BESTSELLING AUTHOR OF AI SUPERPOWERS

KAI-FU LEE

'Dazzling'
New York Times

With a new foreword on ChatGPT

AI 2041

/// TEN VISIONS FOR OUR FUTURE ///

Copyrighted Material

CHEN QIUFAN

AUTHOR OF WASTE TIDE

Praise for *AI 2041*

'A worthy addition to the canon of AI imaginary, an impressive collaboration and a good book to start arguments with' *New York Times Book Review*

'Mixing scientific forecasting and storytelling, Kai-Fu Lee and Chen Qiufan engagingly draw an alarming picture of a world shaped by AI' *Financial Times*

'To say that *AI 2041* is enlightening and valuable, is to understate its significance . . . *AI 2041*'s scientific fiction gives us a way to open our eyes to what is actually going on all around us and where things are heading' John Kao, *Forbes*

'We have reached a momentous inflection point with AI, and no other book I've read captures it with such stunning insight and imagination' Arianna Huffington, founder and CEO, Thrive Global

'An inspired collaboration . . . The pairing of stories and essays is a powerful format, one that makes this a great book for anyone tired of overheated warnings about technology without context' *Wall Street Journal*

'The perfect fusion of science and fiction, illuminating the pervasive impact artificial intelligence will have in our lives and the challenges we face in shaping a techno-future that benefits all of humanity' Marc Benioff, chair and CEO, Salesforce

'Applying AI to business usually means learning the technology first and then figuring out how to apply it. *AI 2041* allows readers to take the exact opposite approach. Lee and Chen take us on an immersive trip through the future and then zoom out with exceptionally clear explanations of the technology at work . . . Enjoyable and eye-opening' Mark Cuban

Copyrighted Material

Kai-Fu Lee is the CEO of Sinovation Ventures and the *New York Times* bestselling author of *AI Superpowers.* Lee was formerly the president of Google China and a senior executive at Microsoft, SGI, and Apple. Co-chair of the Artificial Intelligence Council at the World Economic Forum, he has a bachelor's degree from Columbia and a PhD from Carnegie Mellon. Lee's numerous honors include being named to the *Time* 100 and *Wired* 25 Icons lists. He is based in Beijing.

Chen Qiufan (aka Stanley Chan) is an award-winning author, translator, creative producer, and curator. He is the president of the World Chinese Science Fiction Association. His works include *Waste Tide*, *Future Disease*, and *The Algorithms for Life*. The founder of Thema Mundi, a content development studio, he lives in Beijing and Shanghai.

Copyrighted Material

AI 2041

TEN VISIONS FOR OUR FUTURE

KAI-FU LEE
& CHEN QIUFAN

Copyrighted Material



WH
ALLEN

1

WH Allen, an imprint of Ebury Publishing
20 Vauxhall Bridge Road
London SW1V 2SA

WH Allen is part of the Penguin Random House group of companies
whose addresses can be found at global.penguinrandomhouse.com



Penguin
Random House
UK

Copyright © Kai-Fu Lee and Chen Qiufan 2021 and 2024

Kai-Fu Lee and Chen Qiufan have asserted their rights to be identified as the authors
of this Work in accordance with the Copyright, Designs and Patents Act 1988

The stories in this book are a work of fiction. Names, characters, business, events
and incidents are the products of the authors' imaginations. Any resemblance to
actual persons, living or dead, or actual events is purely coincidental.

First published by in the United States by Currency in 2021
First published in the United Kingdom by WH Allen in 2021
This edition published 2024

www.penguin.co.uk

A CIP catalogue record for this book is available from the British Library

ISBN 9780753559024

Printed and bound in Great Britain by Clays Ltd, Elcograf S.p.A.

The authorised representative in the EEA is Penguin Random House Ireland,
Morrison Chambers, 32 Nassau Street, Dublin D02 YH68

Penguin Random House is committed to a sustainable future
for our business, our readers and our planet. This book is made
from Forest Stewardship Council® certified paper.



Copyrighted Material

What we want is a machine that can learn from experience.

—Alan Turing

Any sufficiently advanced technology is indistinguishable from magic.

—Arthur C. Clarke

Copyrighted Material

Copyrighted Material

FOREWORD FOR THE PAPERBACK EDITION

THE AGE OF AI 2.0 HAS BEGUN

IN JANUARY 1848, historian, philosopher, and statesman Alexis de Tocqueville addressed the French Parliament regarding the growing unease in Paris: "*I believe that we are at this moment sleeping on a volcano.*" Even he could not have known how right he was.

Within months Europe was in disarray, centuries-old social structures disintegrating from Prussia to Paris, Bucharest to Berlin. All of Europe was swept up in the revolutionary fervor of the so-called Springtime of the Peoples as whole new worlds were conceived in the minds of millions, the ramifications of which are still being felt today.

While writing *AI 2041* in 2021, I felt a little like Tocqueville must have in 1848. I knew we were on the cusp of something momentous, something with the potential to sweep the world and create immense change: a new generation of AI that would revolutionize employment and quality of life for millions of people.

But even I could not know how explosive it would be.

The first rumblings occurred during the summer of 2022. Text-to-pictures apps like OpenAI's DALL-E 2, Midjourney, and Stable Diffusion gave consumers a hint of what was to come, but these were just a prelude to the main event.

Copyrighted Material

Our volcano erupted in November 2022 as ChatGPT launched, gaining 100 million users in mere months. The pace since then has been staggering. AI operated in the background for a generation, and now, seemingly overnight, it is at the forefront of culture, industry, and even the arts. The public are now seeing the culmination of decades of research and development come to fruition. It amazes them, excites them, and, for some, scares them.

After a sabbatical with crypto, billions of dollars of venture investment have poured back into the sector, funding dozens of buzzy AI startups. Meanwhile, incumbent Big Tech giants like Google, Meta, and Apple have moved quickly to provide their own offerings, and protect their products.

As I predicted in these pages back in 2021, "Such a platform [of an evolved GPT-3] could evolve into a virtuous cycle in which tens of thousands of smart developers create amazing apps." And this is what has happened. The result is thousands of new consumer-facing applications, allowing everyone to experience the magic of AI, to see it draw, paint, compose, and code on their behalf. Businesses are rushing to integrate this technology into their processes to unlock productivity gains. Governments are preparing regulations to harness and withstand this rupture. In other words, we have moved into a new era: from AI 1.0 to AI 2.0.

But the large language models behind innovative tools like ChatGPT are just the visible tip of the iceberg. The potential for AI encompasses so much more—as you'll find in the pages that follow.

WHAT HAS CHANGED?

This shift that we're seeing with AI 2.0 began with a small team at Google and their 2017 paper "Attention Is All You Need." Their breakthrough provided a language architecture that could understand and create new multimedia content faster and cheaper. Its fuel was data.

The previous age of AI 1.0 was defined by single-domain-specific models built on discrete datasets and labor-intensive labeling, which despite its raw power was expensive to train, narrow in scope, and liable to be brittle.

Copyrighted Material

No more. Now the silo walls have been lifted—under AI 2.0 huge

swathes of available text and multimodal data can be harnessed to power a single foundational model, requiring no human labeling, and able to execute a broad range of tasks to a high degree of competence.

In this new age, the relative cost of creation has become negligible. An advertising campaign that previously would have taken ten people to complete in a week could now be produced by a single person assisted by AI in an hour, with evocative copy, stunning graphics, even an entire website designed from a prompt.

Search engines were the first to be transformed by AI 2.0. ChatGPT and a raft of anthropomorphized chatbots—Claude, Bard, Sydney, and Ernie—are competently and confidently answering millions of queries a day. The effects of this change from website to chatbot are yet to be fully felt, but I believe will be as revolutionary as the arrival of Google Search.

