Unsupervised

AI / ChatGPT™
Blockchain
Quantum
Tokenization
Humans 2.0
Energy

Navigating and Influencing a World Controlled by Powerful New Technologies

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Daniel Doll-Steinberg
Stuart Leaf

WILEY

Praise for *Unsupervised*

"*Unsupervised is an inspiring work that serves as a clarion call for everyone to actively engage with the powerful new technologies rapidly shaping our world today.*"

—Philippe van Caenegem
Mentor and advisor; ex Salesforce MD Strategic Innovation

"*Unsupervised provides a detailed account of what is changing and how it manifests. Daniel and Stuart have done a masterful job.*"

—Clara Durodié
CEO of Cognitive Finance Group and author of
Decoding AI in Financial Services

"*Unsupervised asks the questions; it leaves the answers to the reader in a tone that educates and informs without being patronizing. We have no more reasons to avoid taking a stance on the cognitive revolution around us.*"

—Marta Piekarska-Geater
Director of DAO and Web3 Strategy, Consensys

"*Reading Unsupervised underlined for me just how fundamental technology-instigated changes will be in every aspect of education, healthcare, business, the military, and government. We must all open our eyes and face these opportunities and challenges head-on. A must-read for everyone.*"

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"*Daniel and Stuart have managed to create a seminal work on evolving technology that is also a cautionary tale about unintended consequences. This book is a must-read for anyone who wants to be prepared for how technology—much of which barely even exists today—will impact their business and their life.*"

—Richard Mack
Chief Executive Officer, Mack Real Estate Group and Claros Mortgage Trust; co-creator of the Wharton School's Real Estate Disruptions Course

"*The authors cut through to people who might not usually read books like this, but know the time is now to do so. Really nicely written.*"

—Stephen Khan
Editor of The Conversation (50 million monthly readers globally)

"This is a book on how once again a handful of extremely powerful actors control the mainstream implications of technologies without any transparency, accountability, or fair use/allocation."

—Amit Pradhan
Founder, Silicon Valley Blockchain Society and Rainfall AI; Responsible Leader, BMW Foundation Herbert Quandt; and board member, Norwegian Refugee Council

"Cutting through the clutter, this book has profound implications on the collective action to shape these technologies for our society, responsibly and inclusively."

—Gokce Gizer Clover
Founder, Mercurychange; cofounder, EdenBase; and previously creator of Extreme Tech Challenge (XTC)

"Inspiring, provocative, thoughtful. Having a clear view of these different technologies in combination and the paths they can take, allows investors to deploy funds consciously and ensure we build the right future."

—Carolina Casas Forga
Cofounder, Sangha Capital

"Finally a book for everyone that's low on jargon and realistic about the challenges, but that also helps us start to figure out how to make the best of the incredible opportunity we face."

—Eric Van der Kleij
Cofounder, EdenBase; previously Head of Level39, CEO Tech City

"Unsupervised is a personal revelation. This book will be instrumental in my journey, a must-read for anyone looking to stay ahead of the curve."

—Matt Cyrankiewicz
Founder, Future Group

"By highlighting the trade-offs we face, the authors inspire readers to make the most of the manifold opportunities and challenges before us. With its compelling narrative and empowering perspective, this book is an essential guide for navigating the transformative era we find ourselves in."

—Oskar Hartmann
Founder Hartmann Holdings, LARIX and SIMILE funds and Unicorn Angels community

Unsupervised

Navigating and Influencing a World Controlled by Powerful New Technologies

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Stuart Leaf

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For my very human Mum and Dad, Sarah, Nikki, Jamie, and Ben who taught me that experiences are more important than assets. Heaven forbid computers take these over too.

I would like to thank the very many who said something interesting to me and made me stop and think.

—Daniel

I would like to dedicate my efforts in bringing this work to life, to my parents who both passed during this period. I want to thank my wife and two sons for their patience. I particularly want to thank the many key people around the world who shared their wisdom in many fields, brought up issues Daniel and I had not considered, challenged our thought processes when inconsistent or unclear, and urged us to deliver our messages in ways that are readily understood.

