THE GREAT ACCELERATION

HOW THE WORLD IS GETTING FASTER, *FASTER*

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

CONTENTS

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 th[at] 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 inn[er] 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 leg[s] will remain in perfect synch.

The reason we fall into step is due to a phenomenon called entrainment, in which living creature[s'] natural rhythms unconsciously adjust to each other. It's the same strange force that sees swallow[s] wheel and dive in unison, or brings together the menstrual cycles of women who share the same hous[e]. And when it comes to walking, it would be natural to think that this collective pace is ruled by som[e] 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 cit[y,] the faster people move: in the 19th century it was said that the average New Yorker 'always walks a[s] if he has a good dinner before him and a bailiff behind him'.[2] Today, a child brought up in a city wi[ll] race around a supermarket more than twice as fast as his cousin from a small town, who will spend f[ar] 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 h[as] 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 teachin[g] sabbatical in Brazil, a Californian psychology professor called Robert Levine found his America[n] obsession with punctuality utterly unsuited to the laid-back local norms. He decided to focus h[is] 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[ic] the culture, the faster the country's speed. Western Europe and Japan hurried and scurried, whil[e] Africa and Latin America dawdled and lazed. Within America, the East Coast was the fastes[t,] 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 th[e] 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. Lik[e] Levine's team a decade earlier, they staked out a 60-foot strip of unobstructed pavement in the hea[rt] 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 ce[nt] less time. In particular, the cities of Asia had caught the speed bug. Levine had been surprised tha[t]

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

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What single quality best defines how our society is changing? Is it that life is becoming fairer, [or] more equal, or more prosperous? No: as the experiment above suggests, it is that life is getting faste[r]. This is something many of us will have experienced for ourselves. This book, for example, was bo[rn] 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 cover[ed], were subject to sudden and convulsive change. New trends, ideas and crises appeared to be emergi[ng] 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 are[a], technology was making life quicker, more convenient, more friction-free – not least as more and mo[re] of it moved online. The debates people were having about the internet's effects on our brains, or o[ur] rapacious use of the planet's resources, were all part of the same basic phenomenon: what I call t[he] great acceleration.

Often, this acceleration feels like something we cannot control. Where our grandfathers saunter[ed] and our fathers strode, we find ourselves scampering about our daily tasks. Time-use studies hav[e] shown how work increasingly follows us from the office to the home, with everyone tethered to t[he] office by their smartphone.[7] And that same phenomenon of entrainment – the shared sense of rhyth[m] that sees us all marching in lockstep – means that we instinctively, unconsciously, push ourselves t[o] 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 ha[d] 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] Bombard[ed] by electronic and bureaucratic stimuli, we are pushed into a near-perpetual state of fight or flight. W[e] are apparently so stressed that the very gender balance of our society has shifted, with more gir[ls] 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 a[n] addiction. People are out of control in their push to do more, to always be on and available, and nev[er] 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,' s[he] laments, 'their relationship to technology and speed has become more important than, or eve[n] replaced, human relationships.'[12]

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

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 the on notice if it takes more than two.[16] In a survey carried out by the psychologist Philip Zimbard 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 wi not find comfortable. The process of disruption and automation – the shift from manual labour computer power – is throwing industry after industry into turmoil, as first the working and now th middle classes discover that computers can do their jobs faster and cheaper than they can themselve John Maynard Keynes called this 'technological unemployment' – and the faster technology move 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 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 human hard-wired to crave novelty, speed and convenience. Despite all the stress, people from faster place are far happier with their lives. As Levine found, 'faster overall tempos are highly related to country's economic well-being on every level: to the economic health of the country as a whole . . . the economic well-being actually experienced by the average citizen . . . and to how well people a able to fulfil their minimum needs.'[19] In other words, those people scurrying through the world 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 positiv argument – that in the words of Adrian Wooldridge, management columnist on *the Economist*, 'th storms of creative destruction are blowing us to a better place'.[20] Acceleration has brought prosperit on a scale unimagined even by the optimists. In 2003, in a paper that coined the term BRIC (Braz Russia, India and China) for the rising global players of the future, Jim O'Neill and his colleagues Goldman Sachs ventured some predictions about how quickly power and wealth would shift fro West to East. They imagined that by 2008, China's GDP could be as high as $2.8 trillion; in fact stood at more than $4.3 trillion. Brazil's GDP, similarly, was two and a half times greater tha projected.[21] This ongoing process of economic acceleration has lifted billions of people out poverty.