We are already seeing AI personal assistants, such as Pi, the friendly chatbot companion created by Inflection AI, started by a former DeepMind founder and Reid Hoffman, of LinkedIn and PayPal fame. After trying out Pi, it's not so hard to make the mental leap to what Chen Qiufan and I imagined in chapter 3 of *AI 2041,* called "Twin Sparrows," which features tutor-like AI companions for two orphaned boys built on natural language processing (NLP).

Other recent arrivals on the AI scene seem like they could have stumbled right out of the chapters that follow. New entertainment start-ups like Runway and Metaphysic can quickly generate images, videos, deepfakes, and more, threatening to disrupt an industry already at unease. For the first time, strikes in Hollywood are taking place out of fear of total replacement of actors by artificial replicas. It's going to take innovative thinking, perhaps along the lines that we suggest in chapter 8, "The Job Savior," to forge a future where technologies like this and human work can coexist.

Not everything is changing all at once. In healthcare, strong regulation and compulsory human oversight will remain, at least at first. But in an advisory capacity, AI 2.0 will analyze patients' health conditions, taking in all data, biometrics, medical exams, and history, to form a personalized and holistic diagnosis and treatment plan superior to a team of specialists.

Copyrighted Material

And yet, despite these leaps in performance, we have not yet attained artificial general intelligence (AGI). These models cannot do everything

that humans can. However, AGI is not required to make colossal impacts on the global economy. AI in the here and now is powerful enough to change everything.

WHAT WILL CHANGE?

As in 1848, after a period of explosive growth and momentum, there came a period of counterrevolution. But this time, some of the loudest protesters are, paradoxically, also at the vanguard of AI development. In March 2023, a group of over 33,000 scientists, start-up founders, and corporate leaders signed an open letter calling for a six-month moratorium on training powerful AI systems due to their risks to humanity.

This was followed by an even louder tocsin. A precise twenty-two-word statement from the Center for AI Safety: "*Mitigating the risk of extinction from AI should be a global priority alongside other societal-scale risks such as pandemics and nuclear war.*"

This stark statement was signed by some of the biggest names in AI, the likes of Sam Altman, Bill Gates, Geoffrey Hinton, Demis Hassabis, and Stuart Russell. Even those at the cutting edge of this technology are accelerating forward with their hands itching over the brake.

Beyond the existential risk, reconstituting the world for AI 2.0 brings myriad new challenges. We explored some of the ones that give us white knuckles, like autonomous weapons, in chapter 7, "Quantum Genocide." Two years later, the kind of harrowing scenario we imagined—with a swarm of autonomous drones—is not looking so far-fetched at all. Governments, companies, civil society, and individuals will have to work to mitigate these possible harms. The reality is that regulation will always lag behind innovation, and innovation is moving at light speed.

On a technical level, there are still kinks to iron out. As I point out in chapter 3, generative AI is prone to so-called "hallucinations," providing confident yet inaccurate answers to questions. Accuracy is vital or else public trust and acceptance will be impossible.

Even when working correctly, AI 2.0 could be a Cambridge Analytica on steroids: a disinformation machine, personalizing and adjusting its message to persuade and influence swathes of the population. Previous election interference will be dwarfed as governments struggle to com-

Copyrighted Material

pete with bad actors, as I show in chapter 2, "Gods Behind the Masks." The scalability that makes AI so promising also makes it dangerous.

In the labor market, AI 2.0 will displace workers, resulting in inequality, loss of purpose, and possibly even social unrest—likely unleashing a justified rage against the machine. To avoid backlash, citizens must be supported as they future-proof their careers against the ever-lengthening reach of AI.

Even environmentally there are issues. These models are trained with a vast amount of computing power, which uses electricity, water, and e-waste. In a warming world where water and energy are becoming more competitive, this usage could be hard to justify, stunting the industry.

On a more spiritual level, some people are using generative AI to reincarnate their dead relatives, so called griefbots, a topic I explored with celebrities in "My Haunting Idol." Last year, Pope Francis, Rabbi Eliezer Simcha Weiss (a member of the Chief Rabbinate Council of Israel), and Sheikh Abdallah bin Bayyah (an Islamic scholar) met in Rome to discuss AI and theological consequences of this development.

DIFFERENT APPROACHES

While the calls for moratoriums are not practically enforceable nor actionable, they do get the topic of AI safety onto the agenda and countries are not shying away from regulation.

Different territories are taking different approaches and measures to protect their citizens while harnessing growth. The EU has introduced the Artificial Intelligence Act, China has new Shanghai Regulations, and the White House has developed the Blueprint for an AI Bill of Rights. Industry is taking measures to self-correct too, such as OpenAI's recent "Planning for AGI and Beyond." This ongoing work benefits all competitors in the field and delivers the best possible results to consumers.

As of this writing in mid-2023, the United States has extended an early lead in this new era of AI 2.0—Chinese competitors to American products have yet to reach the same levels of acclaim. Strong offerings come from Chinese Internet giants like Baidu, Alibaba, Tencent, ByteDance, and JD.com, as well as a number of Chinese start-ups, but none have yet reached the quality of OpenAI's GPT-4.

Copyrighted Material

However, this does not mean that China cannot catch up or even advance into the lead. Many had the same attitude to AI 1.0 when the AlphaGo championship caused the world to wake up. China's strong engineering excellence, hardworking entrepreneurship, and supportive policies allowed them to catch up to the United States on AI 1.0 far ahead of expectations.

Now, the world's two AI superpowers are diverging in their strategies and territories. More Chinese generative AI products, both from established players and start-ups, will enter the market throughout 2023. They will iterate and improve rapidly and relentlessly, thanks to the same fast pace of adaptation and implementation that powered China's boom in mobile Internet.

In my previous book, *AI Superpowers,* I predicted that if corporations rather than university labs make breakthroughs, then they would pursue a policy of secrecy in aid of extending their advantage or increasing their profit. As early winners like OpenAI pulled ahead, they have in turn dramatically reduced their publications.

Luckily, strong collaboration still exists between academics across the world, who share papers, insights, methodologies, and tools, to the benefit of all users. These global partnerships will continue to increase the quality of Chinese and other non-Western AI offerings.

We must not miss the forest for the trees, as generative AI is just one aspect of this wide field that includes deep learning, smart robots, autonomous vehicles, and still more. That is why I think *AI 2041* is more important than ever, so people can understand the field in its entirety, rather than just the latest trend.

PROMISE OF THE FUTURE

We cannot raise each new generation in fear of the future. While we are correct not to ignore dangerous elements of artificial intelligence, and to take action, we must place them in proportion and consider the good that will be achieved in harnessing these technologies.

There is unbelievable promise ahead, and we must not lose sight of the ultimate goal—less work, not more. John Maynard Keynes writing in the 1930s predicted fifteen-hour workweeks for his grandchildren, while

Copyrighted Material

famed science-fiction author Arthur C. Clarke's goal was rather more bold: "*full unemployment, so we can play*." I call this post-scarcity future "Plenitude" in the final chapter of this book.

We are now marching toward this outcome in the coming decade. And this generation's work ethics and social contracts are going to face dramatic transitions when our descendants stride into the new AI economy.

I am writing this in the summer of 2023, and you, the reader, will not be seeing it until at least 2024. So much will have changed by then. The pace of progress has rejuvenated and excited me, compelling me to start my own new start-up to build AI 2.0 apps for the whole world.

