"I know of no other book that has argued with such brilliance and historical breadth against the automatic pessimism that prevails in intellectual life. Where history, philosophy, economics, and biology meet, Matt Ridley has made his own rich territory, and he is its own enthralling guide. How wealth—mental as well as material—evolves and spreads is a fundamental question for our times, and *The Rational Optimist* teems with challenging and original ideas."

—IAN McEWAN

THE RATIONAL OPTIMIST

HOW PROSPERITY EVOLVES

MATT RIDLEY

NEW YORK TIMES BESTSELLING AUTHOR OF *GENOME*

THE

RATIONAL OPTIMIST

HOW PROSPERITY EVOLVES

MATT RIDLEY

HarperCollins e-books

For Matthew and Iris

This division of labour, from which so many advantages are derived, is not originally the effect of any human wisdom, which foresees and intends that general opulence to which it gives occasion. It is the necessary, though very slow and gradual, consequence of a certain propensity in human nature which has in view no such extensive utility; the propensity to truck, barter, and exchange one thing for another.

ADAM SMITH
The Wealth of Nations

Contents

Prologue

When Ideas have Sex

In other classes of animals, the individual advances from infancy to age or maturity; and he attains, in the compass of a single life, to all the perfection his nature can reach: but, in the human kind, the species has a progress as well as the individual; they build in every subsequent age on foundations formerly laid.

ADAM FERGUSON

An Essay on the History of Civil Society

On my desk as I write sit two artefacts of roughly the same size and shape: one is a cordless computer mouse; the other a hand axe from the Middle Stone Age, half a million years old. Both are designed to fit the human hand – to obey the constraints of being used by human beings. But they are vastly different. One is a complex confection of many substances with intricate internal design reflecting multiple strands of knowledge. The other is a single substance reflecting the skill of a single individual. The difference between them shows that the human experience of today is vastly different from the human experience of half a million years ago.

This book is about the rapid, continuous and incessant change that human society experiences in a way that no other animal does. To a biologist this is something that needs explaining. In the past two decades I have written four

books about how similar human beings are to other animals. This book is about how different they are from other animals. What is it about human beings that enables them to keep changing their lives in this tumultuous way?

It is not as if human nature changes. Just as the hand that held the hand axe was the same shape as the hand that holds the mouse, so people always have and always will seek food, desire sex, care for offspring, compete for status and avoid pain just like any other animal. Many of the idiosyncrasies of the human species are unchanging, too. You can travel to the farthest corner of the earth and still expect to encounter singing, smiling, speech, sexual jealousy and a sense of humour – none of which you would find to be the same in a chimpanzee. You could travel back in time and empathise easily with the motives of Shakespeare, Homer, Confucius and the Buddha. If I could meet the man who painted exquisite images of rhinos on the wall of the Chauvet Cave in southern France 32,000 years ago, I have no doubt that I would find him fully human in every psychological way. There is a great deal of human life that does not change.

Yet to say that life is the same as it was 32,000 years ago would be absurd. In that time my species has multiplied by 100,000 per cent, from perhaps three million to nearly seven billion people. It has given itself comforts and luxuries to a level that no other species can even imagine. It has colonised every habitable corner of the planet and explored almost every uninhabitable one. It has altered the appearance, the genetics and the chemistry of the world and pinched perhaps 23 per cent of the productivity of all land plants for its own purposes. It has surrounded itself with peculiar, non-random arrangements of atoms called technologies, which it invents, reinvents and discards almost continuously. This is not true for other creatures, not even brainy ones like chimpanzees, bottlenose dolphins, parrots and octopi. They may occasionally use tools, they may occasionally shift their ecological niche, but they do not ‘raise their standard of living’, or experience ‘economic growth’. They do not encounter ‘poverty’ either. They do not progress from one mode of living to another – nor do they deplore doing so. They do not experience agricultural, urban, commercial, industrial and information revolutions, let alone Renaissances, Reformations, Depressions, Demographic Transitions, civil wars, cold wars, culture wars and credit crunches. As I sit here at my desk, I am surrounded by things – telephones, books, computers, photographs, paper clips, coffee mugs – that no monkey has ever come close to making. I am spilling digital information on to a screen in a way that no dolphin has ever managed. I am aware of abstract concepts – the date, the weather forecast, the second law of thermodynamics – that no parrot could begin to grasp. I am definitely different. What is it that makes me so different?

It cannot just be that I have a bigger brain than other animals. After all, late Neanderthals had on average bigger brains than I do, yet did not experience this headlong cultural change. Moreover, big though my brain may be compared with another animal species, I have barely the foggiest inkling how to make coffee cups and paper clips, let alone weather forecasts. The psychologist Daniel Gilbert likes to joke that every member of his profession lives under the obligation at some time in his career to complete a sentence which begins: ‘The human being is the only animal that ...’ Language, cognitive reasoning, fire, cooking, tool making, self-awareness, deception, imitation, art, religion, opposable thumbs, throwing weapons, upright stance, grandparental care – the list of features suggested as unique to human beings is long indeed. But then the list of features unique to aardvarks or bare-faced go-away birds is also fairly long. All of these features are indeed uniquely human and are indeed very helpful in enabling modern life. But I will contend that, with the possible exception of language, none of them arrived at the right time, or had the right impact in human history to explain the sudden change from a merely successful ape-man to an ever-expanding progressive moderniser. Most of them came much too early in the story and had no such ecological effect. Having sufficient consciousness to want to paint your body or to reason the answer to a problem is nice, but it does not lead to ecological world conquest.

