



**MATTHEW BALL**

**THE**

**META-  
VERSE**

**And How It Will  
Revolutionize Everything**

# THE METAVERSE

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Revolutionize Everything*

**MATTHEW BALL**



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# INTRODUCTION

TECHNOLOGY FREQUENTLY PRODUCES SURPRISES that no one predicts. But the biggest and most fantastical developments are often anticipated decades in advance. In the 1930s, Vannevar Bush, then president of the Carnegie Institution of Washington, began work on a hypothetical electromechanical device that would store all books, records, and communications, and mechanically link them together by keyword association, rather than traditional, mostly hierarchical storage models. Despite the enormity of its archive, Bush stressed that this “Memex” (short for “memory extender”) could be consulted “with exceeding speed and flexibility.”

In the years that followed this early research, Bush became one of the most influential engineers and science administrators in American history. From 1939 to 1941, he was vice chairman and temporarily served as chairman of the National Advisory Committee for Aeronautics, the predecessor agency to NASA. In this position, Bush convinced President Franklin D. Roosevelt to establish what became the Office of Scientific Research and Development (OSRD), a new federal agency that would be run by Bush, who would report directly to the president. The agency was provided nearly unlimited funding, primarily for secret projects that would aid the United States’ efforts in World War II.

Only four months after OSRD was founded, President Roosevelt approved the atomic bomb program known as the Manhattan Project, following a meeting with Bush and Vice President Henry A. Wallace. To manage the program, Roosevelt created a Top Policy Group consisting of himself, Bush, Wallace, Secretary of War Henry L. Stimson, Chief of Staff of the Army General George C. Marshall, and James B. Conant, who headed up a subbranch of OSRD previously run by Bush. In addition, the Uranium Committee (later named the S-1 Executive Committee) would report directly to Bush.

After the war ended in 1945, but two years before he left his role as director of the OSRD, Bush wrote two famous essays. The first, “Science, the Endless Frontier,” was addressed to the president and in it, Bush called for an increase in government investments in science and technology, rather than a peacetime reduction, as well as the establishment of the National Science Foundation. The second essay, “As We May Think,” appeared in *The Atlantic* and publicly detailed Bush’s vision of the Memex.

In the years that followed his essays, Bush stepped back from public office and public view. But soon enough, his various contributions to government, science, and society began to converge. Starting in the 1960s, the US government funded a variety of projects within the Department of Defense, in partnership with a network of external researchers, universities, and other nongovernment institutions that together developed the foundation of the internet. At the same time, Bush’s Memex was informing the creation and evolution of “hypertext,” one of the underlying concepts of the World Wide Web, which is typically written in the HyperText Markup Language (HTML) and enables users to instantly access a nearly infinite extent of online content by clicking on a given piece of text. Twenty years later, the US federal government established the Internet Engineering Task Force to guide the technical evolution of the Internet Protocol Suite, and with the help of the Department of Defense founded the World Wide Web Consortium, which, among other duties, manages the ongoing development of HTML.

While technological progress typically occurs out of common sight, science fiction often provides the general public with the clearest view of the future. In 1968, fewer than 10% of American households had a color TV, yet the second-highest-grossing film of the year, *2001: A Space Odyssey*, imagined a future in which humanity had compressed these fridge-sized devices into coaster-thin displays and used them idly during breakfast. Anyone watching the film today will instantly liken these devices to iPads. Per usual, the imagined technology, like Bush’s Memex, took longer to arrive than was originally anticipated. iPads appeared in stores four and half decades after Stanley Kubrick’s groundbreaking film was released, and more than a decade after the futuristic film was set.

By 2021, tablets had become commonplace and spacefaring had begun to feel within reach. Throughout that summer, competing efforts from billionaires Richard Branson, Elon Musk, and Jeff Bezos were under way to bring civilian travel to lower orbit and usher in an era of space elevators and interplanetary colonization. However, it was another decades-old

science fiction concept, the Metaverse, that seemed to indicate the future had truly arrived.

