



**THE GREAT
ACCELERATION**

**HOW THE WORLD IS GETTING
FASTER, *FASTER***

ROBERT COLVILE

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To my father, who taught me how to take things slowly. And to Andrea, who makes my heart beat
faster.

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Introduction

‘All things move, all things run, all things are rapidly changing.’

– *The Technical Manifesto of Futurist Painting*¹

Next time you walk down the street, take a look at people’s feet. Pretty quickly you will notice that wherever you are, however large the crowd, they are marching in perfect lockstep. You can try to break the pattern – to speed up or slow down – but without a supreme effort, you’ll find that you’ve simply lengthened or shortened your stride: your feet are still marching to that same common beat.

This is, when you think about it, rather amazing. Our natural sense of rhythm is so strong, our innate beat so powerful, that it overrides our conscious thoughts. Even if you’re listening to music, it doesn’t matter: your iPhone may be pumping out Schubert while your neighbour’s plays Jay-Z, but your legs will remain in perfect synch.

The reason we fall into step is due to a phenomenon called entrainment, in which living creatures’ natural rhythms unconsciously adjust to each other. It’s the same strange force that sees swallow flocks wheel and dive in unison, or brings together the menstrual cycles of women who share the same household. And when it comes to walking, it would be natural to think that this collective pace is ruled by some primal biological rhythm, like the beat of our hearts. But in fact, it is set by our surroundings. In different places, people entrain in different ways: sometimes we are tortoises, sometimes hares.

This pace is determined, above all, by the nature of our environment. The larger the town or city, the faster people move: in the 19th century it was said that the average New Yorker ‘always walks a mile if he has a good dinner before him and a bailiff behind him’.² Today, a child brought up in a city will run a race around a supermarket more than twice as fast as his cousin from a small town, who will spend far more time talking to the staff or inspecting the produce.³ And if you ask people to listen to a pause of a particular length, those living in cities with a population of more than a million will claim it has lasted twice as long as those from farms or villages.⁴

It is not just the size of communities that matters, however, but their culture. During a teaching sabbatical in Brazil, a Californian psychology professor called Robert Levine found his American obsession with punctuality utterly unsuited to the laid-back local norms. He decided to focus his research on why the pace of life varied around the world: so he and his students spent three years in the early 1990s visiting 31 different cities to measure the differences.

It turned out that the more advanced and industrialised the economy, and the more individualist the culture, the faster the country’s speed. Western Europe and Japan hurried and scurried, while Africa and Latin America dawdled and lazed. Within America, the East Coast was the fastest, followed by the West, while the heartland ambled behind.⁵

Yet cultures change over time – and with them the speed of life. In 2006 a psychologist from the UK called Richard Wiseman enlisted the help of the British Council to carry out a rerun of Levine’s experiment. On a given day in August, its staff took to the streets of 32 cities around the world. Like Levine’s team a decade earlier, they staked out a 60-foot strip of unobstructed pavement in the heart of the city centre, grabbed a coffee, and started the stopwatches.⁶

What did they find? That worldwide, people were covering the same stretch of ground in 10 per cent less time. In particular, the cities of Asia had caught the speed bug. Levine had been surprised that

despite their reputation for haste, the booming, bustling cities of the East were far less speedy than sclerotic old Europe (due, he theorised, to their warmer temperature). But during the years between the two experiments, Singapore and Guangzhou had come from nowhere to match the hastiest Western capitals – just as the Asian economy had first borrowed the West’s hyperactive ethos, and then turbocharged it. In an act of wholesale cultural imperialism, America and Europe appeared to have impressed upon the developing world not only their individualistic, consumerist culture, but also their Western sense of haste.

THE GREAT ACCELERATION

What single quality best defines how our society is changing? Is it that life is becoming fairer, more equal, or more prosperous? No: as the experiment above suggests, it is that life is getting faster. This is something many of us will have experienced for ourselves. This book, for example, was born out of the realisation that it was not just our electronic devices that were getting faster, nor the pace of our working lives. The media industry in which I worked, and the political system which I covered were subject to sudden and convulsive change. New trends, ideas and crises appeared to be emerging in the blink of an eye. It felt like my friends and I had no time to relax, to unwind, to slow down.

The more I studied this phenomenon, the more I realised that it was all connected. In area after area technology was making life quicker, more convenient, more friction-free – not least as more and more of it moved online. The debates people were having about the internet’s effects on our brains, or our rapacious use of the planet’s resources, were all part of the same basic phenomenon: what I call the great acceleration.

Often, this acceleration feels like something we cannot control. Where our grandfathers sauntered and our fathers strode, we find ourselves scampering about our daily tasks. Time-use studies have shown how work increasingly follows us from the office to the home, with everyone tethered to the office by their smartphone.⁷ And that same phenomenon of entrainment – the shared sense of rhythm that sees us all marching in lockstep – means that we instinctively, unconsciously, push ourselves to match the pace of our fastest fellow workers.⁸

In 1990, 49 per cent of Europeans felt their work schedule was too strenuous. By 2000, that had increased to 60 per cent – and those who felt themselves to be rushed were almost twice as likely to complain of the classic stress disorders, such as back pain, or tight shoulders and necks.⁹ Bombarded by electronic and bureaucratic stimuli, we are pushed into a near-perpetual state of fight or flight. We are apparently so stressed that the very gender balance of our society has shifted, with more girls being born than boys – a change more normally seen in the wake of traumatic events such as Hiroshima.¹⁰

The psychologist Stephanie Brown argues that America’s frenzied lifestyle ‘has itself become an addiction. People are out of control in their push to do more, to always be on and available, and never to say no.’¹¹ Speed means progress and success. Slowing down means failure and loss. To regain a sense of control, we fall into other addictions – eating, gambling, computers. ‘For many people,’ she laments, ‘their relationship to technology and speed has become more important than, or even replaced, human relationships.’¹²

Yet at the same time, ours is a society in which speed is not just omnipresent, but venerated. Firms in Silicon Valley compete to be the quickest-moving, the most disruptive. A study of Christmas round-robin letters sent since the Sixties shows not only a remarkable rise in the use of words like ‘hectic’, ‘whirlwind’, ‘consumed’ or ‘crazy’ to describe people’s lives, but their being deployed in a

almost boastful fashion, as a proclamation of worth.¹³ The novelist Jonathan Franzen has written of society that seems to be becoming ‘as restless as capitalism itself’.¹⁴

As life speeds up, our patience thresholds dwindle. In 1999, websites would lose a third of the traffic if they took eight seconds to load. By 2006, that had shrunk to four.¹⁵ Now, Google puts them on notice if it takes more than two.¹⁶ In a survey carried out by the psychologist Philip Zimbardo among readers of *USA Today*, the level of anger and frustration caused by every kind of annoyance from waiting in a queue to getting stuck in traffic, had shot up over the past 20 years.¹⁷

It is not just our biology that is changing: our economy, too, is being altered in ways that many will not find comfortable. The process of disruption and automation – the shift from manual labour to computer power – is throwing industry after industry into turmoil, as first the working and now the middle classes discover that computers can do their jobs faster and cheaper than they can themselves. John Maynard Keynes called this ‘technological unemployment’ – and the faster technology moves, the less we are able to cope with the dislocation it causes.¹⁸

Yet the central argument of this book is not only that acceleration is a good thing, but it is something that we have actively chosen. We are not mere passive victims of some vast, impersonal force: we have, collectively, chosen to bring the great acceleration on ourselves. We are, as humans, hard-wired to crave novelty, speed and convenience. Despite all the stress, people from faster places are far happier with their lives. As Levine found, ‘faster overall tempos are highly related to a country’s economic well-being on every level: to the economic health of the country as a whole . . . to the economic well-being actually experienced by the average citizen . . . and to how well people are able to fulfil their minimum needs.’¹⁹ In other words, those people scurrying through the world’s great cities are by and large doing so, as we shall see, with a spring in their step.

