafty world-building will be revolutionary. These scroll-forward scenarios will have the heft of reality because they will be derived from a full-scale present world. In this way, the mirrorworld may be best referred to as a 4D world»⁴³.

This is where the custodians of cultural heritage enter stage right. From museum basements, conservation laboratories and university research huddles, curators, developers and conservators have been compiling data cloud upon data cloud to preserve cultural objects, artworks, historical buildings and monuments for future generations. After the recent and disastrous fire at Notre-Dame Cathedral in Paris, for example, the international press reported how American historian Andrew Tallon, art professor at Vassar, and architectural historian and Columbia’s Paul Blaer spent five days in 2010 creating an incredibly accurate 3D laser scan of

⁴² <https://www.techopedia.com/definition/12702/six-degrees-of-freedom-6dof>.

⁴³ K. Kelly, *AR Will Spark the Next Big Tech Platform*, cit.

Notre-Dame⁴⁴. If researchers like Tallon and Blaer, and hundreds like them around the world, come together to share their data, these could serve as critical fragments of the future Mirrorworld. It is a question of collaboration and scalability. It sounds complicated – it needs not be so. All you need to do is to gather and combine the data points. Motivated by the terrifying loss of one of Europe's most beloved landmarks, within a few days more than 50 crowdfunding campaigns were launched to restore Notre-Dame on the website GoFundMe⁴⁵. Even more sobering were the Notre-Dame crowdsourced photo/video photogrammetry repositories that were openly shared over several platforms, including shared Sketchfab⁴⁶. The community is already there, and once motivated has much to contribute.

Typically, like an iceberg that is mostly hidden under water, most museums around the world can only showcase a small percentage of their collections at any given time, while other objects and artworks wait for their debut to make it up to the gallery for their moment of fame in the spotlight. However, once these hidden objects have been digitised, they can be called upon to tell their stories, and activated to compile the 4th dimension of the Mirrorworld: the scrolling back and forth in time. For custodians of cultural heritage, the added advantage in the Mirrorworld concerns their decades-long tradition of creating narratives. While most objects on display are exhibited to tell a specific story, in fact, from their own histories, they may have more than one story to tell. Typically, objects are accompanied by captions, labels or short wall texts, not always detailed enough to tell the full story. In a digital world, multi-narratives may be called up to recall the complex and sometimes contentious provenance of objects.

In 1995 a fiery controversy exploded when Enola Gay, the B-29 aircraft that was used to drop the bomb on Hiroshima, was put on display at the National Air and Space Museum (NASM)⁴⁷. Exhibiting the plane fermented bitter dispute: the conflicting historical perspectives that were caught up in its tailwind ended up in upsetting so many communities – war veterans, Japanese survivors – and all parties were enraged by the staging of the narratives, especially regarding the decision to drop the bomb, that Martin Harwit, NASM Director, eventually quit the museum.

⁴⁴ Rachel Hartigan Shea, *Historian uses lasers to unlock mysteries of Gothic cathedrals*, «National Geographic», 16 April 2019: see Notre-Dame cloud point scan: <<https://news.nationalgeographic.com/2015/06/150622-andrew-tallon-notre-dame-cathedral-laser-scan-art-history-medieval-gothic/>>.

⁴⁵ *Over 50 crowdfunding campaigns launched to restore Notre-Dame*, «New Straits Times», 16 April 2019, <<https://www.nst.com.my/world/2019/04/479874/over-50-crowdfunding-campaigns-launched-restore-notre-dame>>.

⁴⁶ <https://sketchfab.com/3d-models/notre-dame-crowdsourced-photogrammetry-c6f03e2284e049f38f118378b012c979>.

⁴⁷ <https://www.atomicheritage.org/history/controversy-over-enola-gay-exhibition>.

The exhibition ran from January 1995 to May 1998. Despite all the controversies, it was one of the most popular special exhibitions in the history of the Air and Space Museum, attracting more than a million visits in its first year alone, and a total of nearly four million visitors by the time it closed. In the Mirrorworld there will be breadth and length enough for all narratives, and we will be able to scroll through competing stories in the batting of an eyelid.