Maybe some of these apps will be taking inspiration from this book, ideas that were still science fiction just a few years ago but now are in our grasp. Art imitates life, but sometimes the reverse is also true.

In 1964, Arthur C. Clarke predicted that the "most intelligent inhabitants of [the] future . . . won't be men or monkeys, they'll be machines." We are seeing this vision come to life. We must be ready for the consequences.

—Kai-Fu Lee,
August 2023

Copyrighted Material

Copyrighted Material

CONTENTS

Foreword for the Paperback Edition:
The Age of AI 2.0 Has Begun vii

Introduction by Kai-Fu Lee:
The Real Story of AI xvii

Introduction by Chen Qiufan:
How We Can Learn to Stop Worrying
and Embrace the Future with Imagination xxv

1. THE GOLDEN ELEPHANT 3
*AN*ALYSIS: DEEP LEARNING, BIG DATA,
INTERNET/FINANCE APPLICATIONS,
AI EXTERNALITIES 22

2. GODS BEHIND THE MASKS 33
*AN*ALYSIS: COMPUTER VISION,
CONVOLUTIONAL NEURAL NETWORKS, DEEPFAKES,
GENERATIVE ADVERSARIAL NETWORKS (GANs),
BIOMETRICS, AI SECURITY 55

Copyrighted Material

3. TWIN SPARROWS 67
ANALYSIS: NATURAL LANGUAGE PROCESSING, SELF-SUPERVISED TRAINING, GPT-3, AGI AND CONSCIOUSNESS, AI EDUCATION 108

4. CONTACTLESS LOVE 121
ANALYSIS: AI HEALTHCARE, ALPHAFOLD, ROBOTIC APPLICATIONS, COVID AUTOMATION ACCELERATION 152

5. MY HAUNTING IDOL 167
ANALYSIS: VIRTUAL REALITY (VR), AUGMENTED REALITY (AR), AND MIXED REALITY (MR), BRAIN-COMPUTER INTERFACE (BCI), ETHICAL AND SOCIETAL ISSUES 200

6. THE HOLY DRIVER 211
ANALYSIS: AUTONOMOUS VEHICLES, FULL AUTONOMY AND SMART CITIES, ETHICAL AND SOCIAL ISSUES 246

7. QUANTUM GENOCIDE 255
ANALYSIS: QUANTUM COMPUTERS, BITCOIN SECURITY, AUTONOMOUS WEAPONS AND EXISTENTIAL THREAT 302

8. THE JOB SAVIOR 313
ANALYSIS: AI JOB DISPLACEMENT, UNIVERSAL BASIC INCOME (UBI), WHAT AI CANNOT DO, 3RS AS A SOLUTION TO DISPLACEMENT 344

9. ISLE OF HAPPINESS 357
ANALYSIS: AI AND HAPPINESS, GENERAL DATA PROTECTION REGULATION (GDPR), PERSONAL DATA, PRIVACY COMPUTING USING FEDERATED LEARNING AND TRUSTED EXECUTION ENVIRONMENT (TEE) 389

10. DREAMING OF PLENITUDE 401
ANALYSIS: PLENITUDE, NEW ECONOMIC MODELS, THE FUTURE OF MONEY, SINGULARITY 423

ACKNOWLEDGMENTS 441

INDEX 443

Copyrighted Material

THE REAL STORY OF AI

> Artificial intelligence (AI) is smart software and hardware capable of performing tasks that typically require human intelligence. AI is the elucidation of the human learning process, the quantification of the human thinking process, the explication of human behavior, and the understanding of what makes intelligence possible. It is mankind's final step in the journey to understanding ourselves, and I hope to take part in this new, but promising science.

I WROTE THESE words as a starry-eyed student applying to Carnegie Mellon University's PhD program almost forty years ago. Computer scientist John McCarthy coined the term "artificial intelligence" even earlier—at the legendary Dartmouth Summer Research Project on Artificial Intelligence in the summer of 1956. To many people, AI seems like the quintessential twenty-first-century technology, but some of us were thinking about it decades ago. In the first three and a half decades of my AI journey, artificial intelligence as a field of inquiry was essentially confined to academia, with few successful commercial adaptations.

AI's practical applications once evolved slowly. In the past five years, however, AI has become the world's hottest technology. A stunning turning point came in 2016 when AlphaGo, a machine built by DeepMind engineers, defeated Lee Sedol in a five-round Go contest known as the Google DeepMind Challenge Match. Go is a board game more complex than chess by one million trillion trillion trillion trillion times. Also, in

Copyrighted Material

contrast to chess, the game of Go is believed by its millions of enthusiastic fans to require true intelligence, wisdom, and Zen-like intellectual refinement. People were shocked that the AI competitor vanquished the human champion.

AlphaGo, like most of the commercial breakthroughs in AI, was built on deep learning, a technology that draws on large data sets to teach itself things. Deep learning was invented many years ago, but only recently has there been enough computing power to demonstrate its efficacy, and sufficient training data to achieve exceptional results. Compared to when I made my cold start in AI forty years ago, we now have about one trillion times more computing power available for AI experimentation, and storing the necessary data is fifteen million times cheaper. The applications for deep learning—and its related AI technologies—will touch nearly every aspect of our lives.

AI is now at a tipping point. It has left the ivory tower. The days of slow progress are over.

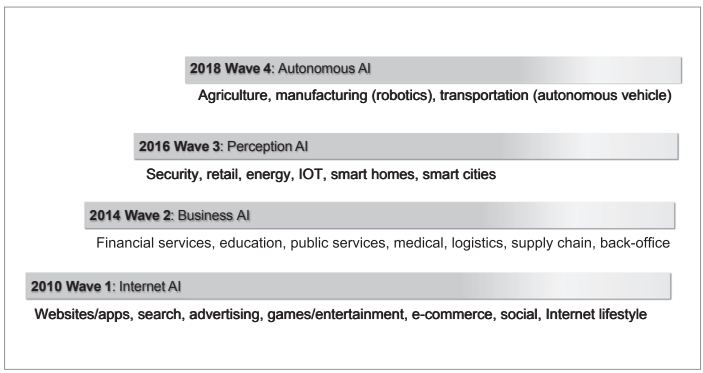
In just the past five years, AI has beaten human champions in Go, poker, and the video game Dota 2, and has become so powerful that it learns chess in four hours and plays invincibly against humans. But it's not just games that it excels at. In 2020, AI solved a fifty-year-old riddle of biology called protein folding. The technology has surpassed humans in speech and object recognition, served up "digital humans" with uncanny realism in both appearance and speech, and earned passing marks on college entrance and medical licensing exams. AI is outperforming judges in fair and consistent sentencing, and radiologists in diagnosing lung cancer, as well as powering drones that will change the future of delivery, agriculture, and warfare. Finally, AI is enabling autonomous vehicles that drive more safely on the highway than humans.

As AI continues to advance and new applications blossom, where does it all lead?

In my 2018 book *AI Superpowers: China, Silicon Valley, and the New World Order,* I addressed the proliferation of data, the "new oil" that powers AI. The United States and China are leading the AI revolution, with the United States leading research advances and China more swiftly tapping big data to introduce applications for its large population. In *AI Superpowers,* I predicted new advances, from big-data-driven decision-making to machine perception to autonomous robots and vehicles. I projected that

Copyrighted Material

AI's new applications in digital industries, finance, retail, and transportation would build unprecedented economic value, but also create problems related to the loss of human jobs and other issues. AI is an omni-use technology that will penetrate virtually all industries. Its effects are being felt in four waves, beginning with Internet applications, followed by applications in business (e.g. financial services), perception (think smart cities), and autonomous applications, like vehicles.



