Contents

Index

About the Author

Roman Krznaric is a social philosopher whose books, including *Empathy*, *The Wonderbox* and *How to Find Fulfilling Work*, have been published in more than twenty languages. He is the founder of the world's first Empathy Museum and of the digital Empathy Library. He is also a founding faculty member of The School of Life and on the faculty of Year Here.

Roman has been named by the Observer as one of Britain's leading popular philosophers. His writings have been widely influential amongst political and ecological campaigners, education reformers, social entrepreneurs and designers. He is an acclaimed public speaker, and his talks and workshops have taken him from a London prison to Google's headquarters in California.

After growing up in Sydney and Hong Kong, he studied at the universities of Oxford, London and Essex, where he gained his PhD in political sociology. Roman has worked as an academic, a gardener and a human rights campaigner. He is also a fanatical real tennis player and has a passion for making furniture.

Praise for *The Good Ancestor*

'A great antidote to the short-term thinking that comes easily to us all. If you want to be a good ancestor, start by reading this book'
Nigel Warburton, author of *A Little History of Philosophy*

'I judge a book's usefulness by how many pages I'm compelled to dog-ear and underline. This book on the pragmatics of long-term thinking earned 50-plus dog-ears'
Stewart Brand, creator of the *Whole Earth Catalog* and co-founder of the Long Now Foundation

'An important and fascinating book that asks whether we've got what it takes to become citizens rather than consumers and create an ecological civilisation. *The Good Ancestor* is a triumph'
Sir Tim Smit, co-founder of the Eden Project

'How timely can a book be? Roman Krznaric fizzes with ideas about how we tackle that cuckoo in the nest, short-term thinking. We need to think today for tomorrow, to give future generations their rightful seat at the table'
Lord John Bird MBE, founder of *The Big Issue*

'Krznaric's seamless and magical prose delights on every page. Let's engrave his "six ways to think long" across the gateway to every Parliament in the world'
Professor Tim Jackson, author of *Prosperity Without Growth*

'There could be few more urgent tasks for any thinking person alive today than encountering this book. Read it: with slow deliberate care ...'
Professor Rupert Read, UEA, author of *This Civilisation Is Finished* and Extinction Rebellion Political Liaison and Spokesperson

'From the seventh-generation thinking of Native American tribes to legally empowered guardians of the future and citizens'

assemblies, Krznaric explores a wealth of ways we can become good ancestors. For anyone who is interested in how we can get today's society to leave the world better than they found it – this is your guide'
Sophie Howe, Future Generations Commissioner for Wales

'Krznaric asks the defining moral question for our age: how will future generations look back on our legacy? A superb intellectual history and razor-sharp analysis of contemporary politics, this book will change how you think about the world and is a call to action. Read it. You owe it to your children's children'
Kevin Watkins, Chief Executive of Save the Children

'In this persuasive book, one of our leading thinkers Roman Krznaric expands his ground-breaking work on empathy to argue that our only hope of survival is to develop deep empathy for future generations across time and space'
Professor Morten Kringelbach, neuroscientist, Universities of Oxford and Aarhus, Denmark

'With a dazzling range of sources, zinging with ideas, stories and jaw-dropping graphics, *The Good Ancestor* is packed with information and insight. Every school should have a copy, with its maps and plans on every classroom wall'
Michael Wood, historian, broadcaster and author of *The Story of China*

'A fascinating and inspiring exploration of one of the great relationship questions of the 21st century: how can we extend our circle of care to future generations?'
John Gray, *New York Times* bestselling author of *Men Are from Mars, Women Are from Venus*

'Roman Krznaric passionately argues that thinking long term would bring untold benefits and may very well be vital to our survival as a species. Lose yourself in these pages, expand your time horizons, and reimagine your relationship to time, to the future, to activism'

Rob Hopkins, founder of the Transition Town movement and author of *From What Is to What If*

The most important question we must ask
ourselves is, ‘Are we being good ancestors?’

Jonas Salk

it’s 3:23 in the morning
and I can’t sleep
because my great great grandchildren
ask me in dreams
what did you do while the earth was
unravelling?