In July 2021, Facebook founder and CEO Mark Zuckerberg said: “In this next chapter of our company, I think we will effectively transition from people seeing us as primarily being a social media company to being a metaverse company. And obviously, all of the work that we’re doing across the apps that people use today contribute directly to this vision.”<sup>1</sup> Shortly thereafter, Zuckerberg publicly announced a division focused on the Metaverse and elevated the head of Facebook Reality Labs—a division that works on miscellaneous futuristic projects including Oculus VR (virtual reality), AR (augmented reality) glasses, and brain-to-machine interfaces—to chief technology officer. In October 2021, Zuckerberg proclaimed that Facebook would be changing its name to Meta Platforms<sup>\*</sup> to reflect its shift to this “Metaverse.” To the surprise of many Facebook shareholders, Zuckerberg also said that his investments in the Metaverse would reduce operating income by over \$10 billion in 2021, while warning that these investments would grow for several more years.

Zuckerberg’s bold pronouncements drew the most attention, but many of his peers and competitors had launched similar initiatives and made similar announcements in the months prior. In May, Microsoft CEO Satya Nadella began to speak of a Microsoft-led “enterprise Metaverse.” Likewise, Jensen Huang, CEO and founder of computing and semiconductor giant Nvidia, had told investors that “the economy in the Metaverse . . . [will] be larger than the economy in the physical world”<sup>†</sup> and that Nvidia’s platforms and processors would be at the heart of it.<sup>2</sup> In the fourth quarter of 2020 and first quarter of 2021, the gaming industry had two of its largest-ever initial public offerings (IPOs) in Unity Technologies and Roblox Corporation, both of which wrapped their corporate histories and ambitions in Metaverse-related narratives.

Throughout the remainder of 2021, the term “Metaverse” almost became a punchline as every company and its executives seemed to trip over themselves to mention it as something that would make their company more profitable, their customers happier, and their competitors less threatening. Prior to Roblox’s IPO filings in October 2020, the “Metaverse” had appeared only five times in US Securities and Exchange Commission filings.<sup>3</sup> In 2021, the term was mentioned more than 260 times. That same year, Bloomberg, a software company that provides financial data and information to investors, catalogued more than a



thousand stories containing the word Metaverse. The prior decade had only seven.

Interest in the Metaverse was not limited to Western nations and corporations. In May 2021, China's largest company, the internet gaming giant Tencent, publicly described its vision of the Metaverse, calling it "Hyper Digital Reality." The following day, South Korea's Ministry of Science and ICT (Information and Communications Technology) announced "The (South Korean) Metaverse Alliance," spanning over 450 companies including SK Telecom, Woori Bank, and Hyundai Motor. In early August, South Korean gaming giant Krafton, maker of *PlayerUnknown's Battlegrounds* (also known as *PUBG*) completed its IPO, the second largest in the country's history. Krafton's investment bankers made sure to tell would-be investors that the company would also be a global leader in the Metaverse. In the ensuing months, Chinese internet giants Alibaba and ByteDance, the parent company of the global social network TikTok, both began to register various Metaverse trademarks and acquire various VR and 3D-related start-ups. Krafton, meanwhile, committed publicly to launching a "PUBG Metaverse."

The Metaverse captured more than the imagination of techno-capitalists and sci-fi fans. Not long after Tencent publicly unveiled its vision of hyper-digital reality, the Communist Party of China (CCP) began its biggest-ever crackdown of its domestic gaming industry. Among several new policies was a prohibition on minors playing video games Monday through Thursday that also limited their play from 8 p.m. to 9 p.m. on Friday, Saturday, and Sunday nights (in other words, it was impossible for a minor to play a video game for more than three hours per week). In addition, companies such as Tencent would use their facial recognition software and a player's national ID to periodically ensure that these rules were not being skirted by a gamer borrowing an older user's device. Tencent also pledged \$15 billion in aid for "sustainable social value," which *Bloomberg* said would be focused on "areas like increasing incomes for the poor, improving medical assistance, promoting rural economic efficiency and subsidizing education programs."<sup>4</sup> Alibaba, China's second-largest company, committed a similar amount only two weeks later. The message from the CCP was clear: look to your countrymen and women, not virtual avatars.

