BACKBONES & BLUEPRINTS

CYBERNETIC APPROACHES TO THE METAVERSE

Australian National University
School of Cybernetics

We acknowledge the Aboriginal and Torres Strait Islander traditional custodians of the land we now call Australia. We pay our respects to their elders past and present, and remember that we are living and working on land that is always sacred, and never ceded, a land where people have been building safe, sustainable and responsible technologies for time immemorial.

“There is an easy seductiveness to stories that cast a technology as brand-new, or at the very least that don’t belabour long, complicated histories. Seen this way, the future is a space of reinvention and possibility, rather than something intimately connected to our present and our past. But histories are more than just backstories. They are backbones and blueprints and maps to territories that have already been traversed. Knowing the history of a technology, or the ideas it embodies, can provide better questions, reveal potential pitfalls and lessons already learned, and open a window onto the lives of those who learned them.”

Genevieve Bell, “The metaverse is a new word for an old idea” MIT Tech Review, 8 February 2022

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BACKBONES & BLUEPRINTS: CYBERNETIC APPROACHES TO THE METAVERSE

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INTRODUCTION

“The metaverse is a new word for an old idea"

Genevieve Bell
MIT Tech Review, 8 February 2022

The metaverse has never been an end in itself. Rather, it is a space of exploration, a gateway, a portal, a refuge, a moment, a mirror, even an inspiration, and always in dialogue with the world that has built it.

The metaverse was first introduced in Neal Stephenson’s novel Snow Crash over thirty years ago, and the book continues to serve as its basic blueprint.[1] Stephenson’s rendering of the metaverse as a persistent, immersive, networked environment that extends or even replaces reality has been taken up as an imagined endpoint for the next phase of life online. The underlying technology stack, centred on VR goggles, can be found faithfully reproduced in the research and development roadmaps of contemporary industry. As a set of technologies, and as a set of ideas, the metaverse continues to evolve and take on different forms, but its foundations have long been laid in the popular imagination.

Now, as concerted efforts by corporations to build the metaverse gain momentum, we can see the consequences of this imaginary unfolding. Already, we can experience immersive virtual worlds, as a large and growing number of people do every day. Each augmented or virtual reality experience online is a metaverse encounter, and our engagement with the metaverse will be a collective set of such encounters. These encounters will be messy, but will inevitably transform us. In this sense, the metaverse has never been an end in itself. Rather, it is a space of exploration, a gateway, a portal, a refuge, a moment, a mirror, even an inspiration, and always in dialogue with the world that has built it.

In this report, we highlight the backbones of this thinking and, in unpacking what led us here, offer the opportunity for a better blueprint. Taken in its entirety, Backbones and Blueprints is the beginning of a different type of exploration: one focused on the pathways by which the metaverse is being defined and developed – through fiction, through history, and through the levers of decision-making in the present. Our goal, in making present discourse on the metaverse legible in the context of story and history, is to offer pathways to consider a safer, more responsible, and more sustainable metaverse for the future.

This exploration is grounded in the approach to cybernetics being pioneered at the Australian National University.

Genevieve Bell
ANU School of Cybernetics

CYBERNETICS AT THE AUSTRALIAN NATIONAL UNIVERSITY

Cybernetics is the study of dynamic, complex systems that comprise people, technology, and environments. The term ‘‘cybernetics’’ was coined in 1948 by American mathematician Norbert Wiener from the Greek, kybernetes, meaning to steer, or pilot. It rose to prominence in a time when computers were novel but rapidly advancing and it tapped into widespread concern about the consequences of the coming age of digitisation. As a field, it fused math, engineering, and philosophy with biology, psychology, anthropology, and many others. Over the last 75 years, it has helped shape everything from Artificial Intelligence (AI) to critical systems theory, computer-driven art and music, design thinking, and even the internet.

What makes cybernetics particularly useful in the 21st century is its insistence on comprehending computing as part of a system. Today computing is ubiquitous and significant in human, ecological, and technological systems, and is itself a product of complex and adaptive systems. The design and implementation of any technology is contingent on human values, on time and circumstances, on locations, interactions, and events experienced by the individuals who create, maintain, and use it.

The School of Cybernetics at the Australian National University was established in 2021 to help safely, sustainably, and responsibly design, build, manage, regulate, and decommission systems with computation at their core. For us, cybernetics offers a language and a set of methods for situating technologies within dynamic, changing contexts that also include humans and environments, and anticipating and course-correcting for unexpected consequences. For us, cybernetics is not just the study of systems. We also aim to develop tools to transform those systems for the better – to make them safe, sustainable, and responsible. Sometimes this means steering them better, sometimes this means radically altering them, and sometimes this means decommissioning them altogether.

We believe cybernetics is an important tool for navigating major societal transformations through capability building, policy development, and creating new approaches to new systems. In our work, we focus on the past, present, and future of systems with computing at their core. We are interested in what we can learn from now defunct systems, as well as those that have yet to be built.

At the school, we are demonstrating how cybernetics – with its insistence on paying attention to both to the components of a system (the human, technical, and ecological) and the dynamic relationships between them (connections and feedback) – can help direct us towards better decision-making in complexity. We have used this approach to find new ways to engage with everything from Generative AI to drone-human interaction to data-driven policymaking, and we believe the metaverse can be approached this way too. Our focus on cybernetics as both a way of seeing the world and as a set of methods for better decision-making informs our commitment to developing safe, sustainable, and responsible approaches to new systems.

Cybernetics is an approach to emerging technological capability that prioritises the relationships between people, technologies, and environments. It enables understanding of the components, connections, and dynamics to shape and steer systems.

MULTIPLE LENSES

In this report, we examine the metaverse through its pasts, presents, and future. We believe this approach can help illuminate the metaverse in new and productive ways, and help steer a path towards its safe, sustainable, and responsible development. We unfold three different ways of making sense of the metaverse, which together comprise a picture of the metaverse as a cybernetic system.

ORIGIN STORIES OF THE METAVERSE explores the metaverse in science fiction, asking: what is it about the idea of the metaverse that is so enduring? How have these stories shaped our current imaginations and instantiations of the metaverse? What is present and missing as a result? And what can we learn about the metaverse, and ourselves, by looking back at the stories we've told before? Through a critical reading of the science fiction that has informed today's understandings of the metaverse, we hope to reunite the technology with its broader imagined contexts and their consequences.

ALTERNATE HISTORIES OF THE METAVERSE looks to the past to explore some of the foundational ideas upon which the metaverse might draw. What can we learn from earlier histories and stories? What are the human and environmental factors influencing the creation of other types of worlds? How does this help us understand how people might be drawn to or away from the metaverse? In exploring different kinds of histories, we hope also to shed new light on how ideas of safety, sustainability, and responsibility might have been enacted or required.

UNPACKING THE METAVERSE AS A SYSTEM engages with the idea of the metaverse as a business venture in the present, questioning dominant narratives and assumptions. What insights can we gain by surfacing and challenging assumptions, and raising new questions, about the agents, agendas, processes, infrastructure, and data involved in the system of the metaverse? In deconstructing the metaverse into a set of component pieces, we also help to surface the many ways in which safety, sustainability, and responsibility could be achieved.

METAVERSE PASTS

METAVERSE PRESENTS

METAVERSE FUTURES

Taken together, these various perspectives and accounts help unfold the metaverse as a cybernetic system, providing insights to challenge your thinking and illuminate a path along which we might steer and shape that system. This report will take you on that journey.

01.

ORIGIN STORIES OF THE METAVERSE

From its slightly disreputable origins in early-20th century pulp magazines, science fiction has evolved into a cultural force, serving as a bellwether, incubator, and accelerant for technological and social change. Over the past century, transformative technologies have routinely made the leap from the pages of science fiction into everyday reality.

In 2014, Genevieve Bell, the inaugural director of the School of Cybernetics, and Paul Dourish, a well-known computer scientist, published a paper exploring how science fiction might have shaped the ways researchers in ubiquitous computing approached building the future. As they put it, these researchers were motivated by the "recognition that scientific practice cannot be entirely separated from the popular culture upon which it draws and to which it contributes".[2] Relying on a close reading of several canonical science fiction works, they charted the ways in which those works had tacitly and explicitly shaped the innovation imagination of Silicon Valley.

As the paper revealed, fictional depictions of new technologies can drive real-world development and prime us to accept new modes of technological progress. Equally, they can lead us to fixate on fictional ideals that may prove impractical or impossible to realise.[3] [4]

ROBOTS: FROM MORALITY TALE TO ENGINEERING CHALLENGE

Robots are a remarkable case in point for how a fictional innovation can become a dominant form of technology, pervading much of our modern lives.

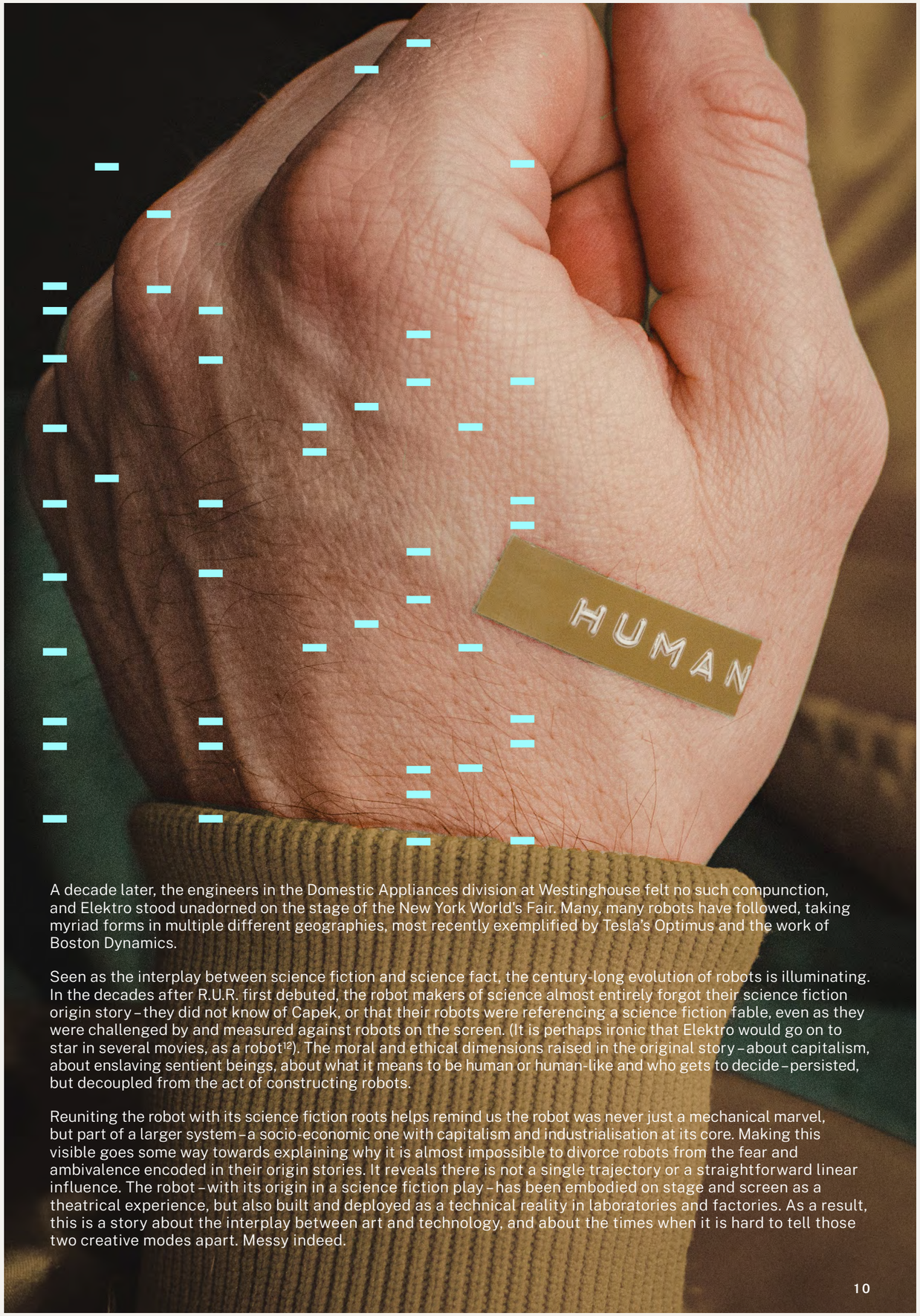
In 1920, Czech writer Karel Capek published his play R.U.R., or Rossumovi Univerzální Roboti [Rossum's Universal Robots]. Influenced by Mary Shelley's Frankenstein and the Golem narratives of Jewish folklore, R.U.R. is a story about a factory owner named Rossum and his product – mechanical humans called robots.[5] Capek invented the word "robot" and defined it in the script:

... the Robots are not people. Mechanically they are more perfect than we are, they have an enormously developed intelligence, but they have no soul. Have you ever seen what a Robot looks like inside? Very neat, very simple. Really, a beautiful piece of work. Not much in it, but everything in flawless order. The product of an engineer is technically at a higher pitch of perfection than a product of nature.[6]

As the play unfolds, it becomes clear these beautiful pieces of work want more from the world than the drudgery to which they are assigned, and they rise up violently against their human creators. Somewhat unexpectedly, this play about engineered humans and the perils of capitalism and mass production was a success. It was translated into English and many other languages, bringing the word "robot" into global circulation. The play would be performed on the British Broadcasting Corporation's radio and television networks, and appear in quick succession on New York's Broadway, in London's West End, and in Japan and Australia.[7] [8]

The play's narrative arc – about engineered beings seeking love and redemption and ending up instead in pitched confrontation with their makers – has been reproduced over and over again on screen, with increasing technological sophistication and verisimilitude. It's the conflict that drives long-running science fiction sagas like Blade Runner, The Terminator, Westworld, The Matrix, Battlestar Galactica, and countless others. There are subtexts of enslavement, rebellion, and the immorality of shackling increasingly sentient beings in servitude, harkening back to both Frankenstein's Monster and the Golem. Such stories portray the creation of human-like creatures as direly problematic, no matter the original intention.[9] Here the technology is always and already part of broader conversations about society, alienation, industrialisation, sustainability, and even the very nature of what makes us human. Unsurprisingly, the ambivalences and anxieties provoked by fictional robots have only increased over time. Imagined robots have always existed, as philosopher Eugene Thacker would have it, at the intersections of science, technology, and society, and the stories they inhabit give us an opportunity to reflect on the consequences of unchecked technological advance.

However, for some who encountered Rossum's robots on radio and television, it was less about a promethean moral reckoning and more about an excellent engineering challenge. From W. H. Richards and A. H. Reffell's 1928 creation Eric the robot, to the 1939 debut of Elektro, a walking, talking, cigarette-smoking robot from the American company Westinghouse, there was a rush to turn the robot of fiction into the robot of fact.[10] [11] With the letters "R.U.R." emblazoned in a heraldic crest across its metallic chest, Eric's literary roots were abundantly clear. Perhaps Richards and Reffell felt the need to legitimise their activity, or at least make it legible to their colleagues through such an explicit connection to the popular play.



A decade later, the engineers in the Domestic Appliances division at Westinghouse felt no such compunction, and Elektro stood unadorned on the stage of the New York World's Fair. Many, many robots have followed, taking myriad forms in multiple different geographies, most recently exemplified by Tesla's Optimus and the work of Boston Dynamics.

Seen as the interplay between science fiction and science fact, the century-long evolution of robots is illuminating. In the decades after R.U.R. first debuted, the robot makers of science almost entirely forgot their science fiction origin story – they did not know of Capek, or that their robots were referencing a science fiction fable, even as they were challenged by and measured against robots on the screen. (It is perhaps ironic that Elektro would go on to star in several movies, as a robot[12]). The moral and ethical dimensions raised in the original story – about capitalism, about enslaving sentient beings, about what it means to be human or human-like and who gets to decide – persisted, but decoupled from the act of constructing robots.

Reuniting the robot with its science fiction roots helps remind us the robot was never just a mechanical marvel, but part of a larger system – a socio-economic one with capitalism and industrialisation at its core. Making this visible goes some way towards explaining why it is almost impossible to divorce robots from the fear and ambivalence encoded in their origin stories. It reveals there is not a single trajectory or a straightforward linear influence. The robot – with its origin in a science fiction play – has been embodied on stage and screen as a theatrical experience, but also built and deployed as a technical reality in laboratories and factories. As a result, this is a story about the interplay between art and technology, and about the times when it is hard to tell those two creative modes apart. Messy indeed.

METAVERSE ORIGINS IN SCIENCE FICTION

In his book Lab Coats in Hollywood: Science, Scientists, and Cinema, David Kirby also explores this overlap between science fiction storytelling and scientific advance, noting “entertainment texts can influence scientific thought by foregrounding specific scientific ideas and providing narrative reasons to accept them as representing reality”.[13] Consider how innovations like space travel, cell phones, and artificial intelligence were presaged by decades of portrayals in science fiction media.

During the 2010s, large technology companies In America's Silicon Valley, including Intel and Microsoft, actively used science fiction storytelling to prompt new kinds of innovations and to surface possible concerns and constraints. Pioneered by science fiction author and futurist Brian David Johnson, the concept of science fiction prototyping is defined as “a short story, movie or comic based specifically on a science fact for the purpose of exploring the implications, effects and ramifications of that science or technology.”[14]

The reverse is also true. There is a long and complicated interplay between portrayals of technology in science fiction and scientific experts advising on film and television productions. Whether it is MIT’s Marvin Minsky acting as technical advisor for Stanley Kubrick’s 2001: a Space Odyssey, or SRI’s Peter Schwartz informing the WOPR’s design in WarGames, or even IBM’s computer starring alongside Tracy and Hepburn in 1959’s Desk Set, the technologies on our screens can feel uncanny precisely because they have been informed by technologists, not just prop designers.[15] These feedback loops can be dense, complicated, frequently delightful, and profoundly messy.

This is certainly true of the metaverse, which both embodies and has begun to emerge from a blurry borderland between fantasy and reality. In this chapter, we explore the origins of the metaverse in science fiction, and the ways its forerunners – both real and imaginary – have defined its current direction. We are especially interested in the ways the metaverse is unfolding at the intersection of technology and society. Or, as we might frame it, how the metaverse is taking shape as a cybernetic system, rather than a laundry list of technologies.

Much like the word robot before it, the term metaverse derives from science fiction. First coined in Neal Stephenson’s 1992 cyberpunk novel Snow Crash, it refers to a persistent, fully immersive, computer-generated world. Also like robot, metaverse represents a modern iteration of a surprisingly old and stubbornly resilient idea.[16] For nearly half a century, portrayals of a simulated world existing adjacent to our own have been a mainstay of both science fiction entertainment and futurist speculation. To understand how this vision of the future arose, and why it so strongly endures, we must explore one set of these virtual world stories ...

IN THE BEGINNING THERE WAS VIRTUAL REALITY

"But what is reality?"[17] So begins the 1935 short story “Pygmalion’s Spectacles” by American science fiction writer Stanley G. Weinbaum. Its protagonist, nondescript everyman Dan Burke, is enjoying a quiet drink at a Manhattan bar when he’s suddenly accosted by a “diminutive old madman”[18] ranting about metaphysics. Dan soon learns this is Professor Albert Ludwig, a man convinced reality is far more malleable than conventionally thought. The Professor boasts of having created a miraculous technology that can “make real a dream”[19] – an immersive movie that engages all five senses, in which the viewer becomes the star of the story.

Despite his scepticism, Dan can’t resist an invitation to try the invention himself. The pair retreats to a nearby hotel room, where the Professor produces a goggled device[20] “vaguely reminiscent of a gas mask”.[21] Dan straps it on, the Professor decants a special liquid into the lenses, and then:

There was a moment of chaos. The liquid before Dan's eyes clouded suddenly white, and formless sounds buzzed. He moved to tear the device from his head, but emerging forms in the mistiness caught his interest... Unbelieving, still gripping the arms of that unseen chair, he was staring at a forest. But what a forest! Incredible, unearthly, beautiful![22]

Magically visiting another world is an idea as old as storytelling; doing so via an inventor’s head-mounted gadget is comparatively new. Published well before the advent of modern computing, “Pygmalion’s Spectacles” arguably marks the first fictional depiction of what we would now call virtual reality (VR), a technology-driven experience of a virtual world.[23]

It would take nearly sixty years, but by the early 1990s Weinbaum’s vision seemed on the cusp of becoming technically feasible. In his 1991 book Virtual Reality, Howard Rheingold recounts this long, strange trip, methodically unpacking the complicated interplay between science and science fiction, magic and modernity. He also catalogues the accumulation of different technologies and innovations that appeared along the way: stereoscopic vision, computer aided design, the US military’s experiments with head-mounted displays for pilots, and even inventor Morton Heilig’s gimmicky Sensorama.[24] Rheingold’s definition of VR nods to this lineage:

VR technology resembles, and is partially derived from, the flight simulators that the Air Force and commercial pilots use to train pilots ... Virtual reality is ... a simulator, but instead of looking at a flat, two-dimensional screen and operating a joystick, the person who experiences VR is surrounded by a three-dimensional computer-generated representation and is able to move around the virtual world and see it from different angles, to reach into it, grab it, and reshape it.[25]

This decades-long history of VR, both fictional and non, is a complex and highly contentious one.[26] As American computer scientist Jaron Lanier puts it, “there is not one single detail of the story of VR that doesn’t involve a priority dispute”, including the origins of the term itself.[27] Computer scientist Ivan Sutherland is often credited with being the first to use “virtual” in reference to computer generated imagery, though it does not appear in his canonical works on the subject. Writing in 1965, he evoked an earlier set of literary traditions to explain his vision of a new kind of digital display:

If the task of the display is to serve as a looking glass into the mathematical wonderland constructed in computer memory, it should serve as many senses as possible ... With appropriate programming such a display could literally be the Wonderland into which Alice walked.[28]

Here, describing the way his proposed technology will feel – a magical transportation to another world – Sutherland recalls Lewis Carroll’s 1865 fantasy novel Alice in Wonderland, inspired in turn by Carroll’s encounters with the technologies on display at the Great Exhibition in London in 1852. Fiction to explain fact that would later inform fiction. Within three years of his “ultimate display” paper, Sutherland had built a working prototype at Harvard University.[29] His ”Sword of Damocles” (1968), with its now-familiar goggled headset, gave the wearer access to a rudimentary mixed-reality world, overlaid with simple wireframe imagery. The sardonically ominous name might have served as a warning, but instead the demo was seen as a herald of the future. It wasn’t much, but it was enough.

FROM VIRTUAL REALITY TO THE METAVERSE

Virtual reality – in the form of simulated worlds and the technologies to access them – has long been a recurring theme in science fiction, as much as a goal in engineering. Similar technologies appear in works like Ray Bradbury's The Veldt (1950) and Danile F. Galouye's Simulacron-3 (1964) which was famously adapted for television by Rainer W. Fassbinder as World on a Wire (1973). The arrival of commercially accessible home computers and video games in the 1980s led to movies like TRON (1982), built on a growing awareness of the new digital realm. From these many and varied accounts began to emerge a new set of cultural and social tropes, reflecting anxieties about what it might mean for reality to become virtual.

Vernor Vinge's 1981 novella True Names is one of the most significant harbingers of this shift in narrative tone. A scientist's science fiction writer, Vinge has never been a household name, but his work has had an outsized impact in certain corners of the tech world. He was teaching computer science at San Diego State University when he wrote True Names, inspired by his experience navigating the school's dial-in computer network. While it wasn't the first work of science fiction to emerge from the nascent hacker subculture, the novella was uniquely prescient.

The story unfolds in a digital netherworld that fully fits our modern conception of a metaverse: a persistent, graphically rendered online environment, parallel to the physical world, into which people project themselves to work, play, and socialise. The narrative follows a pair of small-time cybercriminals caught between the warring forces of the United States National Security Agency and a malevolent hacker called the Mailman. The protagonist, "Mr. Slippery", finds himself railroaded into helping the government (aka "the Great Enemy")[30] when his offline identity is exposed. Vinge likens this doxing to a sorcerer having their "true name" spoken aloud, making them vulnerable to capture and control.[31]

Like the influential text-based computer game Adventure, to which it knowingly alludes,[32] True Names is steeped in the tropes and imagery of fantasy fiction. Vinge's hackers refer to themselves as warlocks and operate in gangs called covens. The technology through which they enter the online world – a console that connects directly to user's scalp via "five sucker electrodes"[33] – is known as a Portal. Mr. Slippery and his cohorts hold secret meetings inside a medieval fortress surrounded by a moat of lava, guarded by a sphinx-like fire demon. Even the name of the virtual space they visit – The Other Plane – is imbued with arcane subtext. Vinge provides a clever in-world explanation for this mystic vernacular:

Sprites, reincarnation spells, and castles were the natural tools here, more natural than the atomistic twentieth-century notions of data structures, files, and communication protocols. It was, they argued, just more convenient to use the global ideas of magic as the tokens to manipulate this new environment.[34]

True Names' blurring of science fiction and fantasy works on multiple levels. It predicts the evolutionary path of user interface design, from the DOS command line to the visual metaphors of the graphical user interface, well before Apple's Macintosh made the latter standard. More significantly, it reframes programming – then a nerdy hobbyists' pursuit comparable to the chess club or ham radio – as a domain of sword and sorcery, wizards and warlocks, epic adventures and legendary deeds. It harkens back to Sutherland and his graduate students, who in creating a light pointer to operate inside their Sword of Damocles demo, chose to call it "The Sorcerer's Apprentice".[35] Vinge is (again) positing a future in which computer technology is fully indistinguishable from magic.

FROM VIRTUAL REALITY TO THE METAVERSE

The impact True Names had was significant. Mark Pesce, cyberneticist and co-creator of Virtual Reality Modelling Language (VRML), reflects on the book's influence:

Vinge's conceit of a magical universe as a description for cyberspace catapults the novella from the class of works that predict the future into the rarefied realm of works that have come to create it… He portrayed this future as so positively heroic — practically mythic in proportion — that any socially ostracised technophile would find within it the seeds of a personal mission.[36]

The book held immediate and obvious appeal for young programmers, whose enthusiasms tended towards the centre of the sci-fi / fantasy Venn diagram. It's hard to overstate the importance of a work that celebrated and made intensely visible their skills and potential. Vinge helped establish a shared stance on what the future of computing might hold.

One notable product of this legacy is Habitat, a 1985 LucasArts project inspired by "computer hacker science fiction, notably Vernor Vinge's novel, True Names".[37] Habitat was developed for the Commodore 64-based internet service Quantum Link (a direct forerunner to America Online) under the direction of Randy Farmer and Chip Morningstar. While it has been called the first massively multiplayer online role-playing game (MMORPG), the duo described their creation not as a game but as a "graphical many-user virtual environment, a make-believe world that people enter using home computers".[38] More succinctly, it was an early metaverse.

This early metaverse was hugely ambitious, particularly given the technical constraints of Quantum Link's dial-up network and the already-aging Commodore 64. The graphics were crude and the controls clunky, but Habitat boasted a vast map of interconnected "regions", interactive objects, and a functioning in-world economy (a portrait of Vernor Vinge graced the local currency). Among the creators' many innovations was the use of the term "Avatar" – borrowed from the Hindu word for a deity's corporeal incarnation on Earth – to refer to the player's onscreen analogue. Via customisable Avatars, players could navigate the environs of Habitat, chatting via text, trading goods and services, and building out the world with objects of their own design. Long before social media, at a time when few options existed for dynamic online communities at scale, the experience found a devoted fanbase. What made it work, for the roughly three years it endured, was the creators' fundamental insight that community, not hardware, was the core of the experience.[39]

As influential as True Names was and remains, the book left curiously little footprint on the popular lexicon. Paraphrasing Mark Twain's musing on the difference between the almost right word and the right word, Vinge describes his Other Plane as a lightning bug compared to the thunderbolt that was William Gibson's cyberspace.[40] Derived from cybernetics,[41] that world-changing neologism made its first appearance in Gibson's 1982 short story ''Burning Chrome",[42] written contemporaneously with True Names and published just a year later. The two stories cover remarkably similar narrative ground – both centre on small-time hackers venturing inside a computer network to battle a godlike threat – but the virtual worlds they depict couldn't be more distinct.

Where Vinge drew on his own experiences navigating an early internet, Gibson took his inspiration from watching teenagers hunched over arcade cabinets, hypnotised by the action on screen:

I could see in the physical intensity of their postures how rapt the kids were. It was like one of those closed systems out of a Pynchon novel: a feedback loop with photons coming off the screens into the kids' eyes… These kids clearly believed in the space games projected.[43]

William Gibson

Like the primitive video games from which it arose, the cyberspace of the author's early work (the so-called Sprawl series, beginning with "Burning Chrome" and running through Neuromancer and its sequels) is a realm of pure abstraction, an "electronic consensus-hallucination"[44] in which data takes the form of "bright geometries",[45] and "lines of light ranged in the non space of the mind".[46] Between these neon shapes is blackness and void. Nobody congregates in cyberspace to chat, play games, or go shopping – it's a harsh frontier where faceless corporations control everything, except the outlaw "console cowboys" jockeying to steal their data.

Gibson previewed an early version of "Burning Chrome" to an audience of four people at a Denver science fiction convention in 1981. Bruce Sterling, one of Gibson's cyberpunk contemporaries, was in attendance. In his preface to a collection of Gibson's early short stories, Sterling reflects on the importance of the author and his work.

It derives from a new set of starting points: not from the shop worn formula of robots, spaceships and the modern miracle of atomic energy, but from cybernetics, biotech and the communications web … in Gibson's work we find ourselves in the streets and alleys, in a realm of sweaty, white-knuckled survival, where high tech is a constant subliminal hum … Gibson's extrapolations show, with exaggerated clarity, the hidden bulk of the iceberg of social change. This iceberg now glides with sinister majesty across the surface of the late twentieth century, but its proportions are vast and dark.[47]

None of this should sound inviting, but to a great many, it was. True Names made the world within the computer magical, but Gibson made it cool, fetishising the aesthetics of tech even as he described a world ravaged by its effects. At a time when personal computers were still institutional-looking beige boxes, Gibson had his hackers access the virtual world via sleek, portable "cyberspace decks" plugged directly into their nervous systems – no goggles required. By bringing street-level attitude to high technology, he made "jacking in" to cyberspace seem both fashionable and thrillingly subversive. And like many of his contemporaries, he made clear the problematics and perils of these seductive virtual worlds – the rapaciousness of capitalism, the alienation, the loneliness.