Set against a depressing picture of stress and uncertainty, indeed, is an equally powerful positive argument – that in the words of Adrian Wooldridge, management columnist on *the Economist*, ‘the storms of creative destruction are blowing us to a better place’.²⁰ Acceleration has brought prosperity on a scale unimagined even by the optimists. In 2003, in a paper that coined the term BRIC (Brazil, Russia, India and China) for the rising global players of the future, Jim O’Neill and his colleagues at Goldman Sachs ventured some predictions about how quickly power and wealth would shift from West to East. They imagined that by 2008, China’s GDP could be as high as \$2.8 trillion; in fact it stood at more than \$4.3 trillion. Brazil’s GDP, similarly, was two and a half times greater than projected.²¹ This ongoing process of economic acceleration has lifted billions of people out of poverty.

Writing in the *New Yorker* in 2011, Adam Gopnik claimed that commentators on technology fall into three basic categories: the Never-Betters, Better-Nevers and Ever-Wasers.²² ‘The Never-Betters,’ he wrote, ‘believe that we’re on the brink of a new utopia, where information will be free and democratic, news will be made from the bottom up, love will reign and cookies will bake themselves.’ The Better-Nevers are more likely to be found lamenting the loss of old certainties and expressing their support for UKIP or the Tea Party. The Ever-Wasers, meanwhile, sagely observe that technological acceleration has been a fact of life since the invention of the Bessemer engine, and that human reactions to it have been remarkably consistent throughout – namely, embracing every possible opportunity for greater speed while complaining about it every step of the way.

The debate about whether the acceleration of life is a good or bad thing has, as this suggests, been going on for as long as life itself has been speeding up. Anyone who worries about families studying on their iPads or the television rather than talking to each other should consult the edition of the *Journal of Education* from 1907 which complained about ‘our modern family gathering, silent around the fire

each individual with his head buried in his favourite magazine'.²³ Similarly, John Freeman's book *The Tyranny of E-mail* outlines a host of past irritations that sound suspiciously familiar to those immersed in today's online culture. Spam? Invented in 1868 by G. S. Smith, who built up a staff of 430 people, all churning out unwanted advertising circulars.²⁴ Nigerian email fraudsters? Try the British-American Claim Agency of the late 1880s, which informed gullible Yankees that they had received legacies – even landed estates – from relatives in England, which they could claim in exchange for a small handling fee.²⁵ Abusive online comments? Soon after the birth of the postcard there were widespread complaints that they were filled (anonymously) with 'gross insolence and contemptuous epithets'.²⁶

But just because these arguments are familiar does not mean they are not urgently important. In every field after field of human activity, the pace of change is accelerating. If we get dazzled by the potential of technology in the way that some in Silicon Valley have, we will be blind to the very real dangers that a lightning-quick economy and society bring. But similarly, if we focus solely on the negative, we will miss the glorious possibilities that await.

Only the most curmudgeonly of traditionalists could fail to feel a twinge of excitement about some of the technologies that seem likely to be with us sooner rather than later: an 'internet of things' built of 100 trillion sensors; self-driving cars; photo-realistic virtual reality; universal 3D printing; medical nanobots able to diagnose and cure diseases without our even knowing. Conversely, only the blithe of Panglossians could be sanguine about the ever-expanding range of ways in which the human race might imminently doom itself, from our rapacious strip-mining of the planet's resources to the prospect of creating superintelligent machines whose interests we have failed to align with our own.

FUTURE PERFECT?

This is not, primarily, a book about technology itself. Rather, it deals with human nature and its response to the technology around us. Each chapter explores how a different particular aspect of society is being transfigured by acceleration. While others have written powerfully about the speeding up of life – such as James Gleick in *Faster*²⁷ – this is the first book to draw together the threads, and show quite how pervasive and universal its effects have become.

To that end, the first chapter examines the acceleration of technology, and the way in which even greater speed is baked into modern business. The second chapter examines the impact of this on our brains and bodies, and the third its effects on our social and romantic lives – how we live, work and raise our children. [Chapter 4](#) traces how acceleration is shaping popular culture, while [chapters 5](#) and [6](#) examine its disconcerting effects on the media and politics. [Chapter 7](#) and [8](#) turn the spotlight on the financial markets and the global system of trade and logistics, while [Chapter 9](#) examines the effects of all this rapacious activity on the natural world. The conclusion explores where this process may ultimately take us – to a world of artificial intelligence, artificial life and even artificial humans.

What emerge from this are seven common themes, which crop up again and again.

First, the benefits of the great acceleration are more substantial than its costs, but less dramatic. We are geared to pay more attention to the one day on which the stock market drops by 10 per cent than the long months in which it ticks slowly up. We worry about the impact of mobile phones on children's brains, without appreciating the miraculous convenience of the connectivity they provide.

Second, the quickening pace of life is promoting the flashy and the superficial. But there is also an expanding market for products and services that help us step out of the currents and catch our breath, such as box sets, long reads or spa treatments. What is suffering instead is what sits between fast and

slow: products or experiences that are neither instant nor immersive, but in the mushy middle. For consumers, this has been a very good thing – even if it has made life distinctly uncomfortable for many producers.

Third, this polarisation between fast and slow is being mirrored by a polarisation between large and small. Whether it is in the technology industry or publishing or popular culture, the great acceleration has created a horde of buzzing, disruptive innovators. But it has also created and rewarded a few giants who have mastered the business of speed, flourishing and dominating the same ecosystem as those of small, nimble operators. This is a world not of hyenas, but of lions and flies, with those who are neither giant generalists nor niche specialists increasingly squeezed out.

Fourth, the benefits of faster and faster change come with a price tag of less and less predictability. An accelerated world is an exciting place, but is also one characterised, as Karl Marx put it in the *Communist Manifesto*, by ‘the constant revolutionising of production, uninterrupted disturbance of all social conditions [and] ever-lasting uncertainty and agitation’.²⁸

Fifth, that price tag also includes fragility. When the pace of change accelerates, we have less leeway to adapt, meaning there is more chance of things going catastrophically wrong. Our just-in-time logistics systems give us cheaper goods and cheaper food, but leave us vulnerable to shocks and disruption. Moving services online makes them easily accessible, but also vulnerable to hacking. Similarly, the ease with which money, ideas and pathogens can spread around the world – the lack of friction in the system – means that disaster can spread before we are even aware of it, let alone in a position to respond.

Sixth, the trends that power the great acceleration all feed off each other. We are drawn to live in cities for their speed; living in cities makes us more innovative and productive; this generates better technology, or new ideas; these make our lives faster still and increase our prosperity; as we become more prosperous, we become more urban – and so on. Such feedback loops arise time after time, each one speeding up the great acceleration.