The CCP's concerns about the growing role of gaming content and platforms in public life became more explicit in August, when the state-owned *Security Times* warned its readers that the Metaverse is a "grand and illusionary concept" and "blindly investing [in it] will ultimately come

back to bite you.”<sup>5</sup> Some commentators interpreted China’s various warnings, prohibitions, and taxes as confirmation of the Metaverse’s significance. For a communist and centrally planned country ruled by a single party, the potential of a parallel world for collaboration and communication is a threat, regardless of whether it’s run by a single corporation or decentralized communities.

Yet China was not alone in its worries. In October, members of the European Parliament began to voice concerns. One particularly important voice was that of Christel Schaldemose, who served as a chief negotiator for the European Union as it worked on its largest-ever overhaul of digital-era regulations (most of which were intended to curb the power of so-called big tech giants such as Facebook, Amazon, and Google). In October, she told the Danish paper *Politiken* that “plans for metaverse are deeply, deeply worrying” and that the union “has to take them into account.”<sup>6</sup>

It’s possible that the many Metaverse announcements, critiques, and warnings are just a real-world echo chamber about a virtual fantasy—or more about driving new narratives, product launches, and marketing than anything life-changing. After all, the tech industry has a history of using buzzwords that are hyped for far longer than they ultimately end up lasting in the market, such as 3D televisions, or that prove to be further away than originally promised, such as VR headsets or virtual assistants. But it’s rare that the world’s largest companies publicly reorient themselves around such ideas at an early stage, thereby setting themselves up to be evaluated by employees, customers, and shareholders on the basis of their success in realizing their most ambitious visions.

The dramatic response to the Metaverse reflects the growing belief that it is the next great computing and networking platform, similar in scope to the transition from the personal computer and fixed-line internet of the 1990s to the era of mobile and cloud computing we live in today. That shift popularized a once-obscure business school term—“disruption”—and transformed almost every industry while reshaping modern society and politics. Yet there is a critical difference between that shift and the impending shift to the Metaverse: timing. Most industries and individuals did not foresee the significance of mobile and cloud, and consequently were stuck reacting to changes and fighting off disruption from those who better understood them. Preparations for the Metaverse are happening much earlier, and proactively.

In 2018, I began writing a series of online essays on the Metaverse,

then an obscure and fringe concept. In the years since, these essays have been read by millions of people as the Metaverse has transitioned from the world of paperback science fiction to the front page of the *New York Times* and corporate strategy reports around the world.

*The Metaverse: And How It Will Revolutionize Everything* updates, expands, and recasts everything I've previously written on the Metaverse. The book's core purpose is to offer a clear, comprehensive, and authoritative definition of this still inchoate idea. Yet my ambitions are broader: I hope to help you understand what's required to realize the Metaverse, why entire generations will eventually move to and live inside it, and how it will forever alter our daily lives, our work, and how we think. In my view, the collective value of these changes will be in the tens of trillions of dollars.

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\* For the sake of clarity, this book refers to Meta Platforms as Facebook. Explaining the Metaverse and its various platforms, while also discussing an early leader in the Metaverse that is called Meta Platforms, would only confuse matters.

† In 2021, global GDP was estimated at roughly \$90 trillion–\$95 trillion by the International Monetary Fund, United Nations, and World Bank.

‡ The *Security Times* cited the author of this book when describing the Metaverse.

*Part I*

**WHAT IS THE METAVERSE?**

## Chapter 1

### A BRIEF HISTORY OF THE FUTURE

THE TERM “METAVERSE” WAS COINED BY AUTHOR Neal Stephenson in his 1992 novel *Snow Crash*. For all its influence, Stephenson’s book provided no specific definition of the Metaverse, but what he described was a persistent virtual world that reached, interacted with, and affected nearly every part of human existence. It was a place for labor and leisure, for self-actualization as well as physical exhaustion, for art alongside commerce. At any given time, there were roughly 15 million human-controlled avatars on “The Street,” which Stephenson called “the Broadway, the Champs Elysees of the Metaverse,” but stretched across the entirety of a virtual planet more than two and a half times the size of the earth. As a point of contrast, there were fewer than 15 million total users of the internet in the real world the year Stephenson’s novel was published.