—Stuart

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Foreword

Throughout human history, "Promethean moments" have happened suddenly, but their impact would spread gradually. Today, technological innovation is increasing the frequency of these moments, which now happen suddenly with an impact that is increasingly sudden as well.

Profound changes are now taking place: the constructs of centralized power that have dominated our economic and societal fabric since the "physical Industrial Revolution" are now dissolving into a spiderweb of bits, where productivity is being redefined.

Increasingly, technology presents us with a new, expansive, and flexible fabric. Activity, productivity, and value are no longer tethered to capital assets; they now flow though wires and glass cables—and also through the air in radio waves, with low friction to mass scale. Massive aggregation of, and seismic shifts in, human collective energy can now express itself in monumental waves at speeds not seen before.

In some ways we are experiencing a "return to the past" in terms of the flexibility of life, away from the tethering of humans to machines, capital assets, and corporate structures that only recently came to dominate society. The tethering and geographic limitations of these structures previously limited reach and rate of change. Technology now can accelerate waves of collective human cognition; this is providing a universal fabric that can

"super amplify" the breadth of reach, the frequency of seismic shifts in collective attitude, and the volatility of outcomes in everything from mass communication, productivity, and war and weaponry, to economic outcomes for people and nations.

As such, technology in the hands of humankind is now akin to a massive double-edged sword—a light saber, in fact, in the hands of an untrained child. Wielding it can create instant and possibly irreversible impact, for good or for bad, faster than one can realize what has happened.

Taking a step back to understand the dynamism of what's happening—through both an historical lens and a forward-looking framework—is important as it helps to put everything in perspective. It's incumbent on us now both to understand the elevation of the impact that is happening with each subsequent generation of technology and to establish guardrails to help nudge everything in the positive direction.

I've spent my working life delivering value across waves of technology, first in silicon, then computer and communication equipment, then networks, then applications in "cloud and mobile," and now in AI, blockchains, and data science. My approach has been simple: leveraging technology to solve problems with a very simple formula: 1) lower friction to a solution, 2) make the solution massively replicable, and 3) make it deeply scalable. That simple formula brought immense good to this world at a critical time as we all saw with solutions like Zoom Video (I was the company's first backer to commit funding) in a time of worldwide crisis.

Daniel and Stuart's book is a great framework to look at the underlying components of what's happening and why, to examine why it's critically important to have a handle on its power to drive change—and to steer it toward positive promise.

—Bill Tai

Venture capitalist and athlete; creator of the Extreme Tech Challenge; Chair of ACTAI Global; seed / angel investor in Zoom, Canva, Dapper Labs and many more

Preface

"Hell is truth seen too late."

—Thomas Hobbes

Technology is advancing at an exponential rate; it is already dramatically affecting our lives. Yet almost all of us remain unaware of its extent. Unless thoughtful and impactful steps are taken now, this evolution will continue to accelerate at a pace truly beyond current comprehension and, scarily, virtually unsupervised. The consequences, both intended and unintended, are existential in their level of importance, so it is vital we work together to help forge the future of humanity, not leaving technology and those who control it to forge us. And time is running out. Who knows, this may be one of the last books ever written exclusively without generative artificial intelligence.

To best understand the context of the issues ahead of us, Part I describes many of the disruptive frontier technologies currently on the market, to provide readers with a broad-based understanding of how they work and why they are potentially so significant. Part II explores how these frontier technologies are now positioned to change almost everything we do, even who we are; and includes profiles of the most important global players, surprisingly few in number, who dominate the current, and quite possibly the future landscape of technology. Finally, Part III

discusses our thoughts on the inevitable dominance of frontier technologies and how we can conscientiously navigate this new tech-driven world.

