

AN MIT COMPUTER SCIENTIST EXPLORES **PARALLEL UNIVERSES,**
THE **SIMULATION HYPOTHESIS,** QUANTUM COMPUTING,
AND THE **MANDELA EFFECT**

THE
SIMULATED
MULTIVERSE

RIZWAN VIRK



Praise for
The Simulated Multiverse *and* The Simulation Hypothesis

“How am I unreal? In *The Simulated Multiverse*, Riz Virk counts the ways. So many ways we might all live in one (or more) simulated worlds. Palpable 'reality' may be as delusional as our old notion that the heavens revolved around Earth. And just like Galileo did then, Virk may help open our eyes to a greater (if humbling) cosmology.”

—**David Brin**, author of *EXISTENCE*, *The Postman* and *EARTH*.

“A few cutting-edge thinkers have posited that this world in which we live is a simulation. In *The Simulated Multiverse*, his second book on the subject of simulation, Rizwan Virk walks us through the concept of a computer-generated reality that Philip K. Dick posited in the speech that he delivered in Metz, France, in 1977. This volume is well-researched and eminently readable. Perhaps *The Matrix* is more than a science fiction film; perhaps it reveals some truth about our world and our lives in this world. Read this book, if you dare.”

—**Tessa B. Dick**, wife of Philip K. Dick and author of *Conversations with Philip K. Dick*,

“Refining his impressions first introduced in *The Simulation Hypothesis*, with the progress of AI since his research at MIT, in *The Simulated Multiverse*, Virk has expanded his thesis in the wider scope of the multiverse, building on the framework of pioneers such as Nick Bostrom and Kurzweil. The result is a new challenge not only to theories of simulation, but to what constitutes reality itself, and human illusions of our rightful place within it.”

—**Jacques Vallée**, venture capitalist, author of *Forbidden Science*

“Virk ... makes a cogent, clear-eyed guide to the head-spinning science of parallel universes, quantum indeterminacy, and the possibility—terrifying or relieving—that our perceived reality is in fact part of a great simulation.”

—**Publishers Weekly**

"I'm grateful to be living in a branch of the multiverse where if I'm asked to go into more detail about the relationship between *Total Recall* and quantum physics, I can simply point someone in the direction of this comprehensive and entertaining book. To quote a certain 1999 blockbuster: Woah."

—**Rodney Ascher**, director of *A Glitch in the Matrix*

"In *The Simulated Multiverse*, Riz Virk takes simulation theory and *The Matrix* to a new level. Using computational tools – complexity, artificial intelligence, video games and quantum computing –Virk explains an interpretation of our world that sounds like science fiction: that we are living multiple parallel timelines. If you want to get glimpses of possible presents, pasts, and futures, read this book!"

—**Brad Feld**, venture capitalist and author of
The Startup Community Way

"MIT scientist's '*Simulation Hypothesis*' makes compelling case for The Matrix."

—**The Next Web**

"My own experience has taught me that we live, teach, learn and love in a virtual world. In *The Simulation Hypothesis*, Riz Virk combines the mind of a scientist with the heart of a mystic, using video games to explain the virtual reality that we live in."

—**Dannion Brinkley**, bestselling author of *Saved by the Light*
and *At Peace in the Light*

"In *The Simulation Hypothesis*, Riz Virk provides a deft and knowledgeable blend of video game history, hard science speculation, and science fiction reference ... I found it fascinating and entertaining."

—**Noah Falstein**, former chair of the IGDA, former Chief Game Designer at Google

"Rizwan Virk's book *The Simulation Hypothesis* is one of the few works that could convince me that I probably live in a simulated universe. If this sounds mind blowing, it is!"

—**Diana Walsh Pasulka**, author of *American Cosmic: UFOs, Religion, Technology*

Praise for *Zen Entrepreneurship* and *Treasure Hunt*, also by Rizwan Virk:

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— **Fred Alan Wolf PhD**, author of *Parallel Universes* and *Dr. Quantum Presents: Do-it-Yourself Time Travel*

“So exciting that someone from the tech world is speaking up about synchronicities, signs, and spiritual guidance. Thanks, Riz, for giving us case studies and a compelling guide for finding the map we all contain inside.”

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“The world around us is speaking to us every day in a language of signs and symbols, if only we pay attention. Virk invites us to look at the patterns of everyday life as a treasure map, offering clues we can follow to manifest our dreams.”

— **Robert Moss**, author of *Conscious Dreaming* and *Sidewalk Oracles*

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— **Foster Gamble**, Creator and Host, *Thrive: What on Earth Will It Take*

“In *Zen Entrepreneurship*, Riz Virk brings the wisdom of ancient Eastern traditions into a purely Western setting. The result is an often hilarious but always insightful book that will change how you view career success and help you discover and walk your own unique path.”

— **Marc Allen**, author of *Visionary Business*, CEO and co-founder of New World Library

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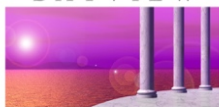
The Simulated Multiverse

*An MIT Computer Scientist Explores
Parallel Universes, the Simulation Hypothesis,
Quantum Computing and
the Mandela Effect*

Rizwan Virk

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For our nephews and nieces,
who easily grasped the multiverse

Danny
Gianna
Daniyal
Rayyan
Emaad
Taimur
and
those to come

Table of Contents



PART I: SOUNDS LIKE SCIENCE FICTION

DOWN THE RABBIT HOLE—FROM GOOGLE INTO THE MIND OF PHILIP K. DICK 2

ERROR! REFERENCE SOURCE NOT FOUND. **ERROR! BOOKMARK NOT DEFINED.**

ERROR! REFERENCE SOURCE NOT FOUND. **ERROR! BOOKMARK NOT DEFINED.**

PART II: SOME FAR OUT SCIENCE

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PART III: BUILDING DIGITAL WORLDS