Finally, this new world is not necessarily fair. In the words of the racing driver Michael Schumacher, ‘to perfect things, speed is a unifying force. To imperfect things, speed is a destructive force.’²⁹ Those people or institutions that are worst placed to respond to acceleration will suffer most from its side effects, while those willing and (crucially) able to adapt to it will make outsized gains, for example from faster devices, or biological enhancements that allow them to think better and act faster.

In the aggregate, the great acceleration is an extraordinarily good thing for humanity. But its benefits are distributed unevenly, and its dangers are almost as great as its opportunities. That is why understanding how to blunt the worst consequences of change and embrace its best effects has never been more important. We cannot stop this acceleration: what we can do instead is ensure that its enormous potential is applied where it best serves our needs. We have it in our hands to build the greatest and most prosperous society in history, or to wreck ourselves through selfishness and greed. Which path we take will be determined by whether we become the slaves of the great acceleration, or its masters.

Permanent Revolution

‘Anything worth doing is worth doing faster.’

– Advertising slogan for the BlackBerry Playbook

‘Google is dead.’ Bill Nguyen makes this pronouncement casually, almost offhandedly – not as if he is handing down a truth, but mentioning something that’s already common knowledge.¹ What, you guys didn’t know already?

The date is May 2011, and the dapper, friendly Vietnamese–American is the toast of the technology industry. Having founded a string of successful firms before the age of 40, the most recent snapped up by Apple, he has just secured \$41 million in funding for his new creation, Color, a location-based photo-sharing website. It is the subject of a tidal wave of hype – being touted as ‘miraculous’ and ‘transformative’, the new new thing that could knock Google and Facebook off their perch.² The fact that he has agreed to drop by the *Daily Telegraph*’s London headquarters to address its reporters is seen by the management as a significant coup.

At the most basic level, what Nguyen means is that the web is shifting away from the automated model pioneered by Google and towards the social approach favoured by Facebook, in which your experience of the internet is filtered by that of your friends. But he is also talking about something more nebulous: the idea that the stardust has vanished, that Google is no longer the coolest kid on the block. Younger, hipper, faster firms are gearing up to take its place. Firms like Color.

Fast-forward just a few weeks, and it is clear that Color is a flop – and a spectacular one. In a startling about-turn, Nguyen is forced to admit that the network of users he was hoping to create is already in place over at Facebook, and has no desire to move. In the months after its humiliating failure to launch, Color is rebuilt from the ground up, to work as just another app within Facebook’s sprawling ecosystem. Within 18 months, the firm will have shut down completely.

Is this just a tale of executive hubris – a cautionary fable about just how deluded the novelty-crazed investors and entrepreneurs of Silicon Valley can be? On the contrary. It tells us some extremely important things about the culture of innovation and disruption that dominates the business world. It is a culture, as we shall see in this chapter, which fetishises ambition, rapidity and transformational world-changing ideas – in which the rewards for success are greater and the costs of failure lower than ever. And it is one which is built, above all, around acceleration: the acceleration of technology, of business, and above all of customers’ tastes and demands.

CHIPS WITH EVERYTHING

Color was, like many technology companies, built around speed. The idea behind its app was that using just your mobile phone, you would be able to take a high-quality digital picture and have it pop up, within an instant, on the screen of a friend sitting a continent away.

That we now find this idea relatively mundane does not make it any less extraordinary. For it relies on computing power and data transmission on a scale beyond anything available to previous generations.

This is the most obvious factor powering the great acceleration: the way in which the power of computing devices has grown so swiftly. The most famous example is Moore's Law. In 1965, the co-founder of the chip-maker Intel, Gordon Moore, observed that the number of transistors that could fit on a single chip had been doubling every two years (or every year, in the original formulation), and would continue to do so. For the computing industry, this became something of a self-fulfilling prophecy: over the past two decades, global computing power has grown by 58 per cent a year.³ This is why a PC today costs a sixth of the amount it did in 1981, but is 500 times more powerful – and why your fridge probably has more computing power than the Apollo 11 module.⁴

It is not just raw computing power. The American futurologist and technologist Ray Kurzweil has shown that computing power, data transmission, memory storage – pretty much any technological metric – is subject to what he calls the 'law of accelerating returns', under which its growth is not linear, but exponential.⁵ Imagine, he says, that the emperor of China wishes to reward the man who came up with the game of chess. The wily inventor asks for an exponential reward: one grain of rice on the first square of his chessboard, two on the second, four on the third, eight on the fourth and so on. As the sacks are brought in, the emperor thinks he is getting the better of the bargain. But slowly the exponential curve takes effect. By the final square, the emperor's generosity will cost him 2⁶⁴ grains of rice, or 9,223,372,036,854,775,808. At a rough approximation, that works out to 250 billion tons, or 40,000 times the weight of the Great Pyramid at Giza.

The power of Moore's Law, and of the law of accelerating returns, can be hard to appreciate. 'It's as if you kneel to plant the seed of a tree,' says the technologist Jaron Lanier, 'and it grows so fast that it swallows your whole town before you stand up.'⁶

One of the best places to see this phenomenon in action is CERN in Geneva – famous among scientists as the home of the Large Hadron Collider, and among techies as the place where Tim Berners-Lee created the World Wide Web (if you look hard enough, you will find a plaque commemorating the achievement outside his old office, opposite an outdated collage of Dilbert cartoons).

The reason Berners-Lee was at CERN in the first place was to facilitate information-sharing – not least between scientists in different parts of the world. In those days, that was achieved via a link partially funded by IBM, running at a then-astonishing 1.5 megabits per second. Fast-forward 20 years, and the humblest 3G smartphone can receive data almost ten times faster.⁷

But CERN hasn't stood still, either. Within the Large Hadron Collider, an \$8 billion particle collider designed to mimic conditions a millionth of a second after the Big Bang, beams of particles race along a 17-mile circular track at 99.9999991 per cent of the speed of light. When they collide, they travel a billion kilometres per hour, they throw off vast amounts of data – too much for any one supercomputer. Instead, the work is divided between thousands of machines in hundreds of data centres worldwide, in a network known as the Grid.

With its ability to transfer billions of gigabytes per year, the Grid is the bullet train to the internet locomotive. But after another 20 years of Moore's Law the processing power available to all of us will be a million times greater. Sooner than we realise, we will all have access to practically infinite data and practically infinite processing power, at practically infinite speeds.

The availability of all this ever more powerful hardware is one of the most important forces behind the acceleration of society. And the possibilities it offers are dizzying. Within five or six years, Intel plans to shrink its fastest processors from 14 nanometres down to 5, a scale so tiny that quantum physics – notably, our inability to pin down both the exact state and the position of subatomic particles – starts to become an actual design factor.⁸ Beyond that lies the point where you can

construct processors – or pretty much anything else – molecule by molecule. That has the potential to revolutionise not just computing, but everything from construction to medicine to energy to agriculture, via the construction of nanotech devices and materials.

A QUICK HISTORY OF DISRUPTION

This acceleration of hardware is necessary for the great acceleration to take place – but it is not sufficient. There have, after all, been convulsive episodes of technology-driven change in the past: mass electrification, say, or the reshaping of cities around the car in the post-war years. What makes things different now?