FROM VIRTUAL REALITY TO THE METAVERSE

Some of Gibson's peers worried that the work was too bleak, too depressing. Jaron Lanier, arguably the most prominent evangelist for early VR, was publicly promoting therapeutic, even spiritual applications for the technology, believing it had the same consciousness-expanding potential hippies ascribed to psychedelics. In his memoir, he recalls reproaching Gibson for the downbeat tone of his work:

Neuromancer is definitely blowing away young [people], no question. But couldn't you try to come up with a more positive future, something to aspire to, since what you're doing is making all this stuff seductive, but it's a bummer?

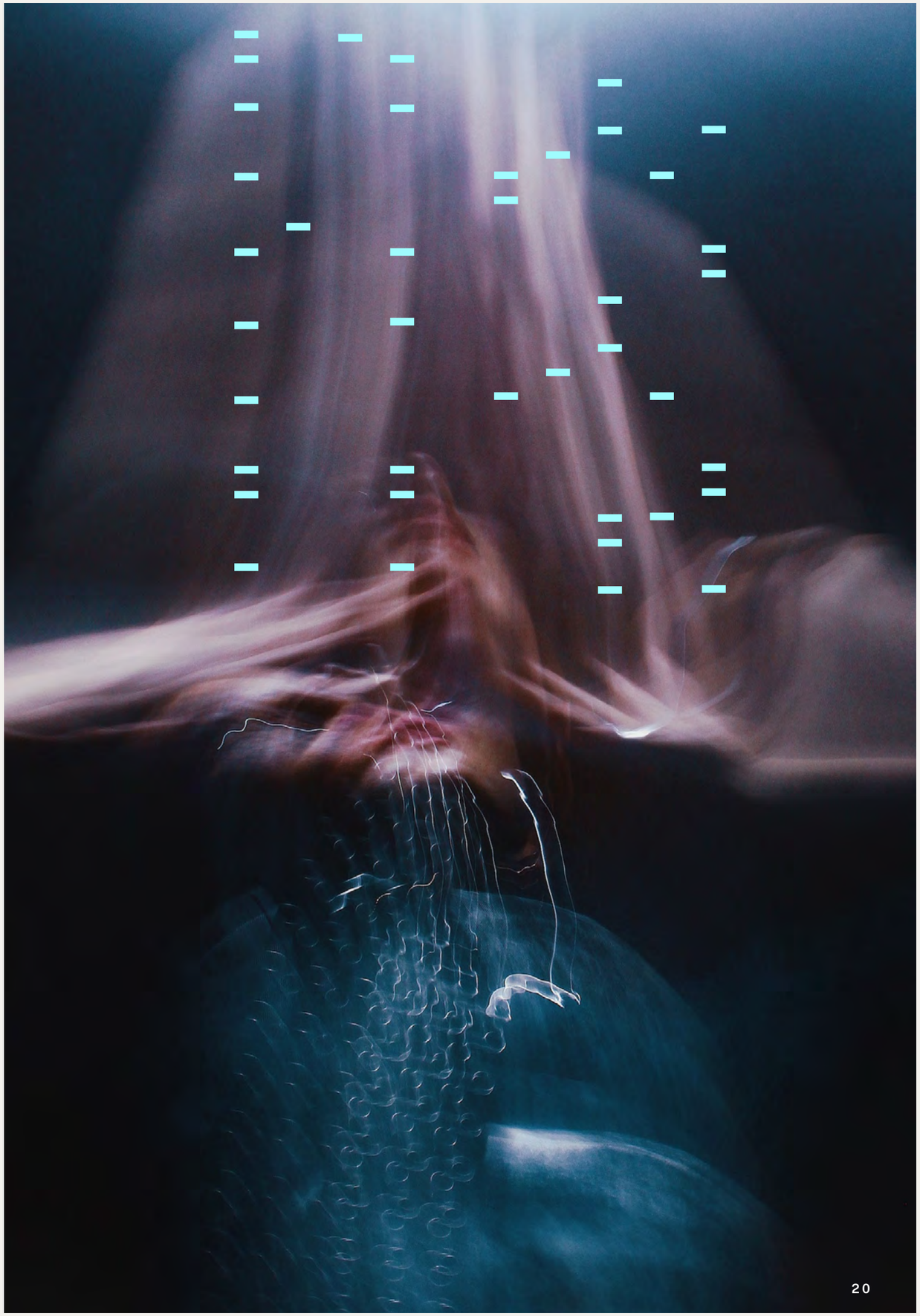
I could try, Jaron, but this is what comes out.[48]

It is interesting to contemplate Lanier's reproach. In asking for a more positive future, was he also asking for a different kind of world to be wrapped around the same technology? Was he asking Gibson to imagine the technology having a different kind of impact, or building upon a different set of affordances and systems? And does Gibson's answer suggest he cannot imagine VR without also imagining a kind of existential alienation and dread?

Despite being a "bummer," Burning Chrome and its successors were hugely popular, and helped make the concept of VR more legible to a mainstream audience, or at least a Silicon Valley one. The mid-1980s saw the first major strides in commercial VR development, with upstart companies like Autodesk and Lanier's VPL Research garnering headlines and generous funding. Gibson is unusually candid about his impact on the fledgling industry:

I met lots and lots of players in the goggles-and-gloves school of virtual reality... To a man or woman, they all allowed as how I had really helped them out. They had this idea, but they'd never been able to explain to anybody what it was. Once they had Neuromancer, they could just go around with a suitcase full of copies.[49]

By 1991, Howard Rheingold could write that, while the word "cyberspace" might indeed have originated in a science fiction novel, "virtual reality is already a science, a technology, and a business, supported by significant funding from the computer, communications, design and entertainment industries worldwide".[50] Clearly, this virtual reality was of tangible commercial and corporate interest.



FROM VIRTUAL REALITY TO THE METAVERSE

Just a year later, a new term would emerge to redefine virtual reality yet again. Published in 1992 and clearly influenced by Gibson's work, Neal Stephenson's novel Snow Crash coined the word ''metaverse'' and gave us an entirely different entry into cyberspace and VR.

The novel follows a freelance hacker cheekily named "Hiro Protagonist" who lives a double life worthy of a comic book superhero (or terminally online gamer). He resides in a rented storage unit and ekes out a meagre living delivering pizzas for a mafia-owned restaurant chain, but when he boots up his computer, straps on his VR goggles, connects to the fibre optics network, and enters the metaverse, he's a master swordsman with an opulent home and a fearsome reputation.

Stephenson describes Snow Crash as "both a dystopian novel, and a parody of dystopian novels",[51] and the book pushes the already-outré tropes of Gibson's cyberpunk to their absurdist limit. In Stephenson's near future, Los Angeles has been carved up by Pynchonian "Franchise-Organized Quasi-National Entities"[52] like Narcolombia and Mr. Lee's Greater Hong Kong. In the streets, lepers roast dogs on spits and people pull handfuls of worthless million-dollar bills from the gutter. The virtual world offers refuge, but only for those with means.[53] Not everyone finds their way into the metaverse, and even when they do, their experiences are defined by the technology and infrastructure they can afford and access. Both worlds, virtual and real, are messy. Snow Crash portrays 21st century America as an economically devastated, libertarian nightmare in which every institution is privatised, squeezed for maximum profit, and configured around elaborate digital systems of surveillance and control.

While the novel's metaverse construct is derivative of earlier virtual worlds, it quickly became the default template in the popular imagination, due largely to its comparative technological realism. Where Vinge's Other Plane is whimsically metaphorical and Gibson's cyberspace coolly impressionistic, Stephenson's metaverse is grounded in credible technical details. The author's early background in science and engineering informs his worldbuilding – everything from the exact circumference of the metaverse to the refresh rate of Hiro's VR goggles is precisely specified.

This realism extends to the rules and mores that govern the community. There are zoning regulations, height limits on avatars, and a loosely observed dress code. Though it's technically possible, you can't just teleport from location to location because "this would be confusing and irritating to the people around you. It would break the metaphor".[54] The specificity of Stephenson's vision, combined with technical advances already underway when Snow Crash debuted, helped make his metaverse a uniquely plausible fantasy, and for some, a clear blueprint for action.

AFTER SNOW CRASH: BUILDING THE FIRST METAVERSES

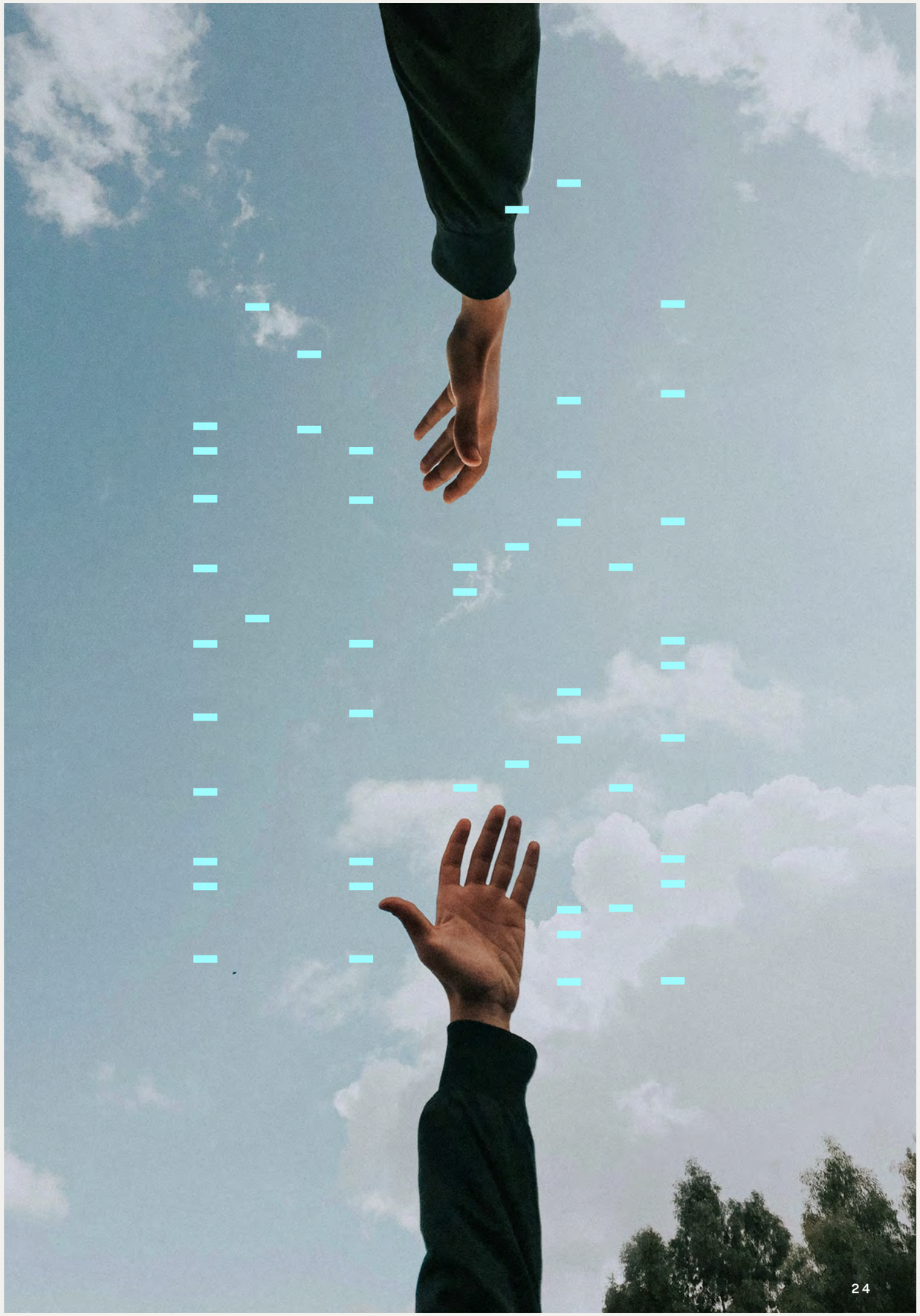
There is a continual interplay between the stories that emerge from science fiction and the technologies that both inspire them and are inspired by them. By the early 1990s the world wide web was open to the public, video games like DOOM offered fully-3D digital worlds to explore, and VR had entered mainstream consciousness through the backdoor of Hollywood movies. These ranged from The Lawnmower Man (1992), made in collaboration with Jaron Lanier's VPL Research, and William Gibson's own Johnny Mnemonic (1995), to the Michael Douglas-starring boardroom thriller Disclosure (1994), which posits VR as a gratuitously futuristic solution to document storage. The props in these movies weren't far removed from actual VR technology –helmets and haptic gloves all around –but their depictions of virtual worlds far exceeded what was feasible at the time. Their fanciful FX sequences, rendered in then-cutting-edge CGI, helped create the conditions to make Snow Crash an enduring crossover success, and to inspire fantasies of making metaverse-style worlds a reality.

No attempt was more ambitious or broadly successful than Linden Labs' Second Life, which went live in 2003. Second Life, a virtual world / social platform clearly harkening back to Habitat, boasted over a million users at its 2000s peak, attracting corporate sponsorships and outsized publicity from credulous journalists and curious academics.[55] In classic Silicon Valley style, creator Phillip Rosedale credits his experience at Burning Man, the art and technology festival held annually in the Nevada desert, with helping him realise his long-gestating vision of an immersive online community. Notably, Rosedale cites Snow Crash as another key influence:

Stephenson, in Snow Crash, had presented a more tangible, achievable idea. The metaverse, as Stephenson described it, and I think of course it wasn't just me who felt this way, but it seemed to many engineers and technology pioneer[s] like something that could be built. It seemed like something that was feasible.[56]

With Second Life, Rosedale sought to emulate the decentralised, pro-social aspects of Burning Man – the egalitarian spirit, the informal barter economy, and the "mystical quality that demolished barriers between people"[57] – inside a virtual world. This was not a game, per se, but another sphere for living.[58] Unlike VR, Second Life was accessed via a computer screen, and the limits of digital graphics, network latency, bandwidth, and processor power very much shaped the experience, which felt quite different from the immersive worlds promised by science fiction.

Second Life couldn't have been further from the cutthroat, satirical vision of Snow Crash, but Rosedale is clear he was building a kind of metaverse, with a twist. In asserting Second Life would be an online world created and owned by its users, Rosedale was trying to build a virtual world that was less of a bummer. He was attempting to disentangle VR from its increasingly dystopic fictional narrative – user-generated not corporate-led – but the pragmatics of establishing and running a fully-fledged virtual world collided quickly with regulators and policy makers. Concerns about fiat currencies, money laundering, and prostitution all surfaced, alongside consumer fears and anxieties about sexualised avatars and anti-social behaviour.[59] Ultimately, Second Life's initial growth curve stalled and the platform was eclipsed by the birth of social media more broadly, and Facebook more particularly.[60] That said, during the pandemic-era shift towards socialising online, Second Life got a second look, and its nearly 1 million users were re-energised.[61]



BUILDING THE FIRST METAVERSES

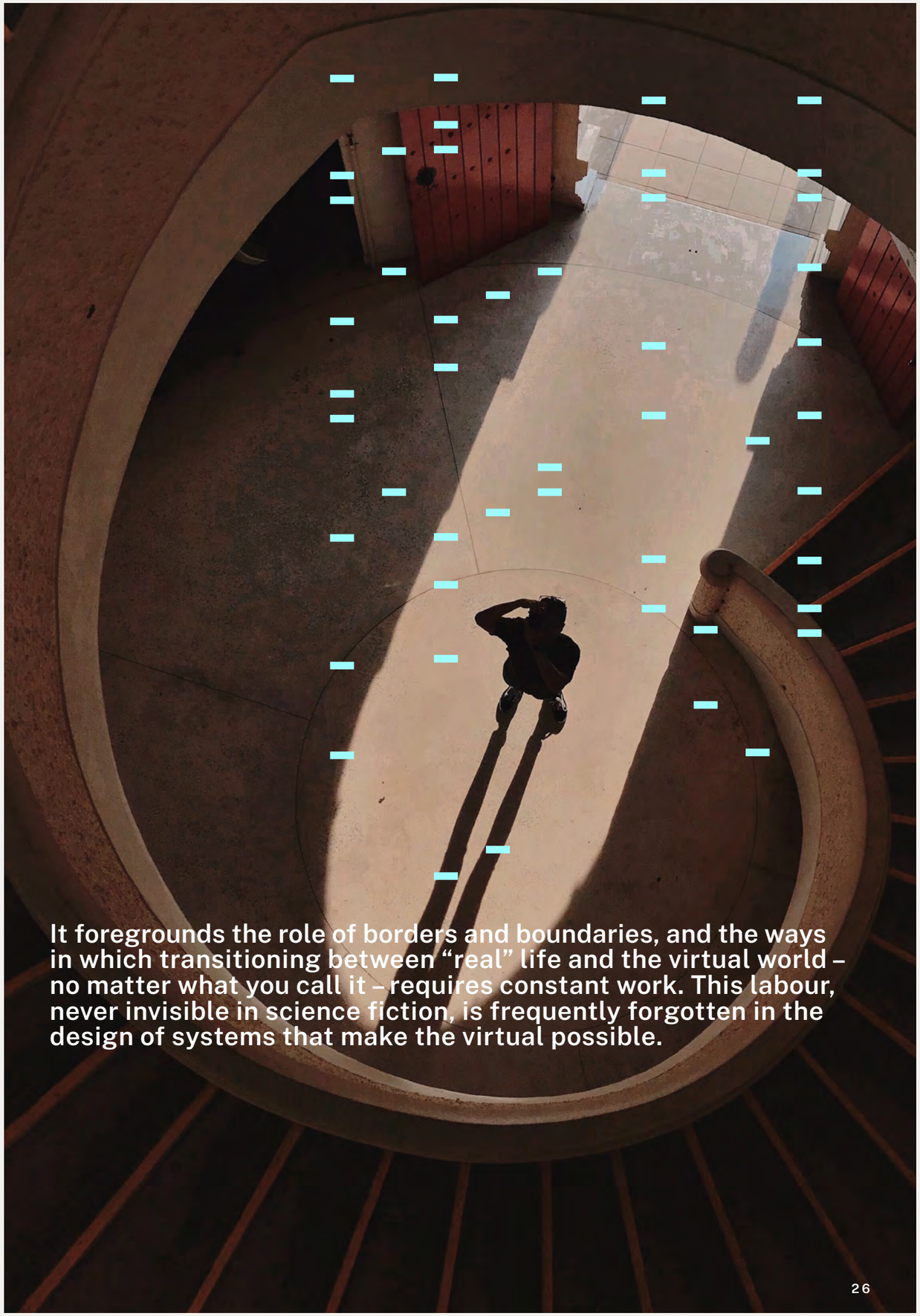
Renewed interest in a Stephenson-style metaverse might be credited in part to the 2011 novel Ready Player One, the most influential depiction of a metaverse-style online world to emerge post-Snow Crash. Written by Ernest Cline and later adapted into a blockbuster movie (2018) by Steven Spielberg, the book offers a familiar premise. The protagonist, Wade Watts, is an impoverished young man living in a dystopian future, where he shares a dilapidated trailer with his aunt and 15 other people. His most prized possessions are the "console, haptic gloves, and visor"[62] which, in combination with a jury-rigged Wi-Fi antennae, enable him to access a more glamorous world online. Cline's version of the metaverse is called the OASIS, and the coin of the realm is knowledge of 1980s pop culture ephemera, which the protagonist – and the author – possess in encyclopaedic abundance.

The plot of Ready Player One involves a scavenger hunt designed by the OASIS's late creator, in which competitors vie for an "Easter egg" that confers control of his trillion-dollar estate. Both the novel and its movie adaptation are best known for their anarchic mashups of intellectual property, combining characters, props, and settings from across the nerd-culture canon. As in many corners of modern social media, fandom is the organising principle of the OASIS. The novel's protagonist explains:

The Firefly universe was anchored in a section adjacent to the Star Wars galaxy, with a detailed recreation of the Star Trek Universe in the sector adjacent to that. Users could now teleport back and forth between their favorite fictional worlds. Middle Earth. Vulcan. Pern. Arrakis… Worlds upon worlds.[63]

It might seem like wielding a Star Wars lightsabre while riding a TRON light cycle through the streets of Neo Tokyo would be a niche proposition, with a limited lifespan of novelty, but it points to a persistent and interesting paradox. While pastiche and mash-ups offer a very particular kind of pleasure in Ready Player One, so equally does the maintenance of boundaries and the ability to police participation. The novel, like Gibson's and Stephenson's work before it, foregrounds the role of borders and boundaries, and the ways in which transitioning between "real" life and the virtual world – no matter what you call it – requires constant work. This labour, never invisible in science fiction, is frequently forgotten in the design of systems that make the virtual possible.

Ready Player One's remixing and matching, imported from contemporary social media, has become standard in metaverse-adjacent sci-fi movies like Wreck It Ralph (2018) and Free Guy (2021) and is the defining feature of the video game Fortnite, perhaps the nearest thing to a scaled-up, functioning metaverse currently on offer. Though not without its detractors, Cline's unbridled fanboy enthusiasm has proven both prophetic and enormously consequential, reshaping the popular perception of what a metaverse might look like, and bringing the word into even wider circulation than it had previously enjoyed.



BUILDING THE FIRST METAVERSES

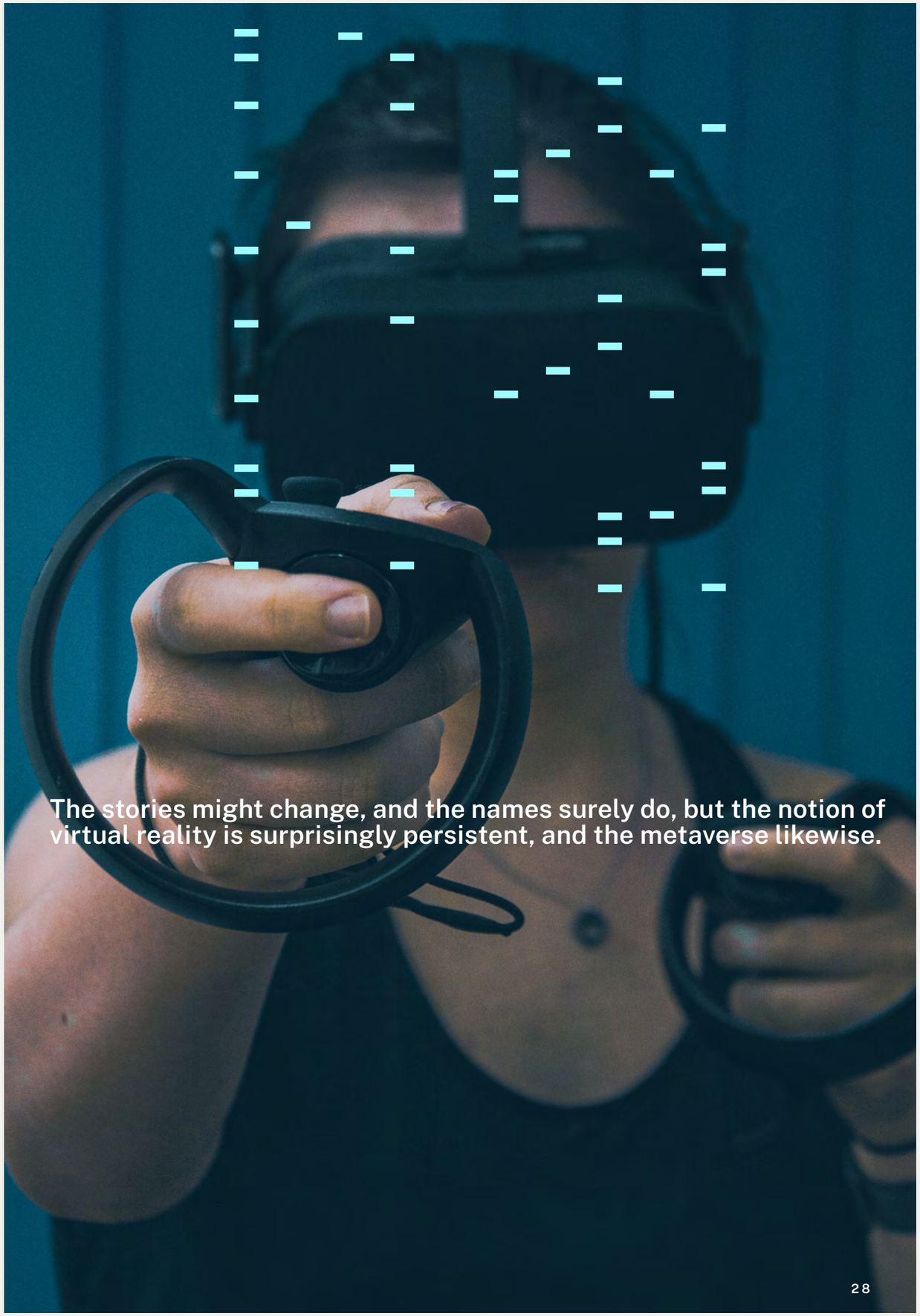
During the 2010s, companies began aggressively building various kinds of virtual and augmented reality technologies, predominantly focused on head-mounted displays for gaming. There were offerings from Microsoft (HoloLens) and Sony (PlayStation VR), as well as newer start-ups. Augmented reality company Magic Leap, founded to much fanfare in 2010, brought Neal Stephenson aboard as their chief futurist, a position he held until 2021. Palmer Luckey's Oculus VR, founded in 2012, sparked a new wave of virtual reality hype and was acquired by Facebook in 2014. Google tried a different tack with Google Glass, a failed experiment in wearable tech. All these endeavors focused on building the technologies necessary to access a virtual realm, with little consideration for the broader context of the realm itself.

Even against this heated backdrop of activity and spending, there was more than a little surprise when the metaverse reappeared at the center of a corporate announcement. In October 2021, Facebook CEO Mark Zuckerberg announced the company would be rebranding to "Meta", with a significant change in mission. Taking the metaverse as a shared conceptual and technological goal, he wrote:

Meta's focus will be to bring the metaverse to life and help people connect, find communities and grow businesses. The metaverse will feel like a hybrid of today's online social experiences, sometimes expanded into three dimensions or projected into the physical world. It will let you share immersive experiences with other people even when you can't be together – and do things together you couldn't do in the physical world.[64]

The announcement was followed by an hourlong concept video entitled "The Metaverse and How We'll Build It Together", in which Zuckerberg personally leads the viewer through his vision for the virtual world, aided by copious green screen effects.

Meta's video is unusual in scope and ambition, but not in kind. Though rarely recognised as such, some of the most influential science fiction of recent years has arrived in the guise of corporate marketing. Following on from J.G. Ballard, Bruce Sterling characterises this as "invisible literature", which he says "shapes our cultures below the level of recognition."[65] Futurist Scott Smith has further described such corporate visualisations as "flatpack futures", evoking the tasteful, readymade efficiency of an IKEA showroom.[66] Apple recently made a notable contribution to the genre, unveiling their long-awaited mixed reality headset, the Vision Pro, in a slickly produced concept video that draws unmistakably on science fiction tropes and aesthetics. Apps hover in the air and respond to voice commands like they do for Marvel's Tony Stark. Several shots of users strapping on their headsets and entering the virtual world borrow liberally from the visual language of Spielberg's Ready Player One.[67] The video has already been watched 54 million times on YouTube. The stories might change, and the names surely do, but the notion of virtual reality is surprisingly persistent, and the metaverse likewise.



THE PERILS AND PROMISE OF SCIENCE FICTION

The science fiction origins of virtual reality and the metaverse seem relatively straightforward. The metaphors might vary – ascend, jack in, goggle in – but the requirements remain quite consistent: persistent, seamless, scalable, fully immersive virtual worlds, where users interact as digital avatars. The technologies and infrastructures that enable this – VR headsets, the internet, computer hardware and software, telecommunication and energy grids, payment and identification systems – are sometimes explicated and always implied.

The temptation to take this as a roadmap, or a blueprint, for how to build a functioning metaverse must be quite tempting, but there are considerable limitations to treating fictional design constraints as necessary facts. For one, narratives of the future are inevitably bound up in the contexts in which they are written. No matter how compelling, science fiction invariably says more about the time and place of its production than it does about the future. This is no less true when it comes to virtual reality and the metaverse.