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ERROR! REFERENCE SOURCE NOT FOUND. **ERROR! BOOKMARK NOT DEFINED.**

PART IV: ALGORITHMS FOR THE MULTIVERSE

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ERROR! REFERENCE SOURCE NOT FOUND. **ERROR! BOOKMARK NOT DEFINED.**

PART V: THE BIG PICTURE

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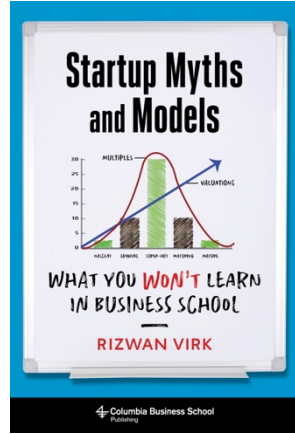
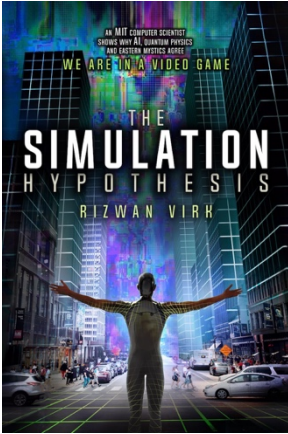
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RIZWAN VIRK

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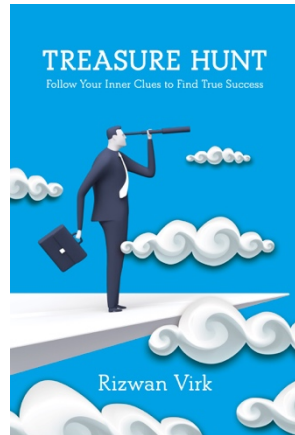
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SUGGESTIONS FOR FURTHER READING	29
END NOTES	33
<i>ERROR! REFERENCE SOURCE NOT FOUND.</i>	ERROR! BOOKMARK NOT DEFINED.
<i>ABOUT THE AUTHOR</i>	34

Part I

Sounds Like Science Fiction

“People assume that time is a strict progression of cause to effect, but...it's more like a big ball of wibbly-wobbly, timey-wimey stuff.”

*—**The Doctor**, Doctor Who¹*

“Can't repeat the past?” he cried incredulously.

“Why of course you can!”

*—**F. Scott Fitzgerald**, The Great Gatsby*



Chapter 1

Down the Rabbit Hole—From Google into the Mind of Philip K. Dick

We are living in a computer-programmed reality, and the only clue we have to it is when some variable is changed, and some alteration in reality occurs. We would have the overwhelming impression that we were re-living the present—déjà vu—perhaps in precisely the same way: hearing the same words, saying the same words.

-Philip K. Dick, Metz Sci Fi Convention 1977

This book is about a complex idea that may sound like science fiction: that we live inside a simulated multiverse. In case you aren't familiar with this idea, it is built on top of two conclusions that, though they might seem fringe, are increasingly supported by many scientists, philosophers, and religious scholars.

The first is that we live inside a digital, simulated world, a high-resolution video game that is similar to the world depicted in the blockbuster movie, *The Matrix*. This concept is broadly referred to today as the simulation hypothesis, and it was the subject of my previous book of that name. It implies that the three-dimensional world around us (what we call space) is not what we think it is.

The second is that far from living in a single universe, we live

in a complex, interconnected network of multiple timelines. This concept is broadly referred to today as the multiverse. Not only does the multiverse warp our understanding of the world around us, it also warps our understanding of the past and the future. In short, neither space nor time is what we think it is.

We will explore many other concepts in this book that support these conclusions—including quantum indeterminacy, quantum computing, video game design, and the Mandela effect. But before we get into the details, I wanted to tell you a bit about my journey from a video game entrepreneur and creator of a virtual reality program at MIT, down the rabbit hole of simulation theory.

From Ping-Pong to *The Matrix*

You could say that I have been obsessed with science fiction and computers my whole life, and not surprisingly, it was the intersection of these two fields that got me started thinking about the simulation hypothesis. This in turn led me to thinking about the simulated multiverse.

A few years before publishing *The Simulation Hypothesis*, in 2016, I had just sold my last video game company and was wondering what to do next with my life. I visited a startup that was building virtual reality (VR) games. VR had captured Silicon Valley's mantle of the *next big thing*. Facebook had bought Oculus for \$2 billion recently, and other technology giants like HTC and Sony were throwing their hats into the virtual reality ring with their own VR headsets.

I visited this startup's office in Marin County, across the Bay from the city of San Francisco, and tried out their new sports VR game. It was a room-scale setup, which means the room was pretty much empty, except for a computer in the corner linked to some wires hanging down from the ceiling. Most of the room was a taped-off square area that served as the arena where the VR

player could move around freely. I put the headset on and looked out across the virtual landscape; I saw a virtual ping-pong table and a virtual opponent.

A paddle magically appeared in front of my hand (which in reality was holding the controller), and as I moved my hand, the paddle moved. Suddenly, a ball appeared, and I started playing against my virtual opponent. Over the next few minutes, I became completely engrossed in the virtual table tennis game. The responsiveness of the system and its underlying physics engine were perfect; it felt like my paddle was hitting a ball, and the ball was following a natural trajectory to bounce off the table toward my opponent. I became so lost in the illusion that by the end of the game, I instinctively put the “paddle” down onto the “table” and attempted to lean on the table, just like I might do after a real table tennis game.

Of course, there was no paddle and no table. The controller in my hand fell on the floor, and I almost fell over as I tried to lean on the nonexistent table. That’s when I realized that VR had started to achieve the kind of immersion that could fool the human mind.

Studies have shown that the brain responds to perceived stimuli in a virtual environment in the same way as it does to real stimuli in a physical environment. For example, if you are standing on the roof of a tall building in VR and you are afraid of heights, you start to have similar physiological responses. Companies have used this knowledge to use VR as an effective therapy to overcome fear of things like heights or spiders, all of which can be simulated safely inside virtual reality.