Drew Dellinger

Preface

Coronavirus (COVID-19) spread worldwide just as this book was going to press. The pandemic has understandably focused our attention on the here and now, with families, communities, businesses and governments acting to confront the fierce urgency of the crisis. In the midst of such an immediate threat, what insights does long-term thinking offer?

Most obviously, those countries that had already made long-term preparations for possible pandemics have so far been able to deal with the virus most effectively: while Taiwan had virus testing and tracing mechanisms in place following its experience of the 2003 SARS outbreak, the US response was hampered by having disbanded the National Security Council's pandemic unit in 2018. At the same time, the catastrophic impacts of coronavirus are a stark reminder that we should be thinking, planning and budgeting for multiple risks that lie on the horizon – not only the threat of further pandemics, but the climate crisis and unchecked technological developments.

Humanity's response to the virus will clearly have long-term consequences that ripple into the decades ahead. Many governments may try to cling on to the emergency powers they have granted themselves – such as heightened citizen surveillance – leaving an authoritarian residue that undermines new democratic possibilities. On the other hand, the rupture that the pandemic has caused may open space for a fundamental rethink of our politics, economies and lifestyles. Just as pioneering long-term institutions such as welfare states and the World Health Organization emerged from the ashes of the Second World War, so too could coronavirus trigger the long-term thinking now needed to challenge the dangers of short-termism, and build resilience in the face of a very uncertain future.

By making wise – and long – choices at this time of crisis, we could well become the good ancestors that future generations deserve.

Oxford, March 2020

Part One

THE TUG OF WAR FOR TIME

1

How Can We Be Good Ancestors?

We are the inheritors of gifts from the past. Consider the immense legacy left by our ancestors: those who sowed the first seeds in Mesopotamia 10,000 years ago, who cleared the land, built the waterways and founded the cities where we now live, who made the scientific discoveries, won the political struggles and created the great works of art that have been passed down to us. We seldom stop to think about how they have transformed our lives. Most of their names have been forgotten by history, but among those who are remembered is the medical researcher Jonas Salk.

In 1955, after nearly a decade of painstaking experiments, Salk and his team developed the first successful and safe polio vaccine. It was an extraordinary breakthrough; at the time, polio paralysed or killed over half a million people worldwide each year. Salk was immediately hailed as a miracle worker. But he was not interested in fame and fortune – he never sought to have the vaccine patented. His ambition was to 'be of some help to humankind' and to leave a positive legacy for future generations. There's no doubt he succeeded.

In later years, Salk expressed his philosophy of life in a single question: 'Are we being good ancestors?'[1] He believed that just as we have inherited so many riches from the past, we must also pass them on to our descendants. He was convinced that in order to do so – and to confront global crises such as humanity's destruction of the natural world and the threat of nuclear war – we needed a radical shift in our temporal perspective towards one far more focused on long-term thinking and the consequences of our actions beyond our own lifetimes. Rather than thinking on a scale of seconds, days and months, we should extend our time horizons

to encompass decades, centuries and millennia. Only then would we be able to truly respect and honour the generations to come.

Salk's question may turn out to be his greatest contribution to history. Rendered in a more active form – 'How can we be good ancestors?' – I consider it the most important question of our time, and one that offers hope for the evolution of human civilisation. The challenge of answering it has inspired this book, but also haunts its pages. It calls on us to consider how we will be judged by future generations, and whether we will leave a legacy that benefits or cripples them. The old biblical aspiration to be a Good Samaritan is no longer enough. It's time for a twenty-first-century update: to be a Good Ancestor.

The Future Has Been Colonised

Becoming a good ancestor is a formidable task. Our chances of doing so will be determined by the outcome of a struggle for the human mind currently taking place on a global scale between the opposing forces of short-term and long-term thinking.