With so much happening almost simultaneously, writing this book has often felt like inscribing a message in the sand with the tide coming in. And the pace is picking up, with some frontier technology advance making new waves every week. With that in mind, for this book, we concentrate on issues that are not simply meaningful but truly compelling and likely to have a direct influence on our future. *Caveat lector*—the rate of change is so rapid that continuing to keep up will require considerable ongoing effort on all our parts.

Whenever possible, we have also attempted not to impose our opinions. This revolution will impact everybody, and yet it is being orchestrated by very few. We do not merely want to add our names to the few but rather encourage discussion and simply be part of the many.

Tracking the Exponential

Throughout time, the human brain evolved to enable the tracking of a single animal moving or accelerating at a linear rate. We are not designed to track one animal in a herd all moving randomly, especially when each one is accelerating exponentially. That is what is happening in technology right now. We are experiencing a seismic change in modern humanity, and most of us are not even aware. And to massively complicate matters, a combination of things is happening all at once:

- Computational speed continues to accelerate dramatically, powering widespread innovation. Many new technologies

are becoming omnipresent, commercialized, and often misused.

- Various powerful technologies are becoming directly accessible to and usable by the general public, no longer requiring domain experts or even programmers to develop them (general purpose). We describe these as frontier technologies.
- There is a growing dependence on technology in every sector, and consumers are becoming addicted—often by design.
- Individuals around the world are building formidable technologies unsupervised, without any real oversight.
- Some of these technologies are able to completely replace targeted human functions, at lightning speeds, with no need to be paid or rest.
- At the same time, after decades of coming together, the world is becoming more divided. Who controls key technologies is a factor not to be ignored.
- Over the past two decades, the amount of money invested by institutions, individuals, venture capitalists, big technology companies, and governments in new technology products, services, and companies has been growing at an insane rate. While this might slow in a down-market cycle, the aggregate power, disruption, and value of these technologies will not.
- People have started to realize the asymmetric advantage of these technologies and are building them fast (mostly for their own benefit and/or power).

These technologies represent both significant benefits and challenges to humanity. Over the past 20 years, with COVID-19 as an incredible accelerant, they have become an indispensable

part of our lives. Going forward, they will completely change our world. It is up to us to determine how.

Over the period of human evolution, 99 percent of humans have lived with barely enough to sustain themselves and enjoyed very few basic rights. In many parts of the world, the past century has witnessed an unprecedented "democratization" (although massive disparities remain). Technology can either further this positive trend or lead to a dangerous consolidation of power. Do our leaders understand the issues, and can they handle them? To make sure, it is vital we all engage in the discussion, striving to maintain the rights we have fought so hard to earn. As these technologies replace aspects of what we do, will we start to lose these rights?

No matter how small our individual actions, the aggregate effect can be enormous—a "swarm effect."

A World Rebooting

Over the course of history, a small number of "innovations" have had a massively disproportionate impact on the course and rate of change of human evolution:

- Harnessing fire
- The wheel
- The astrolabe (then compass) for navigation
- Asymmetric weaponry (e.g., longbow, gunpowder, atom bomb)
- The printing press
- Harnessing energy (hydro, steam, electricity)
- The transistor, silicon chip, the Internet, the smartphone, and social media

The final items have particularly redefined the future and underpinned the mastery by homo sapiens over the rest of life on Earth. Yet they all pale in comparison to what humanity is on the very verge of experiencing.

To say we are undergoing an evolution of existing technologies that had their roots a half century ago vastly understates the exponential nature and magnitude of the changes. It is not simply the continuation of the Industrial Revolution, rather a *Cognitive Revolution* in information and computation—a veritable explosion of artificial intelligence and frontier technologies.

In fact, this switch from the end of the age of the Industrial Revolution to the start of the age of the Cognitive Revolution could be seen as a third Promethean moment in the use of knowledge—the first being the printing press and the second the Industrial Revolution. The difference this time is the unprecedented speed at which the changes are occurring. And this pace will continue to accelerate.

The new Cognitive Revolution, and its many associated evolving technologies, is a vast topic. Although much has been written, there remains a remarkable lack of understanding both of the technologies themselves and of the practical and social implications they create.