The virtual ping-pong experience, which I have spoken about many times, was one of several VR experiences that led me to wonder about immersive simulations. Later that same year, I donned another VR headset and found myself in a virtual cavern, standing on a virtual ledge next to a very steep drop into what looked like the bottomless chasm in the mines of Moria in *The*

Lord of the Rings. Despite having the intellectual knowledge that I wasn't really in the cavern and wasn't in any danger, my body was afraid to move my foot two steps to the side for fear of falling into the dark depths below.

These experiences led me to wonder what elements would have to be in place for us to build a world that was, for all practical purposes, indistinguishable from physical reality and how long it would take our technology to get there.

In my previous book, *The Simulation Hypothesis*, I laid out a roadmap of stages of technology, starting with simple video games and ending up with fully immersive virtual-world simulations that were as convincing as those in *The Matrix*. This would take us to a theoretical point in the future that I like to call the Simulation Point.

I concluded that we weren't that far from the Simulation Point. To my surprise, there was a well-known argument by Oxford philosopher Nick Bostrom (made in his 2003 paper, "Are You Living in a Computer Simulation?") that if any technological civilization ever reached the Simulation Point, we were almost certainly living in a simulation ourselves. Although this sounds like an odd argument at first glance, it has gotten more and more support over time, and I will revisit it in Chapter 3. It turns out that Bostrom wasn't the first philosopher to tell us that the world around us may not be real, and we'll dive into some of these in that chapter also.

Surely, the physicists would be able to give us more confidence that the world around us is a physical construct, I thought. Yet, even more surprising to me was that when I explored some of the biggest mysteries in the world of physics, I found that they could be much more easily resolved if we were living in a simulated reality and not in a purely physical reality. In fact, I found that many prominent physicists had reached the conclusion that the physical world consisted not of physical

matter but of information, a conclusion that formed the underpinnings of *The Simulation Hypothesis*.

Moreover, moving beyond computer science and physics and philosophy into the realm of religion, I realized that this idea had been a key idea not of any one religion, but of all the world's religions—including Eastern religions like Buddhism and Hinduism and the Western religions of Judaism, Christianity, and Islam.

Having written *The Simulation Hypothesis* and explored this idea in depth from all of these angles, I was satisfied that I had been down the rabbit hole and was ready to emerge and resume my career in Silicon Valley and in academia.

It was then that I had several unexpected conversations whose implications caused me to reconsider the width and depth of the rabbit hole. The implications, which I couldn't quite shake, included the thought that if one timeline could be simulated, there was no reason that multiple timelines couldn't be simulated using the same "computer system." Each simulated timeline would basically be a different run of the simulation, with some variables changed. This led me down a winding but scenic road of curiosity from Google into the mind of famed science fiction writer Philip K. Dick and into the quantum world, eventually to settle on the core idea of this book: that we live in a *simulated multiverse*.

Near the Googleplex

Not long after I had published *The Simulation Hypothesis*, I gave a talk on simulation theory at Google.³ Shortly thereafter, I met with an old colleague and fellow MIT alum, Bruce, whom I had worked with years earlier in Boston. He had just joined Google and was visiting the Googleplex in Silicon Valley. Not only is this odd collection of buildings the headquarters of one of the largest companies in the world, it is located in the commercial heart of Silicon Valley, just down the road from where I was living

at the time in Mountain View, California.

Bruce, a sturdy fellow with thick glasses and a sharp but practical mind, and I were sitting outside a coffee shop on Castro St. This street, which sits in the center of Mountain View, a quaint little town at the bottom of San Francisco Bay, has a European flavor but with the added benefit of California sunshine. Since we were both computer scientists, we pretty much ignored the beautiful landscape of the Santa Clarita mountains to the west and the Fremont hills to the east that gave Silicon Valley its name, and immediately started to catch up and geek out.

Bruce had heard of my book, and we naturally started discussing implications of the physical world around us being some kind of simulated computer reality. Although we were initially talking about the kinds of computations that would be involved in generating and maintaining such an ultra-realistic simulation, at some point Bruce told me that he had been reading about the Mandela effect and that I should look into it further.

I had heard of the effect, which was about a subset of people remembering that Nelson Mandela had died in prison in the 1980s. Like most scientifically minded people, I had dismissed it as a fringe theory that could be easily explained away as faulty memory, since Mandela had actually died many years later.

Bruce then mentioned that the simulation hypothesis was actually the best explanation for how something like the Mandela effect could be occurring. This caught my attention, not least of all because he wasn't the kind of person I would've expected to bring up something as esoteric as the Mandela effect, let alone consider that it could be real or how it could be working. The people who brought up the Mandela effect to me were usually either discussing science fiction or were heavily into the paranormal world, bringing it up alongside topics often dismissed by mainstream science such as UFOs, ghosts, and Bigfoot.

I said I'd look into it. Bruce warned me that I had to be

careful, because the figurative rabbit hole in this case went pretty deep, and I was likely to be drawn in.

He was right. I started to explore case studies on various online forums about the Mandela effect. After digesting these, along with the various explanations from mainstream social scientists dismissing it as a case of mass faulty memory, I started to bring it up with some of my more open-minded scientist colleagues to figure out what it might tell us about time and space and simulations, particularly with respect to the idea of multiple timelines in quantum physics. They told me explicitly that if we are to take the findings of quantum mechanics seriously, then the past isn't what we think it is.

These discussions convinced me that if we were in a simulation, then multiple timelines were not such a crazy idea at all. In fact, it made some of the baffling findings for quantum physics that had been a key part of my argument in my previous book that we live in a simulation make *more* sense, not less. Multiple timelines in a simulated universe would actually be a *better* explanation for these mysteries than the worldview of a single, fixed timeline in a single physical universe.