At this moment in history the dominant force is clear: we live in an age of pathological short-termism. Politicians can barely see beyond the next election or the latest opinion poll or tweet. Businesses are slaves to the next quarterly report and the constant demand to ratchet up shareholder value. Markets spike then crash in speculative bubbles driven by millisecond-speed algorithms. Nations bicker around international conference tables, focused on their near-term interests, while the planet burns and species disappear. Our culture of instant gratification makes us overdose on fast food, rapid-fire texting and the 'Buy Now' button. 'The great irony of our time,' writes the anthropologist Mary Catherine Bateson, 'is that even as we are living longer, we are thinking shorter.'[2] This is the age of the tyranny of the now.

Short-term thinking is hardly a new phenomenon. History is littered with examples, from Japan's reckless destruction of its old-growth forests in the seventeenth century to the runaway speculation that led to the Wall Street Crash in 1929. Nor is it always a bad thing: just as a parent might suddenly need to rush an injured child to hospital, a government needs to respond rapidly and with agility to crises like an earthquake or epidemic. But scan

the daily news and you will see multiple instances of harmful short-termism.[3] Governments preferring the quick fix of putting more criminals behind bars rather than dealing with the deeper social and economic causes of crime. Or continuing to subsidise the coal industry instead of supporting the transition to renewable energy. Or bailing out insolvent banks after a crash rather than restructuring the financial system. Or failing to invest in preventative health care, child poverty and public housing. Or – the list goes on and on.

The dangers of short-termism go far beyond these areas of public policy and have now brought us to a crisis point. This is due, firstly, to the growing prospect of what is known as 'existential risk', which typically refers to low-probability but high-impact events that could be caused by new technologies. High on the list are threats from artificial intelligence systems, such as lethal autonomous weapons that cannot be controlled by their human makers. Other possibilities include genetically engineered pandemics or a nuclear war triggered by a rogue state in an era of increasing geopolitical instability. Risk scholar Nick Bostrom is particularly concerned about the future impact of molecular nanotechnology and worries that terrorists might get hold of self-replicating, bacterium-scale nanobots that get out of control and poison the atmosphere. In the face of these threats, many existential risk experts believe that there is around a one-in-six chance that humanity will not make it to the end of the century without catastrophic loss of life.[4]

Just as serious is the possibility of civilisational breakdown due to our relentless destruction of the ecological systems on which our well-being – and life itself – depends. As we keep thoughtlessly pumping out fossil fuels, poisoning our oceans and destroying species at a rate that amounts to a 'sixth extinction', the prospect of devastating impacts gets ever closer. In our hyper-networked age, this threat now exists on a worldwide scale: we have no Planet B to run to. According to environmental historian Jared Diamond, such ecological destruction has been at the root of civilisational collapse throughout human history. Its major underlying cause, he argues, is an overdose of 'short-term decision-making' coupled with an absence of 'courageous long-term thinking'.[5] We have been warned.

These challenges confront us with the inescapable paradox that the need for long-term thinking is a matter of utmost urgency, requiring immediate action in the present. 'Right now we are facing a man-made disaster of global scale, our greatest threat in thousands of years: climate change,' David Attenborough told world leaders at UN climate talks in 2018. 'If we don't take action, the collapse of our civilisations and the extinction of much of the natural world is on the horizon.' According to the naturalist, 'What happens now, and in these next few years, will profoundly affect the next few thousand years.'[6]

Such statements should put us on red alert. But they often fail to convey who exactly will bear the consequences of our temporal myopia. The answer is not just our own children and grandchildren, but the billions of human beings who will be born in the centuries ahead, and who far outnumber everyone alive today.

The moment has come, especially for those living in wealthy nations, to recognise a disturbing truth: that we have colonised the future. We treat the future like a distant colonial outpost devoid of people, where we can freely dump ecological degradation, technological risk and nuclear waste, and which we can plunder as we please. When Britain colonised Australia in the eighteenth and nineteenth centuries, it drew on a legal doctrine now known as *terra nullius* – 'nobody's land' – to justify its conquest and treat the indigenous population as if they didn't exist or have any claims on the land.[7] Today our societal attitude is one of *tempus nullius*: the future is seen as 'nobody's time', an unclaimed territory that is similarly devoid of inhabitants. Like the distant realms of empire, it is ours for the taking. Just as indigenous Australians still struggle against the legacy of *terra nullius*, so too there is a struggle to be had against the doctrine of *tempus nullius*.