Four waves of AI applications are disrupting virtually all industries.

By the time you read this new book in late 2021 or beyond, the predictions I made in *AI Superpowers* will have largely become reality. We must now look ahead to new frontiers. As I've traveled the world talking about AI, I'm constantly asked, "What's next?" What will happen in another five, ten, or twenty years? What will the future hold for us humans?

These are essential questions for our moment in history, and everyone working in the technology space has an opinion. Some believe that we're in the midst of an "AI bubble" that will eventually pop, or at least cool off. Those with more drastic and dystopian views believe everything from the notion that AI giants will "hijack our minds" and form a utopian new race of "human cyborgs" to the arrival of an AI-driven apocalypse. These various predictions may be born out of genuine curiosity or understandable fear, but they are usually speculative or exaggerated. They miss the complete picture.

Copyrighted Material

Speculation varies wildly because AI appears complex and opaque. I've observed that people often rely on three sources to learn about it: science fiction, news, and influential people. In science fiction books and TV shows, people see depictions of robots that want to control or outsmart humans, and superintelligence turned evil. Media reports tend to focus on negative, outlying examples rather than quotidian incremental advances: autonomous vehicles killing pedestrians, technology companies using AI to influence elections, and people using AI to disseminate misinformation and deepfakes. Relying on "thought leaders" ought to be the best option, but unfortunately most who claim the title are experts in business, physics, or politics, not AI technology. Their predictions often lack scientific rigor. What makes things worse is that journalists tend to quote these leaders out of context to attract eyeballs. So, it is no wonder that the general view about AI—informed by half-truths—has turned cautious and even negative.

To be sure, aspects of AI development deserve our scrutiny and caution, but it is important to balance these concerns with exposure to the full picture and potential of this crucially important technology. AI, like most technologies, is inherently neither good nor evil. And like most technologies, AI will eventually produce more positive than negative impacts on our society. Think about the tremendous benefits of electricity, mobile phones, and the Internet. In the course of human history, we have often been fearful of new technologies that seem poised to change the status quo. In time, these fears usually go away, and these technologies become woven into the fabric of our lives and improve our standard of living.

I believe there are many exciting applications and scenarios in which AI can profoundly enhance our society. Firstly, AI will create tremendous value to our society—PricewaterhouseCoopers estimates $15.7 trillion by 2030—which will help reduce hunger and poverty. AI will also create efficient services that will give us back our most valuable resource—time. It will take over routine tasks and liberate us to do more stimulating or challenging jobs. Lastly, humans will work symbiotically with AI, with AI performing quantitative analysis, optimization, and routine work, while we humans contribute our creativity, critical thinking, and passion. Each human's productivity will be amplified, allowing us to realize our poten-

Copyrighted Material

tial. The profound contributions AI is poised to make to humanity need to be explored as deeply as its challenges.

Amid what seems like a feedback loop of negative stories about AI, I believe it's important to tell these other stories, too, and answer that question of "What happens next?" So I decided to write another book about AI. This time, I wanted to extend the horizon a bit further—to imagine the future of the world and our society in twenty years' time, or 2041. My aim is to tell the "real" AI story, in a way that is candid and balanced, but also constructive and hopeful. This book is based on *realistic AI,* or technologies that either already exist or can be reasonably expected to mature within the next twenty years. These stories offer a portrait of our world in 2041, based on technologies with a greater than 80-percent likelihood of coming to pass in that timeframe. I may overestimate or underestimate some. But I believe this book represents a responsible and likely set of scenarios.

How can I be so confident? Over the past forty years, I have been involved in AI research and product development at Apple, Microsoft, and Google, and managed $3 billion in technology investments. So I have hands-on experience with the time and processes needed to take a technology from academic paper to pervasive product. Further, as an adviser to governments on AI strategy, I can make predictions based on my knowledge of policy and regulation frameworks, and the reasoning behind them. Also, I avoid making speculative predictions about fundamental breakthroughs and rely mostly on applying and extrapolating the future of existing technologies. Since AI has penetrated less than 10 percent of our industries, there are many opportunities to reimagine our future with AI infusion into these fields. In short, I believe that *even with few or no breakthroughs, AI is still poised to make a profound impact on our society.* And this book is my testimony.

I've been told that one of the reasons that *AI Superpowers* made an impact on readers was that it was accessible to people with no prior knowledge of AI. So when I embarked on this new book, I asked: What can I do to tell stories about AI in a way that makes them even more widely appealing? The answer, of course, was to work with a good storyteller! I decided to reach out to my former Google colleague Chen Qiufan. After Google, I started a venture capital firm. Qiufan did something more

Copyrighted Material

adventurous—he became an award-winning science fiction writer. I was delighted that Qiufan agreed to work with me on the project, and to dovetail his creativity with my judgment on what technology will be capable of in twenty years. We both believed that imagining the feasible technologies within a twenty-year period and embedding them in stories would be quite engaging, and we wouldn't even have to resort to teleportation or aliens to mesmerize our readers.

Qiufan and I worked out a unique arrangement. I first created a "technology map" that projected when certain technologies would mature, how long it would take to gather data and iterate AI, and how easy it would be to build a product in various industries. I also accounted for possible externalities—challenges, regulations, and other deterrents, as well as story-worthy conflicts and dilemmas that might emerge alongside these technologies. With my input on the technological components, Qiufan then flexed his talents—dreaming up the characters, settings, and plotlines that would bring these themes to life. We worked to make each story engaging, provocative, and technologically accurate. After each one, I offer my technology analysis, digging into the forms of AI revealed and their implications for human life and society. We organized the stories to cover all key aspects of AI, and roughly ordered them from basic to advanced technologies. The sum of these parts, we hope, is a uniquely engaging and accessible primer on AI.

We named our book *AI 2041* because that is twenty years from the initial publication of this book. But it didn't slip our notice that the digits "41" happen to look a bit like "AI."

Many of our readers may love the wonderful storytelling of science fiction, but I imagine there are others who may not have picked up a novel or a collection of short stories since college. That's okay. If you fall into that camp, think of *AI 2041* not as "science fiction" but as "scientific fiction." The stories are set in wide-ranging locations around the world. In some, you may recognize a world that seems not too dissimilar from your own—with narratives that draw on existing customs and habits, albeit with an AI twist. In others, AI has transformed human life dramatically. Both AI enthusiasts and skeptics will have plenty to think about. Creating a book with a significant fiction component is inherently riskier than writing a nonfiction book that simply describes the present and asks questions about the future. Qiufan and I sought to be bold with our

Copyrighted Material

narratives, and we believe the stories that follow will strike a chord with every open-minded reader whose imagination is large enough to ponder what the future holds.

The first seven stories were designed to cover technology applications for different industries in increasing technological complexity, along with their ethical and societal implications. The last three stories (plus chapter 6, "The Holy Driver") focus more on social and geopolitical issues raised by AI, such as the loss of traditional jobs, an unprecedented abundance of goods, exacerbated inequality, an autonomous weapons arms race, trade-offs between privacy and happiness, and the human pursuit of a higher purpose. These are profound changes, and humans may embrace them with compassion, exploit them with malice, capitulate to them with resignation, or be inspired by them to reinvent ourselves. In the final four stories, we decided to show four possible variations and different pathways, as a way of underscoring that the future is not yet written.

We hope the stories entertain you while deepening your understanding of AI and the challenges it poses. We also hope that the book's road map of the coming decades will help you prepare yourself to capture the opportunities and confront the challenges that the future will bring. Most of all, we hope you will agree that the tales in *AI 2041* reinforce our belief in human agency—that we are the masters of our fate, and no technological revolution will ever change that.