The answer to that is not a question of devices, but doctrines – and, in particular, our approach to innovation.

There have always been two basic recipes for innovation: making an incremental improvement to a product, service or process, or coming up with something brand-new. This is the distinction made by Larry Page, co-founder of Google, when he says that his firm's aim should be not to improve existing products by 10 per cent, but to build ones that are ten times better.⁹

A classic example of this kind of disruptive innovation comes from the communications revolution of the 19th century. As late as 1845, it took President James Polk six months to get a message to California.¹⁰ Yet by the time of Lincoln's inaugural address in March 1861, that had been cut to seven days and 17 hours.¹¹ This was partly thanks to better roads and railways – themselves a huge engine of social and economic change – but also to the efforts of the newly formed Pony Express, which based its business model on detaching its horses from cumbersome stagecoaches and flogging the poor beasts to exhaustion (and its riders, too, as its recruitment ads made clear: 'Wanted: Young, skinny, wiry fellows not over 18. Must be expert riders, willing to risk death daily. Orphans preferred').¹²

The Pony Express was a marvel of logistics – not to mention bravery, given the hostile terrain in which young riders would pass through. But within just two years it had folded, victim of the most fundamental law of the market: that the fast displaces the slow.

What eclipsed the Pony Express was what the *Sacramento Bee*, in its obituary for the service, described as a 'new and higher power': the telegraph.¹³ This was an explosive, disruptive and enormously influential technology – what Tom Standage of the *Economist* calls 'the Victorian internet'.¹⁴ At the start of 1846 there was only one experimental 40-mile line, laid between Washington and Baltimore by Samuel Morse.¹⁵ By 1850, 12,000 miles had been laid.¹⁶ By 1858, the first transatlantic cable had entered service, to prodigious rejoicing. "'Tis done!' reported one anonymous poet. 'The angry sea consents, / the nations stand no more apart; / With clasped hands the continents / Feel throbbings of each other's hearts.'¹⁷ So vigorous were the celebrations that City Hall in New York was set ablaze, and only just escaped being burnt down.¹⁸

It wasn't just the telegraph. Just as we do today, the Victorian public seized on anything that offered greater speed or convenience. The first postcard was sent in 1871; by 1873, more than 72 million had been dispatched.¹⁹ In 1896, the first motion pictures were projected for the viewing public in a New York music hall; by 1910, despite the best efforts of Thomas Edison's patent lawyers, the nascent movie industry was turning out 200 one-reel films a week.²⁰

The same process can be seen in transport. Today, footage of Edwardians wobbling around on penny-farthings is a shorthand for sepia-toned gentility. Yet the bicycle was, in its day, a piece of cutting-edge technology – responsible, at one stage, for a third of patents granted in the US,

manufacturers raced to improve the design.²¹ The greatest sign of its influence is that it spurred the same moral panic as every transformative technology from Facebook to steam locomotives: there were dark warnings of the sinful consequences of unmarried couples taking rides in the count together, and of the dangers of ‘bicycle face’, suffered by women who tried to pedal against the breeze at high speeds.²²

It was developments like this that led the great Austrian economist Joseph Schumpeter to come up with his theory of ‘creative destruction’.²³ He argued that waves of disruptive change were not merely a part of business and technology, but their very purpose, sending out ripples of innovation that made markets work better and consumers more satisfied.

So why can we talk about a great acceleration, rather than a ‘great continuation’? Because this kind of change is speeding up. Ray Kurzweil has calculated how long various technologies have taken to win mass acceptance (which he defines as use by a quarter of households). For the printing press, it was centuries; for television and radio, a few decades; for the web, just six or seven years.²⁴ The curve, as Kurzweil points out, is getting ever steeper, meaning that each new technology is embraced more and more quickly. In 2005, just 5 per cent of American adults used social networking sites; six years later, the figure was at 65 per cent and climbing fast.²⁵

What’s changed? In the old days, the public embraced new technologies such as postcards and moving pictures – or the radio, or the railroad – just as eagerly as we do today. But such innovations faced a rockier journey to the mass market, due to obstruction by incumbent firms or a failure of vision among unimaginative investors.

As early as 1816 – 30 years before Samuel Morse – an Englishman called Francis Ronalds demonstrated a working telegraph over 8 miles of wire strung up in his back garden, but the Admiralty expressed no interest, and there was no early venture capitalist to step in instead.²⁶

Lack of imagination was often compounded by sabotage from incumbents: as Machiavelli argued, ‘the innovator has for enemies all those who have done well under the old conditions, and lukewarm defenders in those who may do well under the new’.²⁷ Lawyers at AT&T, the industrial conglomerate created by Alexander Graham Bell, managed to delay the introduction of the voice recorder, the television and the fax machine by years in order to protect their existing business.²⁸ Even breakthroughs such as radio and film were soon colonised by corporations. Tim Wu, the Harvard academic and author of *The Master Switch*, calls this ‘The Cycle’ – a process in which innovation and openness first arise, then are remorselessly choked off by cartels and monopolies.²⁹

Today, it is certainly true that incumbents do their best to maintain their position: witness the way in which the big car companies sought to blunt the impact of electric vehicles until Elon Musk’s first Tesla came along to shock them into action. But for all manner of reasons, this obstructive mentality is much harder to pursue successfully than it was.

Executives today, surveying the turbulent economic and technological landscape, are all too aware of the dangers of complacency, or clinging to a broken business model too doggedly. The result is a commitment to self-disruption which has seen the concept not just embedded in 21st-century capitalism, but fetishised to the point of near-absurdity – resulting in a culture of which Bill Nguyen is the personification.

This mentality was already growing in power, but the man who gave it the status of holy writ was Clayton Christensen, the American academic and business philosopher whose 1997 book *The Innovator’s Dilemma* has become the bible of modern capitalism.³⁰ In it, Christensen tells the story of the steel industry, traditionally centred on vast industrial foundries. Starting in the 1970s, small ‘mini-mills’ appeared that could process steel more cheaply and efficiently. The market leader

weren't worried: the mini-mills could only make the worst quality of steel, and abandoning that high-competitive market would raise their profit margins and allow them to concentrate on higher-technology products. Then the mini-mills got good enough to make the next-highest grade of steel. Again, the big firms abandoned this tough, unrewarding market segment, and watched their margins and share prices soar. Eventually, they realised they were being squeezed out of the market altogether – but by then it was too late.

In the AT&T days, the moral of this story would have been to stamp out your enemies wherever they appear, no matter how small. But Christensen's message was to disrupt yourself, lest you be disrupted. And he could point to an elephants' graveyard of former market leaders to drive home his point: for the steel mills, read Kodak, or Borders, or Ashton-Tate (once the third-largest software firm behind Microsoft and Lotus). Christensen's chilling point to his readers in the boardroom was that, in a disruptive age, even good executives, doing sensible things, can still find their businesses sinking beneath them if they are not constantly willing to reinvent what they do. And half-hearted efforts are not good enough, since the threats are coming from so many different directions.

The evidence backs him up: between 1956 and 1981, an average of 24 companies dropped out of the Fortune 500 list every year. Between 1982 and 2006, the figure had risen to 40.³¹ A similar study found that a firm was falling out of the rival S&P 500 index every two weeks.³² In just the last few years, companies such as Nokia, BlackBerry and Zynga have gone from world-beaters to has-beens after failing to predict where acceleration would take their industries.