Many of the confounding aspects of quantum physics are confounding only if we insist on a completely deterministic, materialist model of the universe, with a single past and a single future. The observer effect, the collapse of the probability wave, even parallel universes all make much more sense if the universe actually consists of information that is stored, processed, duplicated, and, most important, rendered as the physical world we see around us.

This book is an exploration of the possibility of a simulated multiverse, in which timelines other than what we experience as the main timeline might have existed (and might continue to exist). We will explore this complex idea through the lenses of science fiction, hard science, and good old speculation.

From our normal everyday experience, and from a classic

physics point of view, this idea seems like a logical impossibility. But if you think of it from the point of view of a simulated world, suddenly the idea of multiple timelines extending from multiple pasts into multiple futures doesn't seem so strange anymore.

The Strange Mind of Philip K. Dick

If the implications of all this sound to you like they might be more appropriate in a science fiction novel, particularly one by famed writer Philip K. Dick, then you and I are in the same boat. Dick was one of the most prolific and unique writers of science fiction in the twentieth century. In fact, my conversation with Bruce and later explorations into the topic brought me back again and again to my conversation with the late writer's wife, Tessa B. Dick.

I had asked to interview her because the Wachowskis, creators of *The Matrix*, claimed to have drawn inspiration from Philip K. Dick, and because I had heard of a quote from him that we were living in a computer-programmed reality. The quote was a famous clip from his speech in Metz, France, at a science fiction convention in 1977. Since he was one of the first in the modern era to talk publicly about this idea, I figured she could tell me what made him think we were living inside a virtual reality.

Dick's large body of work frequently explored two big questions: what it means to be human (versus nonhuman or, in the case of *Blade Runner*, an android), and how much of our experiences are actually real. That second question, about what is real and what isn't, had burrowed into my mind as I researched the simulation hypothesis.

Originally, like many consumers of pop culture, I had been familiar with Dick only through the various screen adaptations of his work. In addition to *Blade Runner*, some of my favorites included *Total Recall*, *Minority Report*, and the recent TV series, *The Man in the High Castle*, which was adapted from his 1960

Hugo Award-winning novel and was still going on when I interviewed Tessa.

One of the first things Tessa asked me was whether I had seen the whole Metz speech, not just the famous quote, which she repeated word for word:⁴

We are living in a computer-programmed reality, and the only clue we have to it is when some variable is changed, and some alteration in our reality occurs.

I agreed to track down the whole speech if it was available online. My conversation with Tessa and subsequent readings of Philip's full speech, which was titled, "*If You Think This World Is Bad, You Should See Some of the Others*," ended up being largely an interesting aside when I wrote *The Simulation Hypothesis*.⁵ At the time, I was mostly interested in the first part of his statement, about being in a computer-programmed reality, a colorful way to get into the topic for fans of science fiction. I honestly didn't pay a lot of attention to the second part of the statement, or the rest of the speech, where Philip seemed to be saying even stranger things.

After speaking with Bruce and my initial research into the Mandela effect, I dove back into Dick's speech with gusto and dissected my previous interview with Tessa. This caused me to reassess what Dick had been saying from a wider, richer perspective.

I realized that Dick's ideas went much further than I had first thought and presented a very coherent, if somewhat speculative view, of how time and the universe work. The second part of that now famous quote, "...the only clue we have is when some variable is changed, and some alteration occurs in our reality," was perhaps the more important phrase that unlocked the rest of his thinking. It would not just mean we were living in a simulated reality, but that it could run multiple timelines. I realized that this is what the Metz speech was *really* about.

The Man in the High Castle and Alternate Timelines

In an eyebrow-raising moment during our interview, Tessa told me that Phil claimed to have remembered parallel timelines, which had a different history than the one we would call our consensus memory. According to her (and Dick himself, as I verified in the full speech), Philip claimed that his best-received novel, *The Man in the High Castle*, wasn't based solely on his imagination, but was based on *actual* "residual memories" of an alternate timeline.

Although it was always considered a gem in the world of science fiction, the general public is now more familiar with Dick's only Hugo Award-winning novel because of the Amazon adaptation in 2015. The novel takes place in an alternate timeline where the Axis powers, namely Nazi Germany and Imperial Japan, won World War II and have split the United States between them. Dick *claimed* that this was one of his residual memories of a brutal military state.

In a self-referential twist inside Dick's novel, *The Man in the High Castle*, a character, Hawthorne Abendsen, writes a book about an alternate timeline, one in which the Allies won the war and America was not divided between the Nazis and the Japanese. In essence, while Dick is giving us a glimpse of an alternate timeline, Abendsen's fictional book within the book, *The Grasshopper Lies Heavy*, gave the residents of that timeline a view of an alternate timeline—our timeline. The Amazon series ended up turning this literary device into a set of mysterious films that are newsreels from other timelines, which is an even more chilling experience, both for the characters and for the audience.

Although it's not unusual for science fiction writers to start thinking of their work as having taken on a life of its own, this was different.⁶ Both Tessa and Philip were saying something more. Dick, in his Metz speech, admits that he had been obsessed with

a dark version of events in America and that he actually remembered this timeline in fragments:

Does any one of us remember in any dim fashion... nightmare dreams specifically about a world of enslavement and evil, of prisons and jailers and ubiquitous police?

I have.

I wrote out those dreams in novel after novel, story after story; to name two in which this prior ugly present obtained most clearly, I cite *The Man in the High Castle* ... and *Flow My Tears, the Policeman Said*.

I am going to be very candid with you: I wrote both novels based on fragmentary residual memories of such a horrid slave state world...

Until 1974, Dick said he had only these “fragmentary residual memories.” During that year, Dick claimed to have had a set of experiences which convinced him that he wasn’t just writing made-up stories. During that time, he claims that *all the memories of the other timeline* came flooding back to him.