Writing in the *New Yorker* in 2011, Adam Gopnik claimed that commentators on technology fa 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 an 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 expressin their support for UKIP or the Tea Party. The Ever-Wasers, meanwhile, sagely observe tha technological acceleration has been a fact of life since the invention of the Bessemer engine, and th human reactions to it have been remarkably consistent throughout – namely, embracing every possib 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, bee going on for as long as life itself has been speeding up. Anyone who worries about families studyin their iPads or the television rather than talking to each other should consult the edition of the *Journ of Education* from 1907 which complained about 'our modern family gathering, silent around the fir

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 tho[se] 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 th[e] British-American Claim Agency of the late 1880s, which informed gullible Yankees that they ha[d] 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 postcar[d,] 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] field after field of human activity, the pace of change is accelerating. If we get dazzled by th[e] potential of technology in the way that some in Silicon Valley have, we will be blind to the very re[al] dangers that a lightning-quick economy and society bring. But similarly, if we focus solely on th[e] negative, we will miss the glorious possibilities that await.

Only the most curmudgeonly of traditionalists could fail to feel a twinge of excitement about som[e] of the technologies that seem likely to be with us sooner rather than later: an 'internet of things' buil[t] of 100 trillion sensors; self-driving cars; photo-realistic virtual reality; universal 3D printing; medic[al] nanobots able to diagnose and cure diseases without our even knowing. Conversely, only the blithe[st] of Panglossians could be sanguine about the ever-expanding range of ways in which the human rac[e] might imminently doom itself, from our rapacious strip-mining of the planet's resources to th[e] 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 i[ts] 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 speedi[ng] up of life – such as James Gleick in *Faster*[27] – this is the first book to draw together the threads, a[nd] 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 eve[r] greater speed is baked into modern business. The second chapter examines the impact of this on o[ur] brains and bodies, and the third its effects on our social and romantic lives – how we live, work a[nd] 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 [to] the financial markets and the global system of trade and logistics, while Chapter 9 examines the effe[ct] of all this rapacious activity on the natural world. The conclusion explores where this process ma[y] 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. W[e] are geared to pay more attention to the one day on which the stock market drops by 10 per cent th[an] the long months in which it ticks slowly up. We worry about the impact of mobile phones o[n] 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 a[n] expanding market for products and services that help us step out of the currents and catch our breat[h,] such as box sets, long reads or spa treatments. What is suffering instead is what sits between fast a[nd]

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

Third, this polarisation between fast and slow is being mirrored by a polarisation between large an small. Whether it is in the technology industry or publishing or popular culture, the great acceleratio has created a horde of buzzing, disruptive innovators. But it has also created and rewarded a fe giants who have mastered the business of speed, flourishing and dominating the same ecosystem those of small, nimble operators. This is a world not of hyenas, but of lions and flies, with those wl 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 predictabilit An accelerated world is an exciting place, but is also one characterised, as Karl Marx put it in th *Communist Manifesto*, by 'the constant revolutionising of production, uninterrupted disturbance of social conditions [and] ever-lasting uncertainty and agitation'.[28]