Now, let's take a journey to 2041.

Copyrighted Material

Copyrighted Material

INTRODUCTION BY CHEN QIUFAN

HOW WE CAN LEARN TO STOP WORRYING AND EMBRACE THE FUTURE WITH IMAGINATION

IN AUGUST 2019, while visiting the Barbican Centre in London, I came across an exhibition titled *AI: More Than Human*. Like a refreshing summer downpour, the exhibition cleared my senses—and changed most of my preexisting biases and misconceptions toward artificial intelligence. The deceivingly simple name of the exhibition was nowhere near a sufficient representation of the diversity and complexity it contained. Each room of the exhibit revealed new wonders, all with a connection to the curators' expansive definition of what AI encompasses. There was Golem, a mythical creature in Jewish folklore; Doraemon, the well-loved Japanese anime hero; Charles Babbage's preliminary computer science experiments; AlphaGo, the program designed to challenge humans' fundamental intellect; Joy Buolamwini's analysis on the gender bias of facial recognition software; and teamLab's large-scale interactive digital art infused with Shinto philosophy and aesthetics. It was a magnificent and mind-expanding reminder of the power of interdisciplinary thinking.

According to Amara's law, "We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run." Most of us tend to think of AI in narrow terms: the murderbot from *The Terminator,* incompetent algorithms that could never match the wits or

Copyrighted Material

threaten the existence of humans in any way, mere soulless technological inventions that have nothing to do with how humans perceive the world, communicate emotions, manage institutions, and explore other possibilities of life.

The truth—as it has been revealed in stories ranging from the Chinese folktale of Yan Shi, the mechanic who creates a humanoid, to Talos, the bronze automaton in Greek mythology—is that humans' search for artificial intelligence has persisted throughout world history, long before computer science existed as a field or the term "AI" entered the lexicon. From the past era to the present day, the unstoppable force of AI has been revolutionizing every dimension of human civilization, and it will continue to do so.

Science fiction, my chosen field, plays a rather delicate role in investigating the human-machine paradigm. The 1818 novel *Frankenstein,* often praised as the first modern science fiction novel, hinges on questions that still resonate today: With the help of technology, are humans entitled to create intelligent life that's different from all currently existing forms of life? What would the relationship between the creation and the creator look like? The archetype of the mad scientist inflicting his creations on the world originated from Mary Shelley's masterpiece two hundred years ago.

While some may scapegoat science fiction, blaming it for people's narrow and often negative view of AI, that's only part of the story. Science fiction has the capacity to serve as a warning, but speculative storytelling also has a unique ability to transcend time-space limitations, connect technology and humanities, blur the boundary between fiction and reality, and spark empathy and deep thinking within its reader. Historian and bestselling author Yuval Noah Harari has called science fiction "the most important artistic genre" of our time.

That's a high bar to live up to. For science fiction writers like myself, the challenge we face is creating stories that not only reveal hidden truths about our present-day reality, but also, simultaneously, project even wilder imaginative possibilities.

Therefore, when my former colleague from Google Kai-Fu Lee got in touch with me and proposed this collaboration on *AI 2041*—a one-of-a-kind book project that combines science fiction and analysis of big ideas that animate technology—I was thrilled. The Kai-Fu I know is a pioneer-

Copyrighted Material

ing global leader, a savvy and trend-making business investor, and an imaginative, open-minded prophet of tech. His notions on career development in his field have influenced a generation of young people. Now, his mind is set on the future.

Equipped with a profound understanding of cutting-edge research and its applications in the business world, Kai-Fu delineates the ways in which AI could change human society in twenty years in areas ranging from medicine and education to entertainment, employment, and finance. His idea for this project was ambitious, but it was also a kind of magical coincidence. Years earlier, in my own writing, I had developed the notion of "science fiction realism." To me, science fiction is fascinating because it not only generates an imaginative space for escapists to leave behind their mundane lives, play the role of superheroes, and freely explore galaxies far, far away, but it also provides a precious opportunity for them to temporarily remove themselves from everyday reality and critically reflect upon it. By imagining the future through science fiction, we can even step in, make change, and actively play a role in shaping our reality.

In other words, with every future we wish to create, we must first learn to imagine it.

My imagination began developing as a child thanks to classic works of science fiction like *Star Wars, Star Trek,* and *2001: A Space Odyssey.* Since I was ten, these works have been my portal to the vast beyond and worlds unknown. I believe that, before setting pen to paper for each story, the key is always to orient the story in the history of its genre and a greater social context. As someone deeply invested in—even obsessed with—the fantasies of science fiction, I am in awe of how inclusive the spectrum of science fiction storytelling is. Almost any theme or style can find its place in the genre.

Before I became a full-time author, I worked in technology. A lot of people would assume engineers and computer science wizards might have little interest in fiction—because their brains are hardwired for science, as opposed to literature. But during my more than ten years working in tech, I encountered many engineers and technologists who were not-so-secret fans of speculative fiction. This enthusiasm sometimes manifested in meeting rooms with names like "Enterprise" or "Neuromancer," but it also was present among the formidable minds behind

Copyrighted Material

projects like Google X and Hyperloop. From the modern submarine to the laser gun, and from mobile phones to CRISPR, scientists will readily admit they got direct inspirations from fiction. Imagination indeed shapes the world.

From the beginning, I decided that *AI 2041* would challenge the stereotype of the dystopian AI narrative—the kind of tale where the future is irrevocably bleak. Without disregarding AI's faults or nuances, Kai-Fu and I endeavored to portray a future where AI technology could influence individuals and societies positively. We wished to imagine a future that we would like to live in—and to shape. We imagined a future where the next generations could enjoy the benefits of technological development, work to bring more achievement and meaning into the world, and live happily.

The path to imagining the future of our dreams was not always an easy one. Our challenge was to become immersed in the latest AI research and then to project, with science and logic, *realistically,* how the AI scene would appear in twenty years. Kai-Fu and our team spent hours studying recently published research papers, conversing with experts, professionals, and thinkers involved with the AI industry, participating in the AI workshop hosted by the World Economic Forum, and visiting top AI tech companies, in order to ensure we had a comprehensive grasp of the technological and philosophical basis of AI development.

The other challenge was imagining the human future. We wished to represent how individuals from disparate cultures and industries and with different identities would react to the future shock induced by AI. Subtle psychological details are difficult to infer through mere logic and rationalization. To help fill in the emotional portrait of the characters in our stories, we looked to history and drew inspiration from similar world-changing events that have occurred in the past. To stimulate our readers' imagination and capacity to conceptualize alternative human conditions, we knew our stories must also spark empathy if we were to fully convey our vision and sentiment. Kai-Fu's analysis serves as the string that connects the soaring kite of imagination to the graspable reel of reality.

After months of intensive work and rounds of polishing, here are the ten portals we have assembled that will transport you to the time-space

Copyrighted Material

of 2041. We hope that you will embark on this journey with curiosity, an open mind—and an open heart, too.

One last thing: For me, the greatest value of science fiction is not providing answers, but rather raising questions. After you close the book, our hope is that lots of new questions will enliven your mind: For instance, can AI help humans prevent the next global pandemic by eliminating it at the very root? How can we deal with future job challenges? How can we maintain cultural diversity in a world dominated by machines? How can we teach our children to live in a society where humans and machines coexist? We hope our readers' questions will help take us further down the path as we shape a happier and brighter future.

Welcome to 2041!