The global players who have excelled in these kinds of big data projects are those countries that have amassed their cultural holdings at a national level and have created their own portals to promote their country's cultural assets to both local and international users. The portals that span over neighbouring countries, or even whole continents, are even more impressive. In the US the leaders have traditionally been the Smithsonian, and more recently the Digital Public Library of America (DPLA)⁴⁸ – modelled on the pan-European platform Europeana⁴⁹. The latter has over 58 million objects, drawn from European galleries, libraries, archives and museums (GLAMs). The Europeana Foundation is already active in building the proto-Mirrorworld as one of the founding members of the initiative called Time Machine⁵⁰, a consortium of GLAMs and computer science organisations who have made a case for a billion-euro investment package that aims to use AI to their advantage to mass digitise, simulate and interpret big data of the past. According to its website, Time Machine is promising to be one of the most advanced Artificial Intelligence systems ever built:

«The Time Machine will create advanced AI technologies to make sense of vast amounts of information from complex historical data sets. This will enable the transformation of fragmented data – with content ranging from medieval manuscripts and historical objects to smartphone and satellite images – into useable knowledge for industry. In essence, a large-scale computing and digitisation infrastructure will map Europe's entire social, cultural and geographical evolution»⁵¹.

The Time Machine plans to mine Europe's rich past through harnessing digital innovation and creating a living resource that allows you, according to their webpage, «to travel not only through space, but through time»⁵². The standards, frameworks and collections of the Europeana service will become important building blocks for the Time Machine for future generations. The pilot started in March 2019 and aims to deliver a project proposal for the Time Machine project in early 2020.

⁴⁸ <https://dp.la>.

⁴⁹ <https://www.europeana.eu/portal/en>.

⁵⁰ <https://timemachine.eu/>.

⁵¹ <https://www.timemachine.eu/unleashing-big-data-of-the-past-europe-builds-a-time-machine/>.

⁵² <https://www.timemachine.eu/>.

Museum literacy to inform 4D literacy

We can look forward to a time when we will be able to search through physical space in much the same way we search by text on a browser. Perhaps we will be able to call up through gesture or verbal commands the future Siris and Alexas to help us find our way around the Mirrorworld – to scroll across histories and encounter a chorus of multi-narratives. This will demand a new kind of visual or spatial literacy that will enable us to simultaneously consume and produce objects and processes in a 4D environment. Michael Foucault drew attention to the mausoleum-like nature of modern museums that are connected to temporal discontinuities as «heterochronias – in which time never ceases to pile up and perch on its own summit»⁵³. Where heterotopias may be seen as non-places, or physical spaces that have been geographically misplaced, Foucault recognizes how museums (and libraries) act as *heterochronias* – where the characteristic of Western culture in the 19th century dissolves both geography and time. He suggests that

*«the idea of accumulating every-thing, the idea of constituting a sort of general archive, the desire to contain all times, all ages, all forms, all tastes in one place, the idea of constituting a place of all times that is itself outside time and protected from its erosion, the project of thus organizing a kind of perpetual and indefinite accumulation of time in a place that will not move – well, in fact, all of this belongs to our modernity»*⁵⁴.

Conclusion

GLAMs are the ideal sand boxes that will help us master the new literacies of 4D *heterochronias*. Museums are ideally equipped to stage the kind of learning that we will need to safely navigate the Mirrorworld. It is actually not really that far in the future. As individuals acting in today's world, we are already generating tons of data from the moment we wake up and our smartwatch tells us how much, and how well we slept last night, how many times we were in REM dream state and how restless we were between our dream cycles. If we check our pedometer we will be able to recall if we left our beds during the night, perhaps for a drink, or perhaps even sleepwalking. Only my pedometer can tell me. As soon as our fingers touch our keyboards we could be signalling our mood⁵⁵ and through a machine-readable selfie we might be posting, or even broadcasting, our emotional state. Perhaps in the near future we will be shouting out our mental state through a deviation from the rhythm of our normal keyboard strokes – that is if anyone cares to listen in.

⁵³ Michel Foucault, *The Essential Works of Foucault, 1954-1984*, v. 2: *Aesthetics*, edited by J. D. Foubion, translated by R. Hurley and others, London: Penguin, 1997, p. 182.

⁵⁴ *Ibidem*.