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

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

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

In the aggregate, the great acceleration is an extraordinarily good thing for humanity. But i benefits are distributed unevenly, and its dangers are almost as great as its opportunities. That is wl understanding how to blunt the worst consequences of change and embrace its best effects has nev been more important. We cannot stop this acceleration: what we can do instead is ensure that i enormous potential is applied where it best serves our needs. We have it in our hands to build tl greatest and most prosperous society in history, or to wreck ourselves through selfishness and gree Which path we take will be determined by whether we become the slaves of the great acceleration, 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's 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 relied 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 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 on a single chip had been doubling every two years (or every year, in the original formulation), an would continue to do so. For the computing industry, this became something of a self-fulfillin prophecy: over the past two decades, global computing power has grown by 58 per cent a year.[3] Th is why a PC today costs a sixth of the amount it did in 1981, but is 500 times more powerful – and wh 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 ha shown that computing power, data transmission, memory storage – pretty much any technologic metric – is subject to what he calls the 'law of accelerating returns', under which its growth is n linear, but exponential.[5] Imagine, he says, that the emperor of China wishes to reward the man wh came up with the game of chess. The wily inventor asks for an exponential reward: one grain of ric on the first square of his chessboard, two on the second, four on the third, eight on the fourth and s on. As the sacks are brought in, the emperor thinks he is getting the better of the bargain. But slowl the exponential curve takes effect. By the final square, the emperor's generosity will cost him 2 grains of rice, or 9,223,372,036,854,775,808. At a rough approximation, that works out to 250 billi 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 a if you kneel to plant the seed of a tree,' says the technologist Jaron Lanier, 'and it grows so fast that 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 amon scientists as the home of the Large Hadron Collider, and among techies as the place where Ti Berners-Lee created the World Wide Web (if you look hard enough, you will find a plaqu commemorating the achievement outside his old office, opposite an outdated collage of Dilbe cartoons).

The reason Berners-Lee was at CERN in the first place was to facilitate information-sharing – n least between scientists in different parts of the world. In those days, that was achieved via a link pa funded by IBM, running at a then-astonishing 1.5 megabits per second. Fast-forward 20 years, and th 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 partic collider designed to mimic conditions a millionth of a second after the Big Bang, beams of particl race along a 17-mile circular track at 99.9999991 per cent of the speed of light. When they collide, a billion kilometres per hour, they throw off vast amounts of data – too much for any on supercomputer. Instead, the work is divided between thousands of machines in hundreds of da 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 wi be a million times greater. Sooner than we realise, we will all have access to practically infinite dat 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 behi the acceleration of society. And the possibilities it offers are dizzying. Within five or six years, Int plans to shrink its fastest processors from 14 nanometres down to 5, a scale so tiny that quantu physics – notably, our inability to pin down both the exact state and the position of subatom particles – starts to become an actual design factor.[8] Beyond that lies the point where you ca

construct processors – or pretty much anything else – molecule by molecule. That has the potential revolutionise not just computing, but everything from construction to medicine to energy 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 n sufficient. There have, after all, been convulsive episodes of technology-driven change in the pas mass electrification, say, or the reshaping of cities around the car in the post-war years. What mak things different now?

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

There have always been two basic recipes for innovation: making an incremental improvement to product, service or process, or coming up with something brand-new. This is the distinction made 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 California.[10] Yet by the time of Lincoln's inaugural address in March 1861, that had been cut to seve days and 17 hours.[11] This was partly thanks to better roads and railways – themselves a huge engine social and economic change – but also to the efforts of the newly formed Pony Express, which base its business model on detaching its horses from cumbersome stagecoaches and flogging the po 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 i young riders would pass through. But within just two years it had folded, victim of the mo 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 servic described as a 'new and higher power': the telegraph.[13] This was an explosive, disruptive a enormously influential technology – what Tom Standage of the *Economist* calls 'the Victoria internet'.[14] At the start of 1846 there was only one experimental 40-mile line, laid betwee Washington and Baltimore by Samuel Morse.[15] By 1850, 12,000 miles had been laid.[16] By 1858, th first transatlantic cable had entered service, to prodigious rejoicing. ''Tis done!' reported on anonymous poet. 'The angry sea consents, / the nations stand no more apart; / With clasped hands th continents / Feel throbbings of each other's hearts.'[17] So vigorous were the celebrations that City Ha 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 offere greater speed or convenience. The first postcard was sent in 1871; by 1873, more than 72 million ha been dispatched.[19] In 1896, the first motion pictures were projected for the viewing public in a Ne York music hall; by 1910, despite the best efforts of Thomas Edison's patent lawyers, the nascer 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 penny-farthings is a shorthand for sepia-toned gentility. Yet the bicycle was, in its day, a piece 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 countryside 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 firm 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 leaders