Clearly, big brains and language may be necessary for human beings to cope with a life of technological modernity. Clearly, human beings are very good at social learning, indeed compared with even chimpanzees humans are almost obsessively interested in faithful imitation. But big brains and imitation and language are not themselves the explanation of prosperity and progress and poverty. They do not themselves deliver a changing standard of living. Neanderthals had all of these: huge brains, probably complex languages, lots of technology. But they never burst out of their niche. It is my contention that in looking inside our heads, we would be looking in the wrong place to explain this extraordinary capacity for change in the species. It was not something that happened within a brain. It was some thing that happened between brains. It was a collective phenomenon.

Look again at the hand axe and the mouse. They are both ‘man-made’, but one was made by a single person, the other by hundreds of people, maybe even millions. That is what I mean by collective intelligence. No single person knows how to make a computer mouse. The person who assembled it in the factory did not know how to drill the oil well from which the plastic came, or vice versa. At some point, human intelligence became collective and cumulative in a way that happened to no other animal.

Mating minds

To argue that human nature has not changed, but human culture has, does not mean rejecting evolution – quite the reverse. Humanity is experiencing an extraordinary burst of evolutionary change, driven by good old-fashioned Darwinian natural selection. But it is selection among ideas, not among genes. The habitat in which these ideas reside consists of human brains. This notion has been trying to surface in the social sciences for a long time. The French sociologist Gabriel Tarde wrote in 1888: ‘We may call it social evolution when an invention quietly spreads through imitation.’ The Austrian economist Friedrich Hayek wrote in the 1960s that in social evolution the decisive factor is ‘selection by imitation of successful institutions and habits’. The evolutionary biologist Richard Dawkins in 1976 coined the term ‘meme’ for a unit of cultural imitation. The economist Richard Nelson in the 1980s proposed that whole economies evolve by natural selection.

This is what I mean when I talk of cultural evolution: at some point before 100,000 years ago culture itself began to evolve in a way that it never did in any other species – that is, to replicate, mutate, compete, select and accumulate – somewhat as genes had been doing for billions of years. Just like natural selection cumulatively building an eye bit by bit, so cultural evolution in human beings could cumulatively build a culture or a camera. Chimpanzees may teach each other how to spear bushbabies with sharpened sticks, and killer whales may teach each other how to snatch sea lions off beaches, but only human beings have the cumulative culture that goes into the design of a loaf of bread or a concerto.

Yes, but why? Why us and not killer whales? To say that people have cultural evolution is neither very original nor very helpful. Imitation and learning are not themselves enough, however richly and ingeniously they are practised, to explain why human beings began changing in this unique way. Something else is necessary; something that human beings have and killer whales do not. The answer, I believe, is that at some point in human history, ideas began to meet and mate, to have sex with each other.

Let me explain. Sex is what makes biological evolution cumulative, because it brings together the genes of different individuals. A mutation that occurs in one creature can therefore join forces with a mutation that occurs in another. The analogy is most explicit in bacteria, which trade genes without replicating at the same time – hence their ability to acquire immunity to antibiotics from other species. If microbes had not begun swapping genes a few billion years ago, and animals had not continued doing so through sex, all the genes that make eyes

could never have got together in one animal; nor the genes to make legs or nerves or brains. Each mutation would have remained isolated in its own lineage, unable to discover the joys of synergy. Think, in cartoon terms, of one fish evolving a nascent lung, another nascent limbs and neither getting out on land. Evolution can happen without sex; but it is far, far slower.

And so it is with culture. If culture consisted simply of learning habits from others, it would soon stagnate. For culture to turn cumulative, ideas needed to meet and mate. The ‘cross-fertilisation of ideas’ is a cliché, but one with unintentional fecundity. ‘To create is to recombine’ said the molecular biologist François Jacob. Imagine if the man who invented the railway and the man who invented the locomotive could never meet or speak to each other, even through third parties. Paper and the printing press, the internet and the mobile phone, coal and turbines, copper and tin, the wheel and steel, software and hardware. I shall argue that there was a point in human pre-history when big-brained, cultural, learning people for the first time began to exchange things with each other, and that once they started doing so, culture suddenly became cumulative, and the great headlong experiment of human economic ‘progress’ began. Exchange is to cultural evolution as sex is to biological evolution.

By exchanging, human beings discovered ‘the division of labour’, the specialisation of efforts and talents for mutual gain. It would at first have seemed an insignificant thing, missed by passing primatologists had they driven their time machines to the moment when it was just starting. It would have seemed much less interesting than the ecology, hierarchy and superstitions of the species. But some ape-men had begun exchanging food or tools with others in such a way that both partners to the exchange were better off, and both were becoming more specialised.

Specialisation encouraged innovation, because it encouraged the investment of time in a tool-making tool. That saved time, and prosperity is simply time saved, which is proportional to the division of labour. The more human beings diversified as consumers and specialised as producers, and the more they then exchanged, the better off they have been, are and will be. And the good news is that there is no inevitable end to this process. The more people are drawn into the global division of labour, the more people can specialise and exchange, the wealthier we will all be. Moreover, along the way there is no reason we cannot solve the problems that beset us, of economic crashes, population explosions, climate change and terrorism, of poverty, AIDS, depression and obesity. It will not be easy, but it is perfectly possible, indeed probable, that in the year 2110, a century after this book is published, humanity will be much, much better off than it is today, and so will the ecology of the planet it inhabits. This book dares the

human race to embrace change, to be rationally optimistic and thereby to strive for the betterment of humankind and the world it inhabits.