For all its imaginative foresight, Stanley Weinbaum's depiction of a proto-VR device in Pygmalion's Spectacles was still tethered to the photographic technology of the time, and his characters couldn't escape its limits:

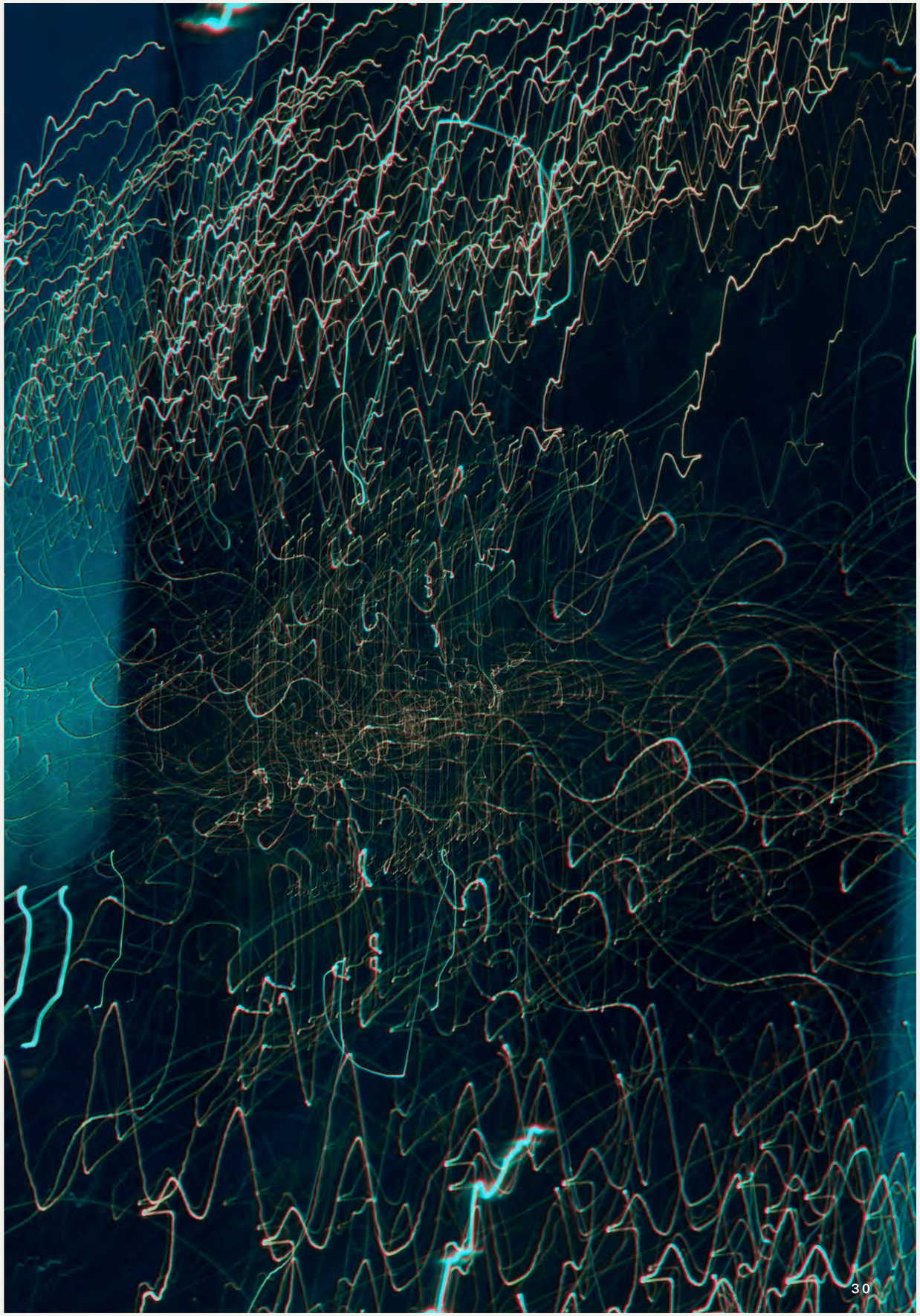
[The professor's] voice turned angry. "Fools! I bring it here to sell to Westman, the camera people, and what do they say? 'It isn't clear. Only one person can use it at a time. It's too expensive.' Fools! Fools![68]

Looking back on the Portal technology of True Names – which requires users to train their imaginations to fill in the blanks of a lo-res image signal – Vernor Vinge admits he was simply unable to imagine the bandwidth existing for fully-rendered 3D worlds. And William Gibson would be the first to point out nobody in Neuromancer ever uses the most ubiquitous tech of the 21st century: a smartphone.

By the time Snow Crash debuted, a headset felt more plausible than the Portals and wetware implants of earlier texts, but Neal Stephenson's commitment to technical realism proved short-sighted in its own way. In a recent interview about the real-world prospects of the metaverse, the author reflects:

We absolutely do not need AR and VR in order to build the metaverse. 30 years ago when I wrote [Snow Crash] I had a different view of it and I assumed it would be all about goggles. A lot has changed since then and we've learned a lot.[69]

Today, there exist a myriad of different ways people encounter virtual worlds and augmented realities. Hundreds of millions of people engage with 3D worlds through the 2D screens of laptops, game consoles, and smartphones. During any given week, more people gather within the crudely rendered environments of Roblox and Minecraft than have ever purchased VR hardware. Even Apple's Vision Pro, the latest in a long line of increasingly sophisticated VR headsets, is arguably more focused on augmenting online experiences than providing a gateway to another world. In order for the metaverse to succeed, it may need to forego the fantasy of transportive total immersion and meet users where they already are.



THE PERILS AND PROMISE OF SCIENCE FICTION

It isn't just the state of existing technology that gets reinscribed in science fiction, but also the prevailing and sometimes dominant social and cultural mores. In shaping narratives, science fiction unfolds ideas about gender, race, class, power, sexuality, relationships, and society at large. This capacity can be, and indeed has been, leveraged to design better futures, but has also served to reinforce unhelpful conceptions of the world as it already exists.

The cyberpunk stories that have largely defined the metaverse, most written in late 20th-century North America, typically revolve around tech-savvy young men embarking on variations of the hero's journey, through which they self-actualise, vanquish their enemies, and get the girl (or lose the girl, but pine for her anyway). As Karen Cadora writes in her critical essay "Feminist Cyberpunk": "Masculinist cyberpunk is very much a boys' club. The protagonists of cyberpunk novels are nearly always male. When women do appear, they hardly ever transcend feminine stereotypes".[70] Sometimes these stories feel particularly narrow, or normative, and sometimes they seem to be celebrating subcultures that are, themselves, quite insular. For instance, Ready Player One has been widely criticised for valorising the kind of nerd-culture gatekeeping that fuelled the online harassment campaign Gamergate.[71]

This is especially troubling when there exists such a clear and persistent feedback loop between storytelling and technology development – a connection sufficiently well established to be the subject of mockery, as in a tweet from The Onion's Alex Blechman:

Sci-Fi Author: In my book I invented the Torment Nexus as a cautionary tale
Tech Company: At long last, we have created the Torment Nexus from classic sci-fi novel Don't Create The Torment Nexus[72]

For all their seductive kit, the fictional futures of Neuromancer, Snow Crash, and even Ready Player One are also dystopian tableaus of societal and environmental collapse. Lanier worried these visions of virtual worlds were a bummer, but perhaps we need to pay heed to the dystopia, and what it indexes. Why are imaginings of advanced technologies, like VR, so frequently coupled to rampant capitalism, aggressive surveillance, and unrelenting economic and social inequalities? What does it say that in science fiction the metaverse represents escape – not only from poverty and boredom, but from a world where your abilities have little worth? In this construct, the virtual world is at best an ambivalent geography.

How might we imagine the metaverse not as an escape from an unwelcome reality, but as something more positive and psychologically integrating?

If the metaverse is meant to serve as a new, widely shared social platform, it's worth reflecting not only on the technological affordances necessary to deliver it, but also on whose values, abilities, and beliefs it will elevate. As the real-world future of the technology unfolds, it won't centre on a hero, protagonist, or Hiro Protagonist. It will involve countless users, creators, and contributors from across the globe, and the least among them may end up impacting the system in the most profound ways. How can we ensure science fiction reflects this, exploring both the perils and promise of the technology, rather than simply the building of it? How can we use science fiction to help ensure the metaverse/s we build are safe, sustainable, and responsible? And what can we learn from these origin stories about the metaverse, and ourselves?

A SELECTED TIMELINE
THE METAVERSE IN SCIENCE FICTION

1935
Pygmalion's Spectacles
by Stanley G. Weinbaum

1950
The Veldt
by Ray Bradbury

1964
Simulacron-3
by Daniel F. Galouye

1981
True Names
by Vernor Vinge

1982
Burning Chrome
by William Gibson

1982
TRON directed
by Steven Lisberger

1984
Neuromancer
by William Gibson

1992
Snow Crash
by Neal Stephenson

1999
The Matrix
directed by the Wachowskis

2011
Ready Player One
by Ernest Cline

There's little question science fiction strongly informs our collective future imaginary, and many of the technical systems we build. In focusing solely on the technologies within the stories, however, we often miss the larger context and lessons. One of the great strengths of science fiction as a vehicle for exploring the future is its focus on the human-scale consequences of radical change. From space travel to cyberspace, science fiction envisions not only new innovations, but the complex systems in which they're embedded and the social ripple effects of their deployment.

To ignore the entirety of that picture, plucking out the shiny gadgets and stripping them of context, is an unfortunate misuse of the genre. It is also a missed opportunity. Jaron Lanier observes that "darkness never seems to serve as a warning when it comes to computer stuff in science fiction",[73] and we have the opportunity to prove him, just a little bit, wrong. Science fiction is a space within which to interrogate the consequences of technological transformation, and we can and should read and create stories from this perspective.

02.

ALTERNATE HISTORIES OF THE METAVERSE

Cybernetics pays attention to the system, including its human, technical, and environmental components. The cybernetics practice that we are developing at the School of Cybernetics also pays significant attention to where that system has come from and where it is going. We routinely turn to history as a way of gaining these insights. We teach our students to explore the people, places, and moments that gave rise to our current systems. Surfacing those people, places, and moments helps ground our understanding, and reminds us that most technologies, and indeed most systems, came from somewhere and someone. We believe that such histories help inform our understanding, as well as provide critical frameworks within which to explore present and future systems.

Often this requires a deeper look into the past than we might imagine necessary. Sometimes the only way to see a system is when it is so well established as to be entirely stable, or when it is no longer in use and its skeleton is bare. In doing this, we might find alternate histories – threads that carry through into the modern system, and give us a new perspective. Or we might find analogous histories – a system that does the same thing as the modern system, even if it is not considered to be the same thing. And frequently there is a little bit of both. This kind of approach to understanding systems is cybernetic, centring on the relationships and dynamics between technologies, humans, and the places in which they enact complex systems.

ALTERNATE HISTORIES OF THE METAVERSE

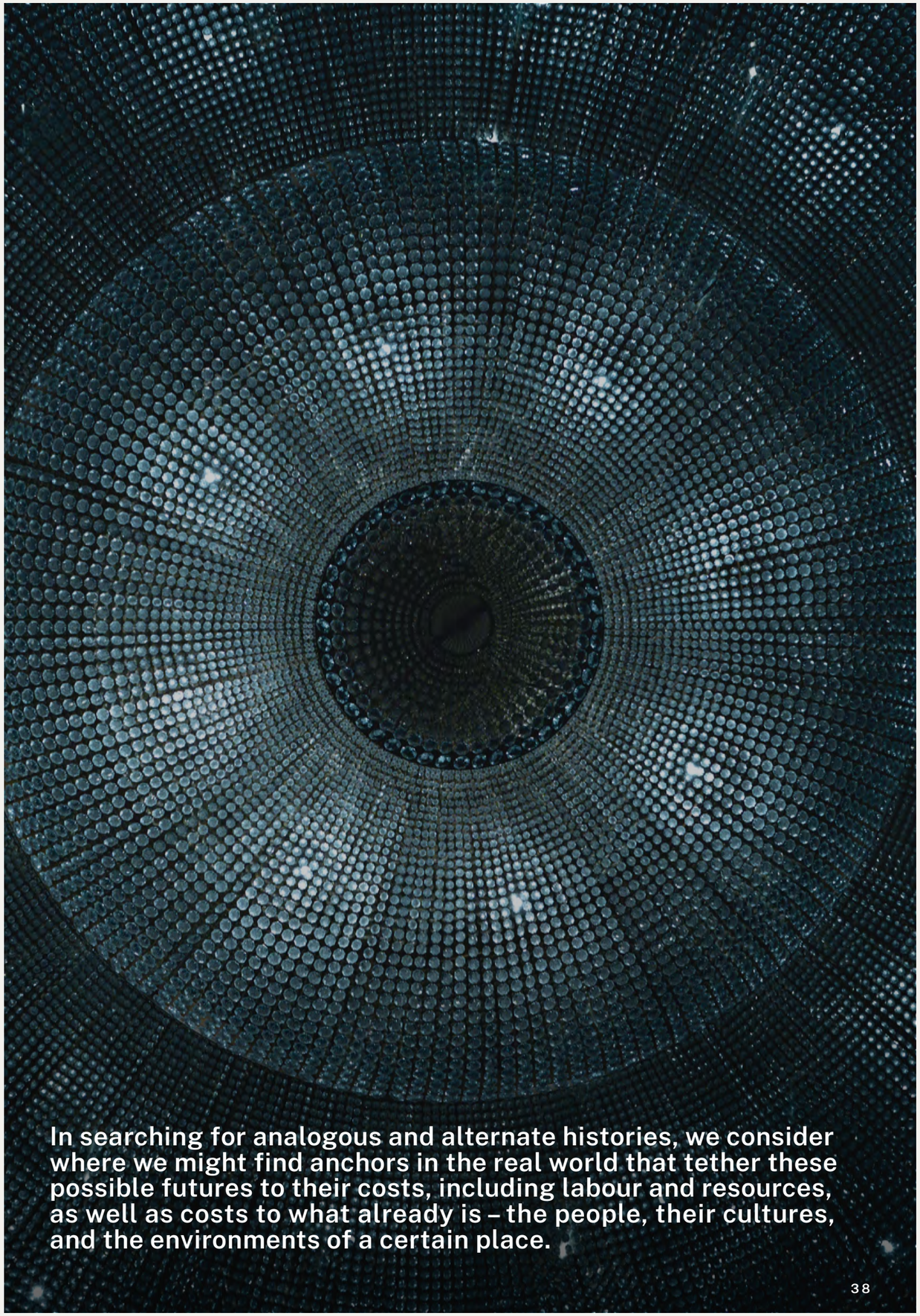
In these moments, slightly less straightforward kinds of histories of complex systems – the kind that illuminate indirectly, or by equivalency, rather than by direct lineage – can be useful. For instance, at the School, we have looked to the role of the Electrical Association for Women in managing the introduction of electricity into British homes in the 1940s as a site for inspiration as we consider the energy transition in the 21st century.[74] We have also considered the uncanny parallels between the evolution of steam engines and the development of AI – where the former lets us ask a vastly different set of questions about unintended consequences of AI, as well as questions about the necessary capabilities, organisations, and regulations to ensure safe, sustainable, and responsible AI at scale.[75]

This approach, where history provides a different kind of backstory or vantage point, provides us with a set of critical questions with which we can interrogate present and future systems. We are interested in where systems come from. What are their intellectual genealogies? Who are the people that made these systems? What was around them at the time? What did they care about? What didn't they care about? And how do we unpack all of that?

It allows us to surface agendas clearly and observe the consequences of decisions playing out over time. This zoomed-out view and the clarity it brings can help guide our decision-making in the present as we navigate towards safe, sustainable, and responsible design. It can make clear otherwise opaque affordances or design choices or expose the consequences of decisions that take generations to unfold. It illuminates some of the choices that have been made to tidy up the mess, including erasures and silences that have been created in so doing.

We have explored the history of many different technologies this way, especially those which continue to unfold or shape our present worlds. We have unpacked the history of robots, artificial intelligence (AI), radio, electricity, the typewriter, and even the telegraph line as ways of making sense of contemporary systems or reminding ourselves of their exceedingly long backstories.[76] We have also looked at broader socio-technical systems this way – exploring the history of the library as a complex dynamic system and even the histories of data as a cultural category.[77] Much of this work has helped reframe the narrative of newness associated with technologies it – helps locate the technologies and the systems in which they are embedded in broader contexts, and conversations.

In this section we apply this technique to the metaverse. Informed by some of the stories about virtual worlds in the previous section, we dig further into the places these stories have emerged on a global stage. We unearth drivers of human behaviour that are pertinent to how people will be drawn to or away from the metaverse in our modern times.



In searching for analogous and alternate histories, we consider where we might find anchors in the real world that tether these possible futures to their costs, including labour and resources, as well as costs to what already is – the people, their cultures, and the environments of a certain place.

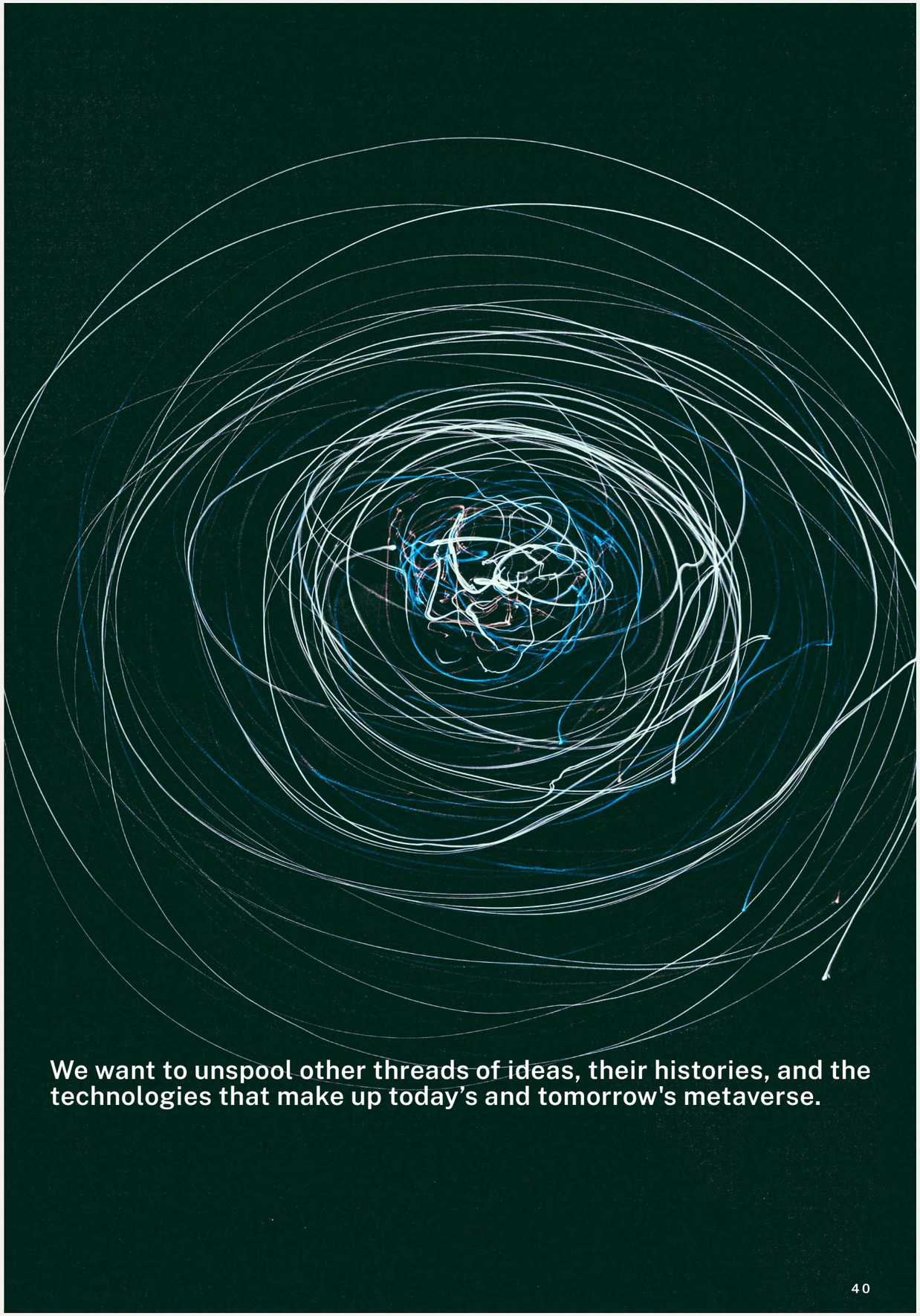
LEARNING FROM HISTORY: A DIFFERENT KIND OF APPROACH TO SEEING THE SYSTEM

So how might we unfold a historically informed approach to the metaverse? What narratives and throughlines can illuminate the metaverse in unexpected ways? After all, the metaverse is hardly old enough to have fully-fledged and well-reported histories. Sometimes we are confronted with technologies and systems that do not have clear and linear histories – the metaverse, as a cybernetic system, both real and imagined, might be one of them. In these instances, we could look to the history of the ideas it embodies, or the technologies it relies upon. We could ask ourselves, what might the metaverse's underlying ideas be, and what might older versions of those ideas tell us about how to enact it now and into the future?

As we saw in Chapter 02, the idea of a futuristic world, bounded in time and space, made possible and accessed through contemporary technology, is hardly new. Nor is the drive to create such worlds and gleefully inhabit them – in fact and in fiction. In seeking out a historical vantage on the metaverse, we can also look beyond science fiction. Not all virtual worlds, bounded in time and space, are futuristic or future-looking per se. Some of them are more hyper-real, an exaggeration of the physical world, an amplification of it, or a carefully edited curation. Here one could look to everything from cruise-ships, which have always shaped our fictional imaginings of space travel (hello Jules Verne 1874),[78] to resorts and planned cities (Las Vegas and Disneyland being paradigmatic examples).

In this chapter, we want to unspool other threads of ideas, their histories, and the technologies that make up today's and tomorrow's metaverse. Here, we are building on the work of Genevieve Bell, and her assertion that the metaverse has a broader set of histories, beyond the obvious one. For her, this is tightly linked to ideas about ''world making'' with events such as the Great Exhibition in London in 1851.[79] We will use slightly indirect histories as a form of exploration.

Specifically, we want to share two historical accounts that offer quite different foundational metaverse constructs: virtual space as revealed in the story of the American instantiation of the World's Fair – the World's Columbian Exposition in Chicago in 1893 – and whole-of-world system technological apparatus as shown through the story of Australia's Overland Telegraph Line. Both accounts are rooted in the 19th century and suggest that the idea of a virtual world has surprising, generative roots and that there might be much to learn from exploring these systems.



THE FIRST WORLD'S FAIR – A VIRTUAL WORLD

"I think the first impression …when you get inside is one of bewilderment. It looks like a sort of fairyland. As far as you can look in any direction, you see nothing but pillars hung about with shawls, carpets, &c., with long avenues of statues, fountains, [and] canopies …"[80]

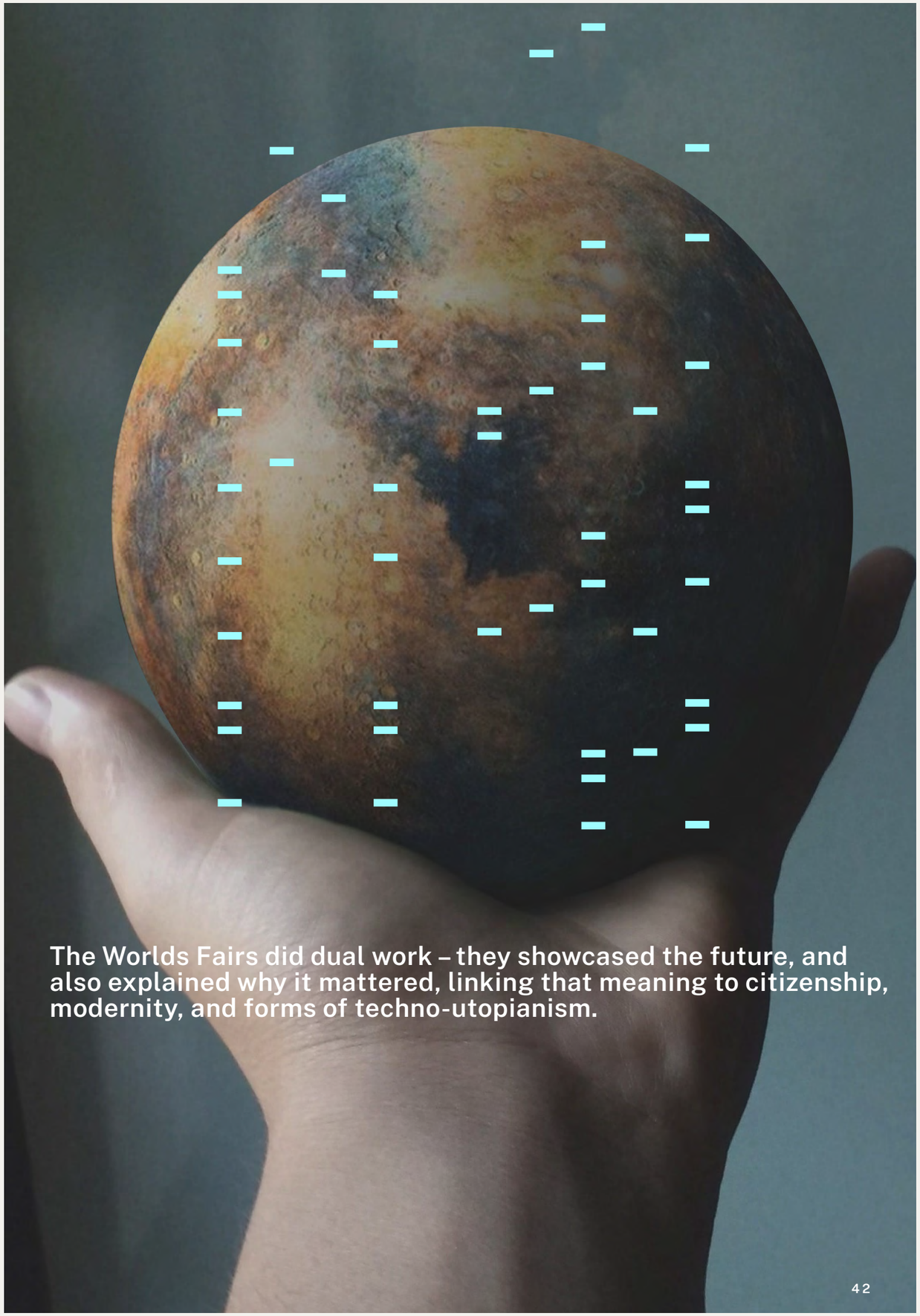
That is Charles Dodgson, who would become Lewis Carroll, describing his first encounters with the very first World Exposition back in in 1851. This was the beginning of the era of World's Fairs – the first, purpose-built world designed to give people an encounter with the future and with the wonder it could provoke. This is a sort of virtual world, a virtual reality, that lived beside the built and physical one. Lewis Carroll's encounters with the future in 1851 helped him frame his fantastical world of Wonderland; a world that Ivan Sutherland – an innovator in computer graphics – would evoke to help explain the future he was building more than 100 years later. In delightful circularity, we now see Biennales and World's Fair-like events being held in the metaverse.[81]

The idea of virtual worlds might have been charged with additional meaning in the 20th century – given a digital context and the possibilities of a world within a computerised realm – but the idea of a self-contained, hyper-real, extraordinary space has unexpected roots in the 19th century. And so, it is helpful to retrace these stories, beginning with the Crystal Palace. The Crystal Palace, or more correctly, the Great Exhibition of the Works of Industry of All Nations, was the brainchild of Prince Albert, Queen Victoria's beloved consort.[82] It took place in a massive, bespoke, multi-storey glass structure in the middle of London's Hyde Park in the summer of 1851. There were more than 100,000 exhibits on display, canvassing the most recent innovations and technological breakthroughs, including arc lights, electricity, and telegraphy, as well as artefacts selected from the far reaches of the British empire. The most recent technologies were used to build this self-contained world – a confection brought into existence to display a future, and all its spectacle.[83]

Not everyone welcomed the Crystal Palace, or the opportunity to encounter this new kind of world. Some worried such a space, set apart from daily life and social norms, would surely encourage lawlessness, violence, and prostitution. Others complained about the content, about who and what was on display and also who and what wasn't.[84] In the press, there were months of ridicule – Colonel Charles Sibthorp, the Nigel Farage of his day, described it as "one of the greatest humbugs, frauds and absurdities ever known".[85] Still others question the motives of its founder; in the Houses of Parliament, Prince Albert's status as a foreign prince led members to suggesting the Great Exhibition was just a publicity exercise to encourage and perhaps mask the rise of immigration in Britain. Undeterred by all this controversy, or maybe compelled by it, nearly 6 million people – or a quarter of the population of Great Britain – would visit the Exhibition in its five-and-a-half month run.

The exhibition benefited from the rapidly expanding British railway network and its multiclass fare structure – church and work outings made the pilgrimage, and special trains were laid on to bring people in from regional centres. In fact, Thomas Cook – the businessman who founded the tourism company Thomas Cook & Sons – got his start in the tourism business arranging package tours to the Great Exhibit. Over 150,000 people attended with his support. The entrance fees were also set in such a way as to encourage maximum participation – a shilling, or about a week's wages for the average British working man, would gain you access. Once you got there, the Crystal Palace was designed for engagement, from its maps and souvenir guidebooks, to the first flushing public toilets in gendered bathrooms, to its corporate sponsorship in the form of Schweppes, it was all about the experience of the visit, individually and collectively.

The Great Exhibition would kick off more than a century of World's Fairs – spaces of spectacle and wonder that would shape the world around them.[86] In so doing, they also created a form of audience participation – both as individual and collective encounters – that were fully embodied and sensory. Starting with the Great Exhibition and expanding out into Europe and the United States, it was quickly clear that there was a willing and paying audience for such spectacles. The World's Fairs created a place where the public could and did interact with new and emerging technologies. These technologies appeared both as vehicles for corporate agendas, as well as national and cultural ideological advancement.



The Worlds Fairs did dual work – they showcased the future, and also explained why it mattered, linking that meaning to citizenship, modernity, and forms of techno-utopianism.

THE WHITE CITY, 1893

When the World's Columbian Exposition, or Chicago World's Fair, was deployed in 1893, marking the 400th anniversary of Christopher Columbus's voyage to the ''new world,'' it was designed to utterly eclipse the 1889 Paris Exposition Universelle, which had given the world the Eiffel Tower. This Exposition manifested itself ambitiously and completely,[87] becoming a whole city with 200 newly-built structures clad in white stucco, laid out following the latest dictates for urban planning. It was engineered to impress and to establish America, once and for all, as the clear owner of THE FUTURE. Its gleaming facades and sparkling lights earned it the nickname the White City.

There was electricity everywhere, including lights, a fully electrical kitchen with dishwasher, an electric chicken incubator, Thomas Edison's kinetoscope and the first public movie house, multi-phase power generators, moving walkways, and the world's first Ferris Wheel. There were promenades and buildings dedicated to different countries, different industries, and even one dedicated to Women, designed by a female architect and containing scientific, literary, and artistic works by women, which featured regular public lectures and speeches.[88] The White City, as it became known, was all spectacle, all the time, and a 50 cent ticket got you through the gates.