While Stephenson’s vision was vivid and, to many, inspiring, it was also dystopic. *Snow Crash* is set at some point in the early 21st century, years after a global economic collapse. Most layers of government have been replaced by for-profit “Franchise-Organized Quasi-National Entities” and “burbclaves,” a contraction of the term “suburban enclaves.” Each burbclave operates as a “city-state with its own constitution, a border, laws, cops, everything”<sup>1</sup> and some even provide “citizenship” purely based on race. The Metaverse offers refuge and opportunity to millions. It was a virtual place where a pizza deliverer in the “real world” could be a talented swordsman with inside access to the hottest clubs. But Stephenson’s novel was clear: in *Snow Crash* the Metaverse has made life in the real world worse.

As with Vannevar Bush, Stephenson’s influence on modern technology only grows with time, even if he is mostly unknown to the public. Conversations with Stephenson helped inspire Jeff Bezos to found the private aerospace manufacturer and suborbital spaceflight company Blue Origin in 2000, with the author working there part-time until 2006, when he became a senior advisor to the company (a position he still holds).

As of 2021, Blue Origin is considered the second most valuable company of its kind, ranked only behind Elon Musk's SpaceX. Two of the three founders of Keyhole, now known as Google Earth, have said their visions were informed by a similar product described in *Snow Crash*, and that they once tried to recruit Stephenson to the company. From 2014 to 2020, Stephenson was also "Chief Futurist" at Magic Leap, a mixed reality company that was also inspired by his work. The company later raised over half a billion dollars from corporations including Google, Alibaba, and AT&T, attaining a peak valuation of \$6.7 billion, before struggles to realize its vaulting ambitions resulted in a recapitalization and the departure of its founder. \* Stephenson's novels have been cited as the inspiration for various cryptocurrency projects and non-cryptographic efforts to build decentralized computer networks, as well as the production of CGI-based movies which are watched at home but generated live through the motion-captured performance of actors that might be tens of thousands of miles away.

Despite his far-reaching impact, Stephenson has consistently warned against a literal interpretation of his works—especially *Snow Crash*. In 2011, the novelist told the *New York Times* that "I can talk all day long about how wrong I got it"<sup>2</sup> and, when asked about his influence on Silicon Valley by *Vanity Fair* in 2017, he reminded the publication to keep "in mind that [*Snow Crash* was written] pre-Internet as we know it, pre-Worldwide Web, just me making shit up."<sup>3</sup> As a result, we should be wary of reading too much into Stephenson's specific vision. And while he coined the term "Metaverse," he was far from the first to introduce the concept.

In 1935, Stanley G. Weinbaum wrote a short story titled "Pygmalion's Spectacles," about the invention of magical VR-like goggles that produced a "movie that gives one sight and sound . . . you are in the story, you speak to the shadows, and the shadows reply, and instead of being on a screen, the story is all about you, and you are in it."<sup>†4</sup> Ray Bradbury's 1950 short story "The Veldt" imagines a nuclear family in which the parents are supplanted by a virtual reality nursery that the children never want to leave. (The children eventually lock their parents inside the nursery, which then kills them.) Philip K. Dick's 1953 story "The Trouble with Bubbles" is set in an era where humans have explored deep into outer space, but never succeeded in finding life. Yearning to connect with other worlds and life-forms, consumers begin to buy a product called "Worldcraft" through which they can build and "Own [Their] Own World," which are cultivated

to the point of producing sentient life and fully realized civilizations (most Worldcraft-owners eventually destroy their worlds in what Dick described as a “neurotic” “orgy of breaking” intended to “assume some god suffering from ennui”). A few years later, Isaac Asimov’s novel *The Naked Sun* was published. In it, he described a society where face-to-face interactions (“seeing”) and physical contact are considered both wasteful and repugnant, and most work and socializing takes place via remotely projected holograms and 3D televisions.

In 1984, William Gibson popularized the term “cyberspace” in his novel *Neuromancer*, defining it as “A consensual hallucination experienced daily by billions of legitimate operators, in every nation. . . . A graphic representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the nonspace of the mind, clusters and constellations of data. Like city lights, receding.” Notably, Gibson called the visual abstraction of cyberspace “The Matrix,” a term repurposed by Lana and Lilly Wachowski 15 years later for their film of the same name. In the Wachowskis’ movie, the Matrix refers to a persistent simulation of the planet earth as it was in 1999, but which all of humanity is unknowingly, indefinitely, and forcibly connected to in the year 2199. The purpose of this simulation is to placate the human race so that it can be used as bioelectric batteries by the sentient, but man-made, machines which conquered the planet in the 22nd century.