Simply ignoring these technologies is dangerous. Had we been more aware 20 years ago of the consequences of social media and other new technologies, would we have so casually followed this path? Awareness and action are vital.

Introduction

"*The greatest victory is that which requires no battle.*"

—*Sun Tzu*

Where the World Is Now

At the start of this project in late 2020, we believed that by 2025, the world would start to "reboot" due to a range of disruptive frontier technologies. It is only 2023, and the process is already underway on many fronts. These include the following:

- The rapid evolution of AI, including the public launch of ChatGPT from OpenAI—a technology few had heard of two years ago when it could not even execute simple mathematical equations for us—that could be accessed and used by millions whatever their technical level, simply through a command prompt becoming truly general purpose. It can now independently conduct research and write papers at graduate-student levels. Each new release promises to be many times more sophisticated.
- An acceleration in funding and real progress in quantum computing.

- The ability for computers to create art—so good it has been banned on certain marketing platforms.
- AI computer code generators starting to match many of the best developers in the world. GitHub Copilot can create usable computer code so impressive, Andrej Karpathy, the previous director of AI and autopilot vision at Tesla, tweeted that he uses it to write about 80 percent of his code.
- A new system called VALL-E was announced that can use a mere 3-second sample to accurately simulate anyone's voice.

And combined, all of these lead toward a concentration of power not seen since the Industrial Revolution.

The Industrial Revolution started in the United Kingdom in the late 1700s with Thomas Newcomen's prototype of the first modern steam engine. By the 1830s, it led to mechanization and the modern factory systems of Europe and the United States and started to replace manual workers. The Industrial Revolution effectively and rapidly replicated and then bettered human beings' physical capabilities starting in manufacturing and farming and led to more than 200 years of astounding human achievement. It has not, however, been without massive dislocation on every front. In the early 1800s, 90 percent of the U.S. population lived on farms; it is now around 1 percent.[1] Humanity has adapted. And just as the developed world has settled in and the developing world is looking to follow, the rules have changed, and there is nothing gradual about it.

The increase in computational power and explosion of new technologies is often referred to as the Fourth Industrial Revolution (4IR), but this term greatly understates its seismic impact. It is forcing, at breathtaking pace, an entire shift in paradigm. Our

[1] Beth Waterhouse, "PBS Online: Death of the Dream," PBS (Public Broadcasting Service), accessed April 5, 2023, www.pbs.org/ktca/farmhouses/sustainable_future.html.

cognitive abilities are being copied, matched, and replaced by technologies—the capabilities of which grow exponentially, while our own increase only linearly, if at all. Today, we are actually in the early stages of the Cognitive Revolution. Entrepreneurs, Big Tech, and governments are spending billions a year, racing to replace what humans have done for millennia, and we are now integrating these technologies into every aspect of our lives and world. As frontier technologies become increasingly general purpose (i.e., not requiring domain experts to create them), more and more people will be able to deliver and deploy them, making them virtually unstoppable. This has enormous upside potential, but also creates considerable challenges. As during every previous leap forward, there will be numerous externalities and unintended consequences.

Over time, technologies will increasingly simulate the world and the human brain more accurately, allowing them to fully execute human processes and activities. Over the past five decades, every 18 months to 2 years, the power of these technologies has doubled. This could slow, but the odds are much stronger that it will accelerate, perhaps at unimaginable rates.

Then there is, of course, the added possibility these technologies become sentient, in which case everything changes—an event referred to as the *Singularity*.

The Cognitive Revolution has already seen technologies take over human roles in agriculture, industry, and even post-industrial domains. This has delivered and will continue to generate huge benefits. But who will gain, and who will lose?

Much of this book focuses on technology and data, but understanding the relative impact on capital and labor is also important. There are two specific lenses:

- Productivity and disruption
- Economic and innovation cycles

By overlaying these two, we can begin to understand the drivers of why the world is entering a period of such enormous and significant change.