Amid such a frenzy of creative destruction, the most successful companies have to engage in a constant process of reinvention and internal competition to remain ahead of the pack: no less a firm than Intel credits Christensen for helping to save it from corporate obsolescence.³³ When a consultancy recently asked hundreds of executives to rate their firms for a Global Speed Survey, those companies that self-identified as 'faster' had 40 per cent higher sales growth and 52 per cent higher operating profit.³⁴

The result is a mindset in which permanent revolution is not just a business model, but almost the only one that makes sense. To stop their firms growing fat, old and lazy, or being rendered an antique by some bright spark in a Californian bedroom, incumbents are adopting the ethos of a start-up, trying to disrupt themselves before they are disrupted in turn. Gary Hamel wrote in the *Harvard Business Review* back in 1999: 'Face it: out there in some garage an entrepreneur is forging a bullet with your company's name on it. You've got one option: you have to shoot first.'³⁵ Or, to use Google's unofficial internal motto: 'If you're not fast, you're fucked.'³⁶

SCHUMPETER'S CHILDREN

This transformation in business mentality hasn't happened because of enlightened self-interest. It happened because companies often don't have a choice. And the most obvious reason for this is the opportunities opened up by the acceleration of technology.

Consider, for example, the story of the most important video cassette in consumer history. The tape in question was a copy of Ron Howard's film *Apollo 13*, and it was rented in 1997 by Wilmot Hastings Jr, a software entrepreneur and former Peace Corps volunteer. At the time, Hastings, known to all by his middle name of Reed, was having a few problems, both with his career and his family life. For various reasons, he failed to get round to returning the tape for six weeks, by which time the late fee had grown to \$40.

For most people, that would have been the end of it: perhaps, at most, they would have resolved

either to return their videos on time in future, or to boycott the vendor. Instead, the aggrieved Reed Hastings decided to build a new company, one that offered unlimited DVDs, delivered by post, with no late fees. (As it happens, Hastings's co-founder and others dispute this version of events, but it has still attained the status of corporate creation myth).³⁷

The business model of this firm – which was given the futuristic name of 'Netflix' – wasn't entirely original, and it certainly wasn't as speedy as walking into Blockbuster. But what marked it out was both its convenience (you didn't have to walk anywhere, simply queue up your film orders online) and its determination to innovate. In 2006 it offered \$1 million to anyone who could improve its engine for recommending films to users by 10 per cent – a challenge accepted by teams of computer scientists from around the world.³⁸ Next, and more momentously, it decided to switch its business model from the physical to the virtual, by streaming or downloading films directly into its users' bedrooms or living rooms.

The results were astonishing. Digital video rapidly came to dominate the home video market, turning the old incumbent, Blockbuster, into just another BlackBerry or Kodak. Today, Netflix is a corporate gorilla, beamed into millions of homes worldwide and raising billions to fund its future expansion, which includes making its own movies and TV shows starring some of the biggest names in Hollywood.

This success was emblematic of the modern business environment in more ways than one. First, Hastings benefited from the accelerating pace of technological progress: the fact that it suddenly became technically feasible to beam movies to our laptops rather than etching them on to magnetic tape or plastic discs. Second, he profited from the general shift from hardware to software – the fact that innovation today is more often about writing code than plugging in wires.

Software innovation has a quicker impact (and is loved by investors) because it is much easier to scale up a product that does not involve building factories, or moving physical objects from place to place. Especially since the marginal cost of adding a million more customers, once your code base is in place, will be no more than the cost of renting the extra server capacity.

The transition from hardware to software also makes it vastly easier to start and grow a company which, in turn, has accelerated the process of disruption. As John Palfrey and Urs Gasser argue in the book *Born Digital*, 'it's much more cost-effective to become a creator of digital content than it was to create similar works in previous areas. In the 1980s, for example, a start-up rock band would have spent roughly \$50,000 to purchase or rent the necessary recording equipment to make an album. Today, a band simply needs a laptop computer and some additional pieces of hardware and software which might cost less than \$1,000.'³⁹

In the absence of the need to build physical products, the only costs for today's entrepreneurs are, says the technology journalist David Kirkpatrick put it in his history of Facebook, 'servers and salaries'. And even those costs are coming down, not least since others – especially the Silicon Valley giants – are more than happy to do the donkey work for you. One of the drivers of the recent start-up boom, for example, has been Amazon Web Services, a cloud-computing platform built by Amazon that enables anyone to rent as much or as little computing power and data storage as their business requires. It is now possible, thanks to the acceleration of computer power, to outsource not just your IT, but your financial reporting, your HR systems and much else. If your start-up needs legal services, for example, you can use software called EDiscovery. In 2011, it analysed 1.5 million legal documents for BlackStone Discovery of Palo Alto for less than \$100,000 – a task which, done by humans, would have been an order of magnitude more expensive, and significantly less accurate.⁴¹

The entire Silicon Valley ecosystem, in fact, is now dedicated to nurturing and supporting small teams of people with big ideas. The latest craze is for the 'lean' start-up – start small, create

minimum viable product, and be prepared to switch tack at a moment's notice (a business philosophy best summed up, Bill Nguyen-style, as 'carry on failing until you succeed'). This kind of operation is obviously a lot easier to set up and fund than something that takes a team of hundreds to pursue a particular vision. For the latest start-ups, actual employees or office spaces are something of a hindrance. For companies such as Uber, smartphones turn thousands of people into contractors without adding to their own overheads, with apps enabling such remote workers to receive tasks from a central hub.

The paradox here is that while these start-ups are smaller than ever, their ambitions are far grander. Indeed, this more than anything is why the gospel of disruption has had such an outsize effect on our lives – why it has fostered that 'constant revolutionising of production' that Marx predicted.⁴² In this new world, it is no longer enough to carve out a profitable niche (not least because others may come along and disrupt you out of it). To be among the cool kids, you need to be planning to completely upend a particular industry or business practice. When Marc Andreessen, the co-author of the world's first web browser turned venture capitalist, claims that 'software is eating the world', he is talking about precisely this: the way that established market sectors are falling like dominos before the power of Silicon Valley, due to the lowering of barriers to entry enabled by the shift from hardware to code.⁴³

Such venture capitalists are, in fact, another engine of acceleration. As Tad Friend put it in a *New Yorker* profile of Andreessen, 'venture speeds the cycle of American impatience: what exists is bad and what replaces it is good – until the new thing itself must be supplanted'.⁴⁴ The more ambitious your chosen target, the greater the scale of the market opportunity: hence Uber's plans to revolutionise not just taxi rides but the very concept of car ownership, or the various start-ups and laboratories working to reinvent agriculture or conquer mortality itself. As Andreessen told Friend, 'we're not funding Mother Teresa. We're funding imperial, will-to-power people who want to crush their competitors. Companies can only have a big impact on the world if they get big.'⁴⁵

It is no wonder that, as a result of all this, the start-up scene is undergoing what the *Economist* has called 'a Cambrian moment' (a reference to the explosion of multicellular life around 540 million years ago). 'Digital start-ups,' it said, 'are bubbling up in an astonishing variety of services and products, penetrating every nook and cranny of the economy.'⁴⁶ The acceleration is not limited to software, either: new technologies such as 3D printing enable companies making actual goods to prototype their products, refine them and bring them to market far more rapidly.