The tragedy is that the unborn generations of tomorrow can do nothing about this colonialist pillaging of their futures. They cannot throw themselves in front of the king's horse like a suffragette, block an Alabama bridge like a civil rights activist or go on a Salt March to defy their colonial oppressors like Mahatma Gandhi. They are granted no political rights or representation, they have no influence at the ballot box or in the market. The

great silent majority of future generations is rendered powerless and airbrushed out of our minds.

The Conceptual Emergency of Long-Term Thinking

This is not the end of the human story. We are at a potential pivot point in history, with multiple forces beginning to coalesce into a global movement intent on liberating us from our addiction to the present tense and forging a new era of long-term thinking.

Its advocates include urban designers and climate scientists, hospital doctors and tech CEOs, who are starting to recognise that a blinkered short-termism lies at the root of many of today's crises – the threat of ecosystem collapse, the risks of automation, the rise of mass global migration, widening wealth inequality – and that the obvious antidote is more long-term thinking. Al Gore argues that 'governing institutions have been suborned by vested interests obsessed with short-term gain rather than long-term sustainability.' Astrophysicist Martin Rees is concerned that there is 'too little planning, too little horizon-scanning, too little awareness of long-term risks' and suggests that we should learn from China about long-range policymaking.[8] The former Facebook executive Chamath Palihapitiya has admitted that 'the short-term, dopamine-driven feedback loops that we have created are destroying how society works', while the chief economist of the Bank of England has openly criticised the 'rising tide of myopia' in capital markets and corporate behaviour.[9] At the same time, there is an emerging international consensus that the lives of future people should not be side-lined in today's moral deliberations and policy decisions. Over the past 25 years, more than 200 UN resolutions have explicitly mentioned the welfare of 'future generations', while Pope Francis has proclaimed that 'intergenerational solidarity is not optional, but a basic question of justice'.[10]

This growing public belief in the importance of long-term thinking as a civilisational priority is unprecedented. Yet far more impressive than such an abundance of fine words has been an explosion of practical projects and initiatives dedicated to turning it into a reality. The Svalbard Global Seed Vault, built inside a rock bunker in the remote Arctic, aims to keep over a million seeds

from 6,000 species secure for at least a thousand years. There are novel political structures, such as the Future Generations Commissioner in Wales and the UAE's Ministry of Cabinet Affairs and the Future. These have been accompanied by youth activism, including the Plant-for-the-Planet campaign started in 2007 by a nine-year-old German boy, Felix Finkbeiner, which has resulted in tens of millions of trees being planted in 130 countries. In the creative arts, musician Jem Finer's composition 'Longplayer' began playing in a London lighthouse at midnight on 31 December 1999, and will play without repetition for a millennium.

Long-term thinking appears to be gaining traction, but there is a problem. Although it can be found in pockets of the science and arts communities, and among some far-sighted businesses and political activists, it still exists on the margins, not only in Europe and North America, but also in the world's emerging powerhouse economies. It has failed – so far – to penetrate deep into the mental structures of the modern mind, which continues to be trapped by the straitjacket of short-termism.

Moreover, as a concept long-term thinking is strikingly undeveloped. I have found myself in countless conversations where it is offered as a solution to our planetary ills but nobody can really explain what it is. The phrase might yield nearly a million hits in an online search, but it is rarely accompanied by a clear sense of what it means, how it works, what time horizons are involved and what steps we must take to make it the norm. While public figures like Al Gore might champion its virtues, it remains abstract, formless, a panacea without principles or a programme. This intellectual vacuum amounts to nothing less than a conceptual emergency.[11]

If we aspire to be good ancestors then our first task is to fill this vacuum. This book attempts to do so by offering a set of six visionary and practical ways to cultivate long-term thinking. Together they provide an essential mental toolkit for challenging our obsession with the here and now.