Some will say that I am merely restating what Adam Smith said in 1776. But much has happened since Adam Smith to change, challenge, adjust and amplify his insight. He did not realise, for instance, that he was living through the early stages of an industrial revolution. I cannot hope to match Smith's genius as an individual, but I have one great advantage over him – I can read his book. Smith's own insight has mated with others since his day.

Moreover, I find myself continually surprised by how few people think about the problem of tumultuous cultural change. I find the world is full of people who think that their dependence on others is decreasing, or that they would be better off if they were more self-sufficient, or that technological progress has brought no improvement in the standard of living, or that the world is steadily deteriorating, or that the exchange of things and ideas is a superfluous irrelevance. And I find a deep incuriosity among trained economists – of which I am not one – about defining what prosperity is and why it happened to their species. So I thought I would satisfy my own curiosity by writing this book.

I am writing in times of unprecedented economic pessimism. The world banking system has lurched to the brink of collapse; an enormous bubble of debt has burst; world trade has contracted; unemployment is rising sharply all around the world as output falls. The immediate future looks bleak indeed, and some governments are planning further enormous public debt expansions that could hurt the next generation's ability to prosper. To my intense regret I played a part in one phase of this disaster as non-executive chairman of Northern Rock, one of many banks that ran short of liquidity during the crisis. This is not a book about that experience (under the terms of my employment there I am not at liberty to write about it). The experience has left me mistrustful of markets in capital and assets, yet passionately in favour of markets in goods and services. Had I only known it, experiments in laboratories by the economist Vernon Smith and his colleagues have long confirmed that markets in goods and services for immediate consumption – haircuts and hamburgers – work so well that it is hard to design them so they fail to deliver efficiency and innovation; while markets in assets are so automatically prone to bubbles and crashes that it is hard to design them so they work at all. Speculation, herd exuberance, *irrational* optimism, rent-seeking and the temptation of fraud drive asset markets to overshoot and plunge – which is why they need careful regulation, something I always supported. (Markets in goods and services need less regulation.) But what made the bubble of the 2000s so much worse than most was government housing and monetary policy, especially in the United States, which sluiced artificially cheap

money towards bad risks as a matter of policy and thus also towards the middlemen of the capital markets. The crisis has at least as much political as economic causation, which is why I also mistrust too much government.

(In the interests of full disclosure, I here note that as well as banking I have over the years worked in or profited directly from scientific research, species conservation, journalism, farming, coal mining, venture capital and commercial property, among other things: experience may have influenced, and has certainly informed, my views of these sectors in the pages that follow. But I have never been paid to promulgate a particular view.)

Rational optimism holds that the world will pull out of the current crisis because of the way that markets in goods, services and ideas allow human beings to exchange and specialise honestly for the betterment of all. So this is not a book of unthinking praise or condemnation of all markets, but it is an inquiry into how the market process of exchange and specialisation is older and fairer than many think and gives a vast reason for optimism about the future of the human race. Above all, it is a book about the benefits of change. I find that my disagreement is mostly with reactionaries of all political colours: blue ones who dislike cultural change, red ones who dislike economic change and green ones who dislike technological change.

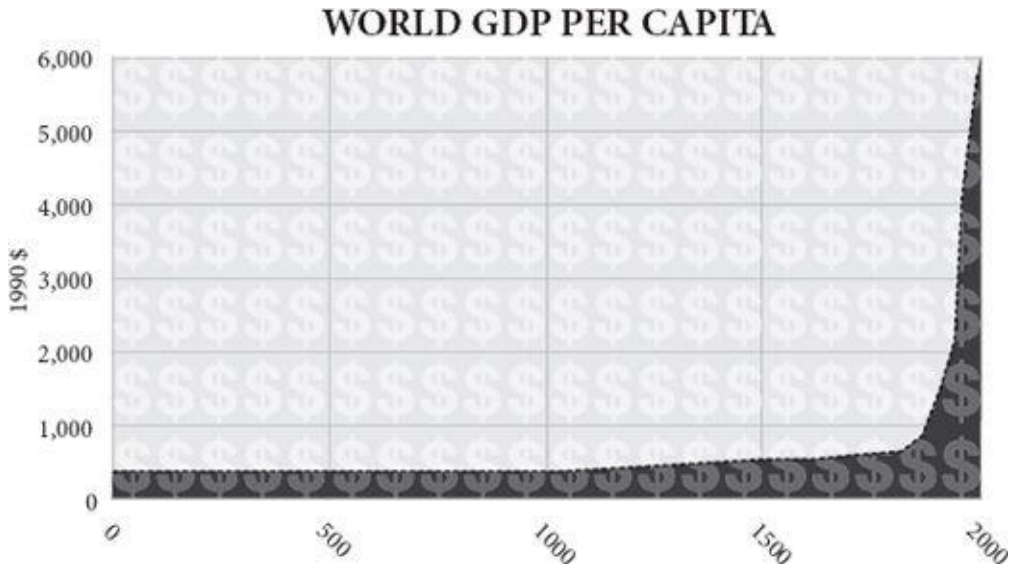
I am a rational optimist: rational, because I have arrived at optimism not through temperament or instinct, but by looking at the evidence. In the pages that follow I hope to make you a rational optimist too. First, I need to convince you that human progress has, on balance, been a good thing, and that, despite the constant temptation to moan, the world is as good a place to live as it has ever been for the average human being – even now in a deep recession. That it is richer, healthier, and kinder too, as much because of commerce as despite it. Then I intend to explain why and how it got that way. And finally, I intend to see whether it can go on getting better.