According to Dick, this was similar to what the Greeks called *anamnesis*, the return of memory from a prior life, though a more literal translation would be “loss of forgetfulness.” The state of forgetfulness, according to the Greeks, was induced by crossing Lethe, the river of forgetfulness, when incarnating (i.e., being born). In the Metz speech, Dick continues to talk about the implications of this process:

...[T]he irony is this: that my own supposed imaginative work *The Man in the High Castle* is not fiction—or rather is fiction only now, thank God. But there was an alternate world, a previous present, in which that particular time track actualized—actualized and then was abolished due to intervention at some prior date ... I retain memories of that other world.

Dick also said that writing stories of an alternate world helped him deal with these dark residual memories. After his

anamnesis, Dick said he no longer needed to write about these dark alternate timelines. Eventually, these memories faded “as would a dream upon the awakening of the dreamer.”

An Alternative Previous Present and Glitches in the Matrix

What are we to make of Dick’s ideas of a “previous present”? Should they be taken seriously, or are they just the ramblings of a highly imaginative mind?

Dick perhaps anticipated the incredulous reactions of many of the Metz attendees (clearly visible in the video clips) by including a disclaimer in the speech itself:

You are free to believe me or free to disbelieve, but please take my word on it that I am not joking; this is a very serious, a matter of importance ... Often people claim to remember past lives; I claim to remember a different, very different present life. I know of no one who has ever made that claim before, but I rather suspect that my experience is not unique; what perhaps is unique is the fact that I am willing to talk about it.

How does Dick think these alternate timelines are formed? It goes back to the second part of his famous quote. According to Dick, it’s all about changing variables and running the events again, which leads us to “relive” the same events again.

This idea that things have changed turned out to be part of his inspiration for his story, *The Adjustment Team*, in which the protagonist stumbles across a team of people who are responsible for adjusting reality. In the 2012 movie adaptation, called *The Adjustment Bureau* (starring Matt Damon and Emily Blunt), they are depicted somewhat like angels (though this was not indicated in Dick’s original version of the story).

Tessa told me Phil wrote the story because of an incident when he went into the bathroom and remembered clear as day that the room had a light that could be turned on or off by pulling

a chain. But the chain was no longer there; it had been replaced with a light switch. He wondered if someone or something was changing reality and his memory of the chain light was from a different version of the alternate present—a small detail that was one of many small changes resulting from an adjustment in a previous past that cascaded into the current present.⁷

The next few lines after the famous quote are also quite revealing, highlighting the central role of these little changes in his thinking:

We would have the overwhelming impression that we were re-living the present—*déjà vu*—perhaps in precisely the same way: hearing the same words, saying the same words. I submit that these impressions are valid and significant, and I will even say this: such an impression is a clue, that in some past time-point, a variable was changed—re-programmed as it were—and that because of this, an alternative world branched off.

The idea of reliving a particular scene or experience but with variables changed was essential to the worldview he described in this speech. This idea that feelings of *déjà vu* were clues to the shifting nature of reality was strangely familiar to me.

In fact, his whole discussion had a weird sense of *déjà vu* for me personally. I had written a whole book, *Treasure Hunt: Follow Your Inner Clues to Find True Success*, about things that seemed off—feelings of *déjà vu*, synchronicity, or funny feelings, and I had used the same terminology, calling them “clues”, perhaps to alternate possible selves in parallel timelines or future versions of us. I had even suggested that these clues were really “glitches in the matrix,” a phrase that came from the 1999 blockbuster movie but is now commonly used for small, anomalous experiences that can’t be explained.

Shifting Timelines and Programmers?

Dick’s speech, if taken literally, presents many questions. If

things were changing, who or what was changing them? Why are they being changed? And what happened to those old versions of the present? How do these alternate realities interact with our current timeline, if at all? In short, these are the subjects of the current book.

In what sounds like it could have come from inside one of his novels, Tessa went further and told me that Dick claimed that he was in communication with beings who told him that they had changed the timeline. They could watch the computer-programmed reality and then rewind it, change some variables, and move it forward again. This sounds eerily close to what we do when building and watching computer simulations, although the term *simulation* had not entered the popular lexicon at that time, and video games were in their infancy.

In fact, these beings were like Dick's fictional "adjustment team": supernatural beings, from our perspective, who could cause us to relive the present based on different variables and parameters. In simulation-speak, we might call these beings programmers or super-users who had the power to manipulate the simulation. In fact, Dick himself used the terms *Programmer* and *Counter-programmer* in his Metz speech, implying one or more beings that were changing the variables as if they were playing a game of chess with the universe we live in.

Tessa gave me another example of different timelines that Philip believed, which he didn't mention in his Metz speech: the assassination of JFK. According to Tessa, Phil told her these beings modified the timeline to try to prevent the assassination of JFK, not just in Dallas in 1963, but in other places. In some of these alternate timelines, JFK was assassinated in another location (in Orlando, for example), so their interventions were fruitless. In others, he wasn't assassinated, but that timeline went into a much worse place than our own (in some cases a nuclear war), so they reverted to our timeline.⁸

It seemed, in Dick's view at least, as if there was a particular reason for running these timelines: to make the outcome of the simulation *better* in some way.

Orthogonal versus Linear Time

Dick himself gives no definitive explanation of how all this worked, but he did have a high-level theory. He referred to the whole thing as “a lateral arrangement of worlds, a plurality of overlapping Earths along whose linking axis a person can somehow move.”

In *The Man in the High Castle*, one character, the writer Abendsen, was sensing this other world in his writing, and another character, trade minister Tagomi, actually was able to go to an alternate timeline (i.e., our timeline). In the series, this alternate timeline was referred to by the Nazis as “Die Nebenwelt” or “the Other World” or “the World Besides.”