My focus on these six ways is based on a deep conviction that ideas matter. I agree with H.G. Wells – perhaps the most influential of all futures thinkers – that 'human history is, in essence, a history of ideas.' It is the prevailing culture of ideas that shapes the direction of a society, that determines what is thinkable and

unthinkable, what is possible and impossible. Yes, factors like economic structures, political systems and technology all play vital roles, but never underestimate the power of ideas. Consider just a few that have been highly influential: that the earth is the centre of the universe; that we are primarily driven by self-interest; that humans are separate from nature; that men are superior to women; that the path to salvation is God or capitalism or communism. Call them worldviews, mental frames, paradigms or mindsets: all of them have determined the course of civilisations.[12] And at this moment in history, short-term thinking – a belief in the primacy of the now – is one of the ideas that reigns supreme and urgently needs to be challenged.

The musician and cultural thinker Brian Eno had already recognised the importance of this issue back in the 1970s when he coined the concept of the 'long now'. Eno had begun to notice just how many people were immersed in a 'short now' mentality, where 'now' meant seconds, minutes or maybe a few days. A result of this high-velocity, short-term culture was a lack of concern for future generations who were facing myriad threats, from environmental collapse to the proliferation of weapons. 'Our empathy doesn't extend far forward in time,' he wrote. The antidote was a longer sense of now, where our idea of what constitutes 'now' extends backwards and forwards by hundreds, if not thousands of years, and our moral vision extends with it.[13] This book offers foundations for creating a 'long now civilisation', a civilisation that has overcome its colonial mentality of enslaving future generations to the present.

For over a decade, my own research and writing on empathy has focused on how we can step into the shoes of people from different social backgrounds in today's world and understand their feelings and perspectives (what is technically known as 'cognitive empathy' or 'perspective-taking' empathy). But I have long wrestled with an even greater challenge: how do we make a personal, empathic connection with future generations whom we can never meet and whose lives we can barely imagine? In other words, how do we empathise not just across space but across time? This book explores how we might do so. In the three years I have spent writing it, I have come to recognise that empathy is not the only bridge we need to extend our moral vision forward in time

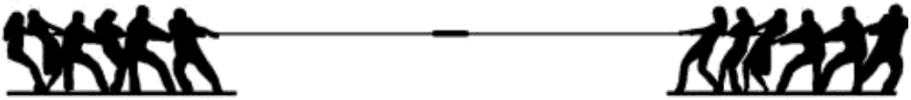
and that other related concepts, such as intergenerational justice and indigenous perspectives of planetary stewardship, can also play a key role. The result is a book that takes an interdisciplinary journey through realms ranging from moral philosophy and anthropology to the latest neuroscience research, conceptual art and political science. While attempting to take into account a broad range of social, economic and cultural perspectives, the analysis is inevitably limited by my own social positioning, so the 'we' that appears in this book usually refers to the economically secure inhabitants of Western industrialised nations, sometimes known as the Global North.

The Tug of War for Time

The national liberation struggles of the twentieth century were fought with guns. The intergenerational liberation struggle of the twenty-first century is a battle of ideas, taking the form of a titanic tug of war for time (see below). On one side, six drivers of short-termism threaten to drag us over the edge of civilisational breakdown. On the other, six ways to think long are drawing us towards a culture of longer time horizons and responsibility for the future of humankind.

The six ways to think long, explored in Part Two, are the core cognitive skills for becoming a good ancestor: a set of fundamental attitudes, beliefs and ideals. They fall into three clusters. *Imagining* the future is grounded in Deep-Time Humility and developing a Transcendent Goal for humanity. *Caring* about the future requires a Legacy Mindset and a sense of Intergenerational Justice. *Planning* for the future beyond our own lifetimes is a skill emerging from Cathedral Thinking and Holistic Forecasting. None of them alone will be enough to create a long-term revolution of the human mind. But together – and when practised by a critical mass of people and organisations – a new age of long-term thinking could arise out of their synergy.