Chapter One

A better today: the unprecedented present

On what principle is it, that when we see nothing but improvement behind us, we are to expect nothing but deterioration before us?

THOMAS BABINGTON MACAULAY
Review of Southey's Colloquies on Society



By the middle of this century the human race will have expanded in ten thousand years from less than ten million to nearly ten billion people. Some of the billions alive today still live in misery and dearth even worse than the worst experienced in the Stone Age. Some are worse off than they were just a few months or years before. But the vast majority of people are much better fed, much better sheltered, much better entertained, much better protected against disease and much more likely to live to old age than their ancestors have ever been. The availability of almost everything a person could want or need has been going rapidly upwards for 200 years and erratically upwards for 10,000 years before that: years of lifespan, mouthfuls of clean water, lungfuls of clean air, hours of privacy, means of travelling faster than you can run, ways of communicating

farther than you can shout. Even allowing for the hundreds of millions who still live in abject poverty, disease and want, this generation of human beings has access to more calories, watts, lumen-hours, square feet, gigabytes, megahertz, light-years, nanometres, bushels per acre, miles per gallon, food miles, air miles, and of course dollars than any that went before. They have more Velcro, vaccines, vitamins, shoes, singers, soap operas, mango slicers, sexual partners, tennis rackets, guided missiles and anything else they could even imagine needing. By one estimate, the number of different products that you can buy in New York or London tops ten billion.

This should not need saying, but it does. There are people today who think life was better in the past. They argue that there was not only a simplicity, tranquillity, sociability and spirituality about life in the distant past that has been lost, but a virtue too. This rose-tinted nostalgia, please note, is generally confined to the wealthy. It is easier to wax elegiac for the life of a peasant when you do not have to use a long-drop toilet. Imagine that it is 1800, somewhere in Western Europe or eastern North America. The family is gathering around the hearth in the simple timber-framed house. Father reads aloud from the Bible while mother prepares to dish out a stew of beef and onions. The baby boy is being comforted by one of his sisters and the eldest lad is pouring water from a pitcher into the earthenware mugs on the table. His elder sister is feeding the horse in the stable. Outside there is no noise of traffic, there are no drug dealers and neither dioxins nor radioactive fall-out have been found in the cow's milk. All is tranquil; a bird sings outside the window.

Oh please! Though this is one of the better-off families in the village, father's Scripture reading is interrupted by a bronchitic cough that presages the pneumonia that will kill him at 53 – not helped by the wood smoke of the fire. (He is lucky: life expectancy even in England was less than 40 in 1800.) The baby will die of the smallpox that is now causing him to cry; his sister will soon be the chattel of a drunken husband. The water the son is pouring tastes of the cows that drink from the brook. Toothache tortures the mother. The neighbour's lodger is getting the other girl pregnant in the hayshed even now and her child will be sent to an orphanage. The stew is grey and gristly yet meat is a rare change from gruel; there is no fruit or salad at this season. It is eaten with a wooden spoon from a wooden bowl. Candles cost too much, so firelight is all there is to see by. Nobody in the family has ever seen a play, painted a picture or heard a piano. School is a few years of dull Latin taught by a bigoted martinet at the vicarage. Father visited the city once, but the travel cost him a week's wages and the others have never travelled more than fifteen miles from home. Each daughter owns two wool dresses, two linen shirts and one pair of shoes. Father's

jacket cost him a month's wages but is now infested with lice. The children sleep two to a bed on straw mattresses on the floor. As for the bird outside the window, tomorrow it will be trapped and eaten by the boy.

If my fictional family is not to your taste, perhaps you prefer statistics. Since 1800, the population of the world has multiplied six times, yet average life expectancy has more than doubled and real income has risen more than nine times. Taking a shorter perspective, in 2005, compared with 1955, the average human being on Planet Earth earned nearly three times as much money (corrected for inflation), ate one-third more calories of food, buried one-third as many of her children and could expect to live one-third longer. She was less likely to die as a result of war, murder, childbirth, accidents, tornadoes, flooding, famine, whooping cough, tuberculosis, malaria, diphtheria, typhus, typhoid, measles, smallpox, scurvy or polio. She was less likely, at any given age, to get cancer, heart disease or stroke. She was more likely to be literate and to have finished school. She was more likely to own a telephone, a flush toilet, a refrigerator and a bicycle. All this during a half-century when the world population has more than doubled, so that far from being rationed by population pressure, the goods and services available to the people of the world have expanded. It is, by any standard, an astonishing human achievement.