Whilst obviously influenced by prior Expositions, the White City was a very American affair. Supported and aggressively promoted by American industry, the White City was a branded landscape, with soon-to-be familiar names like General Electric, Western Electric, and Westinghouse showcasing their technologies and their visions for the future. The desire for businesses large and small to be seen and to be connected with the spectacle of the Exposition speaks to role of marketing, branding, and also to the ways in which broader cultural agendas can and did frame innovation – in this case, aligning companies with an American ideal of science-backed progress.

American publisher John Brisben Walker penned a vivid description of the World's Columbian Exposition, or Chicago World's Fair, for his readers in 1893.[89] In Brisben Walker's description, the Fair is both real and imagined – both experienced and fantasised. It is safe and a spectacle. It is hyper-real and virtual all at once. And the technologies, organisations, and infrastructures that make it possible are only evoked as sideshows to the larger performance of perfect freedom within its contained world.

World's Columbian Exposition

A sense of surprise, of delight, a suggestion of enchanted regions, came to one as he stands for the first time in the great court of the World's Fair. During the first hour spent in this region of wonders three thoughts take possession of the mind .... the first is of the vast change which this object lesson will make in the minds of millions who visit it, broadening, opening, lighting up dark concerns, bringing them in sympathy with their fellow-men, sending them back to homes, however humble, with thoughts that will beautify and gladden entire life-times, furnishing a topic for countless winter nights' exchanges of opinions and themes of stories for generations as yet unborn.

It is safe to estimate that our civilisation and advance in the liberal arts will be moved forward by a quarter of a century as a result of this marvellous Exposition. The second thought which forces itself upon the mind, and remains as an undertone at every minute of a memorable week's stay, is the ever present proof of the pleasure which this enchanted land brings to the missions who are visiting it. What a satisfaction to the men who have given time and labour to building up this great work, to see upon the faces of the throngs who are moving up and down every aisle and every avenue, proofs of such pleasure, satisfaction and joy, such complete and absolute surrender to the surrounding beauty and interest, as come but seldom into the lives of even the luckiest of humanity ...

I walked many miles of avenues on that day: everywhere unmistakable signs of enjoyment, everywhere the comment of intelligent appreciation, and above all, everywhere the utmost good-nature. That, to my mind, was the most marvellous exhibition of all, that in a crowd containing more than three hundred thousand souls there was not ... one drunken man. What a change has come over our civilisation in the past twenty-five years! Such a crowd, anywhere in the United States, before the sixties or seventies, would have been a scene of endless personal conflicts, of drunkenness, not of the hundreds, but the tens of thousands, and women and children could not have taken part in such a gathering without the risk of personal injury. Yet here were only happy, smiling faces, women and children moving with perfect freedom ... all feeling kindly toward each other, all taking part in the general joy and universal pride this was the creation of their countrymen.

The contrasts between the stage-coach and giant locomotive, between the birch bark letter of the Indian and the telegraph message of Gray, the canoe of the Esquimaux and the electric railway, were not so great as that between the customs prevalent in my boyhood and this realisation of hopes for a new civilisation in the midst of which I walked on this Fourth of July, 1893.

John Brisben Walker. The Cosmopolitan Illustrated Monthly Magazine, September 1893 , Vol XV, No.5, p 517-518

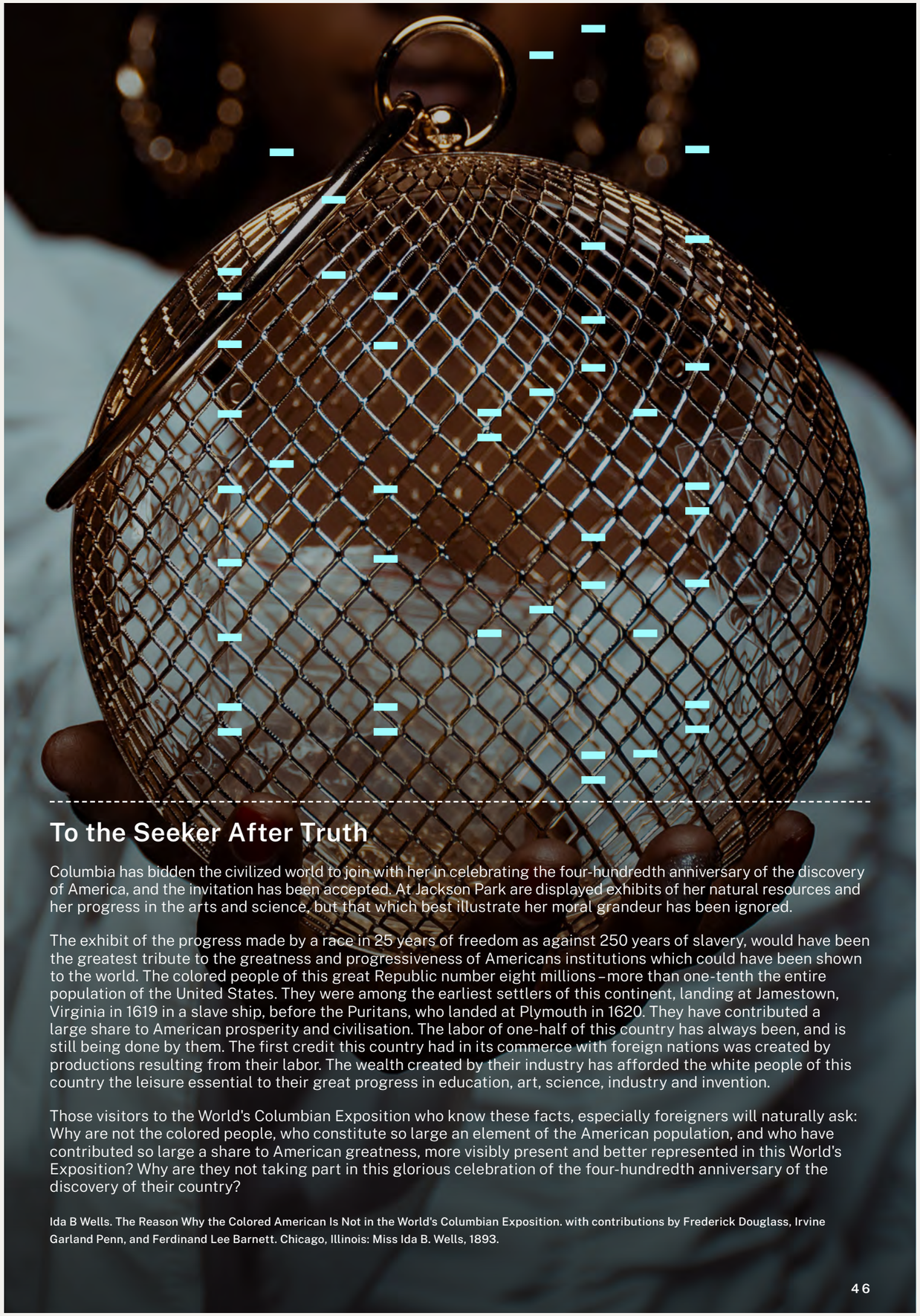
THE WHITE CITY, 1893

While The White City was a fantasy made real for some, it was not without its critiques and critics, from the choice of exhibitions, to the opening hours, to its impact on American architecture.[90] There were calls for greater or different forms of participation; African American public intellectuals, Ida B. Wells and Frederick Douglass were fierce in their denunciation of an Exhibition that saw fit to showcase American women within their own building but offer no formal space in which to celebrate African-American accomplishments since the Emancipation Proclamation.[91] The establishment of a day to celebrate black accomplishments did nothing to assuage Wells who handed out pamphlets decrying the event and enumerating the erased accomplishments, as well as the structural and systemic impacts of racism on her people and on America. The White City might have lived up to its name in more ways than one.

Beyond the well-established experiences of the World's Fairs, Chicago introduced a new kind of spectacle into its temporary, virtual world. Initially the Midway Plaisance, a mile-long stretch of park on the edge of the Exposition site, was slated for a series of ethnological exhibits curated by the Smithsonian and Harvard's Peabody Museum, in which human beings would inhabit dioramas and replicas of their home cultures and communities for the duration of the Exposition.[92] Instead, the Midway became a space dedicated to amusements, rides, concessions, side-shows, and carnival activities, each with separate tickets. Against this backdrop, the planned exhibits became the so-called "human zoo", in which people were put on display, in both the anthropological and grotesque senses, in complicated forms of orientalism, exclusion, appropriation, and celebration.[93]

The Midway was also about food and drink. It introduced visitors to Pabst Blue Ribbon Beer, Cracker Jack popcorn, Hershey's chocolate, Vienna hot dogs, Wrigley chewing gum, Aunt Jemima pancake mix, and Heinz condiments. The Midway proved to be very, very popular and generated a significant profit for the organisers – more than US $4 million in 1893. It is perhaps then unsurprising that the Midway would in turn inspire the creation of Coney Island in New York, and ultimately California's Disneyland,[94] as well as many other spaces dedicated to spectacle, pleasure, and escape.

The White City, like the Great Exhibition before it, created a remarkable, temporary, world. It lasted for six months. Ultimately, 27 million people, or about one quarter of the population of the United States at the time, would visit the White City. And much like its precursors, and indeed successors, it would leave its marks – on Chicago, on the cultural geography and palate of the United States, and in the imaginations and worldviews of its many visitors.



To the Seeker After Truth

Columbia has bidden the civilized world to join with her in celebrating the four-hundredth anniversary of the discovery of America, and the invitation has been accepted. At Jackson Park are displayed exhibits of her natural resources and her progress in the arts and science, but that which best illustrate her moral grandeur has been ignored.

The exhibit of the progress made by a race in 25 years of freedom as against 250 years of slavery, would have been the greatest tribute to the greatness and progressiveness of Americans institutions which could have been shown to the world. The colored people of this great Republic number eight millions – more than one-tenth the entire population of the United States. They were among the earliest settlers of this continent, landing at Jamestown, Virginia in 1619 in a slave ship, before the Puritans, who landed at Plymouth in 1620. They have contributed a large share to American prosperity and civilisation. The labor of one-half of this country has always been, and is still being done by them. The first credit this country had in its commerce with foreign nations was created by productions resulting from their labor. The wealth created by their industry has afforded the white people of this country the leisure essential to their great progress in education, art, science, industry and invention.

Those visitors to the World's Columbian Exposition who know these facts, especially foreigners will naturally ask: Why are not the colored people, who constitute so large an element of the American population, and who have contributed so large a share to American greatness, more visibly present and better represented in this World's Exposition? Why are they not taking part in this glorious celebration of the four-hundredth anniversary of the discovery of their country?

Ida B Wells. The Reason Why the Colored American Is Not in the World's Columbian Exposition. with contributions by Frederick Douglass, Irvine Garland Penn, and Ferdinand Lee Barnett. Chicago, Illinois: Miss Ida B. Wells, 1893.

WHAT CAN THE WHITE CITY TEACH US ABOUT THE METAVERSE?

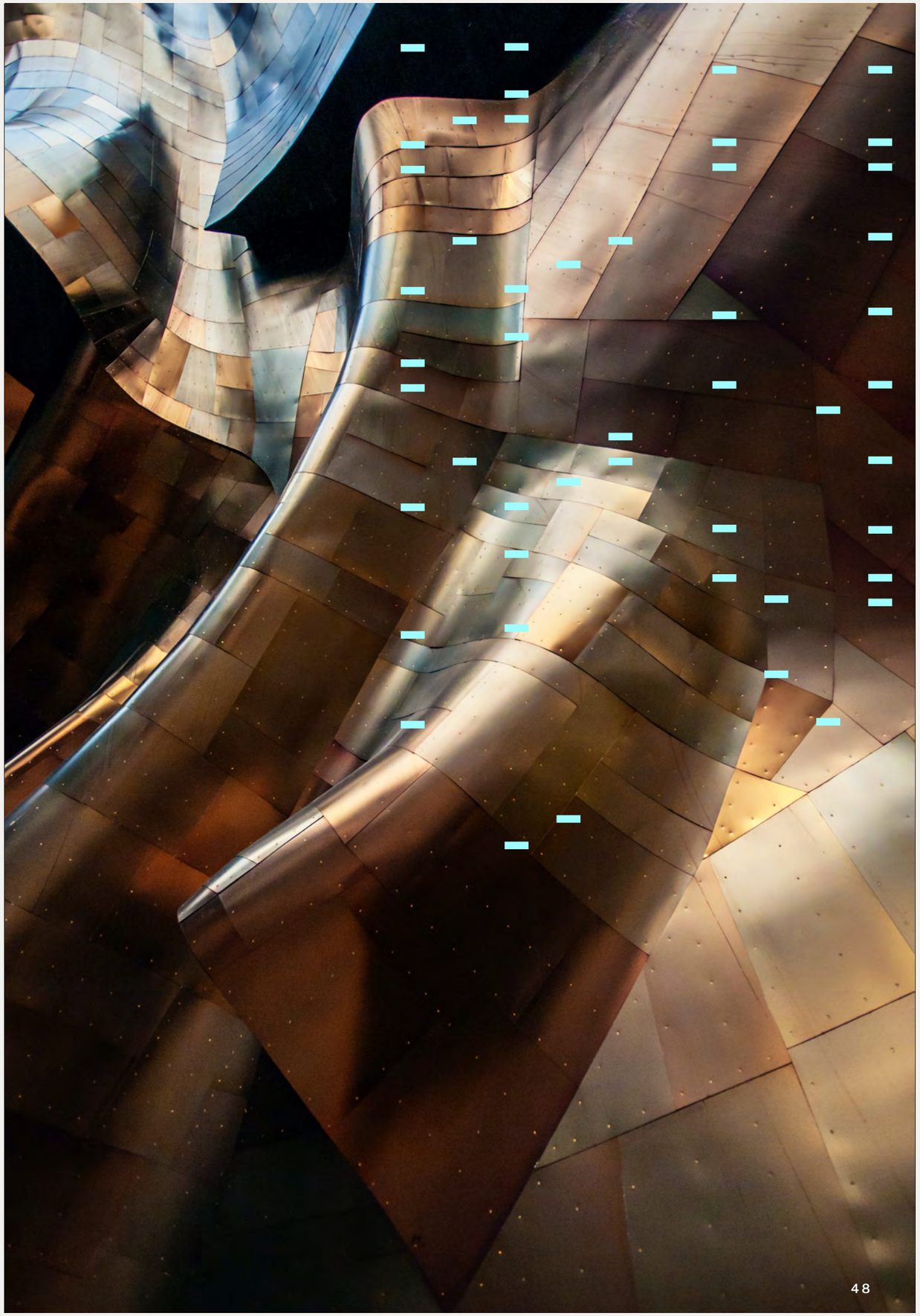
The White City was a kind of virtual, albeit temporary, world. It relied on the latest ideas of urban planning and spatial geography to create a very distinctive space – it had echoes of the world around but was also unlike anything that had been seen to date. It relied on the technology of its day – electricity – to make new possibilities and vistas: a Ferris Wheel, glowing cityscapes, and floodlit buildings and interiors. You acquired a ticket for entry, and you were always a guest in this liminal place. The White City was both an individual and communal experience. You visited the White City, but you also participated in the collective experience of it, and you saw it both through your own eyes and also through all the other reactions and remembrances. It was a shared virtual world.

The White City also deliberately created and shaped its temporary space and the encounters that could be had within it. You might have walked the streets of the White City and explored the Midway, but someone else chose what you would see and how you would see it. Designing, developing, building, and unfolding the White City was all about choices – exhibitors, exhibitions, pricing structures, lighting choices, safety, security, branding. And those choices revealed as much about what mattered to those making the world as it did about those experiencing it.

It was carefully planned, and deliberately curated, even as it drew on and explicitly competed with earlier planned Worlds. It celebrated the "discovery of the new world" and in so doing amplified and reproduced existing power structures: racism, colonialism, sexism, xenophobia, and nationalist discourses. In offering up this new American world, the White City simultaneously opened up new spaces of possibility and profit. Corporations and governments engaged in radical forms of affiliation – they wanted to be where the newest forms of technology were being displayed, where novel experiences were happening, and where the cost of such technological might was being erased or masked to perpetuate the spectacle. This desire to beat the innovation curve carries through to the present day, manifesting in places like the Consumer Electronics Show in Las Vegas, the Mobile World Congress in Barcelona, COMPUTEX in Taipei, and perhaps in the metaverse too.

Although it was fleeting, the White City generated anxiety and wonder, and alternately haunted and shaped a generation of thinkers and doers. The World's Fairs, and their various descendants, remind us that new experiences are frequently controversial, beset with uncalibrated fears that nonetheless are rehearsed along familiar lines – the politics of inclusion and exclusion, the safety of women and children, a mistrust of motives, organisations, governments, and those constituted as other. These anxieties are intertwined with the seduction of the new, the different, and the exotic. And much like the Crystal Palace, the White City existed beyond its physical and time boundaries – it lived on through post-cards, lantern slides, a multitude of souvenirs, and the stories that were told about it.

All of this might sound a little uncanny, and a little familiar, which is why the White City is an important kind of metaverse history we could and should unfold. It is clearly a kind of virtual world – not permanent or accessed digitally, but temporary and clearly unreal. As such, it helps us pay attention to power and the lines of its transmission, to the spectacle and its intended and unintended consequences, and to the narratives that both shape and are shaped by choices we make about how to engineer a world that is separate but connected to our own. These are all important threads to follow as we consider what it will take to build a safe, sustainable, and responsible metaverse.



MAKING WORLD SYSTEMS – INFRASTRUCTURAL BACKBONES

The 19th century, besides providing early exemplars of what it might mean to construct virtual worlds, is also an era from which we may derive insights into what it may mean to build entire world systems. Throughout the 19th century, governments and corporations designed, built, refined, and evolved whole-of-country and whole-of-world information and communication systems. These systems – railways, mail, telegraphy, electricity, telephony – made possible the creation, circulation, and curation of new forms of information and data. They altered the way humans experienced time, space, and social relationships. They engendered moral panic, even as they were extolled for the ways they might save labour and promote safety and peace between nations. These same systems also enabled various kinds of business models, structures of corporations and capitalism, as well as ideas about government, empire, and power. These systems might provide helpful history through which to re/approach the metaverse. After all, the technological constellation of the metaverse represents an analogous system, and one that will likely require all kinds of management.

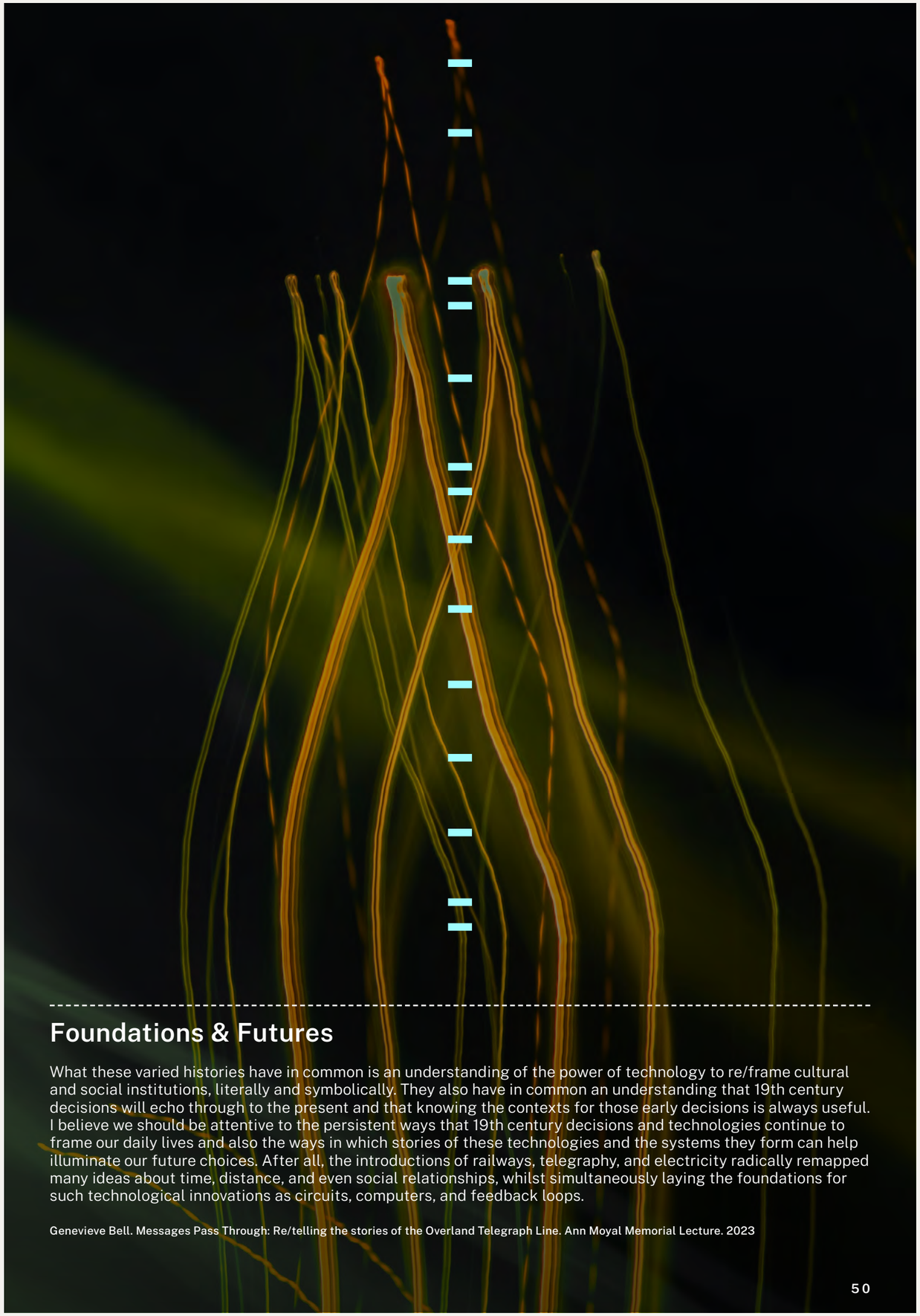
If the White City is a story about the origins of physically built, hyper-real spaces, the rollout of telegraphy globally is a story about the origins of building a system of such a grand scale that it transformed society, and reconfigured ideas about time and space.[95] It is a story about what it takes to create a technological system, and to sustain, manage, and regulate it. It is also a story about scale, and control. Unexpectedly, it is a story about the backbone of our current digital world, and of the metaverse we might plan. And of course, it is also a story about building and maintaining a complex human/technical system at the very cutting edge.

The first experiments with telegraphy took place in the 18th century and involved using visual, line-of-sight communication.[96] In the 19th century, the emergence of new forms of energy storage and advances in electricity generation made possible re-imagining telegraphy as a signal powered down a wire visible at either end through encode/decode machines. Telegraphy no longer required line-of-sight, but the cumbersome machinery necessary to encode and decode the whole alphabet made it slow, expensive, and labour intensive. Samuel Morse's 1830s creation of an abstract code of dots and dashes to represent the alphabet was the breakthrough that helped enable a more widespread adoption of telegraphy. Encoding and decoding Morse required a limited set of tools, and a skilled operator. It represented a standard of sorts, and a way of taking advantage of the affordances of the infrastructure of poles, wire, and electrical charge. And by the 1850s, it turned out that Morse also worked underwater, transmitted along submerged submarine cables, connecting Europe to the rest of the world and setting the conditions for a global telecommunications network.

Telegraphy was on display at the Great Exhibition in London in 1851 – it was part of the future that Prince Albert and the organising committee wanted to showcase and endorse. From new forms of communication machinery to wet cell batteries, morse code, and insulation materials for submarine cables, the contours of this rapidly advancing system became interwoven with ideas about the industrial age. This is perhaps best exemplified in John Grist's well-known 1872 painting American Progress, where Columbia, a ghostly female form dressed in white robes, carries a book and roll of wire in one hand, as she unfurls the telegraph line signalling the arrival of civilisation. The railway and cities follow her, as Native Americans and buffalo scatter into darkness at the edge of the frame.

In the United Kingdom, telegraphy emerged alongside a burgeoning railway infrastructure. Telegraph lines followed rail lines and telegraph operators sat alongside railway clerks. For railway companies, through the real-time transmission of data, telegraphy provided a safe and reliable way of sharing rail tracks. In this context, it was a technology associated first and foremost with making and keeping time. In the United States, by contrast, telegraphy had a broader base of commercial activity. Whilst, telegraphy was linked to the railway, companies like Western Union helped drive broader mass market adoption, along with experiments with business models and new and novel applications.

Telegraphy was a constellation of technologies and practices. It wasn't a single thing; it was a complex dynamic system. It required power and poles, wire and insulators, repeater stations and operators, rules and regulations. Whilst the analogy is far from perfect – morse code was a little bit like telegraphy's VR headset. It allowed people to engage in an entirely new kind of world – one framed by dots and dashes where place and time no longer unfolded in quite the same ways. It wasn't exactly virtual, but it was quite unreal.



Foundations & Futures

What these varied histories have in common is an understanding of the power of technology to re/frame cultural and social institutions, literally and symbolically. They also have in common an understanding that 19th century decisions will echo through to the present and that knowing the contexts for those early decisions is always useful. I believe we should be attentive to the persistent ways that 19th century decisions and technologies continue to frame our daily lives and also the ways in which stories of these technologies and the systems they form can help illuminate our future choices. After all, the introductions of railways, telegraphy, and electricity radically remapped many ideas about time, distance, and even social relationships, whilst simultaneously laying the foundations for such technological innovations as circuits, computers, and feedback loops.

Genevieve Bell. Messages Pass Through: Re/telling the stories of the Overland Telegraph Line. Ann Moyal Memorial Lecture. 2023

THE (AUSTRALIAN) OVERLAND TELEGRAPH LINE, 1872-1979

In Australia, telegraphy started in the 1850s and telegraph systems, funded by the various colonial governments, connected the colonies in the 1850s and 1860s. The news of submarine cables sparked a great deal of interest in connecting Australia to the rest of the world. In a time when it took nearly two months, and a boat, to send a message between Australia and Great Britain – its colonial master – the desire to shorten the communication loop and connect Australia to the burgeoning global telegraphic network was all encompassing.

The Overland Telegraphic Line was built in and by the Colony of South Australia in the 1870s.[97] Conceived of and delivered by the South Australian Postmaster General, Englishman Charles Todd, it would involve not only negotiating and paying for the delivery of telegraphic submarine cables to the small settlement of Palmerston on the far north coast of Australia, but also the construction of a cable line from Adelaide in the continent's far south to Palmerston, a distance of more than two-and-a-half thousand kilometres. And whilst telegraphic technology had advanced sufficiently that there was a significant network of undersea cables and companies that managed them, and whilst there was a great deal of prior experience in establishing large transcontinental systems, the Overland Telegraphic line still represented a significant engineering commitment.

For Todd, that commitment included surveying a route to establish a 20 meter-wide strip for the telegraph line stretching north from Port Augusta to Darwin, identifying 10 locations for repeater stations which would allow telegraphists to boost the signal and rekey the messages, as well as maintain and repair the line, purchasing the necessary tools, poles, insulators, and wire from Europe and delivering them on site, and clearing land, digging holes, and planting poles every 80 meters until the line was finished. And given the contract he had signed with the British-Australia Telegraph Company, he had to complete all of this in less than 24 months or face a considerable monthly non-completion fine.

In August 1872, 22 months after Todd signed the first contract, he and his work parties completed the Line, and it went from taking 44 days on the fastest ship with the wind in your favour to mere seconds (or, at worst, hours) to get a message from London to Adelaide. It was greeted in the newspapers of the time with a familiar kind of valorising optimism, and an unexpected admission about precisely how profit might be made.

Whilst building the Overland Telegraph Line was clearly a monumental achievement, the work it took to run this whole-of-world infrastructure is also revelatory and important to how we might develop a safe, sustainable, and responsible metaverse. This work speaks to the complexities of maintaining large, complex systems, and is important to explore.

On the one hand, the technical components of the system were straightforward: a single galvanised wire, strung between poles, powered by wet cell copper sulphate batteries. Of course, in reality, what that meant was a repeater station had to be built every two hundred to three hundred kilometres to ensure the telegraph line was kept powered. It also meant a bank of at least three hundred batteries in every repeater station. These batteries required constant maintenance and regular supplies of chemicals, copper plates, and glass jars. This also meant human labour.

The Overland Telegraph Line

At 1 o'clock on Thursday we received the welcome intelligence that the line was finished, and that the communicated was all that could be desired. Thus after about two years' hard toil, vexatious difficulties, and heavy expenditure, the great work is completed. For about 2,000 miles right across the very heart of the continent, which ten years ago was practically an unexplored country, we have in a little over twenty months carried a line of wires. On a day like this, which sees the work accomplished, we ought to take off our hats to Charles Todd, through whose indomitable perseverance and self-denying labours the work has in a great measure been brought to a successful termination. Nor ought we to forget the brave band of young colonials who have intelligently contributed the bone and muscle, without which the work could never have been finished.

Of course the cost of the line has far exceeded the original estimate, but that has arisen from circumstances which human foresight could not control. The cost, however, compared with the advantages which the colony will reap from the construction of the line is a mere bagatelle. We have, by the telegraph, given an impetus to the settlement of the Northern Territory; already a large quality of land has been taken up for pastoral purposes in the interior, the rent of which will do something to pay the interest on the expenditure on the line; but above all, a highway has been formed across the very heart of Australia, the future benefits of which no man can at present estimate. This been done by brave men, who risked their lived in the work, and to whom great praise is due.

The amazing rapidity with which questions were asked and answers received could hardly be imagined. In several instances a question containing many words were transmitted, and the reply obtained in less than 30 seconds! The mysterious agent passed over upwards of 40000 miles of wire in less than a minute. In every case in which there was the slightest delay it was to allow time to get at Port Darwin the information sought for. Even when the persons had to be looked at Palmerston, the answer was returned within a minute or two. On no occasion was there the slightest mishap.