The tug of war for time



Six drivers of short-termism

Tyranny of the Clock
the acceleration of time since the Middle Ages

Digital Distraction
the hijacking of attention by technology

Political Presentism
myopic focus on the next election

Speculative Capitalism
volatile boom-bust financial markets

Networked Uncertainty
the rise of global risk and contagion

Perpetual Progress
the pursuit of endless economic growth

Graphic: Nigel Hawtin

Six ways to think long

Deep-Time Humility
grasp we are an eyeblink in cosmic time

Legacy Mindset
be remembered well by posterity

Intergenerational Justice
consider the seventh generation ahead

Cathedral Thinking
plan projects beyond a human lifetime

Holistic Forecasting
envision multiple pathways for civilisation

Transcendent Goal
strive for one-planet thriving

Although the drivers of short-termism, which appear throughout the book, are a formidable force, their victory in the tug of war for time is by no means guaranteed. Contrary to popular opinion, long-term thinking may be one of the greatest unsung talents of our species. We don't just think fast and slow, as Daniel Kahneman has taught us – we also think short and long. The

failure, yet at the same time holds on to the prospect of success despite the odds, driven by a deep commitment to an outcome we value.

This is a book about hope rather than optimism. There is a real possibility that humankind will not wake from its short-termist slumber until an extreme cataclysm takes place – and by then it may be too late to alter our course from the same self-destructive fate as the Roman Empire and the Mayans. But the prospect of civilisational breakdown is far from inevitable, especially if we harness the power of collective action to forge radical change. The first lesson history teaches is that nothing is inevitable until it happens. We should feel hope when remembering that colonialism and slavery came to an end. We should feel hope in the transformative potential of the six ways to think long and in the emerging time rebellion dedicated to winning the tug of war against short-termism. We should acknowledge too that future generations would never forgive us if we gave up while there was still the possibility of change, no matter the odds. We must hear their voices in our dreams and heed them in our decisions.

The path of the good ancestor lies before us. It is our choice whether or not to take it.

2

The Marshmallow and the Acorn

Inside Our Time-Torn Brains

Close your eyes and imagine holding in the palm of each hand a small object that encapsulates the everyday dilemmas we face in our fraught relationship with time. In your left hand you'll find a squishy pink marshmallow. And in your right hand there is a shiny green acorn.

Together they symbolise the fascinating tension that exists within the time horizons of the human mind. Our brains are wired for both short- and long-term thinking, and there is a constant tug of war between them. From the personal to the political, from our private lives to public life, this tension is ever-present. Should you splash out on a beach holiday or save for your retirement? Will politicians enact policies fit for the century ahead or focus on quick wins for the next election? Are you more likely to post a selfie on Instagram for popularity, or plant a seed in the ground for posterity?

Each one of us has what I think of as a 'marshmallow brain', which can become fixated on short-term desires and rewards. But we each also possess an 'acorn brain', which allows us to envision distant futures and work towards long-term goals. The interplay between these two time zones in our minds is a good part of what makes us distinctively human.

The acorn brain makes an almost literal appearance in Jean Giono's *The Man Who Planted Trees*, the story of a shepherd who pops acorns into the ground each day as he tends his sheep and after several decades has grown a vast oak forest – and we find that story compelling. Despite this, and our evident long-term capabilities, the dominant narrative in society constantly

emphasises our inherent short-termism. In my research for this book, whether talking to psychologists or economists, futurologists or civil servants, I repeatedly encountered the belief that we are predominantly driven by immediate rewards and instant gratification, and that there is consequently little hope that we can rise to the long-term challenges of our age. An essay by Nathaniel Rich about our failure to act on the climate crisis illustrates this view. 'Human beings,' he writes, 'whether in global organisations, democracies, industries, political parties or as individuals, are incapable of sacrificing present convenience to forestall a penalty imposed on future generations.'[1]

If we hope to be good ancestors, it is essential to challenge this assumption and fully recognise that our minds are indeed capable of long-term thinking. Doing so is a starting point for building a society that overcomes its current myopic focus on the present. The various forms of long-term thinking explored in this book – such as cathedral thinking, holistic forecasting, and aspiring to a transcendent goal – are founded on our in-built ability to envision and plan for the future. Without it, we would never have invented agriculture, built the cathedrals of medieval Europe, created public health care systems or voyaged into space. And today we need it more than ever.