## **The Program Is More Optimistic than the Pen**

Whatever the differences among each specific author’s visions, the synthetic worlds of Stephenson, Gibson, the Wachowskis, Dick, Bradbury, and Weinbaum are all presented as dystopias. Yet there is no reason to assume that such an outcome is inevitable, or even likely, for the actual Metaverse. A perfect society tends not to make for much human drama, and human drama is the root of most fiction.

As a point of contrast, we can consider the French philosopher and cultural theorist Jean Baudrillard, who coined the term “hyperreality” in 1981 and whose works are often linked to those of Gibson, and those Gibson influenced.‡ Baudrillard described hyperreality as a state in which reality and simulations were so seamlessly integrated that they were indistinguishable. Though many find this idea frightening, Baudrillard

argued that what mattered was where individuals would derive more meaning and value—and speculated it would be in the simulated world.<sup>5</sup> The idea of the Metaverse is also inseparable from the ideas of the Memex, but where Bush imagined an infinite series of documents linked together via words, Stephenson and others conceived infinitely interconnected worlds.

More instructive than Stephenson's texts and those which inspired them are the many efforts to build virtual worlds over the past several decades. This history not only shows a multi-decade progression towards the Metaverse, but also reveals more about its nature. These would-be Metaverses have not been centered on subjugation or profiteering, but on collaboration, creativity, and self-expression.

Some observers date the history of “proto-Metaverses” to the 1950s during the rise of mainframe computers, which represented the first time that individuals could share purely digital messages with one another across a network of different devices. Most, however, start in the 1970s with text-based virtual worlds known as Multi-User Dungeons. MUDs were effectively a software-based version of the role-playing game Dungeons & Dragons. Using text-based commands that resembled human languages, players could interact with one another, explore a fictional world populated by non-playable characters and monsters, attain power-ups and knowledge, and eventually retrieve a magical chalice, defeat an evil wizard, or rescue a princess.

The growing popularity of MUDs inspired the creation of Multi-User Shared Hallucinations (or MUSHs) or Multi-User Experiences (MUXs). Unlike MUDs, which asked players to carry out specific roles in the context of a specific and usually fantastical narrative, MUSHs and MUXs enabled participants to collaboratively define the world and its objective. Players might choose to set their MUSH in a courtroom, while taking on roles such as defendant, attorney, plaintiff, judge, and members of the jury. One participant might later decide to transform the relatively mundane proceedings into a hostage situation—which would then be diffused by a poem that was mad-libbed by the other players.

The next great leap came in 1986 with the release of the Commodore 64 online game *Habitat*, which was published by Lucasfilm, the production company founded by *Star Wars* creator George Lucas. *Habitat* was described as “a multi-participant online virtual environment” and, in a reference to Gibson's novel *Neuromancer*, “a cyberspace.” Unlike MUDs and MUSHs, the world of *Habitat* was graphical, thereby allowing users to actually see virtual environments and characters, though only via pixelated



2D. It also afforded players far greater control over the in-game environment. “Citizens” of *Habitat* were in charge of the laws and expectations of their virtual world, and had to barter with each other for necessary resources and avoid being robbed or killed for their wares. This challenge led to periods of chaos, after which new rules, regulations, and authorities were established by the player community to maintain order.

Though *Habitat* is not as widely remembered as other 1980s video games, such as *Pac-Man* and *Super Mario Bros.*, it transcended the niche appeal of MUDs and MUSHs, ultimately becoming a commercial hit. The title was also the first game to repurpose the Sanskrit term “avatar,” which roughly translates to “the descent of a deity from a heaven,” to refer to a user’s virtual body. Decades later, this usage has become convention—in no small part because Stephenson reapplied it in *Snow Crash*.