In summary, a series of factors have converged to make innovation and acceleration of business models both the norm and the expectation – whether it be start-ups attempting to eat the incumbent's lunch, or incumbents desperately attempting to fend them off. And, given how thin many companies' profit margins are, in an ultra-competitive global market it takes only a little bit of disruption – the growth of Airbnb as a rival to hotels, for example – to throw things into chaos. Or, as Schumpeter would put it, to inject an element of creative destruction.

THE CUSTOMER IS ALWAYS RIGHT

This business model, while extremely powerful, is not without its problems. For one thing, it breeds an ethos that holds that it is better to act first and ask permission (or forgiveness) later. Better, for example, to release a project mashed together in a week of caffeine-fuelled coding than a more polished product that fails to catch the Zeitgeist. Hence Facebook's all-night 'hackathons', or the motto Mark Zuckerberg donated to his company: 'Move fast, and break things.'⁴⁷

In the software market, the race to stay ahead of the game therefore means springing redesign after redesign on your users. Sometimes you'll get it wrong – but that's tough luck. As Reid Hoffman, the billionaire founder of the professional social network LinkedIn and an early investor in Facebook, has said: 'If you're not embarrassed by your first version, you waited too long to ship it.'⁴⁸ (Hoffman is also the author of the perfect image to sum up the new-technology business model: 'You jump off a cliff, and you assemble an airplane on the way down.')⁴⁹

From the outside, however, it can feel like change is being shoved down users' throats. Douglas Coupland, author of *Microserfs*, recently observed: 'It feels wistful to imagine a time when people didn't go about their daily routine with the assumption that at any moment another massive med-tech technology will be dumped on us by some geek in California.'⁵⁰ The same applies to those being competed out of business: one San Francisco driver complained during the middle of the price war between rival ride-hailing apps Uber and Lyft: 'I don't want to be the butt-end of a [venture capitalist] fantasy, I want to make a living.'⁵¹

One rejoinder to such complaints is to quote Schumpeter's observation that 'economic progress, in a capitalist society, means turmoil'.⁵² More turmoil, by this analysis, means more progress. But the better explanation for why we are being constantly bombarded with more innovation is simple – because we are asked for it.

Uber and Airbnb, for example, have succeeded not simply because of venture capitalist support. They are successful because enough of us like what they offer. It may take plenty of failed experiments to figure out exactly what we're after – but the combination of faster computers and better data means that this kind of efficient response to user feedback allows such firms to improve their offerings much more quickly than their predecessors ever imagined.

Of course, there has been a longstanding effort on the part of business to squeeze more efficiency out of its operations. This process was kick-started in the 1890s when the first time-and-motion expert, Frederick Winslow Taylor, set to work at the Midvale Steel plant in Philadelphia, carrying out laborious tests to calculate how long it took workers to do everything from open a drawer to pick up a pencil.⁵³ The equation was simple: greater speed and efficiency equals fewer staff and higher productivity.

Today, the science of management, productivity and leadership is a business in itself: managers carry out constant assessments of their subordinates' performance, armed with all manner of metrics. But it has also become far easier to hone not just how your products are made, but how they are received.

Take the practice of A/B testing. This involves showing two different versions of a product to different people (or, in one famous experiment by Google, 41 different shades of blue on the taskbar).⁵⁴ You can get real-time feedback on their preferences, stripping away the need for human judgement, focus-grouping or lengthy product development. Given a large enough sample size, you can simply spit out hundreds or thousands of different versions of your product until you have reached the ideal version.

This is a hugely powerful technique. The Obama presidential campaign used it to tinker with the photos and slogans on its homepage, increasing the number of supporters signing up by 40 per cent (leading to an extra 4 million email addresses and \$75 million in donations).⁵⁵ When I was an editor at BuzzFeed, we used it on practically every story, creating as many as a dozen different combinations of picture and headline to see which the audience preferred. When you play a game on your mobile phone, you are subject to constant A/B testing: indeed, software companies such as Wooga or Zynga are essentially data analysts masquerading as games designers. The rough launch versions of games

such as *Brain Buddies* or *Monster World* are remorselessly honed and refined, made more and more addictive, until people are clicking faster, staying longer and spending more. And if it turns out that this kind of incremental innovation is not doing the job, that there really is no market for what you are selling, you can simply ditch that particular product or strategy – ‘pivot’, in the jargon – and try something else.

But there’s another thing about this kind of testing: namely, that speed always wins. Consider the history of Google.⁵⁶ For all the innovation of its web-crawling algorithm, and all the fields it has subsequently diversified into, its original offering to customers was blindingly simple: speed. For the sluggish search engines that dominated the scene before its arrival, the point was to keep you hanging around on their site; for Google, the point was to get you to the site you actually wanted. The plain white homepage was a statement of technological as well as aesthetic intent: fewer images to load meant faster delivery of pages, which meant less strain on the servers, quicker searches and happier customers.

Today, Google is near-evangelical about the virtues of speed. A campaign called ‘Every Millisecond Counts’ urged its clients to follow its lead and streamline their homepages – with those burdening the customer with slow load times getting penalised in the company’s search rankings. One of the firm’s public ‘guiding principles’ is that ‘fast is better than slow’: ‘We may be the only people in the world,’ they boast, ‘who can say our goal is to have people leave our homepage as quickly as possible.’⁵⁸

In June 2009, Google revealed the results of a fascinating controlled experiment: slowing down its results had ‘a measurable impact on the number of searches per user’.⁵⁹ The longer the delays, the fewer the searches. According to Vic Gundotra, vice-president of engineering, ‘Our internal data shows that users clearly, even subconsciously, prefer sites and applications that are snappier.’⁶⁰ In 2007, Ron Kohavi and Roger Longbotham of Microsoft revealed that a tenth-of-a-second increase in the loading time of Amazon.com cut sales by 1 per cent, while a half-second delay in displaying Google results slashed revenue from that page by 20 per cent.⁶¹ And more recently, a senior executive at the search giant confided that improving loading times by as little as 400 milliseconds raised traffic by 0.5 per cent.⁶²

In other words, it’s not just that we demand speed: we demand ever greater speed. This is why Google now finds search results for you while you are still entering your query, or Apple pops up suggested words as you enter your text messages. It is only by being ‘faster than the speed of type’ that they believe, that they can satisfy their ever more impatient users.⁶³

The history of another Silicon Valley giant shows the same pattern. Its story may be familiar: a brilliant maverick programmer, broken-hearted after a bad break-up, decides to create a social networking site, essentially to meet girls. There have been a few such sites before, but his is different. For a start, you have to use your real name, forcing a certain level of accountability and maturity upon the users. There is also a ‘killer app’ – the ability to easily upload photographs of yourself from your newfangled digital camera.

The site goes live in March 2003; within six months, 3 million users have flocked to it. Its founder has, in effect, discovered a way to speed up the process of friendship, and has become a superstar. The process: there are interviews, magazine covers, investment from the venture capital elite. Within a year, Google weighs in with a \$30 million buyout offer, but it is turned down.

But here’s the twist. What I am describing isn’t the creation of Facebook, but of Friendster, an earlier social network founded by a Silicon Valley hotshot called Jonathan Abrams.⁶⁴ It has everything that Zuckerberg’s creation later would: the business model, the backing, the audience. S

why haven't you heard of it?