Before embarking on this journey, we should underline that the technologies we discuss are almost all designed by people who strive to achieve "technology for good." And there is little doubt the past couple of decades have seen some of the greatest improvements in human living standards in recorded history, by almost every metric—lifespan, healthcare, child mortality, decreased famine, among untold others. Also, after years of ecological neglect since the Industrial Revolution, we have begun to take serious steps toward reversing the damage. Technology is clearly one of the primary drivers behind sustainability and continues to offer powerful solutions in most areas of our lives. The concerns aired in this book address the very important issue that technology is neither inherently good nor bad; it depends completely on how it is used and by whom. In the wrong hands, much damage can be done.

We must all pay attention.

2030: A New Future

"*When it rains, look for rainbows. When it's dark, look for stars.*"
—Oscar Wilde

By 2030 the AI component alone of new frontier technologies could deliver an almost $16 trillion contribution to the global economy and replace up to 30 percent of current total hours worked, hugely impacting as many as one billion people.[2] Such a market value is almost as large as the United States' economy today, and it is growing much faster.

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[2] Anand S. Rao and Gerard Verweij, "PWC's Global Artificial Intelligence Study: Sizing the Prize," PwC, 2017, www.pwc.com/gx/en/issues/analytics/assets/pwc-ai-analysis-sizing-the-prize-report.pdf.

To put these numbers in perspective, the COVID-19 global lockdowns of 2020 were estimated to have temporarily cost the global economy 4 percent of the gross domestic product (GDP), or around $4.6 trillion,[3] and furloughed 400 million jobs. Yet merely converting to driverless transportation could replace as much as 8 to 10 percent of global jobs.[4]

New frontier technologies are starting to replicate our cognitive abilities and are quickly becoming general purpose, with the potential to boost productivity in every industry—and fast. Two years ago, OpenAI's Generative Pre-trained Transformer version 3 (GPT-3) had just launched, and our tests showed that while it was an amazing technical achievement, it was rather basic. Today, it writes chapters like this one—and soon will probably do so much better than we can.

Founded in 2015, OpenAI made ChatGPT public in November 2022, and it immediately became a major focus of attention because it forced leaders in every sector (and users around the world) to focus on how much technologies like this will impact so much of our lives. In fact, some in the education sector have already called for it to be banned. The Italian government even instituted a ban (now reversed) on ChatGPT over concerns it had processed and used Italian data, citing the EU's General Data Protection Regulations. Even Elon Musk, a cofounder of ChatGPT, along with more than 1,000 other signatories, including AI professors and researchers at DeepMind, signed a letter calling for a 6-month pause on training systems more powerful than GPT-4. But it's too late. This is a battle among the new oligarchs. Each new version released biannually has been exponentially more powerful (particularly when used in conjunction

[3] "Topic: Coronavirus: Impact on the Global Economy," Statista (Statista Research Department, January 17, 2023), www.statista.com/topics/6139/covid-19-impact-on-the-global-economy/#topicOverview.
[4] Vicky McKeever, "The Coronavirus Is Expected to Have Cost 400 Million Jobs in the Second Quarter, UN Labor Agency Estimates," CNBC, June 30, 2020, www.cnbc.com/2020/06/30/coronavirus-expected-to-cost-400-million-jobs-in-the-second-quarter.html.

with other evolving frontier technologies that are now being rapidly developed to augment it). At this rate, by 2030 it will be on version 7 and most likely thousands, or even millions, of times more powerful. Licensed by Microsoft, it is becoming clear the technology behind ChatGPT (and others currently in development) is already at a point that industries will be forced to adopt them or languish. Even the current version is truly transformative—both empowering and potentially devastating.

Most people think the next generation of technologies will be limited to AI like ChatGPT; many transformative applications, however, have already hit the mainstream. LEGO's Mindstorm range, which successfully abstracts and simplifies the complexities of building machines, has long enabled teens to quickly create relatively complex robotics with a combination of hardware and software elements that are easy to assemble and customize. Innovative LEGO creations have included ATMs, vending machines, guitar and piano players, and even T-shirt folders, knitting machines, and mini LEGO car-making assembly lines.