Dick called his theory “orthogonal time.” There was our ordinary linear time inside the computer-programmed reality, and then there was a perpendicular (or orthogonal) axis of time, which existed outside of the simulation, as it were. Tessa mentioned this concept when I interviewed her, but I hadn't really pursued it, so I had to go back to his speech and read his own explanations later.

At no time did I have a theoretical or conscious explanation for my preoccupation with these pluriform pseudo worlds, but now I think I understand. What I was sensing was the manifold of partially actualized realities lying tangent to what evidently is the most actualized one, the one that the majority of us, by consensus gentium agree on.

What were these lateral worlds like?

Dick used the analogy of a closet with suits or shirts arranged next to each other. A person outside the closet could choose one, try it on, then try another, and that's what he said the

programmers were doing. Why? In Dick's estimation, the tinkering was to make a better world, which is why the world we remember today is better than some of the worlds he remembers and writes about.

If this idea could only be dismissed as the drug-crazed rantings of a peculiar science fiction writer (which some have tried to do), then that would be that. But what led me to give Phillip K. Dick's ideas a central position in this book was that I found others, including respected physicists, who had their own versions of this idea, though expressed in a more formal way. This collection of ideas of multiple parallel timelines (or multiple parallel worlds, take your pick) is now informally called the *multiverse*.

The Multiverse Passes the Ten-Year-Old Test

Popular fiction often explodes with a new idea in parallel with the public's comfort level with new scientific discoveries. This was true with time travel and extrasolar planets in the twentieth century and is rapidly becoming true for the idea of the multiverse in the twenty-first century.

For example, the first modern time travel story was *The Time Machine* by H. G. Wells, written in 1895 during the thick of the Industrial Revolution. It was no accident then that Wells's time traveler was one of the first (if not *the* first) to use a machine to travel through time. Before the awareness of machines entered the public's consciousness, although there were some random examples of a character magically ending up out of time (think of Rip van Winkle or Mark Twain's *A Connecticut Yankee in King Arthur's Court*), there were no time machines.

In the twentieth century, a new type of story emerged that demonstrated this trend perfectly: the superhero story. To explain their superhuman powers, superheroes were often depicted as beings from other planets. Superman, the most famous example

of this, came to Earth from the planet Krypton. This reflected a growing comfort level in the general public with our expanded knowledge of our solar system and galaxy. I like to say that Superman showed that exoplanets had passed the 10-year-old test: even 10-year-olds knew enough about the universe not to think it was odd that Superman came from another planet.

In the twenty-first century, the idea that a superhero comes from another planet is no longer novel; in fact, it's kind of old and boring. Today, it seems, creators of superhero stories are incorporating new ideas from science about the universe. As a result, we are meeting superheroes not just from other planets in our physical universe, but from Earth and other planets in other universes altogether, each of which has a different timeline.

Although the idea of parallel universes isn't completely new in science fiction (we'll be exploring many examples in the sidebars in most chapters), the idea really caught on in this century as evidenced by it passing the 10-year-old test with flying colors, thanks to the recent slate of TV shows about superheroes from DC Comics.

These shows, such as *The Flash*, *Arrow*, *Supergirl* (and others), all exist in a multiverse. How do I know this? This was explained to me quite matter-of-factly by my nephews (all of whom were under 10 years old at the time) in great detail as they pontificated about how time travel could create multiple timelines, and how the Superman of Earth 32 was different from the Superman of Earth 16. Since I was an "old guy" who might not get it, they felt it was their duty to lecture me about the multiverse, using their favorite superheroes to explain it in simple terms!

The Multiverse Graph and the Core Loop

The multiverse idea is so common now in the world of physics that physicists have proposed not just one but many types of multiverses. The one that was most interesting to me, given my previous research into simulation theory, was the many-worlds

interpretation (MWI) of quantum physics, also known as the parallel universe theory, or the *quantum multiverse* for short. It is a well-respected explanation for the mystifying phenomenon of quantum indeterminacy by many physicists. In this interpretation, the universe is spinning off new branches every time a quantum measurement is made, resulting in an almost infinite number of parallel universes with some level of shared history.

If you laid this out in a graph, this would become the basis for one of the main models we will be developing in this book, what I like to call the Multiverse Graph. In short it is a map of the different possible states of the universe and the possible timelines between them.

Of course, as a computer scientist, the idea that we would be spinning off an infinite number of physical universes sounds somewhat absurd, because the number just keeps growing, as do the processing and memory requirements. The more logical explanation is that these universes are spun off and are stored as information and only loaded and rendered when they need to be, a process which I described in *The Simulation Hypothesis*.

Another way that computer scientists deal with infinite trees is to prune them along the way, cutting out unnecessary or undesirable paths that no longer serve the purpose of our computation. Basically, the infinite tree is pruned, as necessary by trying out different outcomes, and proceeding forward with only the most promising ones. We will delve into these ideas, along with quantum computation and quantum parallelism, in this book.

What this means is that the universe is not only a computing device, but that it creates tree-like structures, not just in space, but across time. Tree-like structures are present everywhere in nature, from the evolution of species to the evolution of languages. In computer science, tree-like structures are actually

one of the most efficient and flexible ways to store any kind of data or set of nodes.

How are these tree-like structures across time created? Here we arrive at another central model we will explore in this book, which I like to call the Core Loop. In computer science, a loop is a piece of code that gets executed again and again. It might end up making different choices each time, and there are different ways to implement repetitive algorithms, but more or less, the same logic is executed each time until some boundary condition is met and the loop terminates, or it reverts to another loop running at a higher or lower level (called recursion).

In a sense, the central idea that I want to explore in this book is that the universe is a computer running the Core Loop, spinning off possible timelines, each of which is a path through the Multiverse Graph.