The answer is simple: speed. Amid the excited discussions about new markets and features, and squabbles between founder and board, the team at Friendster forgot to focus on making the site work. Users suffered crippling loading delays as demand overwhelmed capacity. Soon they were deserting in droves. Although the site retains a foothold in parts of Asia, Friendster is now, as the *New York Times* has said, Silicon Valley shorthand for unmet potential.⁶⁵

So when, in February 2004, Mark Zuckerberg launched The Facebook (as it then was), his most important asset was not his skill at coding, or his Harvard connections, but – as David Kirkpatrick says in his history of the company, *The Facebook Effect* – a burning desire not to be 'Friendstered'. Zuckerberg's site, just like Larry Page and Sergey Brin's, stripped away everything extraneous. He scorned rivals that were, in his words, 'too useful', that just did 'too much stuff'.⁶⁷ One of his biggest arguments with his initial business partner Eduardo Saverin came when Saverin wanted to add an extra click to the process of requesting a new friend, in order to shove another advert in front of the user. For Zuckerberg, this was 'apostasy'.⁶⁸

Everything Facebook has learned since bears out the wisdom of this approach. When it first brought in the News Feed, allowing you to monitor your friends' updates in real time, the main protest group attracted 700,000 members within three days. Zuckerberg apologised, and tweaked the privacy settings. But the News Feed stayed, for one simple reason. Before the change, users were looking at 1 billion pages a month. Soon after, the figure was 22 billion.⁶⁹

In 2008, when Zuckerberg combined the Wall (the user's homepage) with the News Feed, the explicit rationale was 'to increase the velocity of information flowing between users'.⁷⁰ And when Facebook expanded its Messages software to bring together its users' email accounts, text messages and chats, it was, said Zuckerberg, because its teenage users were abandoning formal emails – with their cumbersome need for subject lines and proper spelling – for even-more-instant messages, just as they have abandoned voice calls in favour of snappier texts.⁷¹

Far from being shoved down our throats, therefore, acceleration turns out to be something we crave – and demand. We will explore the neurological basis for this in the next chapter, but for now suffice to say that its effects are both powerful and inexorable.

One final example will prove the point. For years it was claimed that piracy would destroy the music industry, and the software business too. It is certainly commonplace: in 2011, the British music industry estimated that more than three-quarters of the songs downloaded in the UK were illegally obtained, with twice the proportion of 16- to 54-year-olds stealing music as regularly buying it (29 per cent as against 14 per cent).⁷² In 2009/10, as the Kindle and its cousins entered the mainstream, there was a 50 per cent rise in Google searches for unlicensed copies of books.⁷³ The Business Software Alliance once calculated that P2P traffic – the transfer of files, usually illegal ones, directly between computers – consumed anywhere between 49 per cent and 89 per cent of all internet traffic, rising up to 95 per cent at night.⁷⁴ Bill Gates has claimed that fewer than a tenth of a per cent of the copies of Windows on sale in China are genuine.⁷⁵

But if piracy is a problem, what kind of problem is it? Is it a problem of culture, or morality, or technology? Or is it a problem of speed? It turns out, it is very definitely the last of these. In June 2015, an exhaustive UK government report found that three in five internet users have downloaded or streamed films, games, books, music, TV shows or software – but only one in five had done so illegally, and of those a significant proportion said they only did it because the content they wanted was not available quickly or legally.⁷⁶ In the US, the proportion of people using illegal file-sharing services to download music has been cut in half.⁷⁷

So why has piracy fallen – or, at the very least, why has it failed to destroy the music, entertainment and software industries at quite the rate that was predicted? In a word, speed. People download music illegally because it was the simplest and speediest way to do it. Once iTunes came along, it became far easier to play by the rules – and even more so once iTunes was itself disrupted by the even more convenient streaming services available on YouTube or Spotify.

Or look at the success of Apple’s App store. Technically, it has long been possible to bypass its security. But the speed and convenience of tapping on a symbol and watching your app download have trumped the relatively minor investment of time and effort it would take to crack the system open.

The logic of the on-demand, instant-gratification economy is that consumers will reward services that offer them what they want, when they want it, and punish those that don’t or can’t. This doesn’t just apply to start-ups: what are customer reviews on TripAdvisor but a powerful spur for hotels and restaurants to clean up their act and offer the best possible service? In the case of video streaming, the US technology journalist Farhad Manjoo noted:

Netflix’s dominance over BitTorrent [one of the main file-sharing services, whose traffic was rapidly eclipsed by Hastings’s creation] fits into a larger story about how our Internet use is changing . . . We’re using more of our bandwidth to download stuff we need right now, and less for stuff we need later . . . once we come to expect immediate access to videos, BitTorrent’s download-now, watch-later model seems outdated.⁷⁸

THE REVENGE OF THE DINOSAURS

The corporate landscape described above – with companies pushing to disrupt and innovate, and customers pushing them on further – would seem to be a recipe for perfect competition. Nowhere should that be more apparent than in the technology sector, which is where many of the effects of the great acceleration not only originate but also are most apparent. If the fast is indeed eating the slow, shouldn’t the giant firms be dying off and making way for smaller, nimbler creatures?

But this is perhaps the most counter-intuitive consequence of the accelerated business culture – and a phenomenon we will run into again and again. The advantages of moving fast are not even distributed. Instead, they tend to build on themselves, to the point where those who get ahead of the rivals will end up with a dominant, even monopolistic position.

There are several reasons for this: such firms have the systems in place to scale up faster; their larger size allows them to drive down prices for their customers; and network effects mean that, if their products have a social component, they become more useful the more people are using them (think Facebook or Twitter or even TripAdvisor). This is not just a Silicon Valley phenomenon, either: the momentum towards gigantism is everywhere in the modern market, propelled (as we shall see later) by the financial markets. Investors demand that companies hit endless short-term growth and revenue targets, which they can often do only by scaling up via acquisition.

So why has this not slowed the pace of innovation, in the way that Tim Wu’s ‘Cycle’ predicts? Well, in places it has: as mentioned earlier, the automotive giants showed little interest in electric cars until they were disrupted by Tesla. But there is something qualitatively different. For all the reasons mentioned above, the new breed of monopolists is devoted to sustaining innovation, not least since many of them emerged from acceleration and are committed to pushing it on. Indeed, they frequently compete to host their own innovative parasites: companies or individuals making games or goods or videos that they can distribute via their own channels.

Perhaps the best example of all these trends is Amazon, founded by Jeff Bezos (a former employee of not coincidentally, of one of the computer-driven stock-trading firms whose work we shall examine in [Chapter 7](#)). Like Mark Zuckerberg of Facebook or Larry Page of Google, Bezos is a speed freak:

Brad Stone writes in his excellent history of Amazon, *The Everything Store*, ‘he was constitutional unwilling to watch Amazon succumb to any kind of institutional torpor, and he generated a nonstop flood of ideas on how to improve the experience of the website, make it more compelling for customers, and keep it one step ahead of rivals’.⁷⁹

At the heart of the company’s model is what it calls ‘the virtuous flywheel’. As Amazon gets bigger, it is able to extract lower prices from its suppliers. It feeds these back to its customers, increasing its sales and size and enabling it to put even more pressure on its suppliers.