Even though so much of our life has already been changed by technology, most people dramatically underestimate the full impact on the global economy. This stems from three key concepts:

- **Tesler's Theorem.** AI is whatever hasn't been done yet.
- **Amara's Law.** We overestimate technology in the short term but underestimate it in the long term.
- **Metcalfe's Law.** As any network grows linearly in size and data, it becomes exponentially more powerful.

That said, it won't be long before we are using self-driving cars, holding smartphones that read our minds, and engaging the world through augmented reality (AR)–enabled glasses (or even smart contact lenses with AI and AR built-in) and/or holograms.

And as with ChatGPT, almost none of us will be aware until it bursts onto the scene. And almost right away they will all seem so normal to some and threatening to others. The number of applications is unfathomable and, on the positive side, are allowing us to deal with apparently intractable problems such as global warming. While many negative outcomes are possible, there is much to be optimistic about as well.

Virtually the entire world experienced the power of these new technologies during COVID-19. The relative ease with which people in many countries could remain at home, work, study, get their provisions, etc., mitigated complete financial disasters at the time.

Overall, humanity benefited from the Industrial and Post-Industrial Revolutions, many moving from hard manual labor in the fields to marginally better jobs in factories and gradually into safer and/or more cerebral ones. The number of horses, however, declined almost 80 percent—from 20 million in 1900 to 4.5 million in 1959—as machines replaced most of their functions. They could not adapt and became victims of the unstoppable power of productivity gains. The Cognitive Revolution is real, is happening now, and is happening without direction. It is being led by a small group of people—those with the greatest ability to identify opportunities and pursue their self-interest—and the technologies they are building are made to their vision, largely unsupervised, and predominantly for their own gain. We need many constituents—lawmakers, frontier technology builders, educators, investors, and users, etc.—to step forward and be vocal. We cannot overemphasize the need for active and public debate. Since there is no single optimal pathway, much future leadership will come from unexpected sources, and, unfortunately, many outcomes will result simply from trial and error. However, if we want to avoid real disasters, we cannot afford to

"ostrich" and bury our heads in the sand. Otherwise, we could become the next horse.

Frontier technologies will, like all technologies, mirror their founders and, until sentient, will operate on the principles by which they have been created. *Whoever controls the technology controls our future*. Given the vast implications, we all deserve a say; we all need to take ownership.

1998: So Last Century

> "*We gain our first measure of intelligence when we first admit our own ignorance.*"
>
> —*Socrates*

Every second, Google processes more than 100,000 search queries. Without technology, all Google employees combined probably couldn't manage this task in a decade. Behind every response, immensely powerful computers drive the process, constantly becoming more efficient by learning about us, monitoring our every move, and serving up bespoke responses. Each new piece of information helps enhance its efficiency. The goal is gradually to develop omniscience.

Computers have already begun to evolve their own cognitive ability and, in some instances, already do it better than we can. The programmers at Google merely code a framework that allows computers to catalog a huge universe of online data, together with the rules to capture both our detailed personal information and our every online move, and the search engines deliver results that iteratively become better and better. On the positive side, the search answers (and the products shown to us) generally better reflect our needs. The downside—computers and their handlers literally decide what each of us see. On an individual basis, technology is already the arbiter of what we should know or be allowed to know.

While you read the previous paragraphs, Google processed around three-and-a-half million searches, with each one learning a bit more about how to better increase Google's search superiority. Your computer and your phone are already not only deciding what you see and how you see it, but also working to ensure there are many things you just cannot do without.

Google was founded in 1998. So within just 25 years, the entire way we learn has changed. At that time, Jeff Bezos' Amazon, a public company for just a year, was valued at a mere $10 billion; Mark Zuckerberg was just 13 and celebrating his bar mitzvah; Steve Jobs had just returned to Apple; there was no meaningful online e-commerce, nor Internet searching, and no smartphones; shoppers went out to shop, and computers and the huge systems behind them knew next to nothing about any of us as individuals.