Where We Go from Here

As we've seen in this chapter, some of the ideas we are exploring in this book will sound like science fiction. Philip K. Dick reached some of these conclusions back in 1977, using his own terminology, and in a way, his ideas will serve as a blueprint for the topics that we'll explore in this book. Our tools will not just include science fiction references but will be simulation theory, information theory, video game architecture, quantum mechanics, and quantum computing.

In the end, we will come up not just with a model that can accommodate multiple presents and multiple futures but, also, multiple possible pasts. Like all good models, the models we explore in this book will turn the unexplainable into an inevitable conclusion, even explaining strange effects like the Mandela effect.

In the rest of *Part I: Sounds Like Science Fiction*, I explore ideas that are speculative enough that they sound like science fiction. From here, I will cover the Mandela effect in Chapter 2

and tie that into the simulation hypothesis in Chapter 3, which will also provide an overview of Nick Bostrom’s simulation argument and a recap of my previous book.

In *Part II: Some Far Out Science*, we will switch gears to explore what science has to say about the ideas of time, space, and multiple parallel universes. We’ll start with different versions of the multiverse idea that have been proposed by physicists in Chapter 4. Then we’ll home in on quantum mechanics, because the version of the multiverse we are most interested in for our discussion is the quantum multiverse, which we will get into in Chapter 6. We’ll then do a deep dive into what science has to say about time in Chapter 7, showing how in both relativity and quantum mechanics the past and the future are different from what we think of them as in everyday reality. Although this part contains the most science, we’ll stay away from equations and keep it at the conceptual level, but this should be enough to convince you that time is very strange and not at all what it appears to be.

In *Part III: Building Digital Worlds*, we’ll switch gears yet again to explore the idea of a digital multiverse. Using techniques and concepts from video games and classical computer science, I’ll explore what simplified digital universes might look like. These techniques include creating a simple “gamestate” in a very simple adventure game, *SimWorld*, in Chapter 8. This will be followed by an exploration of cellular automata, which are very simple graphical computer programs that can exhibit complex behavior in Chapter 9. Then, in Chapter 10, we’ll turn our attention away from simple computing structures to how the universe may actually be computing: using qubits and quantum parallelism, which provides a much richer platform for the multiple arrows of time. This is by far the most technical part of the book, including some light code (pseudocode) and logic gates, but you can get the core concepts in each chapter without going

into the details.

In *Part IV: Algorithms for the Multiverse*, we will go back to the two core models introduced by this book to visualize how a simulated multiverse may be working. We'll do this by combining various concepts we have learned over the course of the book to represent multiple parallel universes as tree-like structures in time in *Chapter 11: **Error! Reference source not found.***, and how a computational process might navigate such a graph in *Chapter 12: **Error! Reference source not found.***

Finally, in *Part V: The Big Picture*, we'll look at why we run simulations and how this relates to the core idea of this book, that we are constantly branching and merging universes. This will bring together the four main ideas in this book, parallel universes, the simulation hypothesis, quantum computing, and the Mandela effect in *Chapter 13: **Error! Reference source not found.*** This will include a new metaphor based on an old story, "The Garden of Forking Paths," and will include discussions of other physicists who have proposed similar models, including the work of physicists like Thomas Campbell, Fred Alan Wolf, and Amit Goswami. We will end with *Chapter 14: **Error! Reference source not found.***, where we'll zoom out and ask what, if anything, this might mean to us in our own lives. To do this, we need to move beyond science and technology and look at things from a completely different perspective: what is outside the multiverse? Could it be part of the spiritual dimension that so many religions have told us about?

If this all sounds to you like we've arrived somewhere on the boundary between science, science fiction and absurdity or, as the old show *The Twilight Zone* used to say, "the border between science and superstition," then you are in the right place. Welcome to life in a simulated multiverse.

TIME OUT OF JOINT AND A FALSE REALITY

Although Philip K. Dick often gives his characters reasons to question reality, one of the more pronounced examples of this comes from his novel, *Time Out of Joint*, which was published in 1959 and has not been directly adapted into film (though *The Truman Show* of 1998 had some similarities). The title of the book comes from a line in Shakespeare's *Hamlet* something is amiss in Denmark: "*The time is out of joint; O cursed spite! That ever I was born to set it right!*"

In Dick's novel, we meet Ragle Gumm, who lives in an alternate version of 1959. He lives in an idyllic little town with his sister and her husband. Gumm makes a living by solving a newspaper puzzle contest that appears every day called, "Where will the little green man land next?"

Strange things happen to Gumm in his quiet little community as the story progresses, which he at first thinks are hallucinations. He finds pages of a magazine with an article that features Marilyn Monroe, whom no one has heard of. He finds a soft-drink stand that has disappeared, replaced with a piece of paper that says "SOFT DRINK STAND," and he finds an old phone book with phone numbers from an exchange or town that doesn't exist. At one point, he finds a radio that was hidden away in someone's house and overhears military pilots talking, and they mention him by name. This seems more than a little odd. He even overhears a neighbor saying, "What if Ragle Gumm gets sane again?"

Gumm starts to investigate, even trying to leave the town, but fate seems to intervene, making it difficult for him each time. In the process, he discovers more oddities: a magazine with him on the cover, for example.

Eventually, Gumm escapes and learns what is really going on. The year is actually 1998 and the Earth is in the middle of a war with colonists from the moon, who are sending nuclear strikes to the Earth. The idyllic town he lives in is a construction

set up just for him to look like 1959, a stable environment from his childhood. Ragle Gumm, it turns out, has a unique ability to predict where the next nuclear strike will land. Gumm, unable to shoulder this responsibility, went “insane” and retreated to his childhood. The ruse of the newspaper contest allowed him to continue to predict where the next strike will occur. The novel ends on a hopeful note; Gumm regains his sanity, leaves the artificial world of 1959 behind, and plans to leave Earth to explore the solar system.