This chapter shows that we are capable of such long-term feats by exploring how the acorn brain works and how it developed over two million years of evolutionary history. But we must begin by revealing the inner workings of its great rival: the marshmallow brain.

How the Marshmallow Brain Drives Human Behaviour

I am sitting in an Oxford coffee shop with neuroscientist Morten Kringelbach, a world-renowned expert on pleasure and the brain, eager to discuss the human capacity for long-term thinking. He orders a chocolate brownie and, when it arrives, slides the plate in front of me. I decline the offer, telling him that I'm on a health drive. I look down at the brownie. It looks back. We continue to exchange glances. After a few minutes I can no longer resist my chocolate addiction and I take a bite.

Human beings, Morten tells me, have a pleasure system in our brains that drives us to seek short-term pleasures and rewards, while also prompting us to avoid immediate pain. Many of these pleasures play a positive role in our lives, such as the warm feeling of sun on our skin, the comfort of an embrace or the pleasures we get from sharing and conversation. Sometimes, however, the pleasure system goes awry and becomes dominated by short-term desires and impulses that can easily transform into addictions: we crave the sugar rush of a fizzy drink or can't tear ourselves away from a video game. It is this 'addictive brain', he says, that we really have to watch out for and that drives harmful short-term behaviours (including being hooked on chocolate). These short-term addictive and impulsive traits are what I describe as the marshmallow brain, for reasons that will become clear below.

An early insight into its functioning was revealed in a groundbreaking 1954 study, in which electrodes were implanted into the hypothalamus of rats, and the electrodes then connected to a lever that the rats could press to receive an electric brain stimulus. It turned out that the rats repeatedly pressed the lever – up to 2,000 times per hour – and gave up normal activities like feeding, drinking and sex in order to do so. This research, and subsequent replications, suggests that there are specific brain regions associated with addictive desires, and that the chemical dopamine plays a key role in aiding neural signalling in such areas.[2] Like it or not, we share a common ancestry with rats (going back around 80 million years), so it is not surprising that later research showed that humans possess similar brain regions.[3]

Evolutionary biologists suggest that our focus on short-term pleasures, desires and rewards developed as a survival mechanism in conditions where food might be scarce or safety at risk. Long before the invention of chocolate brownies, our brains developed short-term processing systems directing us to eat all we could when we could, and to make a run for it when we encountered predators. That's why we automatically lean over to smell a newly baked cake without a pause for thought and equally why we immediately turn on our heels if there's a Rottweiler racing towards us.[4]

So when we find it hard to resist the lure of food or drugs, we know that our ancient addictive brain is most probably at work.

When we swipe our phones to check for new messages, we're like those rats obsessively pressing the lever, seeking the instant thrill of a dopamine rush that has been intentionally designed into the technology. And when we can't resist a drag on a cigarette after a few drinks at a party, we're obeying the deep call of our palaeomammalian ancestry. How's that for an excuse?

In fact, much of the everyday short-termism of consumer culture – from bingeing on junk food to the customer stampede at a clearance sale – can be traced back to the here-and-now instincts that are part of our evolutionary heritage. 'The propensity for overconsumption,' argues neuroscientist Peter Whybrow, 'is the relic of a time when individual survival depended upon fierce competition for resources ... The ancient brain that drives us – evolved in scarcity, habit-driven and focused on short-term survival – is poorly matched to the frenzied affluence of contemporary material culture.'[5]

Human beings will even favour satisfying short-term desires over long-term personal interests. Smoking is an obvious example, but we may also eat fatty foods knowing full well that they could give us heart disease further down the line, or choose to spend our savings on a blowout Caribbean holiday rather than put the money away for a rainy day. When it comes to our personal time horizons, our future selves often come second place to the immediate pleasures of the present. We typically prefer a smaller, sooner reward rather than a larger, later one – a phenomenon known as 'hyperbolic discounting'.[6]

One of the best-known examples of our short-term impulsiveness and desire for instant rewards is the marshmallow test. In the 1960s, Stanford psychologist Walter Mischel placed a single marshmallow or similar treat in front of children aged between four and six. If they could resist eating it for 15 minutes when left alone in a room, he told them, they would be rewarded with a second marshmallow. The fact that two-thirds of the children couldn't resist eating the marshmallow in front of them is often taken as evidence of our inherent short-term natures.