weren't worried: the mini-mills could only make the worst quality of steel, and abandoning that high[ly] competitive market would raise their profit margins and allow them to concentrate on higher-te[ch] products. Then the mini-mills got good enough to make the next-highest grade of steel. Again, the b[ig] firms abandoned this tough, unrewarding market segment, and watched their margins and share pric[es] 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 wherev[er] they appear, no matter how small. But Christensen's message was to disrupt yourself, lest you b[e] disrupted. And he could point to an elephants' graveyard of former market leaders to drive home h[is] point: for the steel mills, read Kodak, or Borders, or Ashton-Tate (once the third-largest software fir[m] 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 sinki[ng] beneath them if they are not constantly willing to reinvent what they do. And half-hearted efforts a[re] 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 t[he] Fortune 500 list every year. Between 1982 and 2006, the figure had risen to 40.[31] A similar stud[y] found that a firm was falling out of the rival S&P 500 index every two weeks.[32] In just the last fe[w] years, companies such as Nokia, BlackBerry and Zynga have gone from world-beaters to has-bee[ns] 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 fir[m] 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, tho[se] companies that self-identified as 'faster' had 40 per cent higher sales growth and 52 per cent high[er] operating profit.[34]

The result is a mindset in which permanent revolution is not just a business model, but almost t[he] only one that makes sense. To stop their firms growing fat, old and lazy, or being rendered an antiqu[e] by some bright spark in a Californian bedroom, incumbents are adopting the ethos of a start-up, tryi[ng] to disrupt themselves before they are disrupted in turn. Gary Hamel wrote in the *Harvard Busine[ss] Review* back in 1999: 'Face it: out there in some garage an entrepreneur is forging a bullet with yo[ur] 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 [has] happened because companies often don't have a choice. And the most obvious reason for this is t[he] opportunities opened up by the acceleration of technology.

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

For most people, that would have been the end of it: perhaps, at most, they would have resolv[ed]

either to return their videos on time in future, or to boycott the vendor. Instead, the aggrieved Ree~~d~~ Hastings decided to build a new company, one that offered unlimited DVDs, delivered by post, wi~~th~~ no late fees. (As it happens, Hastings's co-founder and others dispute this version of events, but it ha~~s~~ 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 entire~~ly~~ original, and it certainly wasn't as speedy as walking into Blockbuster. But what marked it out wa~~s~~ both its convenience (you didn't have to walk anywhere, simply queue up your film orders online) an~~d~~ its determination to innovate. In 2006 it offered $1 million to anyone who could improve its engi~~ne~~ for recommending films to users by 10 per cent – a challenge accepted by teams of comput~~er~~ scientists from around the world.[38] Next, and more momentously, it decided to switch its busine~~ss~~ model from the physical to the virtual, by streaming or downloading films directly into its user~~s'~~ bedrooms or living rooms.

The results were astonishing. Digital video rapidly came to dominate the home video marke~~t,~~ 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 futu~~re~~ expansion, which includes making its own movies and TV shows starring some of the biggest nam~~es~~ in Hollywood.

This success was emblematic of the modern business environment in more ways than one. Firs~~t,~~ Hastings benefited from the accelerating pace of technological progress: the fact that it sudden~~ly~~ became technically feasible to beam movies to our laptops rather than etching them on to magnet~~ic~~ tape or plastic discs. Second, he profited from the general shift from hardware to software – the fa~~ct~~ 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~~ir~~ 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 hav~~e~~ spent roughly $50,000 to purchase or rent the necessary recording equipment to make an albu~~m.~~ Today, a band simply needs a laptop computer and some additional pieces of hardware and softwar~~e,~~ 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, ~~as~~ the technology journalist David Kirkpatrick put it in his history of Facebook, 'servers and salaries'.~~[40]~~ 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, f~~or~~ example, has been Amazon Web Services, a cloud-computing platform built by Amazon that enable~~s~~ 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 you~~r~~ financial reporting, your HR systems and much else. If your start-up needs legal services, for exampl~~e,~~ you can use software called EDiscovery. In 2011, it analysed 1.5 million legal documents fo~~r~~ BlackStone Discovery of Palo Alto for less than $100,000 – a task which, done by humans, would hav~~e~~ 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 sma~~ll~~ teams of people with big ideas. The latest craze is for the 'lean' start-up – start small, create ~~a~~