Copyrighted Material

Copyrighted Material

AI 2041

Copyrighted Material

Copyrighted Material

CHAPTER ONE

THE GOLDEN ELEPHANT

STORY TRANSLATED BY BLAKE STONE-BANKS

IT IS BETTER TO LIVE YOUR OWN DESTINY IMPERFECTLY THAN TO IMITATE SOMEBODY ELSE'S PERFECTLY.

—BHAGAVAD GITA (भगवद्गीता, SONG OF GOD OR HINDU SCRIPTURE), CHAPTER 3, VERSE 35

Copyrighted Material

NOTE FROM KAI-FU: The opening story takes readers to Mumbai, where we meet a family who has signed up for a deep-learning-enabled insurance program. This dynamic insurance program engages with the insured in the form of a series of apps intended to better their lives. The family's teenage daughter, however, finds that the AI program's persuasive nudges complicate her search for love. "The Golden Elephant" introduces the basics of AI and deep learning, offering a sense of its main strengths and weaknesses. In particular, the story illustrates how AI can single-mindedly try to optimize certain goals, but sometimes create detrimental externalities. The story also suggests the risks when one company possesses so much data from its users. In my commentary at the end of the chapter, I will explore these issues, offering a brief history of AI and why it excites many but has become a source of distrust for others.

Copyrighted Material

ON THE SCREEN, the three-story statue of Ganesh swayed in the surf of Chowpatty Beach as though synced to the sitar soundtrack. With each wave, the towering idol descended lower until it was engulfed by the Arabian Sea. In the salty brine, the statue dissolved into gold and burgundy foam, washing onto Chowpatty Beach, where the colors clung like blessings to the legions of believers who had gathered for the Visarjan immersion ritual celebrating the end of the Ganesh Chaturthi festival.

In her family's Mumbai apartment, Nayana watched as her grandparents clapped their hands and sang along to the TV. Her younger brother, Rohan, took a mouthful of cassava chips and a deep swig from his diet cola. Though he was only eight, Rohan was under doctor's orders to strictly control his fat and sugar intake. As he wagged his head in excitement, crumbs sprayed from his mouth and flew across the floor. In the kitchen, Papa Sanjay and Mama Riya banged on pots and crooned like they were in a Bollywood film.

Nayana tried to shut them all out of her mind. The tenth-grader was instead focusing all her energy on her smartstream, where she had downloaded FateLeaf. The new app was all Nayana's class-

Copyrighted Material

mates could seem to talk about lately. It was said to possess the answer to almost any question, thanks to the prescience of India's greatest fortune tellers.

The app—its branding and ad campaign made clear—was inspired by the Hindu sage Agastya, who was said to have engraved the past, present, and future lives of all people in Sanskrit onto palm leaves, so-called Nadi leaves, thousands of years ago.

According to the legend, simply by providing one's thumbprints and birthdate to a Nadi leaf fortune teller, a person could have their life story foretold from the corresponding leaf. The problem was that many leaves had been lost to meddling colonialists, war, and time. In 2025, a tech company tracked down and scanned all the known Nadi leaves still in circulation. The company used AI to perform deep learning, auto-translation, and analysis of the remaining leaves. The result was the creation of virtual Nadi leaves, stored in the cloud—one for each of the 8.7 billion people on Earth.

Nayana was not dwelling on the ancient history of the Nadi leaves. She had a more pressing matter on her mind. Users of the FateLeaf app could seek to uncover the wisdom of their Nadi leaf by posing various questions. While her family watched the Ganesh Visarjan celebration on TV, Nayana nervously typed out a question within the app: "Does Sahej like me?" Before she clicked "Send," a notification popped up indicating that an answer to her question would cost two hundred rupees. Nayana clicked "Submit."

Nayana had liked Sahej from the moment his stream first connected in their virtual classroom. Her new classmate didn't use any filter or AR background. Behind Sahej, hanging on the wall, Nayana could see rows of colorful masks, which, she learned, Sahej had carved and painted himself. On the first day of the new term, the teacher had asked Sahej about the masks, and the new student shyly gave a show-and-tell, explaining how the masks combined Indian gods and spirits with the powers of superheroes.

Now, in an invitation-only room on her ShareChat, some of Nayana's classmates were gossiping about Sahej. From the way his room was furnished to the fact that his surname was hidden from public view in school records, these girls were certain Sahej was among

Copyrighted Material

the "vulnerable group" that the government mandated make up at least 15 percent of their student body. At private schools across India, such children were practically guaranteed spots and their tuition, books, and uniforms were covered by scholarships. "Fifteen percent" and "vulnerable group" were euphemisms for the Dalits.

From documentaries she had watched online, Nayana knew about India's old caste system, which was deeply embedded in Hindu religious and cultural beliefs. A person's caste had once determined one's profession, education, spouse—their whole life. At the bottom rung of this system were the Dalits, or, as they were sometimes referred to with derision, "untouchables." For generations, members of this community were forced to do the dirtiest jobs: cleaning sewers, handling the corpses of dead animals, and tanning leather.

The constitution of India, ratified in 1950, outlawed discrimination based on caste. But for years following independence, Dalit areas for drinking, dining, residing, and even burial were kept separate from those of groups considered higher in the system. Members of the higher castes might even refuse to be in the same room as the Dalits, even if they were classmates or colleagues.

In the 2010s, the Indian government sought to correct these injustices by establishing a 15-percent quota for Dalit representation in government positions and in schools. The well-intentioned policy had sparked controversy and even violence. Higher-caste parents complained that such admissions weren't based on academic performance. They argued that their children were paying the price for previous generations' sins and that India was just trading one form of inequality for another.

Despite these pockets of backlash, the government's efforts seemed to be working. The 200 million descendants of Dalits were integrating into mainstream society. It had become more difficult to recognize their past identity at a glance.

THE GIRLS IN NAYANA'S ShareChat couldn't stop talking about the new boy in school, Sahej, debating his background—but also whether they would consider going out with him.

Copyrighted Material

You shallow snobs, Nayana silently huffed.

For her part, Nayana saw in Sahej a kindred artistic spirit. Inspired by Bharti Kher, Nayana dreamed of becoming a performance artist, and she often had to explain that this was nothing like being a superficial pop entertainer. She believed great artists had to be brutally honest about their innermost feelings and should never accept the perspectives of others. If she liked Sahej, then she liked Sahej—no matter his family background, where he lived, or even his Tamil-accented Hindi.

The question Nayana had posed to the FateLeaf app seemed to take forever to process. Finally, a notification popped up on Nayana's smartstream accompanied by a palm leaf icon: "What a pity! Due to insufficient data provided, FateLeaf cannot currently answer your query."

The clink of Nayana's refund vibrated from her smartstream.

"Insufficient data!" Nayana silently cursed at the app.

Annoyed, she finally raised her head from her screen to notice her mother, Riya, putting the finishing touches on dinner. Something was off. In addition to a number of Indian holiday delights, Nayana saw several super-expensive dishes from a Chinese delivery place on the table. Such treats were rare for her penny-pinching father. But there was something even more unusual: Riya was wearing her favorite pure silk Parsi-style sari. She had her hair up and was wearing a complete set of jewelry. Even Nayana's grandparents seemed different—happier than usual—and for once, her fat brother, Rohan, wasn't pestering her with all kinds of stupid questions.

The Ganesh Chaturthi festival couldn't explain all this.

"So, is anyone going to tell me what's going on?" Nayana said as she stared at the spread on the table.

"What do you mean, what's going on?" Riya shot back.

"Am I the only one who thinks all this is a bit out of the ordinary?"

Nayana's parents glanced at each other for a second then burst out laughing.

"Take a look and tell us what's different," Riya said.

Copyrighted Material

Nayana felt like she was about to lose her mind. "What are you hiding from me?"