Yet the marshmallow test, for all its fame, is only part of the story of who we are. For a start, it's worth recognising that fully one-third of the children in Mischel's experiment resisted the temptation. Moreover, replication of the test has shown that the

about the past (the rest of their thoughts were either about the present or not time-specific). Of the time spent dwelling on the future, around three-quarters of it involved making plans.[13] So we think about the future around three times as much as the past, and for every seven hours of thinking we do, roughly one hour of it concerns things that have yet to happen.

Most of this neural processing about the future takes place in an area of the brain called the frontal lobe, which sits at the front of the head above the eyes. People who sustain damage to it can often appear perfectly normal, being able to chat away happily about the weather, drink a cup of tea and do a memory test. But they may fail utterly at anything involving planning, like saying what they will do in the afternoon or completing a puzzle that requires thinking ahead. The frontal lobe (and especially the part of it known as the dorsolateral prefrontal cortex) is the operations centre of the acorn brain, a time machine that enables us to envision situations that are weeks or even decades in the future, and to map out complex plans and processes over long timespans.

The curious thing about the frontal lobe is that it is a relatively new addition to the brain, having only developed in the last two million years (the first brains appeared on earth around 500 million years ago). During this period, our cranial matter more than doubled in mass, from the 1.25-pound brain of *Homo habilis* to the nearly three pounds of *Homo sapiens*. Yet this sudden growth spurt was not evenly distributed; it appeared disproportionately at the front, so the low, sloping foreheads of our earliest ancestors were gradually pushed forward until they reached the almost vertical position they have today. And this is the very part of our cerebral apparatus that is mainly responsible for forward planning and other so-called 'executive functions', such as abstract reasoning and problem solving.[14]

Despite this evolutionary advance in our capacity to think long, most of our prospecting focuses on the very near future. The Chicago study showed that around 80 per cent of thoughts relating to the future referred to the same or next day, with only 14 per cent concerning over a year ahead and just 6 per cent looking more than ten years into the future.[15] So while the acorn brain certainly exists as part of our functional neuroanatomy, it is

clearly dominated by our short-term marshmallow brain and struggles to escape its influence.

The implications are profound. According to Daniel Gilbert, one of the founders of prospective psychology, if alien scientists wanted to destroy our species, they wouldn't send down little green men to blast us into oblivion – that would quickly trigger our well-honed defence mechanisms. Instead, they would invent something like global warming, which would slip under the radar of the human brain because we simply aren't very good at acting on long-term threats. Although we will swiftly get out of the way of a baseball speeding towards our head, we are far less adept at dealing with a danger coming several years or decades down the line. Yet the fact that we can do any long-term thinking at all 'is one of the brain's most stunning innovations', argues Gilbert; we just need to understand that it's at an early stage of development.[16]

> We're very good at clear and present danger, like every mammal is. But we've learned a new trick in the last couple of million years – at least we've kind of learned it. Our brains, unlike the brains of almost every other species, are prepared to treat the future as if it were the present. We can look ahead to our retirements or to a dental appointment, and we can take action today to save for our retirement or to floss so that we don't get bad news six months down the line. But we're just learning this trick. It's a very new adaptation in the animal kingdom and we don't do it all that well.[17]

It's not as if we are unable to think about the long-term future – that would be a genuinely disastrous neurological handicap that would inhibit any response to the ecological, social and technological threats on the horizon, from conflict over water resources to the risk of cyberattacks on a country's defence system. The problem is just that *we don't do it all that well*. Unsurprisingly, some people have already learned to do it well, from indigenous communities who use seventh-generation decision-making to engineers who design bridges that last a century and cosmologists steeped in the mysteries of deep time.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Index

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