Averages conceal a lot. But even if you break down the world into bits, it is hard to find any region that was worse off in 2005 than it was in 1955. Over that half-century, real income per head ended a little lower in only six countries (Afghanistan, Haiti, Congo, Liberia, Sierra Leone and Somalia), life expectancy in three (Russia, Swaziland and Zimbabwe), and infant survival in none. In the rest they have rocketed upward. Africa's rate of improvement has been distressingly slow and patchy compared with the rest of the world, and many southern African countries saw life expectancy plunge in the 1990s as the AIDS epidemic took hold (before recovering in recent years). There were also moments in the half-century when you could have caught countries in episodes of dreadful deterioration of living standards or life chances – China in the 1960s, Cambodia in the 1970s, Ethiopia in the 1980s, Rwanda in the 1990s, Congo in the 2000s, North Korea throughout. Argentina had a disappointingly stagnant twentieth century. But overall, after fifty years, the outcome for the world is remarkably, astonishingly, dramatically positive. The average South Korean lives twenty-six more years and earns fifteen times as much income each year as he did in 1955 (and earns fifteen times as much as his North Korean counter part). The average Mexican lives longer now than the average Briton did in 1955. The average Botswanan earns more than the average Finn did in 1955. Infant mortality is lower today in Nepal than it was in Italy in 1951. The

proportion of Vietnamese living on less than $2 a day has dropped from 90 per cent to 30 per cent in twenty years.

The rich have got richer, but the poor have done even better. The poor in the developing world grew their consumption twice as fast as the world as a whole between 1980 and 2000. The Chinese are ten times as rich, one-third as fecund and twenty-eight years longer-lived than they were fifty years ago. Even Nigerians are twice as rich, 25 per cent less fecund and nine years longer-lived than they were in 1955. Despite a doubling of the world population, even the raw number of people living in absolute poverty (defined as less than a 1985 dollar a day) has fallen since the 1950s. The percentage living in such absolute poverty has dropped by more than half – to less than 18 per cent. That number is, of course, still all too horribly high, but the trend is hardly a cause for despair: at the current rate of decline, it would hit zero around 2035 – though it probably won't. The United Nations estimates that poverty was reduced more in the last fifty years than in the previous 500.

Affluence for all

Nor was 1955 a time of deprivation. It was in itself a record – a moment when the world was richer, more populous and more comfortable than it had ever been, despite the recent efforts of Hitler, Stalin and Mao (who was then just starting to starve his people so that he could use their grain to buy nuclear weapons from Russia). The 1950s were a decade of extraordinary abundance and luxury compared with any preceding age. Infant mortality in India was already lower than it had been in France and Germany in 1900. Japanese children had almost twice as many years in education in 1950 as at the turn of the century. World income per head had almost doubled in the first half of the twentieth century. In 1958 J.K. Galbraith declared that the 'affluent society' had reached such a pitch that many unnecessary goods were now being 'overprovided' to consumers by persuasive advertisers.

He was right that Americans were especially well off compared with others: they were three inches taller in 1950 than they had been at the turn of the century and spent twice as much on medicine as funerals – the reverse of the ratio in 1900. Roughly eight out of ten American households had running water, central heating, electric light, washing machines and refrigerators by 1955. Almost none had these luxuries in 1900. In his 1890 classic *How the Other Half Lives*, Jacob Riis encountered a family of nine in New York living in a ten-foot-square room plus a tiny kitchen, and women earning 60 cents a day for sixteen hours' work in sweatshops and unable to afford more than one meal a day. This would have

been unthinkable by mid-century.

Yet looking back now, another fifty years later, the middle class of 1955, luxuriating in their cars, comforts and gadgets, would today be described as ‘below the poverty line’. The average British working man in 1957, when Harold Macmillan told him he had ‘never had it so good’, was earning less in real terms than his modern equivalent could now get in state benefit if unemployed with three children. Today, of Americans officially designated as ‘poor’, 99 per cent have electricity, running water, flush toilets, and a refrigerator; 95 per cent have a television, 88 per cent a telephone, 71 per cent a car and 70 per cent air conditioning. Cornelius Vanderbilt had none of these. Even in 1970 only 36 per cent of all Americans had air conditioning: in 2005 79 per cent of *poor* households did. Even in urban China 90 per cent of people now have electric light, refrigerators and running water. Many of them also have mobile phones, inter net access and satellite television, not to mention all sorts of improved and cheaper versions of everything from cars and toys to vaccines and restaurants.

Well all right, says the pessimist, but at what cost? The environment is surely deteriorating. In somewhere like Beijing, maybe. But in many other places, no. In Europe and America rivers, lakes, seas and the air are getting cleaner all the time. The Thames has less sewage and more fish. Lake Erie’s water snakes, on the brink of extinction in the 1960s, are now abundant. Bald eagles have boomed. Pasadena has few smogs. Swedish birds’ eggs have 75 per cent fewer pollutants in them than in the 1960s. American carbon monoxide emissions from transport are down 75 per cent in twenty-five years. Today, a car emits less pollution traveling at full speed than a parked car did in 1970 from leaks.

Meanwhile, average life expectancy in the longest-lived country (Sweden in 1850, New Zealand in 1920, Japan today) continues to march upwards at a steady rate of a quarter of a year per year, a rate of change that has altered little in 200 years. It still shows no sign of reaching a limit, though surely it must one day. In the 1920s demographers confidently asserted that average life span would peak at 65 ‘without intervention of radical innovations or fantastic evolutionary change in our physiological make-up’. In 1990 they predicted life expectancy ‘should not exceed ... 35 years at age 50 unless major breakthroughs occur in controlling the fundamental rate of ageing’. Within just five years both predictions were proved wrong in at least one country.