Border Watch, Wednesday 28 August 1872, page 2. 1872[98]

THE (AUSTRALIAN) OVERLAND TELEGRAPH LINE, 1872-1979

Every Telegraph Repeater station had a Telegraph master, an assistant, and four linesmen. For the men who worked at the Repeater Stations, maintaining the batteries was just one of their tasks. They were also responsible for rekeying every message and ensuring that line was never disrupted. They looked after the whole telegraphic system. This in turn meant elaborate rules and regulations that governed daily activity. There were government manuals and forms to ensure shared practices, standards, and organisational culture that bound the Stations and their workers together. These rules and regulations established ideas about maintenance schedules, protocols as well as privacy, and security.

The Repeater stations with their staff and their rules and regulations were little enclaves and support systems for the telegraphic technology. There were buildings for the equipment and buildings for the people, with all the rituals and habits that come along with that. There were also goats, chickens, horses, camels, and sheep to feed everyone and help them move along the Line. The technology was never just the technology; it was always ever so much more.

These stations and their staff relied on and spurred the development of broader systems and networks. The railway slowly carved out a place alongside the Overland Telegraph Line, bringing an even greater reliance on telegraph technology to establish a shared time zone and cadence. Market gardens arose in some locations, with Chinese immigrants growing fresh fruit and vegetables, and establishing grocery depots to supplement the meagre state provisions.[99] Carting goods into remote and regional South Australia, beyond the reach of the railway meant developing a transportation network in places ill-suited to horses. The answer was camels, and also men who came from present day Bangladesh, Pakistan, Afghanistan and India to work the camels.[100] Long camel trains, of fifty to sixty animals, regularly transported things throughout regional and remote Australia well into the 20th century. These cameleers create new communities and new social solidarities – they planted date palms, and they built mosques. There were entire cultural flourishings in the most unexpected places.

That the Overland Telegraph Line also bisected and forever transformed the lands and cultures of numerous First Nations people was a distant secondary consideration for Todd; he instructed his work parties to treat any Aboriginal people they encountered ''firmly but kindly''.[101] In what can only be regarded as a cruel irony, the surveyors appear to have followed traditional trading routes and laid claim to important water holes and springs.[102] This of course meant that supporting the communities along the Line often happened at the expense of First Nations people, and the impacts of European settlement and the supply chains it demanded altered the landscape, polluted water holes, and created conflicts, at least of one of which escalated to a massacre that still reverberates today.[103]

In 1872, Todd and the young men of bone and muscle connected Australia to a network of submarine telegraph cables and companies. The Eastern Telegraphy Company controlled nearly 50% of the undersea cables in the second half of the 19th century and was closely aligned with the British government. Its cables flowed across the entirety of the Empire, and allowed the British government to enact colonial control in all the places they came ashore. Perhaps this goes some of the way to explain why the South Australian government that was willing to manage and run a system that was not profitable for 30 years. Clearly, there was more at work here than just profit. This was about connectivity, this was about control, this was about shaping the world – a telecommunications highway across Australia. This was about being willing to make a long-term investment over the event horizon.

Secrecy

Officers cannot be too strongly cautioned to observe the strict secrecy in regard to all messages passing through their station or along the line. No Information whatever is to be given to any person, except the sender or addressee, in accordance with the regulations. Any officer guilty of divulging, or in any way making use of the contents of any message will render himself liable to a fine not exceeding One Hundred Pounds (£100), or to be imprisoned with hard labour for any period not exceeding six calendar months. To make known the names of parties between whom any telegram may have passed, or to let it be known to any other than the sender or addressee that there was any such message is to be considered as a breach of confidence rendering the officer giving the information liable to the penalties beforementioned.

1874 . Rules and Regulations for the Guidance of Railway Telegraph Clerks . Adelaide

WHAT CAN THE OVERLAND TELEGRAPH LINE TEACH US ABOUT THE METAVERSE?

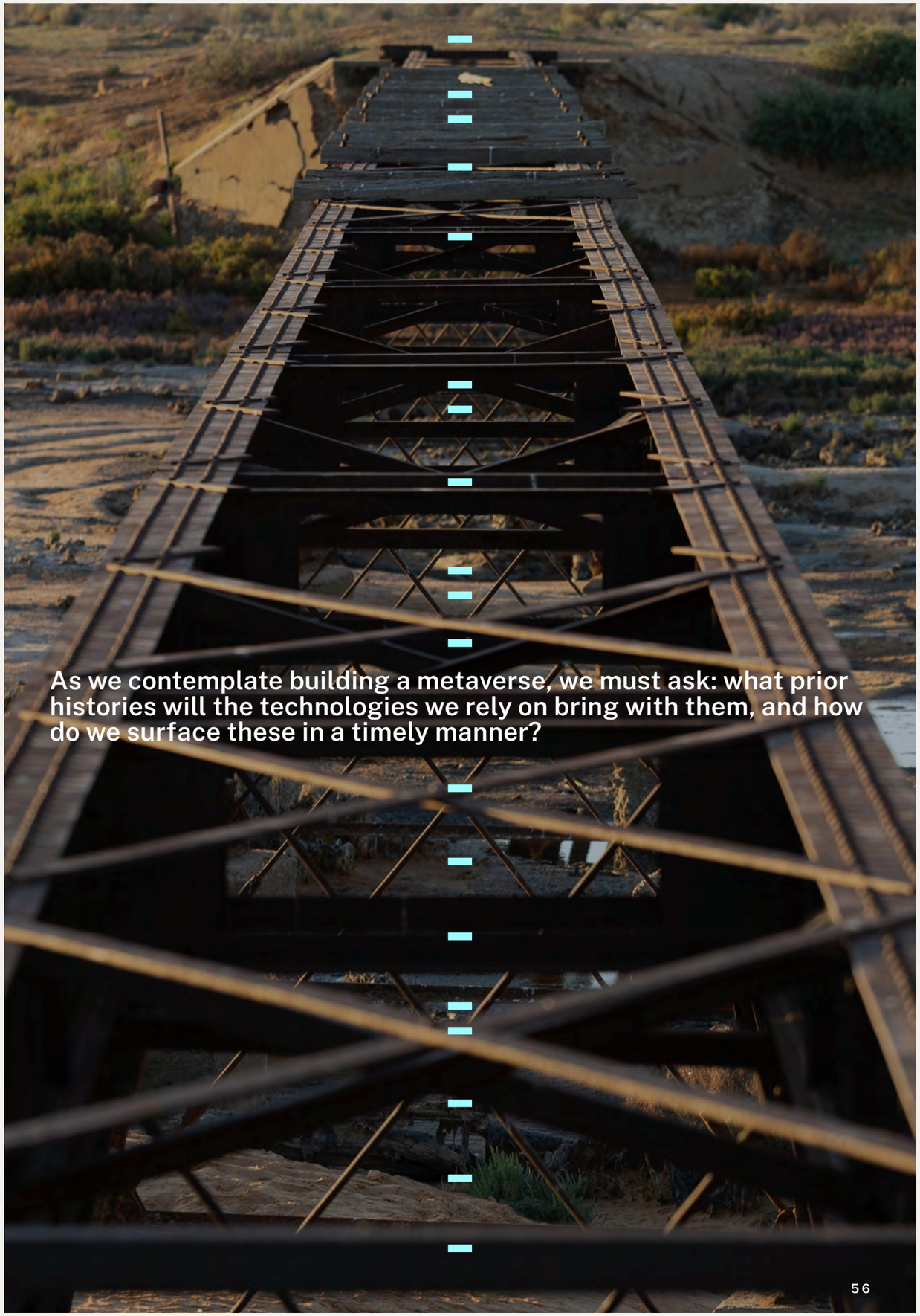
In his book, The Victorian Internet, historian Tom Standage, compares telegraphy to the internet, and rightly so. The rollout of telegraphy globally in the 19th century is an instructive story about creating whole-of-world communication platforms – how communication and transportation diverged into separate paths and how new forms of connectivity, new business models, new regulations, new kinds of work and workers, and new kinds of networks, relationships, and dynamics arose. Our examination of the Overland Telegraph line reveals how much hidden labour, energy, and resources are always necessary to sustain large complex systems.

It also highlights the importance of agendas and agents in developing and maintaining a system, which we might unpack as "humans in the loop". In this case, we might also need to ask: which humans and which loops? Because it's never quite as straightforward as it seems. And it is also important to remember that the legacies of those loops and those humans will be written on the landscape for centuries. The very repeater stations that made possible whole-of-world communication systems also utterly and profoundly disrupted traditional Aboriginal land tenure practices, traditional religious practices, and traditional cultural practices.

The impact of the Overland Telegraph system also manifests itself in the location and resilience of 21st-century infrastructures. The choices that Todd and his surveyors made to locate the line near water, because of the needs of 19th-century wet-cell batteries, later influenced the location of railways, roads, electricity, and even high-speed broadband cables, as people clustered infrastructures into known corridors. However, the locations that suited that first technology do not suit those that have followed, resulting in frequent washouts of rail, roads, and broadband. The explicit and tacit ways that current technical choices adopt older affordances is a point worthy of reflection.

As we contemplate building a metaverse, we must ask: what prior histories will the technologies we rely on bring with them, and how do we surface these in a timely manner?

Read in all these ways, there are clear insights for the metaverse in the story of the Overland Telegraph Line. We find a place to ask – given what we know about global communications systems and huge leaps in connectivity – what are the things we could do now to ensure a better outcome for humans and the planet? By asking these questions, it becomes clear that the Line can be a tool for helping us think about the metaverse.



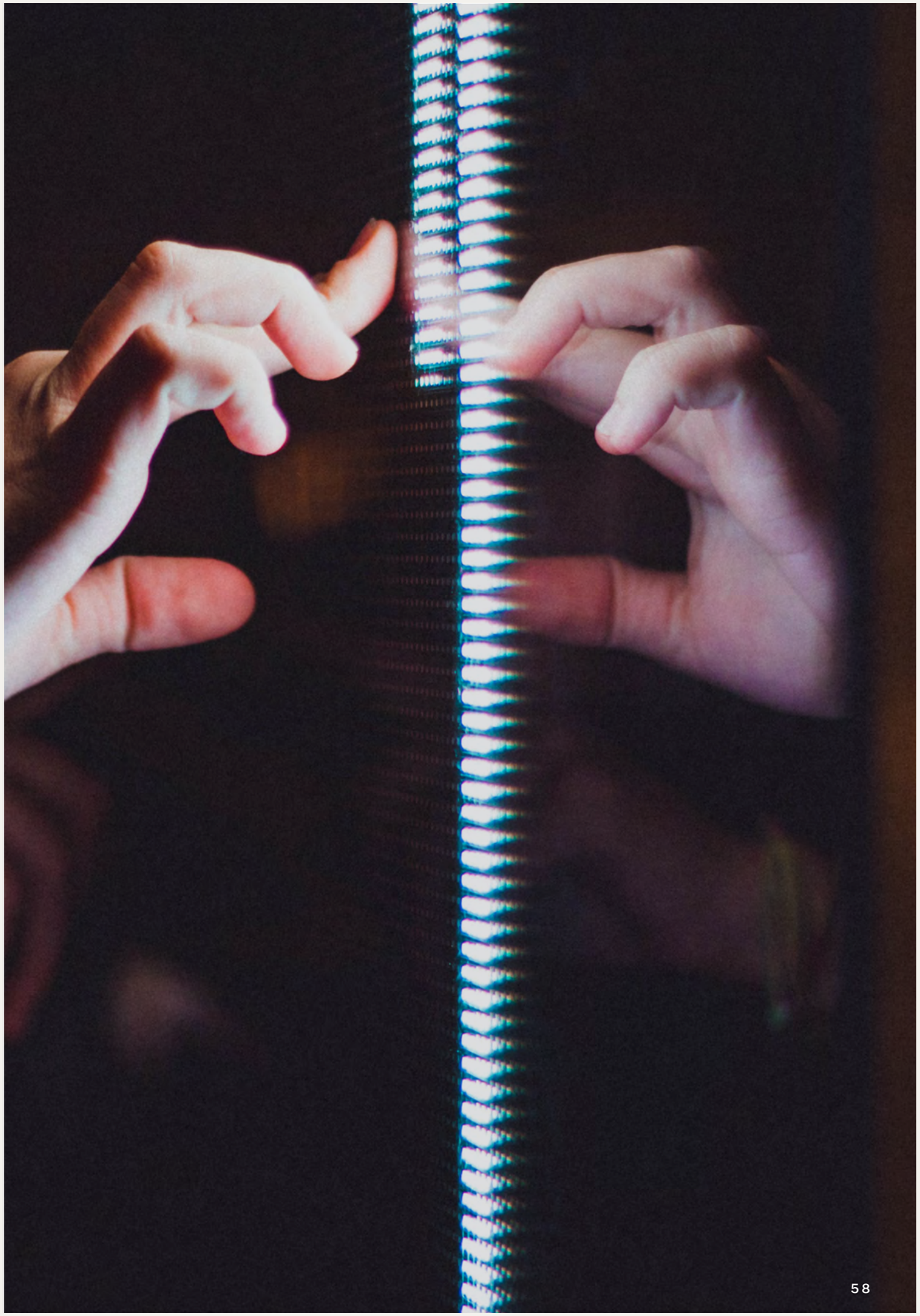
APPROACHING HISTORY: TOOLS TO THINK WITH

These disparate histories – of the Chicago World's Fair and the Overland Telegraph line – are not histories of the metaverse per se, nor are they predictions. First and foremost, they are alternate and analogous histories about making worlds and making world systems – temporary worlds, hyper-real worlds, connected worlds, and future worlds.

These histories are alive with possibilities and perils, and offer clear parallels to our present. They are indexical stories about systems that are relevant to the present and future of the metaverse. These are also, unsurprisingly, stories about technologies, and about humans. All the humans you need to make a system function – the content makers, the consumers, the citizens, the regulators, the various and overlapping audiences, the workers, and the builders.

These are even stories that reveal the importance of understanding and attending to the motives and contexts of commercial and governmental actors. In that way, these are stories about power, stories about inequities, and often about disruptions. They remind us to ask: who is being empowered and disempowered here? Who is being disrupted, and who is being amplified? And of course, who is being erased and silenced?

The White City and the Overland Telegraph Line are historical stories that can provide useful avenues for critically engaging with the metaverse. They provide a series of questions and vantages that could inform the design, construction, operation, maintenance, and eventual decommissioning of the metaverse. After all, questions about audience, modes of participation, advertising, innovation, unintended consequences, time frames, rules, regulations, workers, spheres of impact, power, control, inequity and dangerous omissions and silences are not just questions for the history of the telegraph line or World's Fairs, they are also questions for the future of the metaverse.



03.

UNPACKING THE METAVERSE AS A SYSTEM

Analysing a technology system in the present is as important as exploring its stories and histories. In previous chapters we explored how science fiction can help us understand the motivations behind the system, drawing throughlines between the past, present, and future. We analysed histories of other, now-decommissioned systems, to find parallels with the conversations circling around the metaverse, and their possible consequences. In this chapter, we propose to examine the current context of the metaverse, using techniques to expand our view to incorporate multiple perspectives, to draw different boundaries around our system of analysis, and importantly to consider the dynamics in the metaverse as a current system.

That is a complicated thing – analysing the metaverse as it is now. Just as the debates around artificial intelligence turn quickly to an imagined endpoint – machine sentience, or the singularity – discourse surrounding the metaverse has largely focused on what it might one day become. Now, with a new wave of technological advances redefining the limits of what is possible, we seem closer than ever to building the metaverse of our imaginations. Improved VR headsets seem less like amusing toys and more like interfaces for new modes of experience. Generative AI promises 3D world building at a previously unimagined scale, inching us towards a seamless, pervasive, virtual world. We are still talking about the metaverse in the future tense, but the levers for building it are visible here in the present.

In this chapter, we observe and analyse those levers, and the legacy systems they will rely on, and we consider what this all might mean for how the metaverse is emerging at this moment. This means not simply seeing the metaverse as a technology or set of technologies, but as a set of relationships over time — between people, technology, and the environment in which they coexist. By making these dynamic components of the emerging metaverse explicit, we can ask critical questions about what we are building, and assess: Is it safe? Is it sustainable? Is it responsible?

THE CYBERNETIC STAR

At the School of Cybernetics, we seek to observe a system through its component parts, and their interconnections and dynamics. Often, the systems surrounding a technology are not made explicit or visible until something goes wrong. We may understand a technology and its capabilities, but can't fully visualise the surrounding systems until it breaks. When a system breaks, an in-depth analysis generally ensues; what happened, when, and who was involved. What interactions between parts of the system led to the situation? We have developed a tool that lets you undertake this style of analysis (without the breaking!).

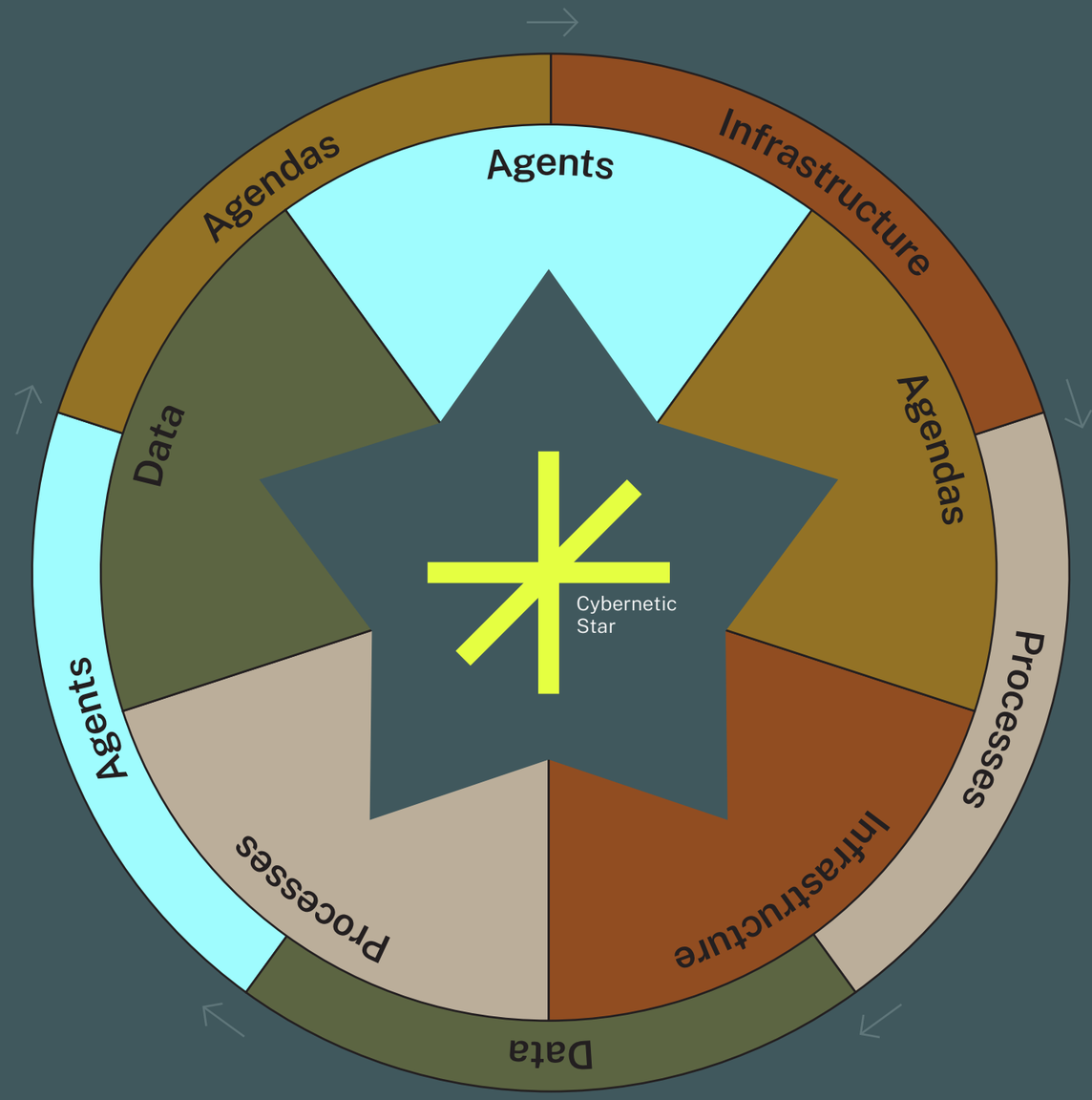
Our tool is called The Cybernetic Star (the Star) and was developed during a collaboration between the School of Cybernetics and the National Library of Australia in 2021.[104] The Star is a tool for observing and analysing the systems that have new technologies embedded within them. Our aim for this tool is to help shift thinking beyond any single technology to broader, more complex systems. The Star helps to scope these systems and their components for analysis, and we will use this tool to analyse the metaverse in this chapter.

The first step to using the Star is to clarify what sits under each of its five points: Agendas, Infrastructure, Data, Agents, and Processes. As a set, these components help make visible parts of a system that are often invisible or obscured, and invite us to think about who or what is acting in a system, and what motivates certain actions and behaviours. By mapping these elements, the Star becomes a helpful starting point to unpack the ways a technology or a set of technologies sits within and interacts with broader contexts and systems.

The Star can also help us explore dynamics between each of its five components. The concentric circles rotate to form component pairs, such as "agendas + infrastructure" or "agents + data", inviting deeper consideration of how they interrelate. Teasing out these relationships between components can reveal how they correspond, create tension, and reinforce broader goals, allowing us to discern different consequences and pathways for the system to shape and change.

Here, we use the Star to unpack, distil, and connect various conversations about the metaverse that is now unfolding among users, researchers, regulators, educators, and the tech industry.

We run through the points on the star to highlight what is relevant to the metaverse, encompassing things in plain sight and others that are perhaps hidden. Then we engage particularly with the agendas that are currently playing out in the metaverse conversation and how they are influencing dynamics across the broader system.



Navigation

Steer by rotating the outer wheel to arrive at different connection points to explore the relationships between each of the 5 components.

Agents

Humans and non-humans with agency, who influence or are influenced by a system.

Agendas

Motivations, goals and constraints that influence the way a system works, or which are influenced by that system.

Infrastructure

Basic digital and physical structures and tools that need to be in place for a system to function.

Processes

Formally documented and informally followed activities that are part of deploying, maintaining and decommissioning a system.

Data

Information created, collected, stored and/or used as part of the operation of the system.

AGENDAS:

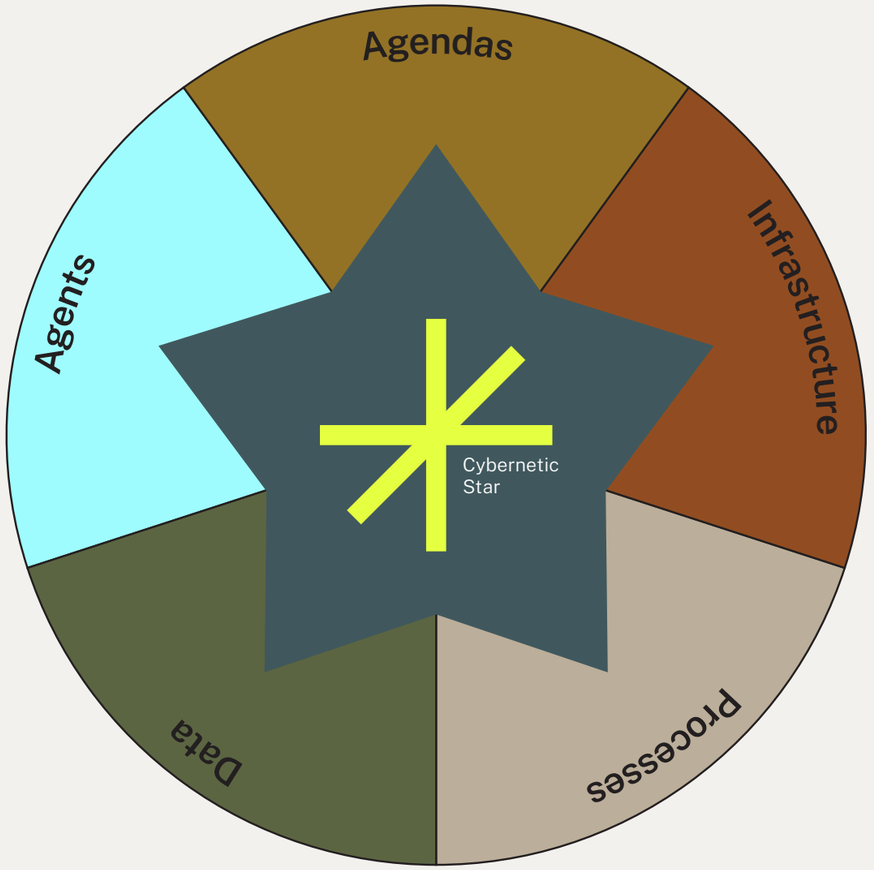
What goals are present in the system and how are they expressed?

There are multiple sets of agendas – that is, motivations, goals, and constraints – influencing development of the metaverse. These agendas are reflected in the conversations now occurring, within and across sectors, that will determine how the metaverse is realised. They involve developers and engineers, striving to deliver on the potential of the technology. They involve regulators, translating their concerns for the rights and protections of users and market players to this new context. They involve researchers, futurists, and storytellers, challenging and anticipating how the metaverse might transform aspects of work, culture, and community. They also involve the media, engaged with commercial and public interests to tell stories about what the metaverse could mean for our collective futures. From these conversations emerge the dominant ideas now driving how the metaverse is being understood and created.

As we demonstrated in Chapter 01, the speculative worlds of science fiction have also been critical in shaping our popular understanding of the metaverse. Specifically, that the technology is immersive, enables user agency, is scalable, interoperable, seamless, synchronous, persistent, and pervasive. While these criteria are not formal or uniformly held, they nevertheless reflect a converging ideal for what the metaverse could be – an ideal taken up through the public and media imaginary, and by technology developers.

These ideals constitute a threshold for realising the metaverse in its end state, and as such shape a prevailing agenda for what its unique features will be. (This goes some way towards explaining the persistent assumption the metaverse will be encountered through head-mounted displays that look like swim goggles).

Corporate agendas that centre on specific technology capabilities and consumer needs underpin, and to a large extent amplify, how the metaverse is emerging. Fuelled by the broader context of the Covid-19 global pandemic, which radically changed how we viewed work, offices, and physical proximity to one another, conversation about the metaverse peaked in October of 2021 when Facebook announced[105] a new corporate structure and a new orientation. As Facebook CEO Mark Zuckerberg said in a letter to staff "we will be metaverse-first, not Facebook first".[106] The pandemic had sent millions of people home to work online and people were craving a way to continue to connect in an embodied way, in the face of the necessity of lockdowns. This made the idea of the metaverse incredibly appealing to a broad range of people. A vision for "enterprise metaverses" emerged, including virtual campuses and tools for digital collaboration, VR forums to extend social media and gaming environments, and simulations of real-world buildings and factories.



Since its first announcement, Meta has consistently stated that they will not be building the metaverse alone, and has committed publicly to the principle of an open, interoperable metaverse. And indeed, other large American-based technology companies including Microsoft, Intel, and Qualcomm also announced investments in and technologies to enable the metaverse in 2021.

In June 2023, Apple launched the Vision Pro headset, which it pitched as an entry point to "the era of spatial computing".[107] Rather than a gateway to a new virtual world, as VR headsets have been advertised previously, the Vision Pro is being promoted as a tool to augment the digital experiences people are already having, but this marketing is a natural first step towards readying people for the metaverse.

As the market for developing the metaverse has proliferated over the past couple of years, and engaged many actors within the technology sector, enterprise metaverses increasingly foreshadow a future of plural and distinct metaverses, rather than a single and homogenous vision, which breaks from the prevailing model defined by science fiction. While some technology creators are still pursuing a seamless, synchronous, persistent, and pervasive metaverse, business is offering a multiplicity of visions and uses.

These corporate agendas have the potential to be more powerful than the unified metaverse agenda, but the interplay between them is a complex mix of user demands and desires, business models, competition, and behaviour shaping.

In Australia, we have seen the research and regulatory landscape galvanise in response to corporate agendas with the establishment of the Responsible Metaverse Alliance in 2022 and the development of the Metaverse and Standards White Paper in collaboration with Standards Australia.[108] Over recent years there have arisen an increasing number of centres and labs at universities dedicated to virtual reality research, the most recent being the Australian Research Centre for Interactive and Virtual Environments, at UniSA. Government agencies and bodies have programs looking at the metaverse from different perspectives: safety (E-Safety Commission), regulation (The Australian Communications and Media Authority (ACMA)), and the potential for economic growth (NSW Government Department of Customer Service).[109] The public agenda will inevitably be focussed on safety in building and deploying the metaverse, which can be served by connection and coordination among this collective, and more broadly.