Today, we have multiple new frontier technologies. As well as AI, this new generation of general purpose technologies includes additive manufacturing (3D and 4D printing), augmented reality (AR) and virtual reality (VR), blockchain, always-on communications (such as 5G and soon 6G), cryptocurrency and tokenization, decentralization, Internet of Things (IoT), and robotics and automation. All verge on being "supercharged" with quantum computing. The rate of adoption has been increasing across almost every discipline.

Within a few years, quantum computing might be able to break RSA encryption, the public-key cryptosystem that is widely used for securing all our data. Without countermeasures, this will render the entire systems driving our economies vulnerable. Quantum will be able to retrospectively decrypt every bit of information ever securely stored and access every secure device, in every network, no matter how remote, around the world.

It will probably take a decade to adapt encryption for quantum computing; even if we start now, it is a race against time. Various countries, most visibly China, are believed to be amassing huge warehouses of secure data on everyone and everything

globally. These cannot yet be decrypted, but as soon as quantum computing solutions become available, they will become transparent. Our data cannot be taken back. Think of a stranger owning a "copy" of your safe containing all your private details, just waiting for the key to be delivered. This type of power should keep us all awake at night.

Data security is merely the tip of the iceberg. Technology now allows Big Tech and governments to know (and soon to anticipate) almost all our moves. Our phones silently allowed track and trace to "ping" us when we came close to someone suspected of having COVID-19; our appliances can monitor our speech and actions; government and nongovernment actors are positioned to manipulate our elections. What is clear, for better or worse, is we are now dependent on many technologies and incapable of operating without them. These technologies will soon grow to include domains such as centrally controlled digital currencies, vehicles, medical and financial data, enhanced movement tracking, vast realms of behavioral science, and countless others. Every one of these can have enormous individual and collective benefits. But they can also be the source of enormous harm. Imagine any bad actor (or even a government) with this level of power—able to use all our data to identify, manipulate, stop/redirect a vehicle, or even eliminate assets, all at the push of a button. None of this is science fiction. As you read this, all these technologies are in development or already deployed to some extent.

What is next? By 2040, frontier technologies are likely to be thousands of times more powerful than today. And there are many innovators out there already trying hard to create what could become a "species" that is, by design, superior to us. For instance, in 2019 alone, Amazon spent $36 billion on research and development (R&D) to develop human replacement technologies, from robots to smart home assistants. This investment is greater than the GDPs of 34 countries.

The world as we know it—public and private—has long followed a linear path that grows incrementally and relatively manageably and stably; frontier technologies, however, are accelerating exponentially. The battle ahead *is between our linear trajectory and technology's exponential one*.

Humans 2.0

"*Talent hits a target no one else can hit. Genius hits a target no one else can see.*"

—*Schopenhauer*

While much attention over the past few decades has focused on robots replacing human labor, now that frontier technologies are reaching the general purpose stage, there is a distinct shift toward computers replacing cognitive jobs rather than physical ones. COVID-19 accelerated the movement toward working from home; ironically, if you can work from home, you become more digitally replaceable than if you are in a job that requires direct physical and/or human interaction. Despite the Industrial Revolution targeting manual work, the physical roles that remain are often more robot-immune, requiring dexterity, creativity, and empathy, or are more entangled in the human way of thinking. For the moment, robot creators and developers are also finding it hard to replicate many of the remaining physical skills. In contrast, computers relentlessly improve their abilities to deliver on cognitive tasks, as this is a new domain for them. They can now read and write contracts, trade financial services, manage your accounts, answer telephone calls, organize your day, and do many human tasks. And, as many of these human roles are already performed remotely, swapping them out with computers can be staged and seamless. When was the last time you visited a travel agent? Which professions are next? Much of what attorneys,

accountants, bankers, insurance agents, and bureaucracies in general do is repetitive and codifiable. And, as Wright's Law captures, technologies get cheaper with scale. Humans do not.