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

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

Such venture capitalists are, in fact, another engine of acceleration. As Tad Friend put it in a *Ne Yorker* profile of Andreesen, 'venture speeds the cycle of American impatience: what exists is bad an what replaces it is good – until the new thing itself must be supplanted'.[44] The more ambitious yo chosen target, the greater the scale of the market opportunity: hence Uber's plans to revolutionise n just taxi rides but the very concept of car ownership, or the various start-ups and laboratories workin to reinvent agriculture or conquer mortality itself. As Andreesen told Friend, 'we're not fundin Mother Teresa. We're funding imperial, will-to-power people who want to crush their competitio 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* h called 'a Cambrian moment' (a reference to the explosion of multicellular life around 540 millio years ago). 'Digital start-ups,' it said, 'are bubbling up in an astonishing variety of services an products, penetrating every nook and cranny of the economy.'[46] The acceleration is not limited software, either: new technologies such as 3D printing enable companies making actual goods 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 busine models both the norm and the expectation – whether it be start-ups attempting to eat the incumbent lunch, or incumbents desperately attempting to fend them off. And, given how thin many companie profit margins are, in an ultra-competitive global market it takes only a little bit of disruption – t growth of Airbnb as a rival to hotels, for example – to throw things into chaos. Or, as Schumpet 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 bree an ethos that holds that it is better to act first and ask permission (or forgiveness) later. Better, f example, to release a project mashed together in a week of caffeine-fuelled coding than a mo polished product that fails to catch the Zeitgeist. Hence Facebook's all-night 'hackathons', or th 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 aft~~redesign on your users. Sometimes you'll get it wrong – but that's tough luck. As Reid Hoffman, th~~ billionaire founder of the professional social network LinkedIn and an early investor in Facebook, ha said: 'If you're not embarrassed by your first version, you waited too long to ship it.'[48] (Hoffman also the author of the perfect image to sum up the new-technology business model: 'You jump off 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. Dougla Coupland, author of *Microserfs*, recently observed: 'It feels wistful to imagine a time when peop didn't go about their daily routine with the assumption that at any moment another massive med technology will be dumped on us by some geek in California.'[50] The same applies to those bein competed out of business: one San Francisco driver complained during the middle of the price wa between rival ride-hailing apps Uber and Lyft: 'I don't want to be the butt-end of a [venture capitalis fantasy, I want to make a living.'[51]

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

Uber and Airbnb, for example, have succeeded not simply because of venture capitalist suppor They are successful because enough of us like what they offer. It may take plenty of faile experiments to figure out exactly what we're after – but the combination of faster computers an better data means that this kind of efficient response to user feedback allows such firms to impro 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 efficienc out of its operations. This process was kick-started in the 1890s when the first time-and-motio expert, Frederick Winslow Taylor, set to work at the Midvale Steel plant in Philadelphia, carrying o laborious tests to calculate how long it took workers to do everything from open a drawer to pick up pencil.[53] The equation was simple: greater speed and efficiency equals fewer staff and high productivity.

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

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

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

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

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

Today, Google is near-evangelical about the virtues of speed. A campaign called 'Eve[ry] Millisecond Counts' urged its clients to follow its lead and streamline their homepages – with thos[e] burdening the customer with slow load times getting penalised in the company's search rankings.[57] One of the firm's public 'guiding principles' is that 'fast is better than slow': 'We may be the onl[y] 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 i[ts] results had 'a measurable impact on the number of searches per user'.[59] The longer the delays, th[e] fewer the searches. According to Vic Gundotra, vice-president of engineering, 'Our internal da[ta] 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 displayi[ng] Google results slashed revenue from that page by 20 per cent.[61] And more recently, a senior executiv[e] at the search giant confided that improving loading times by as little as 400 milliseconds raised traff[ic] by 0.5 per cent.[62]

In other words, it's not just that we demand speed: we demand ever greater speed. This is wh[y] Google now finds search results for you while you are still entering your query, or Apple pops u[p] suggested words as you enter your text messages. It is only by being 'faster than the speed of typ[ing]' 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 soci[al] networking site, essentially to meet girls. There have been a few such sites before, but his is differe[nt]. For a start, you have to use your real name, forcing a certain level of accountability and maturity up[on] the users. There is also a 'killer app' – the ability to easily upload photographs of yourself from yo[ur] newfangled digital camera.