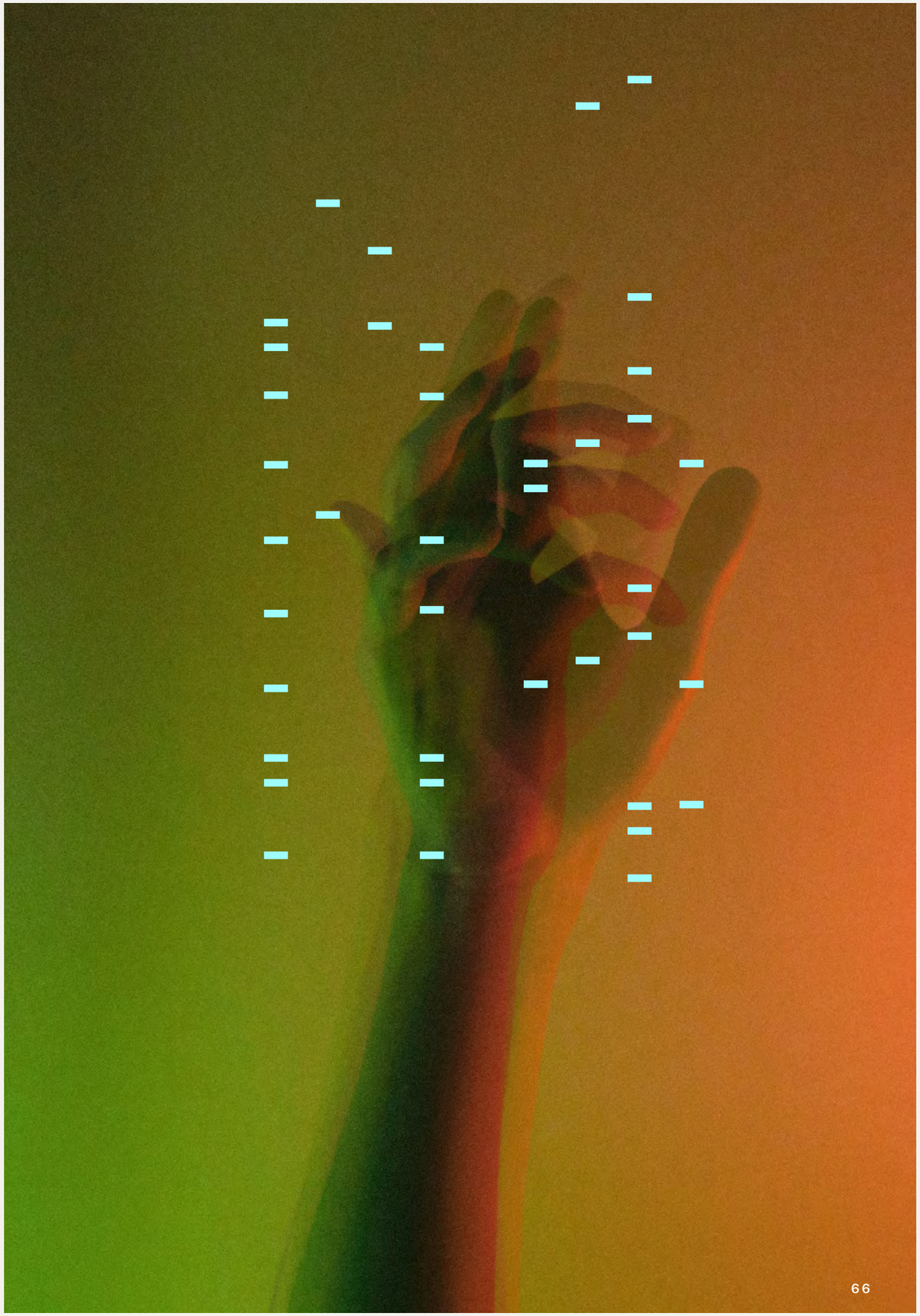
AGENDAS:

Alongside these corporate imaginaries, as well as research and regulatory responses, there are also numerous, emerging proposals and interpretations for how a metaverse should sit alongside or be integrated into daily life. Mark Pesce,[110] cyberneticist and futurist, imagines the metaverse becoming what sociologist Ray Oldenberg calls a "Third Place"[111] – a destination between the workplace and home, which anchors community life by facilitating connections and communication outside the realms of work and family. In this scenario, the metaverse would occupy the role once filled by the local pub or coffee shop. Other theories suggest the metaverse constitutes a new reality that merges the physical and the virtual – a "surreality", rather than a virtual or alternate reality.[112] How these theories play out will depend on how the technology is shaped and constrained by what is possible, both in terms of technical limitations and the limits imposed by individuals, families, communities, schools, businesses, and regulators.

Beyond agendas for what the metaverse should become, there are multiple sets of goals and agendas embedded in the technologies that will form its foundations. These legacy and parallel technologies, such as the web, 3D graphics engines, and AI models, contain within them sets of ideas likely to be grandmothered into future instantiations of the metaverse. For example, the World Wide Web Consortium (W3C) – established in 1994 and still headed by Tim Berners-Lee – has directed that the web should be safe, accessible, decentralised, and "interoperable for everyone around the globe".[113] These values, along with commitments to open data, open governance, and open access, defined the early culture of the web. As we are already seeing, they now inform a similar vision of what the metaverse should be: decentralised, co-created, user-defined, accessible, diverse, and open. Undoubtedly, as the technology takes shape, we will need to consider ways of maintaining or gracefully leaving behind some of these embedded values and ideals.

In a similar vein, ideas around ownership and economic viability will need to be negotiated anew, as the environment that birthed the once-groundbreaking and hugely popular online worlds now heralded as early metaverse-like systems, like Habitat or Second Life, shifts and advances. Habitat and Second Life fulfilled a particular need in the absence of anything else at the time (i.e. socialising with strangers online), but has been superseded by something that doesn't look like the original system, but fulfils the same need – not another virtual world, but the social media platforms that arose in the 2010s.

As these unfolding conversations suggest, building the metaverse will mean aligning multiple technologies, systems, and agents whose visions for the metaverse are nonuniform and dynamic. Given these often-competing agendas, determining how a metaverse should emerge will require rigorous negotiation, iteration, and transparent planning, particularly if the technology is to be deployed in a safe and sustainable way.



INFRASTRUCTURE:

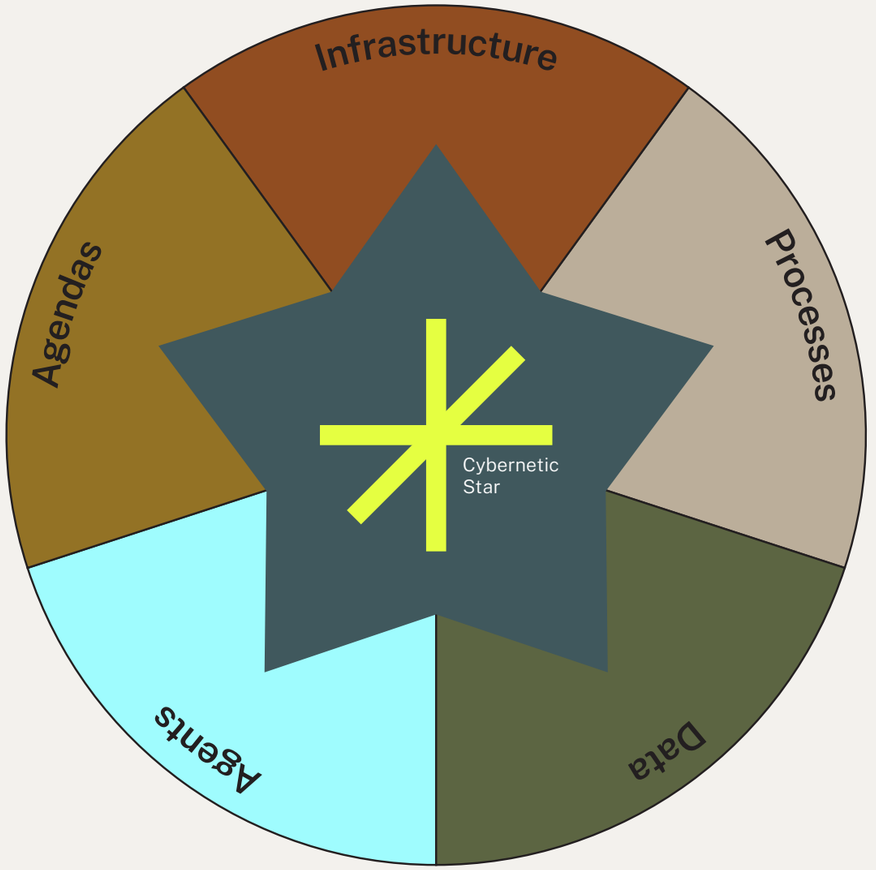
What structures and tools enable agency and affect goals?

Infrastructure is the basic digital and physical structures and tools that need to be in place for a system to function. For the metaverse to operate at scale, it must bring together a wide array of technologies, many of them at different stages of maturity.

The online worlds of gaming, now decades old, have long proven how people can use the web to connect, communicate, and collaborate in new ways. Advances in augmented reality (AR) and virtual reality (VR) are poised to deliver immersive, life-like digital experiences. Web 3.0 technologies and distributed ledgers hold the promise of interoperability, as well as solutions to digital ownership and identity in their many and varied forms.

The term “metaverse” has become shorthand for any number of virtual worlds, but the persistent idea of the “true” metaverse would integrate all these technologies, along with AI (for real-time data-driven sensing, inferring, and acting), and would be interoperable across as many platforms as required (Web 3.0) to re/create the entire world.

As we discussed in Chapter 01, this view of the metaverse's technology stack is articulated in and reinforced by science fiction. The degree to which its real-world deployment will resemble its science fiction counterparts hinges on how these technologies align to deliver capabilities like real-time interactivity, 3D renderings of digital worlds, and immersive experiences involving spatial sound and haptic feedback.



Weaving these technologies into an integrated whole, and making them play well together, presents a nontrivial challenge, but significant strides are already being made. AR, which involves layering digital imagery over material objects, has already become prevalent through smartphone applications. While headsets have previously failed to capture large consumer markets, the Apple Vision Pro, to be released in 2024, along with Microsoft’s HoloLens 2, approach long-held visions for what VR headsets ought to be – a tool for ongoing immersion in digital environments.

One notable innovation of recent headsets allows users to oscillate between full and partial immersion. For example, users can experience 3D renderings of applications via Apple’s new spatial operating system, but they can also dial their sense of immersion up and down, adjusting the transparency of the visuals to let through more or less of their physical surroundings. Derided by some as uncanny, the digital projection of the user’s eyes on the headset’s outward-facing display also represents an effort to design a device with applications beyond solitary gaming. For now, the battery life and price points of the Apple Vision Pro and HoloLens 2 do not suggest ubiquitous uptake, but refinements in design and production, along with economies of scale, could fuel more widespread adoption.

Other technologies are being developed to enhance the illusion of embodied presence in the metaverse. Digital twins are revolutionising telepresence by enabling interaction with physical objects and spaces at distance via real-time 3D modelling. Haptic gloves and suits promise to deliver sensory experiences emulating physical touch. There are even experimental efforts underway to replicate scent and taste within digital worlds.

If the ultimate goal of the metaverse is for AR and VR to provide synchronicity between digital and physical environments, it will require enormous leaps in 3D graphics, image registration, and sensor technology. These technologies will need to be integrated with existing systems, each with their own embedded histories and agendas.

INFRASTRUCTURE REQUIRED TO ACHIEVE THE METAVERSE

Core elements of infrastructure required to achieve these current and near-future metaverse goals are likely to include:[114]

Telecommunications:
5G, 6G, and beyond – transmitting data at rates necessary for real-time interactivity will require speed and connectivity that can only be facilitated by 5G and 6G telecommunications networks. These networks will build upon and expand existing infrastructure.

Computing Capabilities: Edge and Cloud Computing:
Any version of the metaverse will require enormous computing power, involving cloud computing as well as edge computing for processing time-sensitive data.

Artificial Intelligence + Machine Learning:
Providing people with embodied agency in the metaverse will require machine recognition and responses to facial movement, gestures, speech, and eye-tracking, all of which will rely on AI-driven systems. Real-time and responsive systems at scale will also require automated processes for cleaning, classifying, and initiating actions from data. It is also imagined that AI models will be involved in procedural generation of 3D environments and text / voice-based interactions with digital agents.

Internet of Things + Internet of Everything:
Through a combination of high-speed networks, sophisticated sensors and cameras, and persistent XR, it may be possible to merge the physical world with the metaverse. For example, remote work would be done with 3D digital twins linked to physical machines, like robots on a factory floor, which respond in real time via virtual interface.

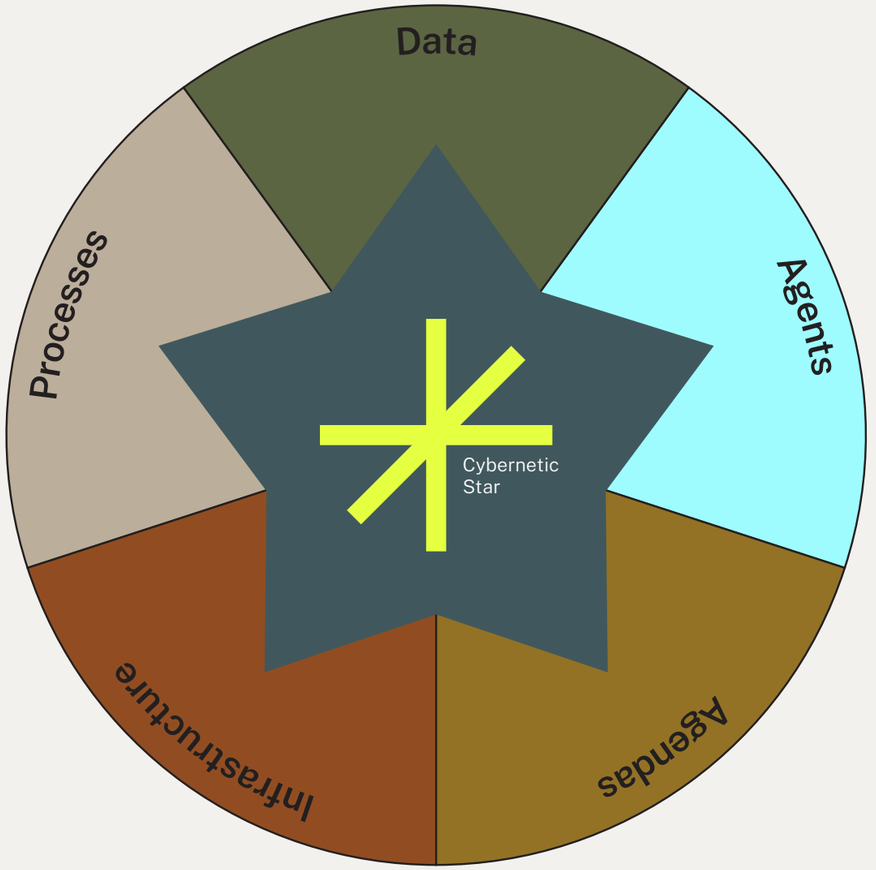
Digital Currency:
The need for a functioning economy – with appropriate levels of security and privacy, allowing for exchange both within and between the digital and physical world – suggests blockchain technology may have utility in the metaverse. Earlier lessons from Second Life and "Linden dollars" might be instructive in shaping how currency in the metaverse functions.[115]

Public Ledger:
There are also proponents for using blockchain to provide transparency in the metaverse through a public registry of transactions. Proponents suggest a public ledger could offer users and regulators the means to safeguard against illicit activities in the metaverse, especially in a largely decentralised model. The pitch behind blockchain technology, for the metaverse, frequently hinges on facilitating a kind of interoperability between different platforms and creative properties as imagined in the science fiction origin stories discussed in Chapter 02.

Energy Infrastructure:
Deploying the metaverse at a scale will require unprecedented amounts of energy, far in excess of what the internet in its current form demands.

Extended Reality (XR) Interfaces + Smart Devices:
As currently envisioned, the metaverse will rely heavily on virtual reality (VR) and augmented reality (AR). These are collectively known as extended reality (XR), and will form the basis for how people inhabit and interact with the digital world.

DATA:



What numbers, statistics, words and media are accumulated, exchanged, stored or used?

Data is the information created, collected, stored and/or used in the operation of a system. Both its content and mode of transmission can affect how data is treated, and new categories of data can necessitate entirely new systems. For the metaverse to function with the level of real-time interactivity widely envisioned will require vast amounts of data to be amassed and processed at unprecedented speeds. Much of this data will be obscured from public view as it flows through the multiple layers of technology capturing, transmitting, and relaying it between the physical and virtual world.

As an individual user in the metaverse, providing payment data, biometric data, and behavioural data will be pervasive and necessary. Scans of peoples' bodies and faces, along with biometric feedback from wearables, will likely determine how avatars appear, gesture, and move. Data-capturing sensors and devices such as cameras and microphones may also pick up contextual data from a user's location, and from others nearby.

Processing the massive amounts of data generated through immersive metaverse applications will require new kinds of infrastructure, such as the use of AI to automatically process, clean, and classify data for transfer across systems, more easily enabling interoperability. Other applications of AI will generate data of their own, as AI models are deployed to write code, generate 3D graphics, and automate the countless processes the metaverse will need to subsist. This implies machine-to-machine data transmission at a massive scale, with humans removed entirely from many automated activities and processes.

Barring regulations to prevent it, this data will almost certainly be used to drive consumer engagement with specific products and services, as is common with online data sharing now. While they are not necessarily created to survey and manipulate, the very existence of this data creates the moral hazard to use it for specific ends (that may not have been consented to). Some have cautioned that with the metaverse we are creating a "global panopticon society of constant surveillance in public or semi-public spaces".[116]

The necessity of data privacy and the risks of surveillance and exploitation have been part of the metaverse story from its earliest beginnings in science fiction. A central theme of Vernor Vinge's True Names, covered in Chapter 01, is the danger of personal data falling into the wrong hands, whether those of criminal malefactors or the federal government. The novella's forward thinking on these issues made it a formative text for the "cypherpunk" movement, a cadre of early digital rights activists dedicated to securing personal data and communications through widely available public cryptography.

For certain applications, continuous data capture from sensors, cameras, and microphones will likely be used to create digital twins of physical objects and environments, transposing them into the metaverse in real time. For example, enterprise metaverses promise the possibility of remotely performing manual labour – working on an assembly line or similar – via telerobotics and digital twins. In such a scenario, synchronising people, places, and objects will require data to be shared continuously across multiple networks and technology platforms, likely to be owned and operated by various agents and overseen by various regulators.

Surveillance in corporate settings feels less complicated than in public spaces, however it is still contested. We are yet to test the edges of our acceptance of corporate measurement of productivity and staff morale through the logging of key strokes, time away from keyboard, time in emails, and hours of work, which feels to many like private and personal data. Enterprise metaverse applications will be subject to the same questions around data use.

When it comes to the data conversation, we are at a crossroads. The consumer "contracts" of the 2010s social media companies (use the platform free, pay with your data) are being challenged. The metaverse – which anticipates even greater capture of data – is under the spotlight as this plays out. We need to imagine that we can allow machines to use data, without the need to store it, or only to store it as long as is necessary for the functioning of the tech. And, as we improve automation in data capture and use, that it can be captured again, rather than reused.

DATA IMPLICATIONS OF THE METAVERSE

Handling Big Data involves significant challenges and concerns, many of which translate to the metaverse. These include the ways in which data can reify and amplify existing power structures. In exploring the propensity for Big Data to be seen only for its potential and not its risks, Bell et al. pose a series of questions that may be useful to consider in reference to an emerging metaverse:

Would there be changes in business models?

Would these new Big Data systems give rise to new data-centric business models that might in turn up-end multiple market segments?

Would there be more advertising?

Would there be more surveillance?

Would the ways in which capitalism was enacted be transformed?

Could transnational disputes arise that would pit commercial entities against governments, and citizens?

Would these new Big Data systems create new centres of power and concentration?

Would there be new kinds of literacies, inequities and accumulations because of these Big Data systems?[117]

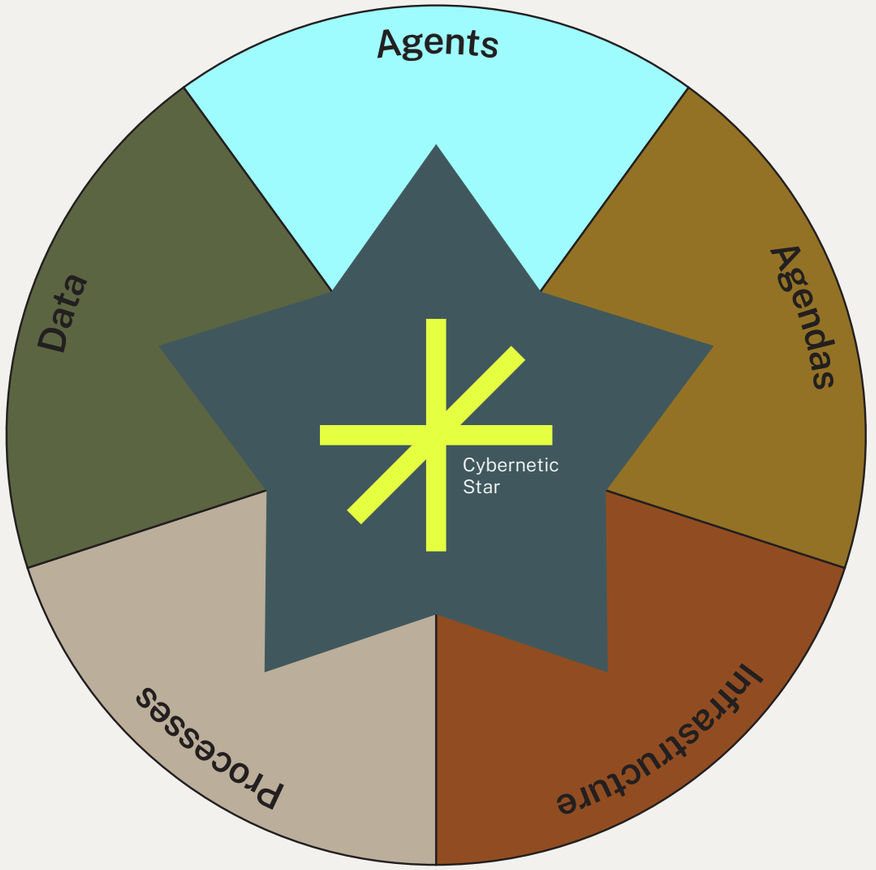
AGENTS:

What in the System has Agency?

The big agendas driving the development of the metaverse – corporate, political, and tech development agendas – can dominate the landscape and obscure the many different agents intersecting with the metaverse as a system. In developing sweeping goals for the metaverse, individuals are reduced to data points or homogenised into faceless (though perfectly segmented) users. By exploring who these less obvious agents are, we can examine how they can in fact influence the system. Similarly, while corporate agendas can render them equally faceless, what role do powerful individual agents play? And as we move into an era where automation is more and more sophisticated, trending towards advanced AI, what about non-human agents?

As Chapter 01 suggests, science fiction stories about the metaverse often reflect our fears of relinquishing control. In these stories, the protagonist is beset by government and corporate powers wielding outsized, dictatorial authority. While it usually offers refuge, the metaverse itself is sometimes portrayed as a system with the power to suppress people's agency, trapping them in hallucinations and denying them exit from the virtual world.

Earlier technologies, from automation to atomic power, sparked similar fears and inspired science fiction narratives of their own. Long before the advent of modern computing, stories like Frankenstein and the myth of the Golem captured fears about the monsters we create, and the chaos they might unleash. New technologies leave us perpetually navigating uncertainty over the agency we have and fear losing.



These fears underlie a shifting idea of who or what will have agency in the metaverse now being built. As machines' actions and reactions become more autonomous, we will need to rethink our relationships with them, and renegotiate the balance of power between human and non-human agents. Already, we are seeing glimmers of what pervasive AI-powered agents might look like in the metaverse.[118]

Mark Zuckerberg recently announced Meta's roadmap for the use of AI on their existing platforms, confirming the long-term plan is to "focus on developing AI personas that can help people in a variety of ways". This includes, "exploring experiences with text (like chat in WhatsApp and Messenger), with images (like creative Instagram filters and ad formats), and with video and multi-modal experiences".

Early hints at how these AI chatbots, called "personas", might be implemented are beginning to emerge. In 2023, Mobile developer Alessandro Paluzzi leaked information on a new Instagram feature, suggesting the platform might offer as many as 30 different AI "personalities" to chat with.[119] These personas would react to voice or text prompts, and even join conversations between users as a third party.

This nascent technology suggests the metaverse could be similarly populated by AI personas, acting as customer service providers for the platform, but also as agents enmeshed in intimate social contexts, including our private conversations. As AI models become more sophisticated and widely deployed, this trend will only continue. How we determine, shape, and limit the role of machines with agency in the metaverse will require planning, research, and cautious iteration.

Of course, the need for cautious design and deployment in this space is implicit to a context in which humans and machines are increasingly entangled, each holding autonomy in their spheres of action and interaction. The risks here do not lie squarely in the potential for these interactions between human and machines to go awry. Instead, they are foreshadowed by the power dynamics at play in the places where the machines are being built, trained, and deployed, and also who has access to the data being collected, stored, and transmitted between machines in the metaverse. Managing these risks means building our organisations to reflect and enact the same values we would wish to uphold in the metaverse.

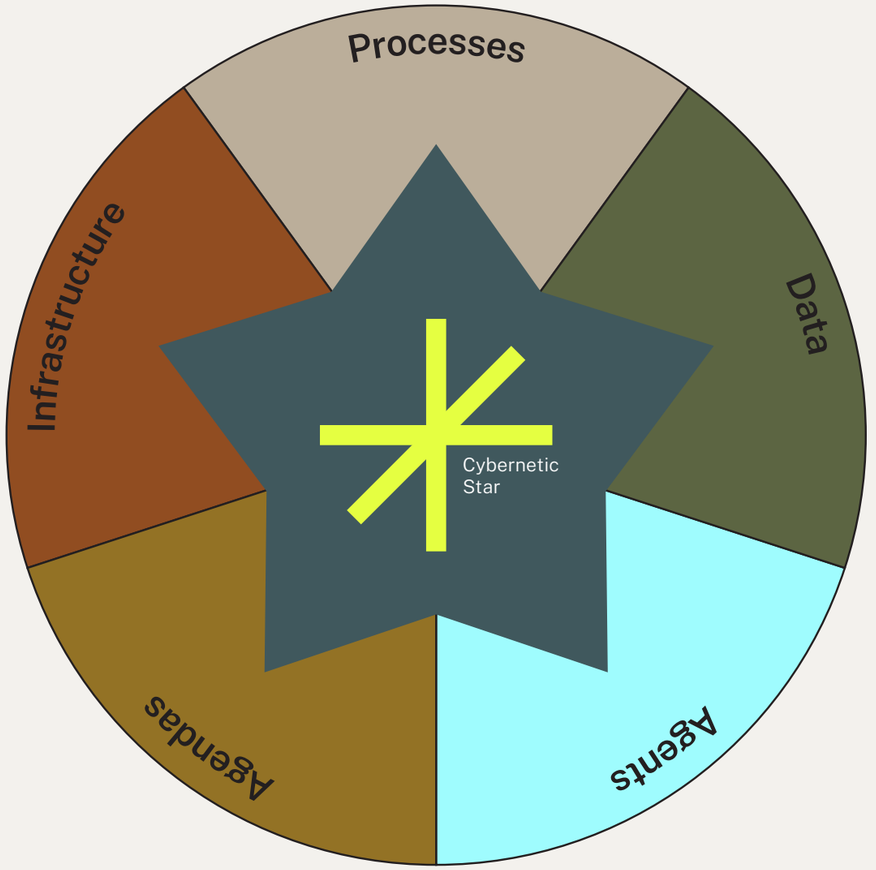
PROCESSES:

What actions are repeated – how, why, where and how often?

Processes in the metaverse will be built around the numerous actions that happen in the metaverse, including: the ways we transmit data, the ways we shape interactions both among and between people and machines, the ways we create and upload content, the ways we determine how people should behave, and the ways in which we deploy, maintain, and decommission the platform, in part or in total. These processes will shape who is empowered to do what, and which resources will be allocated where. Speculating on what the processes for a metaverse might entail helps shift perspective to the grounded, tangible, and messy realities of bringing the technology to fruition.

One emergent quality of the metaverse is that automated processes will be highly necessary and will require both discriminative and generative AI modelling. Whether it is automated data transmission and analysis, or automatically generated text and graphics, large-scale, complex, and highly effective automatic processes are the only way to sustain a metaverse at scale. Levels of automation will also increase depending on other factors, such as the extent to which experiences in the metaverse are personalised.

Automating processes often renders them invisible, and buries the agendas that power these processes behind their function. For the metaverse, asking how much automation, enacted by which technologies, will be essential to establishing a safe, responsible metaverse. We will need to assess how palatable these modes of automation are in certain circumstances. Moreover, we will need to map the unintended consequences of these processes before deploying.



A helpful starting point for thinking through the processes and the unintended consequences that may emerge in the metaverse is to ask how functions and capabilities we observe in other web platforms might translate. For example, what will the processes look like for using search in the metaverse? What will it mean to “go viral” in the metaverse? And what might the process be for connecting and disconnecting from the metaverse – what sort of rhythm might emerge? Will people connect for an entire workday? For just a few hours? Or will intervals between connection and disconnection be frequent and irregular?

Technology systems all require constant maintenance, upkeep, and work to mitigate negative impacts on the environment and human systems. These operations within the metaverse will demand real-world resources, new jobs, and new informal roles. Entirely new systems will arise, comprising infrastructure and components that will remain in the world long after the metaverse itself becomes obsolete. For this reason, decommissioning processes must be considered up front, and throughout the system’s lifecycle. Part of scenario testing for the metaverse must involve imagining its eventual end. We must take time now to consider its long-term impacts, and what could be put in place to ensure the metaverse, when viewed from the future as an historical artefact, is something to celebrate.

A FOCUS ON AGENDAS:

Steering toward an alternate future using the Star

Part of renavigating an alternate endpoint for the metaverse – one not tied to the already scripted science fiction imaginary – is seeking examples of people challenging and diverging from these dominant narratives. Using the Star, we have chosen a single point – Agendas – as a vantage from which to observe frictions, gaps, and narratives apart from those we see proliferating in the majority discourse. In many ways, the metaverse is still in its design phase. The various and competing agendas of those working to build it, as well as those potentially impacted, will drive many important decisions across the system, ultimately determining what it becomes.

The following spotlights pair Agendas with other points on the Star, highlighting some of the observable interplays between them. Identifying emerging dynamics in the metaverse – observing the system being built – helps us to ask appropriate questions about how it might take shape, what our ultimate vision for the technology should be, and how we might approach building it more safely, sustainably, and responsibly. An analysis of these dynamics also allows us to expand the boundaries of how we see the system, bringing in multiple perspectives and stories beyond the dominant narratives taking place. This enables us to imagine futures we can shape deliberately.