But Amazon, like other tech firms, is also ruthless about crushing the competition. Whenever it spots a challenge to its burgeoning monopoly in a particular product category, it is willing to do everything it can to acquire or destroy its rival – or, preferably, to put such pressure on that it sells on at a cut-rate price.

In the case of nappies, for example, Amazon threw \$100 million down the drain in three months on its own bargain-basement delivery service in order to drive the existing market leader, Diapers.com, into its arms.⁸⁰ In its original business of books, meanwhile, the lawyers had to insist that the ‘Gazelle Project’ be renamed the ‘Small Publisher Negotiation Program’ – on the grounds that the idea of Amazon running these delicate, vulnerable creatures to the ground then clawing out their innards might not be the image the company wanted to project.⁸¹

Above all, however, Amazon’s history shows the power of the platform – both as a spur to innovation in others, and as a bulwark against competition for its owner. Amazon’s Marketplace, which permits third parties to sell goods on its site, now makes up 40 per cent of all its retail sales, shifting two billion units a year.⁸² That’s good for Jeff Bezos, and good for the sellers – but better for Bezos, given that Amazon’s bots drive the prices of its own products to the lowest point possible, forcing others to match them.

As with Amazon’s logistical services, in which it lets others use its warehouses, or its cloud computing business, the effect is to help others grow faster by carrying out vital functions more cheaply than they ever could – as long as they accept their place in Amazon’s food chain. If I wanted to start a delivery business, for example, there is absolutely no way I could compete with the Amazon algorithms that compute thousands of alternative delivery mechanisms for every single package in order to minimise time and cost.

That is not just because Amazon is smart, but because it has invested hugely in solving these problems, in the process taking the average ‘click to ship’ time down from three days to four hours inside a year (the standard for the rest of the industry at the time was a comparatively sluggish 10 hours).⁸³ A further advantage is that Amazon is not just running these platforms, but using them as well: so if it sees rising sales in a particular sector in the Marketplace, or notes an upsurge in demand for a particular brand of T-shirt, it can position its own buyers to leap on the trend before anyone else even notices it.

The same is true for the other tech giants. YouTube has, under Google’s stewardship, been a phenomenal success. Yet without Google’s servers to keep the site going (at phenomenal cost), or its ‘Content ID’ algorithm to identify copyrighted content and stave off crippling lawsuits, YouTube would have found it far harder to sustain its explosive growth.⁸⁴ Bill Nguyen’s Color was only one of many firms to try to challenge the big boys – and fail.

What truly makes these mega-firms different from their predecessors is that, for all the advantages, they constantly feel terrified of being displaced as the technological wheel turns. Indeed, the common thread between Mark Zuckerberg, Larry Page and Jeff Bezos – the owner-leaders of Facebook, Google and Amazon – is that they are not just messianic, but petrified. Petrified that

something faster will come along and lure away their customers; that they won't or can't move fast enough to cope with the public's appetite for novelty.

Facebook's endless redesigns, for example, spring in part from its executives' (largely justified) conviction that they are the helpless slaves of its customers, the obedient instruments of their ever greater craving for information. 'Mark's view,' David Kirkpatrick was told by Adam D'Angelo, one of Zuckerberg's oldest friends, 'is that Facebook had better not resist the trends of the world or else it'll become obsolete. Information is moving faster. That's just how the world is going to work in the future as a consequence of technology, regardless of what Facebook does.'⁸⁵ Bezos, too, once proclaimed that 'Amazon isn't happening to the book business. The future is happening to the book business.'⁸⁶ He is merely its instrument – and if not him, then someone else.

Their firms, therefore, put frenzied efforts into remaining agile and innovative. Despite their ever increasing bulk, Facebook and Google have clung to their start-up mentality: keeping staff levels low and project teams tiny, and putting a premium on creative thinking. Both are also willing to disrupt themselves before others do it for them. When Google created a mobile-first messaging app called 'Inbox', the explicit goal was to blow its own Gmail out of the water; Facebook, virtually simultaneously, launched its own app called 'Rooms' to provide a faster and better version of its own core services. Larry Page has taken to using his mobile to do all his work, rather than a desktop computer: if smartphones are how billions of potential customers in Asia and Africa are accessing the web, he wants to make sure Google gets to them before anyone else does.⁸⁷

Again, Reed Hastings is the poster child for this kind of behaviour – for reasons both good and bad. In 2011, Hastings announced – to general consternation – that the online portion of Netflix was being separated from the DVD-by-mail business (still the major profit engine), with the latter renamed 'Quickster'. But the move, allied to a hiking up of subscription fees, resulted in the loss of 800,000 customers; within a few weeks, Hastings was forced to announce that it had all been a very stupid idea, and things would go back to normal.⁸⁸

What lay behind such an act of self-immolation? The idea, of which Christensen would approve, was to devote his and his best minds' full attention to the online arena, where the threat of competition and disruption was greatest. As Farhad Manjoo wrote, '[Netflix's] all-you-can-eat business model disrupted, and eventually killed, the previously dominant Blockbuster model for movie rental. Hastings is likely paranoid, then, that Netflix is vulnerable to the same kind of disruption. And that's the logic behind the mail/streaming separation. Hastings would prefer to kill his own golden goose before anyone else beats him to it.'⁸⁹

TODAY SILICON VALLEY, TOMORROW THE WORLD

The disruptive ethos may have been born in California's technology sector, but it has since spread to conquer the world. Indeed, this is the most obvious safeguard against any particular monopolist using its position to slow down the pace of change: the fact that such a monopoly will tend to be limited either to one particular area or to one particular iteration of the technology we use, and thus vulnerable to disruption from outside.

It is a truism, for example, to say that we now have a global marketplace, with more eager consumers and more dedicated entrepreneurs than at any point in human history. But that does not make it any less powerful a phenomenon. Today's executives know that they have customers – and rivals – everywhere from Shanghai to Saratoga to São Paulo. They also know that, in order to outcompete them, you need to move faster than them. The cumulative effect is to further accelerate

the market.

There is also huge scope for this to increase: despite the tumultuous impact of globalisation, the world is still remarkably parochial, with the percentage of investment that crosses borders still in the single figures.⁹⁰ As faster communication and the pressure of competition erode national boundaries, new ideas will percolate back and forth ever more quickly – such as the dual SIM cards on knock-off Chinese phones that are now making their way into Western products, allowing people to switch seamlessly between work and home accounts. Asia, in particular, will provide a huge new market: by 2030, it will be home to 60 per cent of the global middle class.⁹¹ But it will also prove a hotbed of innovation: China is already churning out more PhDs than America, and its own Googles and Facebooks and Amazons and Ubers are starting to stretch out their tendrils overseas.

In this chapter, we have seen how the great acceleration is being driven forward by a powerful alliance between hardware and software – between technology and ideology. Day by day, year by year, this process is reaching further into our lives, as the billionaires and would-be billionaires of Silicon Valley widen their ambitions. Space travel, education, energy, agriculture, transportation – all these sectors and more are in their sights. In their quest to disrupt the world, they and their cousins around the world are aided and abetted by the availability of raw computing power on a scale unimaginable a few decades ago. Yet the real reason this process of acceleration has such momentum, as we shall now see, is that it is exactly what our brains have programmed us to want.

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