Consequently the number of years of retirement is rocketing upwards. Starting from 1901, it took sixty-eight years for the mortality of British men between 65 and 74 to fall by 20 per cent. Subsequent 20 per cent falls took seventeen years, ten years and six years – the improvement has accelerated. That is all very well,

say pessimists, but what about quality of life in old age? Sure, people live longer, but only by having years of suffering and disability added to their lives. Not so. In one American study, disability rates in people over 65 fell from 26.2 per cent to 19.7 per cent between 1982 and 1999 – at twice the pace of the decrease in the mortality rate. Chronic illness before death is if anything shortening slightly, not lengthening, despite better diagnosis and more treatments – 'the compression of morbidity' is the technical term. People are not only spending a longer time living, but a shorter time dying.

Take stroke, a big cause of disability in old age. Deaths from stroke fell by 70 per cent between 1950 and 2000 in America and Europe. In the early 1980s a study of stroke victims in Oxford concluded that the incidence of stroke would increase by nearly 30 per cent over the next two decades, mainly because stroke incidence increases with age and people were predicted to live longer. They did live longer but the incidence of stroke in fact fell by 30 per cent. (The age-related increase is still present, but it is coming later and later.) The same is true of cancer, heart disease and respiratory disease: they all still increase with age, but they do so later and later, by about ten years since the 1950s.

Even inequality is declining worldwide. It is true that in Britain and America income equality, which had been improving for most of the past two centuries (British aristocrats were six inches taller than the average in 1800; today they are less than two inches taller), has stalled since the 1970s. The reasons for this are many, but they are not all causes for regret. For example, high earners now marry each other more than they used to (which concentrates income), immigration has increased, trade has been freed, cartels have been opened up to entrepreneurial competition and the skill premium has grown in the work place. All these are inequality-boosting, but they stem from liberalising trends. Besides, by a strange statistical paradox, while inequality has increased within some countries, globally it has been falling. The recent enrichment of China and India has increased inequality within those countries by making the income of the rich grow faster than that of the poor – an income gap is an inevitable consequence of an expanding economy. Yet the global effect of the growth of China and India has been to reduce the difference between rich and poor worldwide. As Hayek put it, 'once the rise in the position of the lower classes gathers speed, catering to the rich ceases to be the main source of great gain and gives place to efforts directed towards the needs of the masses. Those forces which at first make inequality self-accentuating thus later tend to diminish it.'

In another respect, too, inequality has been retreating. The spread of IQ scores has been shrinking steadily – because the low scores have been catching up with the high ones. This explains the steady, progressive and ubiquitous improvement

in the average IQ scores people achieve at a given age – at a rate of 3 per cent per decade. In two Spanish studies, IQ proved to be 9.7 points higher after thirty years, most of it among the least intelligent half of the group. Known as the Flynn effect, after James Flynn who first drew attention to it, this phenomenon was at first dismissed as an artefact of changes in tests, or a simple reflection of longer or better schooling. But the facts do not fit such explanations because the effect is consistently weakest in the cleverest children and in the tests that relate most to educational content. It is a levelling-up caused by an equalisation of nutrition, stimulation or diversity of childhood experience. You can, of course, argue that IQ may not be truly representative of intelligence, but you cannot argue that something is getting better – and more equal at the same time.

Even justice has improved thanks to new technology exposing false convictions and identifying true criminals. To date 234 innocent Americans have been freed as a result of DNA fingerprinting after serving an average of twelve years in prison; seventeen of them were on death row. The very first forensic use of DNA in 1986 exonerated an innocent man and then helped to catch the real murderer, a pattern that has been repeated many times since.

Cheap light

These richer, healthier, taller, cleverer, longer-lived, freer people – you lot – have been enjoying such abundance that most of the things they need have been getting steadily cheaper. The four most basic human needs – food, clothing, fuel and shelter – have grown markedly cheaper during the past two centuries. Food and clothing especially so (a brief rise in food prices in 2008 notwithstanding), fuel more erratically and even housing has probably got cheaper too: surprising as it may seem, the average family house probably costs slightly less today than it did in 1900 or even 1700, despite including far more modern conveniences like electricity, telephone and plumbing. If basic needs have got cheaper, then there is more disposable income to spend on luxuries. Artificial light lies on the border between necessity and luxury. In monetary terms, the same amount of artificial lighting cost 20,000 times as much in England in the year 1300 as it does today.

Enormous as that difference is, in labour terms the change is even more dramatic and the improvement is even more recent. Ask how much artificial light you can earn with an hour of work at the average wage. The amount has increased from twenty-four lumen-hours in 1750 BC (sesame oil lamp) to 186 in 1800 (tallow candle) to 4,400 in 1880 (kerosene lamp) to 531,000 in 1950 (incandescent light bulb) to 8.4 million lumen-hours today (compact fluorescent

bulb). Put it another way, an hour of work today earns you 300 days' worth of reading light; an hour of work in 1800 earned you ten minutes of reading light. Or turn it round and ask how long you would have to work to earn an hour of reading light – say, the light of an 18-watt compact-fluorescent light bulb burning for an hour. Today it will have cost you less than half a second of your working time if you are on the average wage: half a second of work for an hour of light. In 1950, with a conventional filament lamp and the then wage, you would have had to work for eight seconds to get the same amount of light. Had you been using a kerosene lamp in the 1880s, you would have had to work for about fifteen minutes to get the same amount of light. A tallow candle in the 1800s: over six hours' work. And to get that much light from a sesame-oil lamp in Babylon in 1750 BC would have cost you more than fifty hours' of work. From six hours to half a second – a 43,200-fold improvement – for an hour of lighting: that is how much better off you are than your ancestor was in 1800, using the currency that counts, your time. Do you see why my fictional family ate by firelight?