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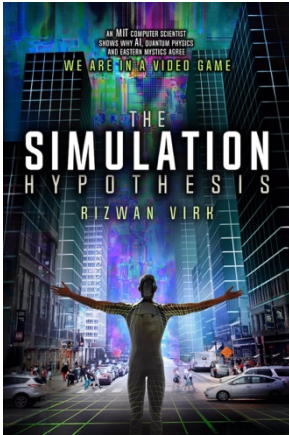
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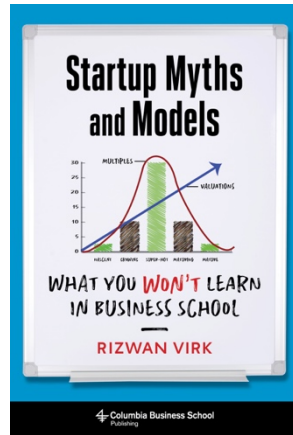
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Suggestions for Further Reading

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End Notes

Chapter 1: Down the Rabbit Hole—From Google into the Mind of Philip K. Dick

¹ From the episode, “Blink,” 2007 (Episode 10, Series 3, of the revised *Doctor Who*).

² The Metz speech has been recorded and is on YouTube in many locations. A full version of the text, was written out as, “If You Find This World Bad, You Should See Some of the Others,” and reprinted in many places, including in the *PKDS Newsletter*, no. 27, August, 1991, and published in a volume of Dick’s writings edited by Lawrence Sutin’s *The Shifting Realities of Philip K. Dick* (Random House: Vintage, 1995, p. 233).

³ The book was published on March 31, 2019, exactly twenty years to the day after *The Matrix* was released on March 31, 1999, and the talk was on July 22, 2019. You can find the talk on YouTube on *Talks at Google*.

⁴ The famous quote seems to have been ad libbed in Metz and can be seen in the various videos of the talk, but I couldn’t find it in the written version. In the past decade, this quote became a touchstone for people who are interested in simulation theory and questioning reality. It has even made its way into popular songs, including Maxthor’s “Another World.” It was used extensively in the documentary, *Glitch in the Matrix* in 2021.

⁵ Excerpts from my call with Tessa are available in Episode #1 of my podcast, *The Simulated Universe with Riz Virk*, available on most podcasting platforms and at <https://simulateduniverse.podbean.com>. An edited version of the transcript is available on my medium account: <http://www.medium.com/@rizstanford>.

⁶ In his book, *I Am Alive and You Are Dead: A Journey into the Mind of Philip K. Dick*,” Emmanuel Carrère writes extensively about the content and process of writing Dick’s first major literary novel, *The Man in the High Castle*.

⁷ Actually Tessa said that Philip told that story many times but she couldn’t remember if it was a chain light or switch first. She also implied that Philip himself might have told the story with slightly different parameters.

⁸ This was also one of the outcomes in Stephen King’s time travel novel, *11/22/63*.

About the Author

Rizwan (“Riz”) Virk is a successful entrepreneur, investor/venture capitalist, bestselling author, video game industry pioneer, and indie film producer. Riz was the founder of Play Labs @ MIT (www.playlabs.tv), and is a venture partner at Griffin Gaming Partners. Riz is a graduate of MIT in Computer Science, and Stanford’s Graduate School of Business in Management, and is currently at the School for the Future of Innovation in Society at Arizona State University.

Since catching the startup bug at the age of 23, Riz has been a founder, investor and adviser in many startups, including Gameview (DeNA), CambridgeDocs (EMC), Tapjoy, North Bay, Funzio (GREE), Pocket Gems, Disruptor Beam, Discord, Telltale Games, Theta Labs, Tarform, Upland, and 1BillionTech. These startups have created software used by thousands of enterprise and video games with millions of players, such as *Tap Fish*, and games based on *Penny Dreadful*, *Grimm*, *Game of Thrones*, *Star Trek* and *The Walking Dead*.

Riz has produced many indie films, including the online phenomenon *Thrive: What On Earth Will It Take?*, *Sirius*, *Knights of Badassdom*, *The Outpost* and adaptations of the works of Philip K. Dick and Ursula K. Le Guin.

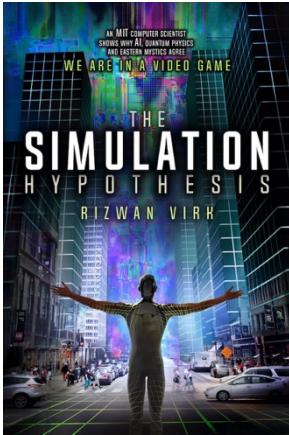
Riz is the author of *The Simulation Hypothesis*, *Startup Myths & Models: What You Won’t Learn in Business School*, *Zen Entrepreneurship* and *Treasure Hunt*. Riz’s writing and startups have been featured everywhere from Tech Crunch to The Boston Globe from Vox.com to NBCNews.com, from Coast-to-Coast AM to the History Channel.

He lives in Mountain View, CA, Cambridge, MA and Tempe, AZ. His personal and professional sites are www.zenentrepreneur.com and www.bayviewlabs.com.

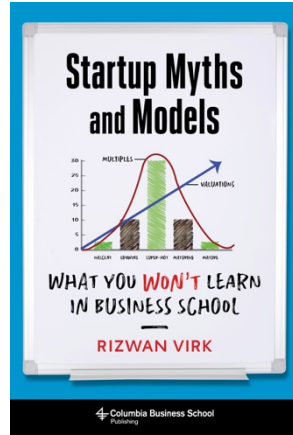
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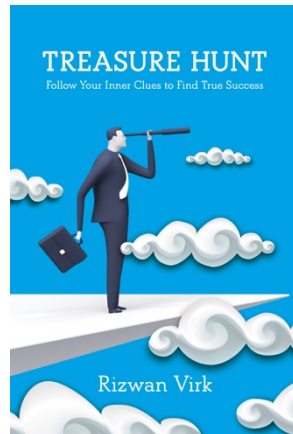
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