The site goes live in March 2003; within six months, 3 million users have flocked to it. Its found[er] has, in effect, discovered a way to speed up the process of friendship, and has become a superstar [in] 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 ha[d] everything that Zuckerberg's creation later would: the business model, the backing, the audience. S[o]

why haven't you heard of it?

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

So when, in February 2004, Mark Zuckerberg launched The Facebook (as it then was), his mo important asset was not his skill at coding, or his Harvard connections, but – as David Kirkpatric 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. H scorned rivals that were, in his words, 'too useful', that just did 'too much stuff'.[67] One of his bigge arguments with his initial business partner Eduardo Saverin came when Saverin wanted to add extra click to the process of requesting a new friend, in order to shove another advert in front of th user. For Zuckerberg, this was 'apostasy'.[68]

Everything Facebook has learned since bears out the wisdom of this approach. When it first broug in the News Feed, allowing you to monitor your friends' updates in real time, the main protest grou attracted 700,000 members within three days. Zuckerberg apologised, and tweaked the privac settings. But the News Feed stayed, for one simple reason. Before the change, users were looking at 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, th explicit rationale was 'to increase the velocity of information flowing between users'.[70] And whe Facebook expanded its Messages software to bring together its users' email accounts, text message and chats, it was, said Zuckerberg, because its teenage users were abandoning formal emails – wi their cumbersome need for subject lines and proper spelling – for even-more-instant messages, just 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 v crave – and demand. We will explore the neurological basis for this in the next chapter, but for no 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 th music industry, and the software business too. It is certainly commonplace: in 2011, the British mus industry estimated that more than three-quarters of the songs downloaded in the UK were illegal obtained, with twice the proportion of 16- to 54-year-olds stealing music as regularly buying it (29 p cent as against 14 per cent).[72] In 2009/10, as the Kindle and its cousins entered the mainstream, the was a 50 per cent rise in Google searches for unlicensed copies of books.[73] The Business Softwa Alliance once calculated that P2P traffic – the transfer of files, usually illegal ones, directly betwee 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 copi 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, technology? Or is it a problem of speed? It turns out, it is very definitely the last of these. In Ju 2015, an exhaustive UK government report found that three in five internet users have downloaded streamed films, games, books, music, TV shows or software – but only one in five had done illegally, and of those a significant proportion said they only did it because the content they wante was not available quickly or legally.[76] In the US, the proportion of people using illegal file-shari 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, entertainme[...] and software industries at quite the rate that was predicted? In a word, speed. People downloade[...] music illegally because it was the simplest and speediest way to do it. Once iTunes came along, [...] became far easier to play by the rules – and even more so once iTunes was itself disrupted by the eve[...] 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 it[...] security. But the speed and convenience of tapping on a symbol and watching your app download hav[...] 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 servic[...] that offer them what they want, when they want it, and punish those that don't or can't. This doesn[...] just apply to start-ups: what are customer reviews on TripAdvisor but a powerful spur for hotels [...] 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, an[...] customers pushing them on further – would seem to be a recipe for perfect competition. Nowhe[...] should that be more apparent than in the technology sector, which is where many of the effects of t[...] great acceleration not only originate but also are most apparent. If the fast is indeed eating the slo[...] 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 – an[...] 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; the[...] larger size allows them to drive down prices for their customers; and network effects mean that, [...] their products have a social component, they become more useful the more people are using the[...] (think Facebook or Twitter or even TripAdvisor). This is not just a Silicon Valley phenomenon, eithe[...] the momentum towards gigantism is everywhere in the modern market, propelled (as we shall s[...] later) by the financial markets. Investors demand that companies hit endless short-term growth an[...] 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 car[...] until they were disrupted by Tesla. But there is something qualitatively different. For all the reason[...] mentioned above, the new breed of monopolists is devoted to sustaining innovation, not least sinc[...] many of them emerged from acceleration and are committed to pushing it on. Indeed, they frequent[...] compete to host their own innovative parasites: companies or individuals making games or goods [...] 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 employe[...] not coincidentally, of one of the computer-driven stock-trading firms whose work we shall examine [...] 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[ly] unwilling to watch Amazon succumb to any kind of institutional torpor, and he generated a nonsto[p] flood of ideas on how to improve the experience of the website, make it more compelling f[or] 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 ge[ts] bigger, it is able to extract lower prices from its suppliers. It feeds these back to its custome[rs,] 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 o[ut] 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.co[m,] into its arms.[80] In its original business of books, meanwhile, the lawyers had to insist that the 'Gazel[le] 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 innar[ds] 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 Marketplac[e,] which permits third parties to sell goods on its site, now makes up 40 per cent of all its retail sale[s,] shifting two billion units a year.[82] That's good for Jeff Bezos, and good for the sellers – but better f[or] Bezos, given that Amazon's bots drive the prices of its own products to the lowest point possibl[e,] forcing others to match them.