The 1990s saw no major “proto-Metaverse” games, but advances continued. That decade, millions of consumers took part in the first isometric 3D (also known as 2.5D) virtual worlds, which gave the illusion of three-dimensional space, but only allowed users to move across two axes. Not long after, full 3D virtual worlds emerged. A number of games, such as 1994’s *Web World* and 1995’s *Activeworlds*, also empowered users to collaboratively build a visible virtual space in real time, rather than through asynchronous commands and votes, and introduced a number of graphic/symbol-based tools to make world-building easier. Notably, *Activeworlds* also had the express purpose of building Stephenson’s Metaverse, asking players to not just enjoy its virtual worlds, but to invest in expanding and populating it. In 1998, *OnLive! Traveler* launched with spatial voice chat, which allowed users to hear where other players were positioned relative to other participants, and for an avatar’s mouth to move in response to the words spoken by the player.<sup>6</sup> The following year, Intrinsic Graphics, a 3D gaming software company, completed the spinoff of Keyhole. While Keyhole did not become broadly popular until the middle of the next decade and after its acquisition by Google, it represented the first time anyone on earth could access a virtual reproduction of the entire planet. In the ensuing 15 years, much of the map was updated to partial 3D and connected to Google’s much larger database of mapping products and data, enabling users to also overlay information such as real-time traffic.

It was with the launch of (the aptly named) *Second Life* in 2003 that many, especially those in Silicon Valley, began to contemplate the prospect of a parallel existence that would take place in virtual space. In its first year, *Second Life* attracted over one million regular users, and shortly

thereafter, numerous real-world organizations established their own businesses and presences inside the platform. This included for-profit corporations such as Adidas, BBC, and Wells Fargo, as well as nonprofits such as the American Cancer Society and Save the Children and even universities, including Harvard, whose law school offered exclusive courses inside *Second Life*. In 2007, a stock exchange was launched on the platform with the aim of helping *Second Life*-based companies raise capital using the platform's Linden Dollars currency.

Crucially, developer Linden Labs did not intermediate transactions in *Second Life*, nor actively manage what was made or sold. Instead, transactions were made directly between buyers and sellers and based on perceived value and need. Overall, Linden Labs operated more like a government than a game-maker. The company did provide some user-facing services, such as identity management, ownership records, and an in-world legal system. But its focus wasn't on building out the *Second Life* universe directly. Instead, it enabled a thriving economy via ever-improving infrastructure, technical capabilities, and tools that would attract more developers and creators who would then create things for other users to do, places for them to visit, and items for them to buy—attracting more users and therefore more spending, which would in turn attract more investment from developers and creators. To this end, *Second Life* also offered users the ability to import virtual objects and textures made outside the platform. By 2005, just two years after it launched, *Second Life*'s annualized GDP exceeded \$30 million. By 2009, it exceeded half a billion dollars, with users cashing out \$55 million into real-world currency that year.

For all the success of *Second Life*, it was the rise of virtual world platforms *Minecraft* and *Roblox* that brought its ideas to a mainstream audience in the 2010s. In addition to offering significant technical enhancements compared to their predecessors, *Minecraft* and *Roblox* also focused on children and teenage users, and were therefore far easier to use, rather than just offer greater capabilities. The results have been astounding.

Throughout the 2010s, bands of users collaborated in *Minecraft* to build cities as large as Los Angeles—roughly 500 square miles. One video game streamer, Azttter, constructed a stunning cyberpunk city out of an estimated 370 million *Minecraft* blocks, having worked an average of 16 hours per day for a year.<sup>7</sup> Scale is not the sole achievement of the platform. In 2015, Verizon built a cellphone inside *Minecraft* that could make and receive live video calls to the “real world.” As the COVID-19 virus spread across China in February 2020, a community of Chinese

*Minecraft* players rapidly re-created the 1.2-million-square-foot hospitals built in Wuhan as a tribute to the “IRL” (“in real life”) workers, receiving global press coverage.<sup>8</sup> One month later, Reporters Sans Frontières (also known as Reporters Without Borders) commissioned the construction of a museum within *Minecraft* that was composed of over 12.5 million blocks assembled by 24 virtual builders in 16 different countries over some 250 hours combined. The Uncensored Library, as it was called, allowed users in countries such as Russia, Saudi Arabia, and Egypt to read banned literature, as well as works promoting free speech and detailing the lives of journalists such as Jamal Khashoggi, whose murder was ordered by political leaders in Saudi Arabia.