Much of this improvement is not included in the cost-of-living calculations, which struggle to compare like with unlike. The economist Don Boudreaux imagined the average American time-travelling back to 1967 with his modern income. He might be the richest person in town, but no amount of money could buy him the delights of eBay, Amazon, Starbucks, Wal-Mart, Prozac, Google or BlackBerry. The lighting numbers cited above do not even take into account the greater convenience and cleanliness of modern electric light compared with candles or kerosene – its simple switching, its lack of smoke, smell and flicker, its lesser fire hazard. Nor is the improvement in lighting finished yet. Compact fluorescent bulbs may be three times as efficient as filament bulbs in turning electrons' energy into photons' energy, but light-emitting diodes (LEDs) are rapidly overtaking them (as of this writing LEDs with ten times the efficiency of incandescent bulbs have been demonstrated) and have the added benefit of working at a portable scale. A cheap LED flashlight, powered by a solar-charged battery, will surely soon transform the life of some of the 1.6 billion people who do not have mains electricity, African peasants prominent among them. Admittedly, LEDs are still far too expensive to replace most light bulbs, but that might change.

Think what these improvements in lighting efficiency mean. You can either have a lot more light, or do a lot less work, or acquire something else. Devoting less of your working week to earning your lighting means devoting more of it to doing something else. That something else can mean employment for somebody else. The improved technology of lighting has liberated you to make or buy

another product or service, or do a charitable act. That is what economic growth means.

Saving time

Time: that is the key. Forget dollars, cowrie shells or gold. The true measure of something's worth is the hours it takes to acquire it. If you have to acquire it for yourself, it usually takes longer than if you get it ready-made by other people. And if you can get it made efficiently by others, then you can afford more of it. As light became cheaper so people used more of it. The average Briton today consumes roughly 40,000 times as much artificial light as he did in 1750. He consumes fifty times as much power and 250 times as much transport (measured in passenger-miles travelled), too.

This is what prosperity is: the increase in the amount of goods or services you can earn with the same amount of work. As late as the mid-1800s, a stagecoach journey from Paris to Bordeaux cost the equivalent of a clerk's monthly wages; today the journey costs a day or so and is fifty times as fast. A half-gallon of milk cost the average American ten minutes of work in 1970, but only seven minutes in 1997. A three-minute phone call from New York to Los Angeles cost ninety hours of work at the average wage in 1910; today it costs less than two minutes. A kilowatt-hour of electricity cost an hour of work in 1900 and five minutes today. In the 1950s it took thirty minutes work to earn the price of a McDonald's cheeseburger; today it takes three minutes. Healthcare and education are among the few things that cost more in terms of hours worked now than they did in the 1950s.

Even the most notorious of capitalists, the robber barons of the late nineteenth century, usually got rich by making things cheaper. Cornelius Vanderbilt is the man for whom the *New York Times* first used the word 'robber baron'. He is the very epitome of the phrase. Yet observe what *Harper's Weekly* had to say about his railways in 1859:

> The results in every case of the establishment of opposition lines by Vanderbilt has been the permanent reduction of fares. Wherever he 'laid on' an opposition line, the fares were instantly reduced, and however the contest terminated, whether he bought out his opponents, as he often did, or they bought him out, the fares were never again raised to the old standard. This great boon – cheap travel – this community owes mainly to Cornelius Vanderbilt.

Rail freight charges fell by 90 per cent between 1870 and 1900. There is little

doubt that Vanderbilt sometime bribed and bullied his way to success, and that he sometimes paid his workers lower wages than others – I am not trying to make him into a saint – but there is also no doubt that along the way he delivered to consumers an enormous benefit that would otherwise have eluded them – affordable transport. Likewise, Andrew Carnegie, while enormously enriching himself, cut the price of a steel rail by 75 per cent in the same period; John D. Rockefeller cut the price of oil by 80 per cent. During those thirty years, the per capita GDP of Americans rose by 66 per cent. They were enricher-barons, too.

Henry Ford got rich by making cars cheap. His first Model T sold for $825, unprecedentedly cheap at the time, and four years later he had cut the price to $575. It took about 4,700 hours of work to afford a Model T in 1908. It takes about 1,000 hours today to afford an ordinary car – though one that is brimming with features that Model Ts never had. The price of aluminium fell from $545 a pound in the 1880s to 20 cents a pound in the 1930s, thanks to the innovations of Charles Martin Hall and his successors at Alcoa. (Alcoa's reward for this price cut was to be sued by the government on 140 counts of criminal monopoly: the rapid decrease in the price of its product being used as evidence of a determination to deter competition. Microsoft suffered the same allegation later in the century.) When Juan Trippe sold cheap tourist-class seats on his Pan Am airline in 1945, the other airlines were so insulted that they petitioned their governments to ban Pan Am: Britain, shamefully, agreed, so Pan Am flew to Ireland instead. The price of computing power fell so fast in the last quarter of the twentieth century that the capacity of a tiny pocket calculator in 2000 would have cost you a lifetime's wages in 1975. The price of a DVD player in Britain fell from £400 in 1999 to £40 just five years later, a decline that exactly matched the earlier one of the video recorder, but happened much faster.