As with Amazon's logistical services, in which it lets others use its warehouses, or its clou[d] computing business, the effect is to help others grow faster by carrying out vital functions mo[re] cheaply than they ever could – as long as they accept their place in Amazon's food chain. If I wante[d] to start a delivery business, for example, there is absolutely no way I could compete with the Amazo[n] 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 thes[e] problems, in the process taking the average 'click to ship' time down from three days to four hour[s] inside a year (the standard for the rest of the industry at the time was a comparatively sluggish 1[2] hours).[83] A further advantage is that Amazon is not just running these platforms, but using them a[s] well: so if it sees rising sales in a particular sector in the Marketplace, or notes an upsurge in deman[d] for a particular brand of T-shirt, it can position its own buyers to leap on the trend before anyone els[e] 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 it[s] 'Content ID' algorithm to identify copyrighted content and stave off crippling lawsuits, YouTub[e] 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[ir] advantages, they constantly feel terrified of being displaced as the technological wheel turns. Indee[d,] 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 th[at]

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

Facebook's endless redesigns, for example, spring in part from its executives' (largely justifie conviction that they are the helpless slaves of its customers, the obedient instruments of their eve greater craving for information. 'Mark's view,' David Kirkpatrick was told by Adam D'Angelo, or of Zuckerberg's oldest friends, 'is that Facebook had better not resist the trends of the world or el it'll become obsolete. Information is moving faster. That's just how the world is going to work in t future as a consequence of technology, regardless of what Facebook does.'[85] Bezos, too, on proclaimed that 'Amazon isn't happening to the book business. The future is happening to the bo 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 eve increasing bulk, Facebook and Google have clung to their start-up mentality: keeping staff levels lo and project teams tiny, and putting a premium on creative thinking. Both are also willing to disru themselves before others do it for them. When Google created a mobile-first messaging app call 'Inbox', the explicit goal was to blow its own Gmail out of the water; Facebook, virtual simultaneously, launched its own app called 'Rooms' to provide a faster and better version of its ow core services. Larry Page has taken to using his mobile to do all his work, rather than a deskt computer: if smartphones are how billions of potential customers in Asia and Africa are accessing t 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 ba In 2011, Hastings announced – to general consternation – that the online portion of Netflix was bei separated from the DVD-by-mail business (still the major profit engine), with the latter renam 'Quickster'. But the move, allied to a hiking up of subscription fees, resulted in the loss of 800,0 customers; within a few weeks, Hastings was forced to announce that it had all been a very stup idea, and things would go back to normal.[88]

What lay behind such an act of self-immolation? The idea, of which Christensen would approv was to devote his and his best minds' full attention to the online arena, where the threat of competiti and disruption was greatest. As Farhad Manjoo wrote, '[Netflix's] all-you-can-eat business mod 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 the logic behind the mail/streaming separation. Hastings would prefer to kill his own golden goo 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 conquer the world. Indeed, this is the most obvious safeguard against any particular monopolist usin its position to slow down the pace of change: the fact that such a monopoly will tend to be limit either to one particular area or to one particular iteration of the technology we use, and thus vulnerab to disruption from outside.

It is a truism, for example, to say that we now have a global marketplace, with more eag consumers and more dedicated entrepreneurs than at any point in human history. But that does n make it any less powerful a phenomenon. Today's executives know that they have customers – an rivals – everywhere from Shanghai to Saratoga to São Paulo. They also know that, in order outcompete them, you need to move faster than them. The cumulative effect is to further accelera

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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