Devices

"*He wears a mask, and his face grows to fit it.*"

—*George Orwell*

Twenty years ago, mobile phones were slow and cumbersome, used only for calls and texting. Today they are powerful computers as well as working and entertainment devices that are seemingly always in hand. We are not only addicted to them but actually dependent on them. And their functionality expands daily. We check our smartphones right before bed, when we wake up, and we carry them all day, almost as an extension of ourselves. They are indispensable, having become our core interface with the world, combining the physical with the digital. Creators seamlessly and constantly add new features, making obsolete so many products we have grown used to—radios, music players, maps, etc.—dematerializing our world. And soon, they will not need to be handheld, or perhaps even optional—we will access them through our glasses, contact lenses, or even implants. They can and will be permanently "on," constantly assisting us, while at the same time continuously assessing us as well.

As frontier technologies become more general purpose, new products can be created by people who are not experts in the field, and eventually by virtually anybody. In fact, soon, frontier technologies will even be able to independently build products and eventually re-create themselves. Many newly deployed technologies have been developed (or acquired) by a small number of very large companies, mostly founded by brainy, well-intentioned young entrepreneurs, without meaningful regulatory control. Now, there are also millions of new entrepreneurs around the

world experimenting with even more powerful technologies—once again virtually without oversight. The first group we know something about; the second we do not. The past quarter of a century has been the Wild West. Who can we entrust to be the new sheriff in town?

A snapshot of where the world is now should encourage readers to think about the future—harnessing the benefits of technology, while at the same time becoming more cognizant of the underlying dangers. None of us is too small to have our voice heard. As the Dalai Lama neatly summed up, "If you think you are too small to make a difference, try sleeping with a mosquito."

People Going Binary—Computers Going Quantum

"Being wrong might hurt you a bit, but being slow will kill you."
—Jeff Bezos

While innovators are building a new and potentially superior intelligence in their own image, who is looking out for our well-being? Unfortunately, even those leaders and policymakers who believe they have our best interests in mind rarely have the knowledge, power, and capacity to deliver. And, from a practical basis, most are required to reach a consensus; the time this takes almost guarantees not only that they miss the target, but that the target they are aiming at is no longer even there. In most democracies, the stark reality is as follows:

- Those who make the decisions need to be re-elected—meaning popularity is frequently more important than action.
- As elected officials are often not around to see the results of their inaction (or actions), they need not fear being held accountable.

Our leaders' seeming inability (or unwillingness) to look out for us is partially our own fault. The general public increasingly demands binary, yes/no answers, and instant results. Our governments (and media) look to deliver just that. Yet most issues are immensely complex and nuanced and often extend over timeframes that exceed their times in office. Yet by abdicating their responsibility to engage in what is really going on, our leaders are simply allowing technologies and their creators to become increasingly powerful and appear more than willing to just wait and see where the chips fall.

Humans' historical ability to be flexible in processes and use diverse information sources is narrowing, becoming more unequivocal and dogmatic. In some ways, this can be linked to computerization—when we enter a search or program, we expect a result. And whereas Google provides a list of suggestions, ChatGPT now gives us a single answer. While humans tend to be analog in our thinking and have historically incorporated different viewpoints and accepted multiple outcomes, computers have been only digital—designed only to recognize and process ones and zeros. It is indeed ironic, as humans appear to move toward binary thinking, computers, with quantum methods and their ability to handle and accept multiple states simultaneously, may be moving toward the analog.

One result of our move from analog to binary thinking is the clear polarization we are seeing in many countries around the world. If we consider some of the more complex and challenging subjects of today—climate change, gender and race equality, the impacts of the global COVID-19 pandemic, etc.—we demand more and more definitive answers to questions that cannot be answered definitively without a blithe willingness to ignore evidence that does not fit the outcomes we want. This results in governments, the media, and other information sources deciding