IMAGINING AN INDIGENOUS-FIRST METAVERSE

In seeking to unearth the ways in which different agendas for the metaverse relate to one another – reinforcing, balancing, or exposing trade-offs between one agenda over another – it is clear there are many possible opportunities to rethink whose agendas are dominant, and develop the metaverse to support more varied perspectives than have been represented by past technologies. For example, agendas for building the metaverse in non-western, non-coloniser nations contrast starkly with the Snow Crash imaginary. One optimistic outlook is that the metaverse will allow communities, for which technology has generally not been built to serve them specifically, the opportunity to leapfrog existing technology systems and economies that have traditionally excluded them, but only if they have agency and control to build the systems themselves. For social impact entrepreneurs, the appeal of the metaverse is spaces for innovation that have not yet been monopolised by more privileged interests. To that end, subversion of certain types of power – specifically decolonising the metaverse – is as much a goal as accessibility.

In Australia, several First Nations-led projects highlight a similar optimism about the possibility of creating an Indigenous metaverse by and for Indigenous peoples. The work of Mikaela Jade, founder and CEO of Indigital, shines a light on possible Indigenous-led directions for the metaverse. Their website states:

"With the dawn of the metaverse, First Nations peoples have an unprecedented opportunity to express our cultures, traditions and values in new and exciting ways. From creating immersive virtual experiences to crafting digital art – this is a chance for Indigenous creativity to thrive."[120]

Lynette Wallworth, Australian artist and filmmaker, has shown the potential for sharing Indigenous stories in profound new ways through virtual reality (VR). Her work "Collisions"[121] invites audiences to hear the story of Indigenous elder Nyarri Nyarri Morgan from the Martu tribe in the deserts of Western Australia whose first contact with Western culture came when he witnessed an atomic test in the South Australian desert. Wallworth's immersive VR experience reimagines what it means to tell stories about Indigenous history and perspectives centred in Country and verbal traditions.

In the United States, projects such as Biskaabiiyaang – an Anishinaabe word to describe "cultural resurgence, for resisting colonial violence, and for reclaiming [Anishinaabe] ways of being" – employ a metaverse-like environment to practice traditional Anishinaabe storytelling and create "inclusive, sustainable, high-quality intercultural learning materials produced by and in support of Indigenous Peoples".[122] Unlike the Snow Crash metaverse, Biskaabiiyaang and other First Nations-led projects use virtual worlds to deeply and spiritually connect to the physical world through education and storytelling about Country.

If Indigenous peoples are supported to exercise their agency in shaping the metaverse, there is hope that creating the metaverse could be a decolonising act. Seeking to honour and promote Indigenous-led agendas for the metaverse may require dismantling ideas of a "universal" (read homogenous) metaverse, and through this create space for new imaginations to emerge.

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THE SUSTAINABILITY AGENDA & ENERGY USE IN THE METAVERSE

If we look to how agendas inform the infrastructure we build, the scales we build it at, and the costs we allow it to have economically, environmentally, and other, we begin to render more visible the choices we have to build and deploy infrastructure safely, sustainably, and responsibly. Indeed, the infrastructure underlying a technological system determines much more than the system's capabilities; it also determines its impacts. The decisions we make regarding infrastructure reflect how we value other interconnected human and ecological systems.

With digital and virtual technologies, the connections between people, technology, and the environment can seem abstract, but they remain both real and profoundly consequential. Increasing awareness of how digital infrastructure consumes vast amounts of electricity and other resources has implicated new technologies in the politics of energy transition. Environmentalist efforts are surfacing the extent to which technologies required for the metaverse will demand unprecedented levels of energy use, relying on existing energy infrastructure that still depends heavily on fossil fuels.

For example, a considerable body of research has shown that generative AI models require a massive energy investment for their initial deployment, and that their ongoing use consumes far more energy than conventional internet activities, such as search queries. In 2019, Strubell, Ganesh, and McCallum from the University of Massachusetts Amherst determined that creating the generative AI model BERT consumed the equivalent energy cost of a round-trip transcontinental flight. Preparing GPT-3, a much larger generative AI model, produced the emissions equivalent of 123 gasoline-powered passenger vehicles driven for a year, according to a study by Patterson et al.

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Size is not the only variable to manage when limiting the energy costs of generative AI. A study by Google found that using more efficient processor and model architectures, along with a greener data centre, could reduce the carbon footprint for models of GPT-3's size by 100 to 1000 times. For example, a model called BLOOM, developed by the Big Science project in France and covered in Patterson et al.'s study, is similar in size to GPT-3, yet has a lower energy cost.

The energy costs of using generative AI models are more difficult to calculate. However, industry estimates agree that generative AI queries consume 4-5 times more energy than conventional search engines.[123] If AI will be among the underlying technologies of the metaverse, thorough and transparent research into the environmental impact of deploying and maintaining generative AI models needs to be conducted in order to uphold and support broader sustainability goals. Here we have an opportunity to build world systems and anticipate environmental costs, including energy use. We already know the environmental consequences of building world systems in the 19th century – a legacy that we are still coming to terms with, and transitioning away from.

ENTERING
THE “SEAMLESS” METAVERSE

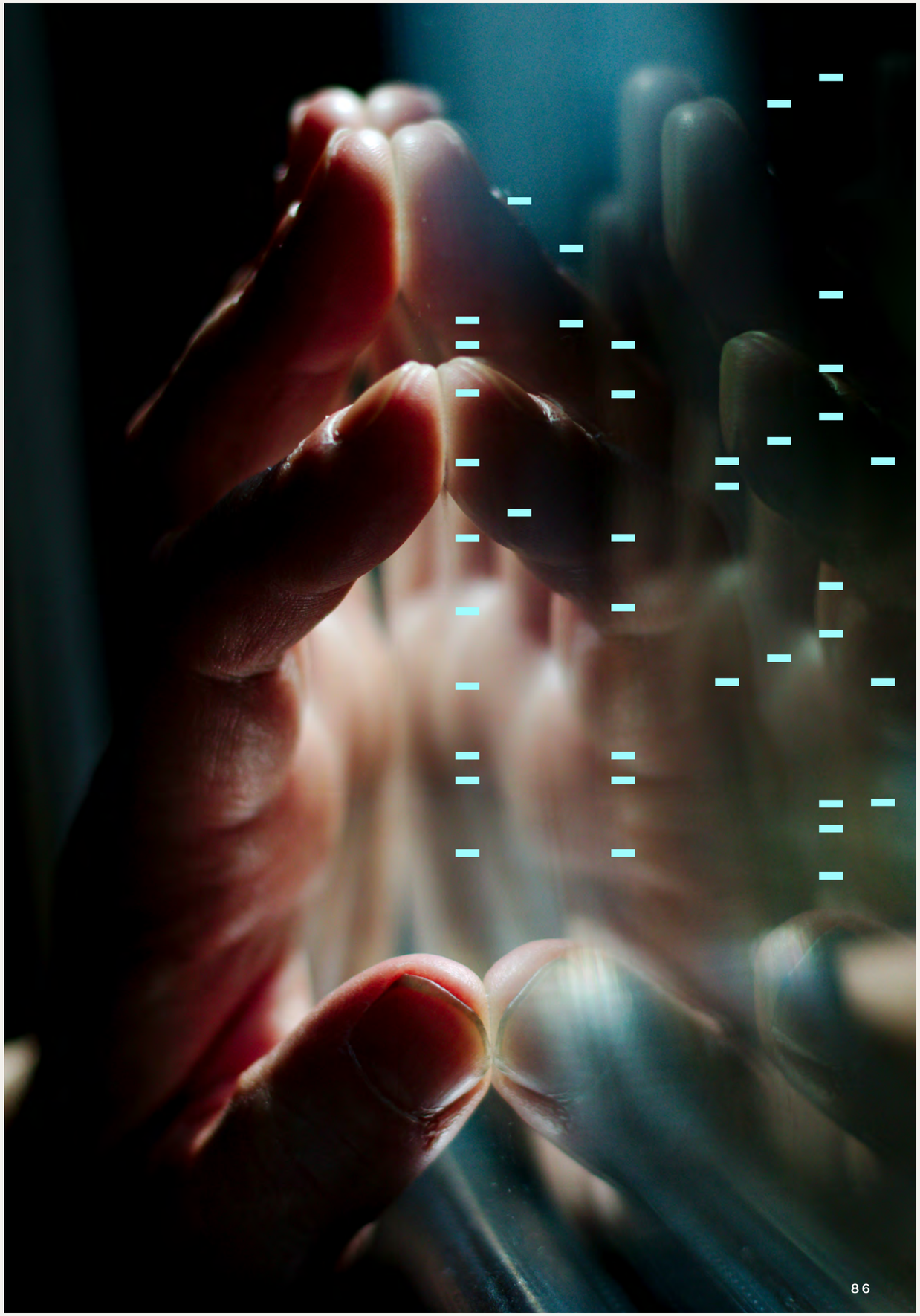
Beyond the broad structural and systemic trade-offs we should be attentive to in building the metaverse, there are also personal contexts in which it is possible to see how technologies shape the banal processes of our everyday, and through this transform how we live.

Stories of user experiences with early prototypes of the metaverse reveal how processes for connecting and disconnecting from the virtual world might work. Journalist Kashmir Hill from the New York Times describes her experiments with Meta’s Horizon Worlds as a departure from home and family life.[124] When she enters “the metaverse”, she is in a room just down the hall from her children and husband, but she describes the experience as being transported to another place – it requires a “good-bye” and absence from her children’s bedtime routines. For Hill, entering the metaverse is crossing a threshold, and her anchors to her physical environment – the sounds, movements, and possible interruptions – are either blocked out by the headset or by the closed door.

Shaping these processes for entering virtual worlds are design choices angled toward making them seamless. But by obscuring physical reference points, these virtual spaces can resemble the liminal space of a casino, designed without clocks so that time slips by unnoticed.

Peak hours within proto-metaverses – often early morning hours (1am – 3am in Horizon Worlds) – reinforce how the rhythms of attendance in the metaverse require a necessary separation between life and virtual life. It is not yet clear how these lengthy excursions into the virtual will sit alongside the rituals of home, work, and being physically present in the world , but early indicators suggest a clear division will be in place. The habits, routines, and processes of daily life will still be conducted outside of the metaverse, rather than collapsing into it.

These personal choices, the ways we choose to incorporate the technology into our routines, or not, constitute a critical dynamic that will shape the future of the metaverse, the utility we seek from it, and the ways we might allow it to merge with the ordinariness of our lives.



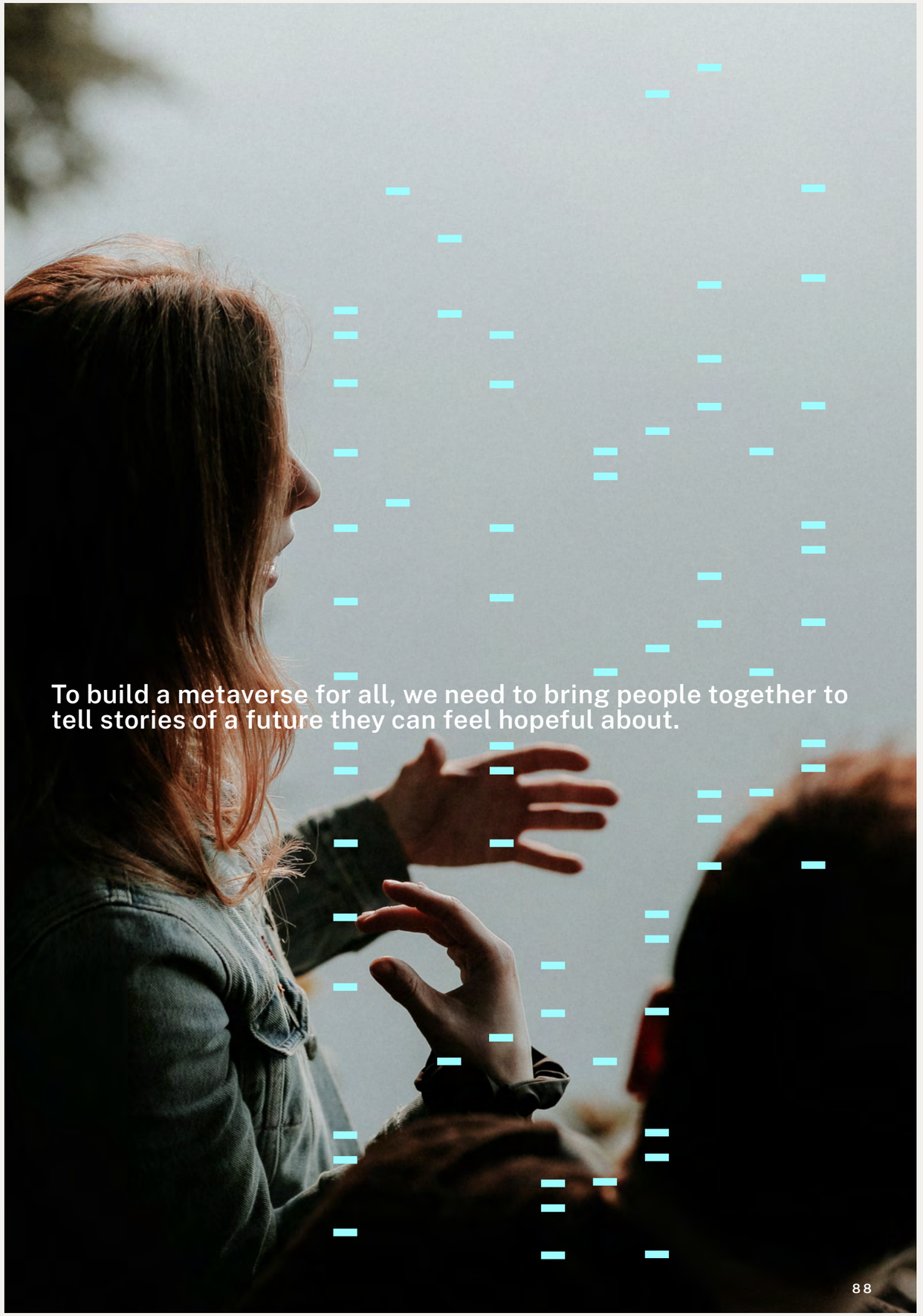
BLUEPRINTS FOR A BETTER METAVERSE

A safe, sustainable, and responsible approach to building the metaverse requires us to dismantle and rebuild its imaginary. It means holding in view where we are constrained in building a system meant to be perpetual and expansive. It means occasionally grounding ourselves in the banalities of the everyday as we formulate ideas for how a metaverse can fit within our lives, and how daily life will shape it. And it means being attentive to the influence of past stories in our construction of new stories.

If we look to only the dominant ideas for what we want the metaverse to be, and to the people who hold them, we risk perpetuating the tropes of systems (technological and social) we may not wish to live with. Whether these tropes for the metaverse come from the science fiction imaginary, or from the legacies of world systems we have built and sustained over decades and centuries, pathways for a better metaverse must come from agendas that are attentive to diverse values and needs.

Using the Cybernetic Star to break open the present and see clearly how the metaverse is emerging helps identify opportunities for steering toward better futures. Indigenous-led agendas, environmental perspectives, or simply personal contexts can offer us alternate goals for a future metaverse, as can many other perspectives now emerging against the grain of prevailing discourse. From these divergent voices and narratives extend potential levers for exploring the idea of a safer, more sustainable, more responsible metaverse. And it is in these places of tension, or in the space between the dominant narratives, that we can create a better blueprint for its construction.

To build a better metaverse we need to encourage people to get involved with the broader development of the technology. We need to open up technology development to diverse groups of people, not just as “end users” but as part of development teams. We need to assess and review how to take forward or transition away from the legacies of technology systems we build atop, including their effects on broader human and ecological systems. And, we need to be conscious of which metaphors and stories we tell about the metaverse.



SUMMARY: CYBERNETIC TECHNIQUES FOR EXPLORING THE METAVERSE

In this report, we have used cybernetic techniques to examine the metaverse from multiple angles, with the goal of illuminating the stories and agendas that have influenced, and continue to influence, its development and direction. The approach of analysing a technology as a cybernetic system paves the way to consider its safe, sustainable, and responsible design.

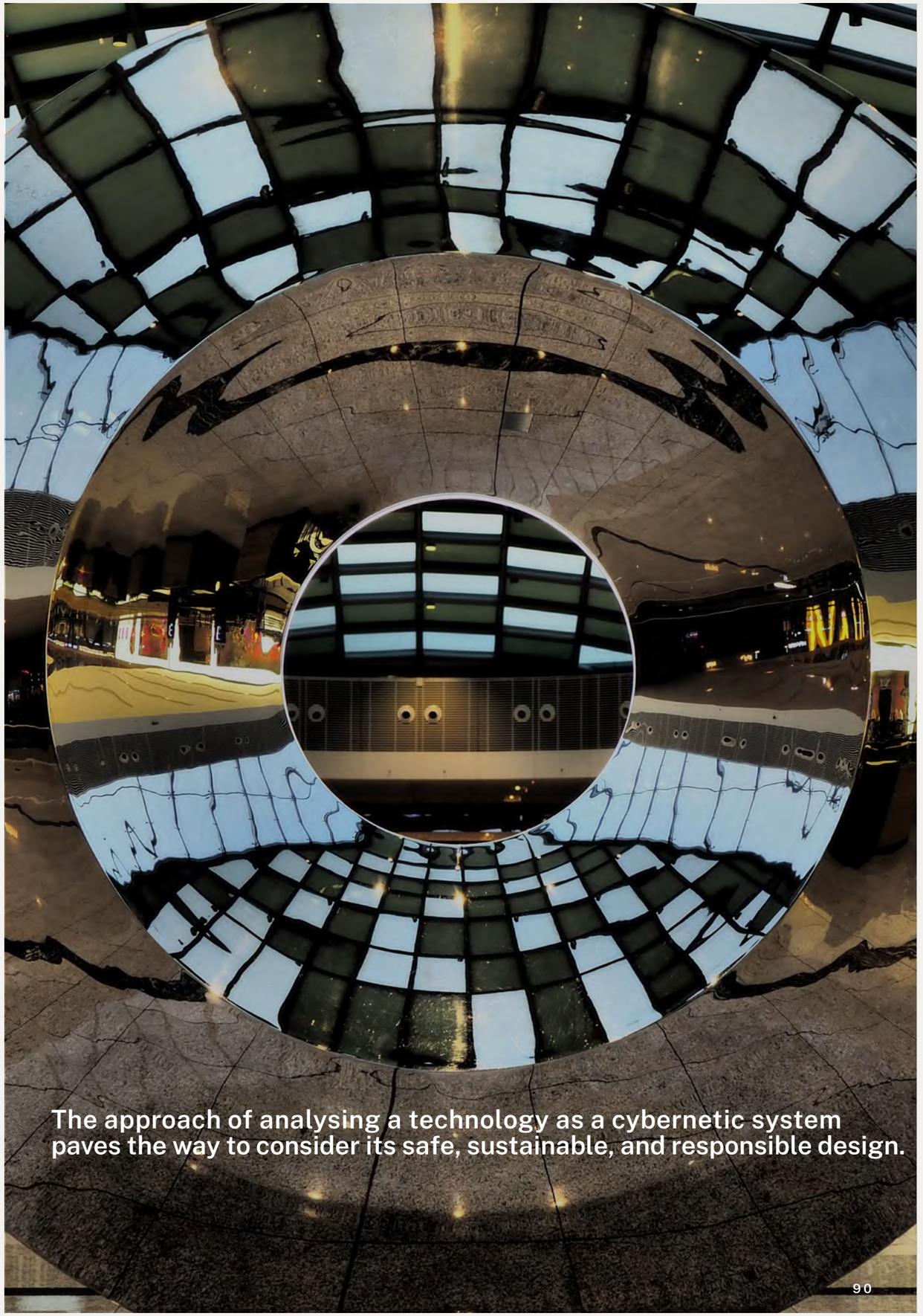
In Chapter 01, we reviewed the stories we have told about the metaverse over the last 100 years and how this has influenced the conversation today. Highlighting the stories that underpin our imaginings of a technology helps us to see these are only stories, not blueprints for technology design, and opens the possibility of imagining different stories for a future metaverse. In particular, the idea that our current spec for the metaverse as interoperable, seamless, synchronous, persistent and pervasive is less a design blueprint and more a set narrative of tropes that enabled a generation to imagine what might be possible. Acknowledging this means designing the metaverse needn't be held hostage by a totalising narrative of inevitability. This allows many different perspectives and agendas into the conversation.

We acknowledge that all technologies have histories and pre-histories and that these need surfacing so that we can understand what drives how we approach them today.

In Chapter 02, we took the idea of virtual worlds and connected communication and surfaced analogous and alternate histories of the metaverse to see the impact of other, decommissioned systems on the environment, and the creation of legacy infrastructures and processes. Examining analogous and alternate histories can reveal ways in which a technology might have broad-reaching impacts beyond our immediate agendas, allowing us to contemplate the intended and unintended consequences of the technology. Through this analysis, we see clearly how issues of race, power, sustainability, and colonialism have pervaded the design, construction, and decommissioning of other world systems, and still do today. Just because a technology seems "new", this does not let us off the hook for considering its impacts. Indeed, when we see the stated agendas of those in power who initiated previous systems, and hear their promises to transcend the very human issues any such system must inevitably face, we can bring a new awareness to similar rhetoric espoused in connection with the metaverse.

We acknowledge that the present of technologies is always more complicated and involves more people and sits in more contexts than we expect, and that this too needs surfacing so that we can understand the dynamics that shape technologies.

In Chapter 03, we analysed the metaverse with respect to its component parts, existing, emerging, and imagined. Using the Cybernetic Star, we made visible the vast amounts of infrastructure and data that will be required to build the metaverse, and the agents and processes that come up against and through it. We took a particular look at the various agendas that are at play in the metaverse, and where they appear in the context of other points on the star. Looking at a cybernetic system through the lens of the Cybernetic Star highlights places of activity and hidden agendas in relation to that system, revealing opportunities for intervention. When we consider multiple perspectives rather than only the dominant ones, we see more possibilities for safe, sustainable, and responsible design.



THE METAVERSE IS A CYBERNETIC SYSTEM

In much of the current discourse, beyond the pages of this report, the idea of “the metaverse” is totalising, encouraging us to think of it as a technology, singular. This is not uncommon with emerging technologies – generative artificial intelligence has been subject to similar misconceptions. But of course, the metaverse is actually a constellation of technologies, one created by different companies, interoperable with different platforms, and accessible by different cohorts of customers.

Through an exploration of three cybernetic approaches to the metaverse, this report reveals many things held in tension. The metaverse is a term coined in science fiction. The metaverse is a sort of virtual reality. The metaverse is the rallying cry for a range of commercial and governmental interests. The metaverse is a collection of technologies that is dynamic and ever evolving. The metaverse is an enabler of the best and worst of ourselves. The metaverse is an idea, realised and unrealised in equal measures. The metaverse is already happening, and always a little bit out of reach. It has, like other ideas foreshadowed in the cyberpunk tradition, found its way into broader conversations, and shaped much of the digital landscape in which we now find ourselves.

This journey through the metaverse leads us to an important realisation: the metaverse is itself a cybernetic system. Cybernetics, with its description and application of feedback and control, as well as governance and steering systems, has helped us analyse the metaverse. Using a cybernetic lens in this report has helped us explore the metaverse in multiple ways, as a dynamic and changing system that must traverse many time scales, relationships, and stories.

Our cybernetics brings story, history, and dynamics to systems analysis. To see a system cybernetically, we engage with the following ideas:

+ Dynamics in the system occur not only between people, or technological parts within the system, but also between people, technologies, and their environments. These are not easily reducible to data points, and are frequently expressed through stories.

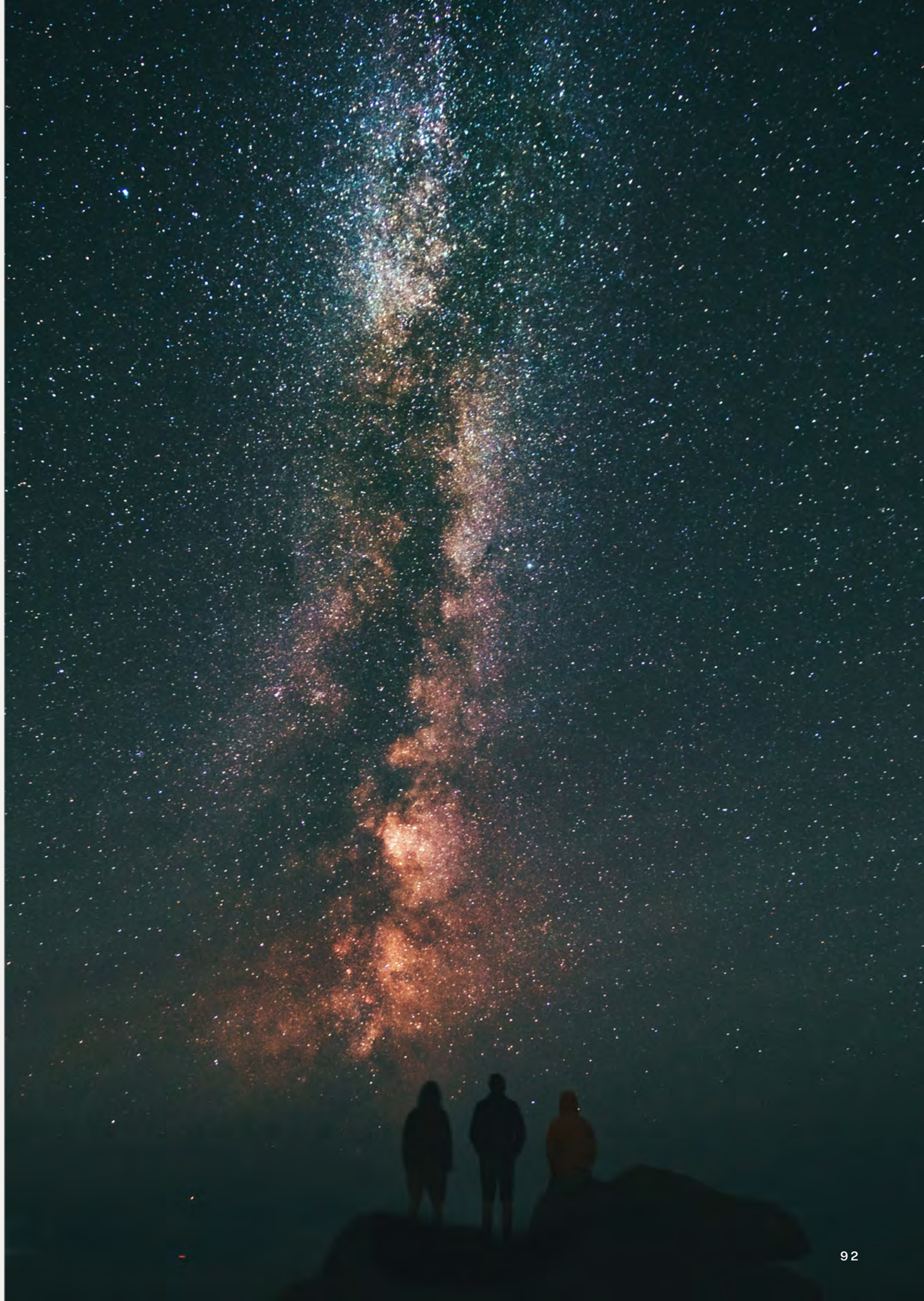
+ The system must be viewed from multiple time scales and through actions in the past, present, and in our stories about the future. So dynamics wax and wane over time, according to the emergence and diminishment of connections between people, technology, and environments.

+ Attention must be paid to the stories that convey meaning and prompt action throughout the system, through people and their interaction with technology and environments. These stories are emergent but can be shaped and steered, which can in turn shape and steer the system.

If the goal is simply to see the system more fully, we can deploy any number of systems mapping tools that help us choose the questions to ask and the places to look for a fuller picture of a complex system like the metaverse. But simple awareness of the broader system is not enough. Recognising the metaverse as a cybernetic system from the outset provides a useful framework, as it acknowledges that rather than a technology, the metaverse is a collection of technologies and ideas, that include humans and environments, in a complex dance that is forever shifting and changing.

Whilst designing the blueprint of such a complex system in its entirety is beyond any one group’s capabilities, some components of this system can and should be intentionally crafted, particularly those that touch upon our accountability, our responsibility for one another, and for the part of our universe – the earth – without which the metaverse cannot exist.

Cybernetics offers tools to challenge our thinking about systems. This report is an example of a cybernetic analysis. But it would be a shame if it stayed on static pages, on a shelf. The goal with any cybernetic analysis is for it to be taken into real contexts, challenged, tested, talked about, and used to bring new voices into the conversation. If this report can spark more and varied conversations about the metaverse, then we are on our way to a better blueprint.



ENDNOTES

[1] Wagner James Au, “Neal Stephenson isn’t giving up on the metaverse –or crypto,” Fast Company, (August 10 2023), https://www.fastcompany.com/90935596/neal-stephenson-on-reclaiming-his-metaverse

[2] Genevieve Bell and Paul Dourish, ‘’Resistance is Futile: Reading Science Fiction alongside Ubiquitous Computing,” Pervasive and Ubiquitous Computing, (2014) 18:778.

[3] Around the turn of the 21st century, the refrain “Where’s my jetpack?” became an early internet meme, signalling frustration with long-promised futuristic innovations that had failed to arrive (generally for good reason). Science fiction author Daniel H. Wilson’s 2007 book Where’s My Jetpack? offers a survey of the category, covering flying cars, moon colonies, and yes, jetpacks.

[4] Patricia S. Warrick, “The Cybernetic Imagination in Science Fiction,” MIT Press, (1980).

[5] Karel Čapek, “R.U.R.,” translated by Paul Selver and Nigel Playfair. Dover Publications, (2001).