⁵⁵ Will Knight, *Your smartphone's AI algorithms could tell if you are depressed*, «MIT Technology Review», 3 December 2018, <<https://www.technologyreview.com/s/612499/your-smartphones-ai-algorithms-could-tell-if-you-are-depressed/>>.

CTV cameras already populate our cities. In China, facial recognition in public places allows individuals to simply smile in order to pay for a meal, as a pilot which is being tested in KFC in the Chinese city of Hangzhou does, or, on a different scale, it can help the police to catch criminals walking in the street⁵⁶. Through tracking individuals over their mobile phones, China already has the capability to keep tabs on its population. Through the quickly evolving “social credit system”, surveillance technology is not only able to monitor, but even to regulate the everyday life of its population by automatically generating ratings for each citizen and affecting everything accordingly, from loan approvals to the permission to board flights⁵⁷. The future is not coming soon – it is already here.

This call to action cannot halt the growing progression of the authorities to take over public space, even though some cities are taking a bold stance to staunch this relentless progression when they feel threatened by the potential of the digital gone wild⁵⁸. But once these technologies are instituted, GLAMs can play an active role in perpetuating narratives of cultural heritage, through digital enterprise and the spatial and *heterochronic* nature of their institutions. Leaders such as Europeana have been promoting these kinds of initiatives since 2015:

«We believe that the digital cultural heritage available via Europeana can make Europe an even better place to live, learn, work or visit. That's why, under the recent Presidencies of the Council of the European Union, we worked with experts, member state and EU policy-makers to forge a path and create Recommendations for the use of our digital cultural heritage in four sectors - research, education and learning, tourism and the creative industries»⁵⁹.

Essentially it is up to custodians of cultural heritage to become proactive in building the Mirrorworld rather than wait for commercial actors to advance their own fabricated stories – and with the GLAM community blazing the trail in the Mirrorworld these unique and precious stories will be accessed, shared, and augmented in confidence.

⁵⁶ Bernard Marr, *The Fascinating Ways Facial Recognition AIs Are Used In China*, «Forbes», 17 December 2018, <<https://www.forbes.com/sites/bernardmarr/2018/12/17/the-amazing-ways-facial-recognition-ais-are-used-in-china/#767249c35fa5>>.

⁵⁷ Zhou Jiaquan, *Drones, facial recognition and a social credit system: 10 ways China watches its citizens*, «South China Morning Post», 4 August 2018, <<https://www.scmp.com/news/china/society/article/2157883/drones-facial-recognition-and-social-credit-system-10-ways-china>>.

⁵⁸ Kate Conger Richard Fausset Serge F. Kovalski, *San Francisco Bans Facial Recognition Technology*, «The New York Times», 14 May 2019, <<https://www.nytimes.com/2019/05/14/us/facial-recognition-ban-san-francisco.html>>.

⁵⁹ <https://pro.europeana.eu/post/getting-heritage-out-of-its-boxes-and-into-the-real-world>. All the online references were accessed on 24 July 2019.

Questo articolo vuole spronare i custodi del patrimonio culturale a farsi trovare preparati dalla nuova piattaforma in arrivo: le esperienze 3D e 4D del nascente Mirrorworld.

Costruito sulla base delle prime generazioni di esperienza online e sulla tentacolare piattaforma di comunicazione del World Wide Web e veicolato dalla portata universale di social network e gaming online, il Mirrorworld supererà le limitazioni intrinseche delle esperienze 2D per condurci in un ambiente 3D completamente funzionante.

Le istituzioni pubbliche che gestiscono il patrimonio culturale rivolto all'utenza (gallerie, biblioteche, archivi e musei - GLAM) sono nella posizione ideale per poter avviare la rete di comunicazioni spaziali che guiderà la nuova piattaforma.

Chiaramente vi sono sfide notevoli da superare, ma è compito dei custodi del patrimonio culturale partecipare attivamente alla costruzione del Mirrorworld, piuttosto che aspettare che soggetti terzi avanzino interessi commerciali producendo cultura imitativa, storie simulate, o storie inventate.

Come guardiani degli oggetti culturali i GLAM hanno la capacità, l'esperienza e soprattutto la responsabilità di raccontare le loro storie in maniera potente, precisa e con una tecnologia 4D pienamente funzionante.

L'ultima consultazione dei siti web è avvenuta nel mese di giugno 2019