By the end of 2021, more than 150 million people were using *Minecraft* each month—more than six times as many as in 2014, when Microsoft bought the platform. Despite this, *Minecraft* was far from the size of the new market leader, *Roblox*, which had grown from fewer than 5 million to 225 million monthly users over that same period. According to Roblox Corporation, 75% of children ages 9 to 12 in the United States regularly used the platform in Q2 2020. Combined, the two titles amassed more than 6 billion hours of monthly usage each, which spanned more than 100 million different in-game worlds and had been designed by over 15 million users. The *Roblox* game with the most lifetime plays—*Adopt Me!*—was created by two hobbyist players in 2017 and enabled users to hatch, raise, and trade various pets. By the end of 2021, *Adopt Me!*'s virtual world had been visited more than 30 billion times—more than fifteen times the average number of global tourism visits in 2019. Furthermore, developers on *Roblox*, many of whom are also small teams with fewer than 30 members, have received more than \$1 billion in payments from the platform. By the end of 2021, Roblox had become the most valuable gaming company outside of China, worth nearly 50% more than storied gaming giants Activision Blizzard and Nintendo.

Despite the enormous growth in *Minecraft*'s and *Roblox*'s audiences and developer communities, many other platforms began to emerge and grow towards the tail end of the 2010s. In December 2018, for example, the blockbuster video game *Fortnite* launched *Fortnite Creative Mode*, its own riff on *Minecraft*'s and *Roblox*'s world-building. Meanwhile, *Fortnite* was also transforming into a social platform for non-game experiences. In 2020, hip-hop star (and Kardashian family member) Travis Scott hosted a concert that was attended live by 28 million players, with millions more watching live on social media. The track Scott premiered during the concert, which featured Kid Cudi, debuted at #1 on the *Billboard* Hot 100

charts a week later, was Cudi's first #1 track, and finished 2020 as the third-largest US debut of the year. In addition, several of the tracks Scott performed from his two-year-old *Astroworld* album returned to the *Billboard* charts after the concert. Eighteen months later, *Fortnite's* official event video had accumulated nearly 200 million views on YouTube.

The multi-decade history of social virtual worlds, from MUDs to *Fortnite*, helps explain why the ideas of the Metaverse have recently shifted from science fiction and patents to the forefront of consumer and enterprise technology. We are now at the point when these experiences can appeal to hundreds of millions and their bounds are more about the human imagination than technical limitation.

In mid-2021, only weeks before Facebook unveiled its Metaverse intentions, Tim Sweeney, CEO and founder of *Fortnite* maker Epic Games, tweeted prerelease code from the company's 1998 game *Unreal*, adding that players "could go into portals and travel among user-run servers when Unreal 1 was released in 1998. I remember a moment where folks in the community had created a grotto map with no combat and were standing in a circle chatting. This style of play didn't last for long though."<sup>9</sup> A few minutes later, he added: "We've had metaverse aspirations for a very, very long time . . . but only in recent years have a critical mass of working pieces started coming together rapidly."<sup>10</sup>

This is the arc of all technological transformations. The mobile internet has existed since 1991, and was predicted long before. But it was only in the late 2000s that the requisite mix of wireless speeds, wireless devices, and wireless applications had advanced to the point where every adult in the developed world—and within a decade, most people on earth—would want and be able to afford a smartphone and broadband plan. This in turn led to a transformation of digital information services and human culture at large. Consider the following: when instant messaging pioneer ICQ was acquired by internet giant AOL in 1998, it had 12 million users. A decade later, Facebook had over 100 million monthly users. By the end of 2021, Facebook had 3 billion monthly users, with some 2 billion using the service daily.

Some of this change, too, is a result of generational succession. For the first two or so years following the release of the iPad, it was common to see press reports and viral YouTube videos of infants and young children who would pick up an "analogue" magazine or book and try to "swipe" its nonexistent touchscreen. Today, those one-year-olds are eleven to twelve.