[6] Karel Čapek, “R.U.R.,” 11.

[7] Genevieve Bell, “Smart, Fast and Connected: what it means to be human and Australian in the digital world,” Boyer Lectures, Australian Broadcasting Corporation, (2017). https://www.abc.net.au/radionational/programs/boyerlectures/series/2017-boyer-lectures/8869370. 2017: Episode 3.

[8] Genevieve Bell and Andrew Meares, “Whirring machines: cybernetics and the pre/histories of automata,” Torer, Russell (ed), Jordan Wolfson: Body Sculpture, National Gallery of Australia, Canberra, (forthcoming 2023). See also Genevieve Bell, “Making life: a brief history of human-robot interaction,” Consumption Markets & Culture, 21:1, 22-41.

[9] Mary Wollstonecraft Shelley. “Frankenstein, or, The Modern Prometheus”, the 1818 Text. Oxford ; New York : Oxford University Press, (1998). Moshe Idel, “Golem: Jewish Magical and Mystical Traditions on the Artificial Anthropoid,” Albany, New York: State University of New York Press.

[10] Jessica Riskin. “The Restless Clock: A History of the Centuries-Long Argument Over What Makes Living Things Tick,” University of Chicago Press. 2016 p. 301

[11] Scott Schaut, ”Robots of Westinghouse”: 1924-today, Mansfield, Ohio : Scott Schaut, Mansfield Memorial Museum, 2006, pp 91-200.

[12] Schaut, “Robots of Westinghouse,” 182.

[13] David A. Kirby, “Lab Coats in Hollywood: Science, Scientists, and Cinema,” Cambridge, Mass: MIT Press, (2011): 15.

[14] [1] Johnson, Brian David (20 April 2011). “Science Fiction Prototyping: Designing the Future with Science Fiction,” Morgan & Claypool, 22

[15] Minisky is referenced in Kirby, “Lab Coats in Hollywood,” 36; Scharwtz is referenced in Johnson “Science Fiction Prototyping”, 22; and the Desk Set is referenced in Nathan Ensmenger, “The Computer Boys Take Over: Computers, Programmers and the Politics of Technical Expertise,” MIT Press, 2010, 137-138.

[16] A great deal has been written about this space, including: Rob Shields, “The Virtual,” Routledge, (2002), https://doi.org/10.4324/9780203987186; Tom Boellstorff, “The Long History of Virtual Worlds,” Deccan Herald, 19 August 2022, https://www.deccanherald.com/special-features/the-long-history-of-virtual-worlds-1137606.html; Terry, QuHarrison, and Scott Keeney, “History of the Metaverse,” The Metaverse Handbook: Innovating for the Internet’s next Tectonic Shift, 1st ed., 57–73. Indianapolis: John Wiley and Sons, 2022.

[17] Stanley G. Weinabum, “A Martian Odyssey and Other Science Fiction Tales,” Westport, Connecticut: Hyperion Press, (1974): 160.

[18] Weinbaum, A Martian Odyssey, 160

[19] Weinbaum, A Martian Odyssey, 160

[20] The cutting-edge consumer technology of Weinbaum’s era was that of the camera, and his device employ a chemical process akin to photography. Weinbaum, “A Martian Odyssey,” 162.

[21] Weinbaum, “A Martian Odyssey,” 162

[22] Weinbaum, “A Martian Odyssey,” 163

[23] Mark W Bell, “Toward a Definition of “Virtual Worlds,” Journal For Virtual Worlds Research 1, no. 1 (2008): 1–5, https://doi.org/10.4101/jvwr.v1i1.283; Carina Girvan, “What Is a Virtual World? Definition and Classification,” Educational Technology Research and Development 66, no. 5 (2018): 1087–1100, https://doi.org/10.1007/s11423-018-9577-y; Maravilla, Morelia Malina, Angela Cisneros, Alvorado Stoddard, Desiree DeAndrea Scretching, Brian Kyle Murray, and Elissa Redmiles, “Defining Virtual Reality: Insights from Research and Practice,” iConference 2019 Proceedings, University of Illinois, 2019, https://doi.org/10.21900/iconf.2019.103338.

[24] Howard Rheingold, “Virtual Reality,” 49-67.

[25] Howard Rheingold, “Virtual Reality,” 16-17

[26] There is a rich vein of work exploring the history of virtual reality, including: Howard Rheingold’s “Virtual Reality,” p 49-128; Mark Pesce’s “Augmented Reality: unboxing Tech’s next big thing” Polity Press, (2021); as well as Joseph Conte ‘’Virtual Reality” in Stephen J Burn, Ed, American Literature in Transition, 1990-2000. (Cambridge University Press, 2017), (pp.279-294)

[27] Jaron Lanier, “Dawn of the New Everything: A Journey through Virtual Reality,” London: The Bodley Head, (2017): 42

[28] Ivan Sutherland, “The Ultimate Display,” Proceedings of IFIP Congress, (1965), pp. 506-508.

[29] Ivan Sutherland, “A head mounted three dimensional display,” Proceedings of AFIPS 68, (ACM 1968), pp. 757–764. See also Howard Rheingold, “Virtual Reality,” 104-112

[30] Vernor Vinge and James Frenkel, “True Names by Vernor Vinge and the Opening of the Cyberspace Frontier” 1st ed., (New York: Tor): 241.

[31] Vernor Vinge and James Frenkel, “True Names,” 241.

[32] Vernor Vinge and James Frenkel, “True Names,” 251-252.

[33] Vernor Vinge and James Frenkel, “True Names,” 250.

[34] Vernor Vinge and James Frenkel, “True Names,” 271.

[35] Howard Rheingold, “Virtual Reality,” 110.

[36] Vernor Vinge and James Frenkel, “True Names,” 227-228.

[37] Vernor Vinge and James Frenkel, “True Names,” 175.

[38] IEEE Computer Society, “Digest of Papers: COMPCON Spring 94, February 28-March 4, 1994,” Los Alamitos, California: IEEE Computer Society Press, (1994): 187.

[39] IEEE Computer Society, “Digest of Papers,” 188.

ENDNOTES

[40] Vernor Vinge and James Frenkel, “True Names,” 20.

[41] Patrick A. Smith, “Conversations with William Gibson,” Literary Conversations Series, (Jackson: University Press of Mississippi, 2014): 43.

[42] William Gibson, “Burning Chrome,” (London: Gollancz, 2016): 179.

[43] Patrick A. Smith, “Conversations with William Gibson,” 43.

[44] William Gibson, “Burning Chrome,” 181.

[45] William Gibson, “Burning Chrome,” 181.

[46] William Gibson, “Neuromancer: With a New Afterword by the Author,” (London: HarperCollins, 1995): 67.

[47] Bruce Sterling, Preface, in William Gibson, “Burning Chrome,” (London: Gollancz, 1986): 2-5.

[48] Jaron Lanier, ”Dawn of the New Everything,” 246.

[49] William Gibson, “An Interview with William Gibson” by Noel Murray, avclub.com, August 22, 2007, https://www.avclub.com/william-gibson-1798212115

[50] Rheingold, “Virtual Reality,” 17.

[51] Steph Smith, “Neal Stephenson on the Future of the Metaverse,” a16z Podcast, November 22, 2022, https://a16z.simplecast.com/episodes/neal-stephenson-on-the-future-of-the-metaverse-wJB_KBkr

[52] Neal Stephenson, “Snow Crash,” Great Britain: Penguin UK, (2022): 18

[53] As stated in the text, if you build something in the metaverse “the hundred million richest, hippest, best-connected people on earth will see it every day of their lives”, which presumably helps explain investors’ enduring enthusiasm for the idea.

[54] Neal Stephenson, “Snow Crash,” 43.

[55] Tom Boellstorff, “Coming of Age in Second Life: An Anthropologist Explores the Virtually Human,” New Jersey: Princeton University Press, (2008); Thomas M Malaby, “Making Virtual Worlds: Linden Lab and Second Life,” Ithaca: Cornell University Press, (2009).

[56] Kate Linebaugh, “How to Build a Metaverse, Part 1: Genesis,” The Journal Podcast, (September 23, 2022), https://www.wsj.com/podcasts/the-journal/how-to-build-a-metaverse-part-1-genesis/a4ccd7fe-08ef-4079-b809-3c374d034e84

[57] Wagner James Au, The Making of Second Life: Notes from the New World, (New York: Collins, 2008): 21

[58] Wagner James Au, “The Making of Second Life: Notes from the New World,” New York: Collins, (2008): 21.

[59] Tom Boellstorff, “Coming of Age,” New Jersey: Princeton University Press, (2008); Caroline Meek-Prieto, “Just Age Playing Around - How Second Life Aids and Abets Child Pornography,” North Carolina Journal of Law and Technology 9, no. 3 (2007): 88–111, https://scholarship.law.unc.edu/cgi/viewcontent.cgi?article=1134&context=ncjolt&httpsredir=1&referer= ; Irwin, Angela, and Jill Slay, “Detecting Money Laundering and Terrorism Financing Activity in Second Life and World of Warcraft,” 41–50, Perth, Western Australia: Edith Cowan University, 2010, https://ro.ecu.edu.au/icr/5/; Robert Stokes, “Virtual Money Laundering: The Case of Bitcoin and the Linden Dollar,” Information & Communications Technology Law 21, no. 3 (2012): 221–36, https://doi.org/10.1080/13600834.2012.744225; Christina Koutra, “Is “Second Life” Taking over “Real Life”? Sociability and Social Interaction within the “Second Life” Environment: An Electronic Ethnographic Study,” Computing and Information Systems 18, no. 2 (2014): 2–17, https://eprints.bournemouth.ac.uk/21263/.

[60] Leslie Jamison writing for The Atlantic attributes to the fact that ‘people wanted a curated version of real life more than they wanted another life entirely — they wanted to become their most flattering profile picture more than they wanted to become a wholly separate avatar’ (Source: https://www.theatlantic.com/magazine/archive/2017/12/second-life-leslie-jamison/544149/).

[61] Simon Parkin. Who needs the metaverse: meet the people still living on Second Life, the Guardian, June 10 2023. https://www.theguardian.com/technology/2023/jun/10/who-needs-the-metaverse-meet-the-people-still-living-on-second-life

[62] Ernest Cline, “Ready Player One,” (New York: Crown Publishers, 2011): 25

[63] Ernest Cline, “Ready Player One,” 49

[64] META. Introducing META: a social technology company. Press Release. October 2021. https://about.fb.com/news/2021/10/facebook-company-is-now-meta/

[65] Bruce Sterling, “Preface,” 4.

[66] ”Scott Smith (Changeist) @ MFW13”, VIMEO video, posted by Media Perspectives, https://vimeo.com/66314529

[67] A similar ad for Disney’s planned offerings for the Vision Pro promises full immersion in the worlds of Marvel and Star Wars, and even has Mickey Mouse offering an ”OASIS GETAWAY”.

[68] Weinbaum, “A Martian Odyssey,” 161-162.

[69] Steph Smith, “Neal Stephenson on the Future of the Metaverse”.

[70] Karen Cadora, “Feminist Cyberpunk”, Science Fiction Studies vol. 2, no. 3 (November 1995): 357-358.

[71] Constance Grady, “The Ready Player One Backlash, Explained,” Vox, (26 March 2018), https://www.vox.com/culture/2018/3/26/17148350/ready-player-one-book-backlash-controversy-gamergate-explained ; Alfie Bowen, “Steven Spielberg’s Film Portrays Video Gamers at Their Worst,” The Guardian, 30 March 2018, sec. Opinion, https://www.theguardian.com/commentisfree/2018/mar/30/steven-spielberg-video-gamers-ready-player-one-gaming.

[72] Blechman, Alex (@alexblechman) ”Sci-Fi Author: In my book I invented the Torment Nexus as a cautionary tale Tech Company: At long last, we have created the Torment Nexus from classic sci-fi novel Don't Create The Torment Nexus” Twitter, November 19, 2021, 9:49 a.m. https://twitter.com/AlexBlechman/status/1457842724128833538?lang=en

[73] Jaron Lanier, “Dawn of the New Everything,” 246.

[74] Genevieve Bell, "Switching On: our pre/history and the lessons we can learn," Keynote, Energy Networks Australia, Brisbane, (March, 2022). Reported in the press here: Rae, M. 2002. Putting people back into energy transition. PerthNow. March17 2002. https://www.perthnow.com.au/business/putting-people-back-into-energy-transition-c-6090314

ENDNOTES

[75] Genevieve Bell, "Touching the Future: Stories of Systems, Serendipity and Grace," Griffith Review 71, (2021).

[76] There is a considerable body of scholarship that informs the approach in this chapter. See in particular: Genevieve Bell, "Fast, Smart and Connected: What is it to be Human, and Australian, in a Digital World?," The Boyer Lectures, (Sydney: Australian Broadcasting Corporation, 2017); "Making Life: a Brief History of Human-Robot Interaction," Consumption Markets & Culture 21, no. 1 (2018). https://doi.org/10.1080/10253866.2017.1298555 ;"Talking to AI: An anthropological encounter with Artificial Intelligence," Handbook of Cultural Anthropology. Edited by, Pedersen, L and L Cliggett, (New York: Sage Publishing, 2021): 428-444. "Touching the Future: Stories of Systems, Serendipity and Grace," Griffith Review, 71, (2021). "The Metaverse is a New Word for an Old Idea," MIT Technology Review, February (2022). https://www.technologyreview.com/2022/02/08/1044732/metaverse-history-snow-crash/. "Switching On: our pre/history and the lessons we can learn," Keynote, Energy Networks Australia, (Brisbane March, 2022. ''Messages pass through: Re/telling stories of the Overland Telegraph Line," Ann Moyal Memorial lecture, (Canberra: National Library of Australia, 2023). Also included here is Genevieve Bell and Andrew Meares, "Whirring machines: cybernetics and the pre/histories of automata," In Torer, Russell (ed), Jordan Wolfson: Body Sculpture, National Gallery of Australia, Canberra, (forthcoming 2023).

[77] Here there are two joint works emerging from the School of Cybernetics. See Genevieve Bell, Maia Gould, Brenda Martin, Amy McLennan and Ellen O'Brien, "Do More Data Equal More Truth? Toward a Cybernetic Approach to Data," Australian Journal of Social Issues 56, no. 2 (2021), https://doi.org/https://doi.org/10.1002/ajs4.168 https://onlinelibrary.wiley.com/doi/abs/10.1002/ajs4.168; Genevieve Bell, Alex Zafiroglu, Zena Assaad, Charlotte Bradley, Ned Cooper, Ellen O'Brien, Kathy Reid, and Lorenn Ruster, "Custodians and Midwives: The Library of the Future," School of Cybernetics, Australian National University, 2021.

[78] Jules Verne, "A Floating City," London: Sampson Low, Marston, Low & Searle, 1874.

[79] Genevieve Bell, "The Metaverse is a New Word for an Old Idea".

[80] Stuart Dodgson Collingwood, "The Life and Letters of Lewis Carroll," Musaicum Books, (2017), Chapter II.

[81] Ravail Khan, "First Metaverse Architecture Biennale Converges Global Meta-Creators to Reshape Virtual Realm," designboom, (14 July 2023), https://www.designboom.com/architecture/first-metaverse-architecture-biennale-global-meta-architects-virtual-realm-07-14-2023/.

[82] Key works on the great exhibition include: Altick, R.D. "The Shows of London," Belknap Press, Harvard University Press, (1978). J. Auerback, "The Great Exhibition of 1851: a nation on display," Yale University Press, (1999). E. Chang, "Ivory Balls and Porcelain Plates: exhibiting China in mid-victorian London," Cultures of Exhibition, (Last modified 2005). https://case.edu/affil/sce/Texts_2005/Chang.htm ; R. Douglas-Fairhurst, "The Turning Point: a year that changed Dickens and the world," Jonathan Cape & BH, (2021). J. Nash, L. Haghe, D. Roberts, "Dickinsons' comprehensive pictures of the Great Exhibition of 1851," London: Dickinson, Brothers, Her Majesty's Publishers, (1852).

[83] Genevieve Bell, "The Metaverse is a New Word for an Old Idea".

[84] Charles Babbage, "The Exposition of 1851; or Views of the Industry, the Science, and the Government, of England," London: John Murray, (1851).

[85] Kate Colquhoun, "A Thing in Disguise: The Visionary Life of Joseph Paxton," (HarperCollins, 2004), Ch. 16

[86] There is a whole body of excellent critical literature on the Worlds Fairs. Key works here include: R. Barbrook, "Imaginary Futures: from thinking machines to the Global Village," (2007), London: Pluto Press. P. Greenhalgh, "Fair World: a history of world's fairs and expositions from London to Shanghai," (1851-2010); Papadakis, (2011) ; Robert W. Rydell, "All the World's a Fair: Visions of Empire at American International Expositions," University of Chicago Press, (1987). Robert W. Rydell, J.E. Findling and K.D. Pelle, "Fair America: World's Fairs in the United States" Smithsonian Books, (2000). Robert W. Rydell and L.B. Schiavo, "Designing Tomorrow: America's World's Fairs of the 1930s," Yale University Press, (2011).

[87] N. Bolotin, and C. Laing, "The World's Columbian Exposition: the Chicago World's Fair of 1893," University of Illinois Press, (2002); L. D. Schrenk, "Building a century of press: the architecture of Chicago's 1933-1934 World's Fair," University of Minnesota Press, (2007). N. Gate, "The Midway Plaisance at the 1893 World's Columbian Exposition in Chicago," (2017).

[88] G. Gullett, "Our Great Opportunity: Organized Women Advance Women's Work at the World's Columbian Exposition of 1893." Illinois Historical Journal 87, no. 4 (1994): 259–276. http://www.jstor.org/stable/40192854

[89] John Brisben Walker, "The Cosmopolitan Illustrated Monthly Magazine," September, Vol XV, No.5 (1893): 517-518.

[90] Wright, F.L. "A Testament," New York: Bramhall House, (1957). Bederman, G. "Manliness and Civilization: A Cultural History of Gender and Race in the United States 1880-1917" (1 ed.), Chicago: University of Chicago Press, (1996).

[91] Ida B. Wells, "The Reason Why the Colored American Is Not in the World's Columbian Exposition," with contributions by Frederick Douglass, Irvine Garland Penn, and Ferdinand Lee Barnett. Chicago, Illinois: Miss Ida B. Wells, (1893).

[92] N. Bolotin, and C. Laing, "The World's Columbian Exposition: the Chicago World's Fair of 1893," University of Illinois Press, (2002). N. Bolotin, and C. Laing, "Creating the World's First Midway," In Chicago's Grand Midway: A Walk around the World at the Columbian Exposition, 1–19. University of Illinois Press, (2017). http://www.jstor.org/stable/10.5406/j.ctt1q31sd7.5 ; N. Gate, "The Midway Plaisance at the 1893 World's Columbian Exposition in Chicago," (2017); I. Ormos, "Cairo in Chicago: Cairo Street at the World's Columbian Exposition of 1893," (2021).

[93] Curtis M Hinsley, and David R Wilcox (ed). "Coming of Age in Chicago: the 1893 World's Fair and the coalescence of American Anthropology," University of Nebraska Press, (2016).

[94] Works references here: S.M. Silverman, "The Amusement Park: 900 years of Thrills and Spills, and the dreamers and schemers who built them," New York: Black Dog, (2019) ; Richard Snow, "Disney's Land: Walt Disney and the history of the amusement park that changed the world", (2020). J. Wood, (Ed). "The Amusement Park: history, culture and the heritage of pleasure," Routledge, (2017).

[95] Chris Morash, "Re-Placing "the Triumph over Time and Space: Ireland, Newfoundland, and the Transatlantic Telegraph," The Canadian Journal of Irish Studies 43, (2020): 58–79, https://www.jstor.org/stable/27041315; Ken Beauchamp, "History of Telegraphy," IEE History of Technology Series 26, London: Institution of Electrical Engineers, (2001); Geoffrey Blainey, "The Tyranny of Distance: How Distance Shaped Australia's History," Rev. ed., 21st century ed. Sydney: Pan Macmillan, (2001); Simone Müller, "Wiring the World: The Social and Cultural Creation of Global Telegraph Networks," Columbia Studies in International and Global History, New York: Columbia University Press, (2016).

[96] Tom Standage, "The Victorian Internet: The Remarkable Story of the Telegraph and the Nineteenth Century's On-Line Pioneers," Berkley trade pbk. ed. New York, N.Y: Berkley Books, (1999); Alexander J. Field, "French Optical Telegraphy, 1793-1855: Hardware, Software, Administration," Technology and Culture 35, no. 2 (1994): 315–47, https://doi.org/10.2307/3106304 ; Kirwan, Adrian James Kirwan, "R.L. Edgeworth and Optical Telegraphy in Ireland, c. 1790–1805," Proceedings of the Royal Irish Academy: Archaeology, Culture, History, Literature 117C (2017): 209–35, https://doi.org/10.3318/priac.2017.117.02.

[97] The key works on the overland telegraph line include: Frank Clune, "Overland Telegraph: The Story of a Great Australian Achievement and the Link between Adelaide and Darwin," 1st ed. (Sydney: Angus and Robertson, 1955); Peter Taylor, "An End to Silence: The Building of the Overland Telegraph Line from Adelaide to Darwin," 1st ed. (Sydney: Methuen Australia, 1980); Ann Moyal, "Clear Across Australia: a History of Telecommunications," 1st ed., 35-60. Melbourne Australia: Thomas Nelson Australia, (1984); and Derek Pugh, "Twenty to the Mile: The Overland Telegraph Line," Sesqincentenary ed.: Derek Pugh, (2021).

[98] "THE OVERLAND TELEGRAPH LINE," Border Watch (Mount Gambier, SA : 1861 - 1954), p. 2, (28 August), viewed 05 Jul 2023, http://nla.gov.au/nla.news-article77127553

ENDNOTES

[99] Jennifer Martiniello, "As Strands of Plaited Music: My Chinese-Aboriginal-Anglo Heritage." In Lost in Whitewash: Aboriginal-Chinese Encounters from Federation to Reconciliation, edited by Penny Edwards and Yuanfang Shen, 23-35. Canberra, Australia: Humanities Research Center, Australian National University, (2003).

[100] There is a significant range of works on camels and cameleers in Australia. Here we are drawing on: M. Cigler, "The Afghans in Australia," 1st ed. Melbourne, Australia: AE Press, (1986); Philip Jones and, A. Kenny, "Australia's Muslim Cameleers: Pioneers of the Inland 1860s–1930s," Kent Town, Australia: Wakefield, (2007); Christine Stevens, "Tin Mosques and Ghantowns: a History of Afghan Camel Drivers in Australia," Melbourne, Australia: Oxford University Press, (1989).

[101] M. J. Gooley, "The Construction of the Overland Telegraph Line - Port Augusta to Darwin," Overland Telegraph Centenary Symposium, Australian Post Office, 1972.

[102] Philip Gee, "Lake Eyre South: A History of Pastoralism in the Lake Eyre South Drainage Basin," Adelaide, Australia: Royal Geographic Society of South Australia, (2000).

[103] Grace Koch and Koch H and Institute for Aboriginal Development (Alice Springs, N.T.) (eds). "Kaytetye Country: An Aboriginal History of the Barrow Creek Area," Alice Springs, N.T: Institute for Aboriginal Development Publications, (1993).

[104] Genevieve Bell, Alex Zafiroglu, Zena Assaad, Charlotte Bradley, Ned Cooper, Ellen O'Brien, Kathy Reid, and Lorenn Ruster, "Custodians and Midwives: The Library of the Future," School of Cybernetics, Australian National University, 2021.

[105] Meta, "The Facebook Company Is Now Meta". Meta (blog), (28 October 2021). https://about.fb.com/news/2021/10/facebook-company-is-now-meta/.

[106] Mark Zuckerberg, "Founder's Letter, 2021". Meta (blog), (28 October 2021): para. 29. https://about.fb.com/news/2021/10/founders-letter/.

[107] Apple, "Apple Vision Pro". (Accessed 31 July 2023). https://www.apple.com/apple-vision-pro/.

[108] Standards Australia, "Metaverse risks & consumer safety requirements highlighted in a new whitepaper," (May 12, 2023), https://www.standards.org.au/news/metaverse-risks-consumer-safety-requirements-highlighted-in-new-whitepaper

[109] Digital NSW, "The metaverse and the NSW Government," (November 2022), https://www.digital.nsw.gov.au/policy/metaverse-and-nsw-government

[110] T. Parisi, and M. Pesce, "A brief history of metaverse," A podcast, (2022). https://nextbillionseconds.com/a-brief-history-of-the-metaverse/

[111] Ray Oldenberg, "The Great Good Place: Cafes, Coffee Shops, Community Centres, Beauty Parlors, General Stores, Bars, Hangouts, and How They Get You Through the Day," Paragon House, (1989).

[112] Yuntao Wang, Zhou Su, Ning Yang, Dongxiao Liu, Rui Xing, Tom H. Luan and Xuemin Shen. "A Survey on Metaverse: Fundamentals, Security, and Privacy," TechRxiv, Preprint. 2022. https://doi.org/10.36227/techrxiv.19255058.v1

[113] "History of the Web." World Wide Web Foundation. Last modified 2022. https://webfoundation.org/about/vision/history-of-the-web/

[114] There are multiple authors who have written on the taxonomies of infrastructure in the metaverse, including: S.-M. Park and Y.-G. Kim, "A Metaverse: Taxonomy, Components, Applications, and Open Challenges," IEEE Access, vol. 10, pp. 4209-4251, (2022), doi: 10.1109/ACCESS.2021.3140175; H. Wang et al., "A Survey on the Metaverse: The State-of-the-Art, Technologies, Applications, and Challenges," IEEE Internet of Things Journal, vol. 10, no. 16, pp. 14671-14688, (15 Aug 2023), doi: 10.1109/JIOT.2023.3278329; G. D. Ritterbusch and M. R. Teichmann, "Defining the Metaverse: A Systematic Literature Review," IEEE Access, vol. 11, pp. 12368-12377, (2023), doi: 10.1109/ACCESS.2023.3241809; D. B. Rawat and H. El Alami, "Metaverse: Requirements, Architecture, Standards, Status, Challenges, and Perspectives," IEEE Internet of Things Magazine, vol. 6, no. 1, pp. 14-18, (March 2023), doi: 10.1109/IOTM.001.2200258; Z. Huang, C. Xiong, H. Ni, D. Wang, Y. Tao and T. Sun, "Standard Evolution of 5G-Advanced and Future Mobile Network for Extended Reality and Metaverse," IEEE Internet of Things Magazine, vol. 6, no. 1, pp. 20-25, (March 2023), doi: 10.1109/IOTM.001.2200261. Wolfe, Samantha G., Martina Welkhoff, Amy LaMeyer and Luis Bravo Martins. Metaversed: See Beyond the Hype. Wiley, (2023); Leslie Shannon, "Interconnected Realities: How the Metaverse Will Transform Our Relationship with Technology Forever," John Wiley & Sons, Incorporated, (2023). ProQuest Ebook Central, https://ebookcentral-proquest-com.virtual.anu.edu.au/lib/anu/detail.action?docID=7255373; Antonio Flores-Galea, "Journey to the Metaverse: Technologies Propelling Business Opportunities," Business Expert Press, (2023). ProQuest Ebook Central, https://ebookcentral-proquest-com.virtual.anu.edu.au/lib/anu/detail.action?docID=30379236.

[115] Gordon Scott, "Linden Dollar: What It Is, How It Works, Tax Implications," Investopedia, (29 September 2022), https://www.investopedia.com/terms/l/linden-dollar.asp; European Central Bank, "Virtual Currency Schemes," Frankfurt am Main: European Central Bank, (October 2012), https://www.ecb.europa.eu/pub/pdf/other/virtualcurrencyschemes201210en.pdf.

[116] Katitza Rodriguez, and Kurt Opsahl, "Augmented Reality Must Have Augmented Privacy," Electronic Frontier Foundation, (16 October 2020): para. 12. https://www.eff.org/deeplinks/2020/10/augmented-reality-must-have-augmented-privacy.

[117] Genevieve Bell, Maia Gould, Brenda Martin, Amy McLennan, and Ellen O'Brien. "Do More Data Equal More Truth? Toward a Cybernetic Approach to Data," Australian Journal of Social Issues 56, no. 2 (2021): 26. https://doi.org/10.1002/ajs4.168.

[118] Mark Zuckerberg, "We're creating a new top-level product group at Meta focused on generative AI to turbocharge our work in this area...", Facebook, (February 28, 2023). https://www.facebook.com/zuck/posts/pfbid0vvSykpAEXpHHaKKyWMZ423TCq3qQDKtLu7m4XiRfUEYRrxzwpdewh3yYepnc1Bsrl

[119] Chris Griffin, "AI Chatbot with 30 Personalities: Your next Instagram Friend," Boxmining, (June 7, 2023). https://boxmining.com/ai-chatbot-with-30-personalities-your-next-instagram-friend/#:~:text=Alessandro%20Paluzzi.

[120] Indigital, "The Soul of our Nguran/ our place," (Last modified 2023). https://www.indigital.net.au/first-nations

[121] Lynette Wallworth, "Collisions," Canberra: Australian National Museum, (2019).

[122] Biskaabiiyaang, "Biskaabiiyaang: the indigenous metaverse," (Last modified 2023). https://www.biskaabiiyaang.com/

[123] Kate Saenko, "Is Generative AI Bad for the Environment? A Computer Scientist Explains the Carbon Footprint of ChatGPT and Its Cousins," The Conversation, (May 23, 2023). https://theconversation.com/is-generative-ai-bad-for-the-environment-a-computer-scientist-explains-the-carbon-footprint-of-chatgpt-and-its-cousins-204096.

[124] Kashmir Hill, "This Is Life in the Metaverse," The New York Times, (October 7, 2022), sec. Technology. https://www.nytimes.com/2022/10/07/technology/metaverse-facebook-horizon-worlds.html.

BACKBONES & BLUEPRINTS: CYBERNETIC APPROACHES TO THE METAVERSE

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