"My sweet little girl, eat first." Grandmom began to pull apart the naan.

"Wait. Did Dad get promoted? Did we win the lottery? Did the government cut taxes?"

Dad wobbled his head back and forth. "All beautiful ideas. But no. It's all for your mother—"

Nayana spun toward her mother. "Mom, what did you buy this time?"

"Your tone should be more respectful when talking with your elders," Riya chided.

"It wasn't me who got taken to the cleaners for buying cheap . . ." Nayana's voice trailed off into a sigh.

Nayana exhaled. "And what exactly is it you bought?"

"Ganesh Insurance! They had an amazing sale for the holiday. First time ever that GI was fifty percent off! All the neighbors got it, too, and they're even more thrifty than me."

Dad clapped his hands in excitement. So did Nayana's grandparents.

"Wait! Hasn't our family always had a policy from the Life Insurance Corporation of India?"

"That policy wasn't nearly enough! Your grandparents are old and rely on us. What if something were to happen to us? Where will the money come from? We have to save where we can. And you and your younger brother are both in private school, and don't you still want to go to SOFT at Rai University? Tuition and dormitories cost a lot more than public universities in Mumbai."

"Why does the conversation always have to twist back to blaming me?"

"To plan for the future, you must also think about what's in front of you," Grandfather observed.

"So, what's the deal with this insurance exactly?"

"Well, Mrs. Shah from next door filled me in," explained Riya. "It's a platform that uses AI to adjust the insurance plan according to the family's needs. And for a very good price. And it's not just the one platform, more like a little family of apps. There's one for calculating and paying insurance fees, and one for investments, and my favorite one is the home goods shop. Another one

Copyrighted Material

shows you deals in your area. And just look at my hair. The salon the Cheapon deals app recommended only cost four hundred rupees."

Just as Rohan was about to steal a sweet, Nayana slapped the back of his hand, which he withdrew with a sheepish look.

"You sound like an advertisement," Nayana told her mother. "Why would an insurance company tell you where to get your hair done? And how exactly does this AI insurance know so much about our family?"

"This, well . . ." Mom searched for a way out of the question. "To get the benefits of Ganesh Insurance, we share data link access for each member of the family."

"What?" Nayana's eyes grew as wide as brass bells.

"It's all kept strictly confidential, unless we give permission for GI to use it."

"What right do you have to share my data link with some insurance company!"

"Hey, don't talk to your mother like that." Dad wagged his finger at Nayana. "Don't forget you're still a minor. As your parents, we have the right to make data decisions for you."

Nayana's face turned bright red; she was unaccustomed to such a sharp rebuke from her father. She threw her knife and fork down onto the plate and raced back to her room. She grabbed her quilt and pulled it over her head, imagining that somewhere on her Nadi leaf, it was written that today was the worst day of her life.

NAYANA AND HER MOTHER'S cold war lasted a week, until Nayana's smartstream began pushing some unusual new notifications:

```
IT'S GOING TO RAIN TODAY
SO TAKE AN UMBRELLA.
RESPIRATORY ILLNESSES ARE BECOMING MORE
PREVALENT, SO YOU SHOULD WEAR A MASK.
THERE'S A TRAFFIC ACCIDENT ON YOUR ROUTE
SO TO AVOID THE CONGESTION . . .
```

Copyrighted Material

At first, Nayana was skeptical about the endless stream of notifications. But she found she couldn't stop reading them. From time to time, she actually got a useful tip. A clothing deal, a discount at a lunch place she liked . . . Of course, to actually redeem the deals, Nayana had to install the Cheapon deals app and other various golden-elephant-branded Ganesh Insurance apps on her smartstream and permit them to access her data.

It seemed Mom had already forced the golden elephant onto all the family's smartstreams. Women controlled data sharing in more than 60 percent of Indian households. All that personal data was linked to the national ID Aadhaar card and the unique identifying number issued to all of India's 1.4 billion residents by the Unique Identification Authority of India. Since implementing the system in 2009, after twenty years of development, the government had collected data including citizens' fingerprints, retina signatures, genetic histories, family information, occupations, credit scores, home-buying history, and tax records. With its clients' consent, Ganesh Insurance was able to tap into this rich trove of data to personalize its services.

Of course, there were some privacy restrictions. For example, social media data needed to be separately authorized, and use of minors' data required consent of their legal guardians.

Nayana aimed to be vigilant in every interaction with GI. In her data literacy class in high school, she had learned that on the Internet every click might sell you out. She carefully studied the fine print before choosing between "I accept" or "I need more time to consider." Yet it seemed every time she selected "I need more time to consider," GI would send appealing new discounts and suggestions for how to solve her immediate problems.

For example, how exactly could she attract Sahej's attention?

Sahej was really cute, especially his sheeplike eyes. He instinctively wanted to please every classmate. He had even sent each classmate a wood carving he had made of a small animal head. But the virtual classroom had its limits. Sometimes all Nayana could see was just a blurry headshot icon and a glitchy voice due to Sahej's poor connection. After finally meeting Sahej during one of the school's "in-person" days, Nayana found it even more difficult

Copyrighted Material

to contain her feelings for him. She sought any excuse to talk with him. But for some reason, the boy kept his distance.

Does Sahej not like me? Or is it another reason?

Could Sahej's background, Nayana wondered, account for his shyness around her?

AS THE QUESTION LINGERED in Nayana's mind, little golden elephants popped up in a notification from MagiComb, GI's lifestyle advice app, about "how to make yourself more attractive to guys." Nayana guessed that the AI was able to use her online browsing and shopping data to infer what she was thinking, but these recommendations disturbed Nayana for another reason. Why should women need to change themselves to win a man's favor? Why couldn't women show men who they really were and see if they were or weren't a match?

Though she was still feeling annoyed at her mother, Nayana decided to ask her about the golden elephant's odd messages.

"Silly girl, machines only learn what is taught to them by human beings." Riya looked at her newly bought long skirt in the mirror and turned. "But what's this all about? Have you met someone?"

"Not at all," Nayana replied, with a tinge of guilt.

"You can hide it from me, but not from the AI," her mother joked. "Are you sure you don't want me to help you scheme? You know, your mother knows a thing or two about men."

"I just don't know how I can find out what he really thinks of me. I give him likes online, but he never seems to respond."

"Ahh, so there *is* someone! It's not enough to give someone a like online. You've got to have guts. And that reminds me. If you permit GI to access your ShareChat account data, its recommendations will be better. Not to mention, the premium for our family will also dip just a bit more."

Nayana shook her head and left the room. She recalled that only a few weeks earlier, her mother had rejected Nayana's request to share her data link with a different app—FateLeaf—to obtain

Copyrighted Material

more accurate fortune-telling. Now, their positions were reversed. Of course, now money was on the line.

It wasn't just her mother. To Nayana, everyone in the family had been brainwashed by that little golden elephant. They had become hyperaware that any change in behavior might raise or lower their premiums. Once something was linked with money, it seemed to Nayana that the human brain went on autopilot. They'd do whatever it took to score an award and evade a penalty.

It wasn't that GI didn't have its plus side. The little golden elephant would remind Nayana's grandparents to take their medicine and nudge them to schedule doctor appointments. Even Nayana's father, who had never listened to anyone, gave up smoking when the little golden elephant kept chiding him. He swapped his favorite arrack for a healthier single nightly glass of red wine. His driving style even became more restrained. At the app's urging, he no longer zigzagged through Mumbai's congested streets like an out-of-work race car driver. GI had given him an incentive—by changing his behavior, he was able to lower his auto, health, and life insurance premiums.

If anyone in the family could resist the GI app's nudges, Nayana suspected it would be her brother, Rohan. After all, fat and sugar were as addictive as heroin, especially for children with no self-control. But that golden elephant made it happen. Even if the eight-year-old didn't understand insurance premiums or delayed gratification, the rest of the family were conditioned to see any sweet near the boy as a threat to their bank account. Their former indulgence of Rohan's sweet tooth was over.

It naturally made sense. Insurance companies wanted people to live healthier, longer lives—it made for better profits.

As for herself, Nayana was still on the fence. Should she hand over the data link of her ShareChat?

Equally puzzling was the question of Sahej. When Sahej had given everyone in the class a handmade wood carving, he chose a crow's head covered in patterns to give to Nayana. The tenth-grader practically tore her hair out thinking about what hidden meaning the gift might hold.

Copyrighted Material

Doesn't the crow symbolize bad luck? Is he telling me to not be so loud and annoying? Am I coming on too strong? What's he saying exactly?

Nayana tortured herself with such questions. Her first thought was to turn to FateLeaf for a divination, but her mother had forbidden her to permit that app to access her data. *What about MagiComb?* Nayana wondered. Lovesick, she decided she would see what the elephant's omnipotent algorithm had to say about her future.

The future the little golden elephant imagined, however, wasn't anything like the one she'd hoped for.

EVERYTHING FELT IMMEDIATELY WRONG.

Granting GI access to her data on ShareChat, Nayana knew from her data literacy class, was like opening the door to your bedroom. Your whole private life might be visible at a glance. Although GI guaranteed that all data was fed anonymously to its AI for purposes of federated learning and that no third party could access it, Nayana thought that sounded a bit like a farmer telling the turkey a week before Thanksgiving, "Hey, you're safe here."

Whenever she was browsing, chatting, liking, or even selecting emojis on ShareChat, all Nayana could think about now was how her choices would affect the family's insurance premiums. She found the whole system infuriating and ridiculous.

But perhaps, she wondered, *it's even more ridiculous to expect this AI to act as my matchmaker.*

Sahej posted almost nothing on ShareChat. He was like a person from some bygone era who had failed to keep up with technology. He occasionally posted a news article, quotes he liked, or outdated memes. But his usage was sporadic and unpredictable. His account, Nayana thought, looked like a fake zombie account.

The AI was supposed to help Nayana get together with Sahej, but how could it learn anything important about Sahej from his boring account? Meanwhile, it was all too easy for AI to understand Nayana's intentions, given her incessant clicking. To the AI, such things were a matter of math, not love.

Copyrighted Material

To Nayana, something fishy was going on with GI when it came to Sahej. She found it odd that every time she refreshed Sahej's page or liked one of his posts, GI would send her a weird notification, as if trying to break her focus. If she tried to come up with a reason to talk with him, browsed online for a gift for him, or even just thought about inviting him out to coffee, that little golden elephant would pop up with some totally ridiculous recommendation or seemingly load a page in error.

The only possible explanation Nayana could think of was that the little golden elephant didn't want her to get close with Sahej at all. It was actively working against her.

Was the elephant like this with everyone? Is it because I'm too young? But isn't coupling up and marriage a good thing? Aren't we told that as a country of 1.4 billion, our reproductive capacity will make us invincible on the world stage? What's the problem?

As her thoughts spiraled, Nayana noticed her mother watching her from the doorway.

"What in the hell have you been up to, young lady? Our premium is going through the roof!"

"Me?" Nayana didn't know what to say. It was clear to her the little golden elephant was determined to turn her whole virtual world upside down.

"Tell me now, or I'm taking your smartstream away!"

"No, you can't!"

"Sorry, but yes, that's exactly what I'm going to—"

Before Riya could finish, Nayana shot up, rushed past her mother, and raced out of the house as fast as her legs would carry her.

Clenching her smartstream, Nayana ran until she no longer recognized where she was. Finally, she saw the familiar relief sculptures of the New India Assurance Building in the Fort district. Sunset lit the weathered façade's artfully sculpted farmers, potters, spinners, and porters as Nayana decided it was the perfect moment to give Sahej a call, no matter how much it raised her family's premium.

Copyrighted Material

The boy's avatar image popped onto her smartstream as the screen flickered with GI notices. Nayana could see that her fam-

ily's premium had already increased by 0.73 rupees. It was a long time before he answered, and Nayana was about to give up when the phone finally connected with a videostream so dark she could barely make out the contours of a face and white-toothed grin.

"That you, Sahej?" Nayana asked timidly.

"It's me. Nayana?"

"I was afraid you weren't going to answer."

"Ermmm . . . it's a bit complicated. I can't speak long. But I really do want to talk with you."

"Me, too." Nayana's heart jumped. "I'm going to give you the address of a restaurant. Can we meet there?"

Sahej glanced about in silence for a moment before finally whispering, "Okay."

After hanging up, Nayana couldn't help but cheer.

Then someone called her name. She spun to see her mother shining gold and red against the setting sun, as though the goddess Saraswati had come down to Earth.

"How did you find me?"

"I'm the data manager of our house, and don't you forget it!" Her mother glared at her.

"I'm sorry." Nayana didn't dare look into her mother's eyes. "But, remember I told you about that guy? I'm going to meet up with him. But GI won't allow it, so . . ."

"You think that's why the premium's going up? GI wants to keep us living healthier and longer—and prevent us from doing stupid things that will harm us, not . . . Unless this is some kind of dangerous person?"

Nayana shook her head. "No, he's just my new classmate, Sahej. He's smart, a real talent. And this is the present he made for me. He carved it himself."

Her mother inspected the wooden crow head Nayana handed her.

"He doesn't sound like such a dangerous person. Is he handsome?"

Nayana let slip a shy smile, but it quickly turned into a grimace. "This sucks. What does GI know that I don't? Maybe I'll live longer if I never meet up with him."

Copyrighted Material

"Sweetie, let me tell you something." Nayana's mother draped an arm over her daughter's shoulder. "I know we don't always see eye to eye. But I'm not as blind as you may think! You know, talking to you makes me think about something I read recently. Actually—it was an old ebook suggested by the MagiComb, come to think of it."

"What was it?" Nayana became curious.

"It was a book from 2021, and there was a story in there about a mom who is so superficial and proud and obsessed with her image that she ignores her daughter's growing distress. And the family was Indian just like us! It hit me hard.

"When I was your age, my parents wanted me to marry as soon as possible. I wanted to go to school to become a lawyer. But they didn't want me entertaining suitors or making my own decisions. I wasn't brave enough to stand up for myself. I gave in, and I regret it to this day. And that's why I would never be mad at you for wanting to follow your heart, whether it's about a boy or who you want to become in the world."

Nayana's mother kept her hand on her daughter's shoulder. Nayana noticed the sun glinting in her mother's eyes.

"I have always worked to give you the sense of security and comfort I never had, so you won't ever have to rely on who you marry to bring you happiness. Go to SOFT at Rai University and become whoever you are supposed to be. Don't let anyone tell you who you are. No one, human or AI. If they try, don't you dare listen. There is no easy answer, and you'll never find it unless you try."

"So you don't mind if I leave Mumbai for Ahmedabad?"

"Well, if you study and pass the exam." Her mother smiled. "Don't forget the competition is fierce."

"You won't mind then if our family's premium keeps going up because of me?"

"Some risks are worth taking."

"Thank you, Mom. I'm going to see Sahej now. I'll bring the answer back for you."

A red double-decker SmartBus turned the corner. Nayana kissed her mother and skipped toward the station as the sun dipped below the horizon.

Copyrighted Material