Falling consumer prices is what enriches people (deflation of asset prices can ruin them, but that is because they are using asset prices to get them the wherewithal to purchase consumer items). And, once again, notice that the true metric of prosperity is time. If Cornelius Vanderbilt or Henry Ford not only moves you faster to where you want to go, but requires you to work fewer hours to earn the ticket price, then he has enriched you by granting you a dollop of free time. If you choose to spend that spare time consuming somebody else's production then you can enrich him in turn; if you choose to spend it producing for his consumption then you have also further enriched yourself.

Housing, too, is itching to get cheaper, but for confused reasons governments go to great lengths to prevent it. Where it took sixteen weeks to earn the price of 100 square feet of housing in 1956, now it takes fourteen weeks and the housing is of better quality. But given the ease with which modern machinery can

assemble a house, the price should have come down much faster than that. Governments prevent this by, first, using planning or zoning laws to restrict supply (especially in Britain); second, using the tax system to encourage mortgage borrowing (in the United States at least – no longer in Britain); and third, doing all they can to stop property prices falling after a bubble. The effect of these measures is to make life harder for those who do not yet have a house and massively reward those who do. To remedy this, governments then have to enforce the building of more affordable housing, or subsidise mortgage lending to the poor.

Happiness

As necessities and luxuries get cheaper, do people get happier? A small cottage industry grew up at the turn of the twenty-first century devoted to the subject of the economics of happiness. It started with the paradox that richer people are not necessarily happier people. Beyond a certain level of per capita income ($15,000 a year, according to Richard Layard), money did not seem to buy subjective well-being. As books and papers cascaded out of the academy, *Schadenfreude* set in on a grand scale among commentators happy to see the unhappiness of the rich confirmed. Politicians latched on and governments from Thailand to Britain began to think about how to maximise gross national happiness instead of gross national product. British government departments now have ‘well-being divisions’ as a result. King Jigme Singye Wangchuck of Bhutan is credited with having been the first to get there in 1972 when he declared economic growth a secondary goal to national well-being. If economic growth does not produce happiness, said the new wisdom, then there was no point in striving for prosperity and the world economy should be brought to a soft landing at a reasonable level of income. Or, as one economist put it: ‘The hippies were right all along’.

If true, this rather punctures the rational optimist’s balloon. What is the point of celebrating the continuing defeat of death, dearth, disease and drudgery, if it does not make people happier? But it is not true. The debate began with a study by Richard Easterlin in 1974, which found that although within a country rich people were generally happier than poor people, richer countries did not have happier citizens than poor countries. Since then the ‘Easterlin paradox’ has become the central dogma of the debate. Trouble is, it is wrong. Two papers were published in 2008 analysing all the data, and the unambiguous conclusion of both is that the Easterlin paradox does not exist. Rich people are happier than poor people; rich countries have happier people than poor countries; and people

get happier as they get richer. The earlier study simply had samples too small to find significant differences. In all three categories of comparison – within countries, between countries and between times – extra income does indeed buy general well-being. That is to say, on average, across the board, on the whole, other things being equal, more money does make you happier. In the words of one of the studies, ‘All told, our time-series comparisons, as well as evidence from repeated international cross-sections, appear to point to an important relationship between economic growth and growth in subjective well-being’.

There are some exceptions. Americans currently show no trend towards increasing happiness. Is this because the rich had got richer but ordinary Americans had not prospered much in recent years? Or because America continually draws in poor (unhappy) immigrants, which keeps the happiness quotient low? Who knows? It was not because the Americans are too rich to get any happier: Japanese and Europeans grew steadily happier as they grew richer despite being often just as rich as Americans. Moreover, surprisingly, American women have become less happy in recent decades despite getting richer.

Of course, it is possible to be rich and unhappy, as many a celebrity gloriously reminds us. Of course, it is possible to get rich and find that you are unhappy not to be richer still, if only because the neighbour – or the people on television – are richer than you are. Economists call this the ‘hedonic treadmill’; the rest of us call it ‘keeping up with the Joneses’. And it is probably true that the rich do lots of unnecessary damage to the planet as they go on striving to get richer long after the point where it is having much effect on their happiness – they are after all endowed with instincts for ‘rivalrous competition’ descended from hunter-gatherers whose relative, not absolute, status determined their sexual rewards. For this reason a tax on consumption to encourage saving for investment instead is not necessarily a bad idea. However, this does not mean that anybody would be necessarily happier if poorer – to be well off and unhappy is surely better than to be poor and unhappy. Of course, some people will be unhappy however rich they are, while others manage to bounce back cheerful even in poverty: psychologists find people to have fairly constant levels of happiness to which they return after elation or disaster. Besides, a million years of natural selection shaped human nature to be ambitious to rear successful children, not to settle for contentment: people are programmed to desire, not to appreciate.

Getting richer is not the only or even the best way of getting happier. Social and political liberation is far more effective, says the political scientist Ronald Ingleheart: the big gains in happiness come from living in a society that frees you to make choices about your lifestyle – about where to live, who to marry, how to express your sexuality and so on. It is the increase in free choice since

1981 that has been responsible for the increase in happiness recorded since then in forty-five out of fifty-two countries. Ruut Veenhoven finds that ‘the more individualized the nation, the more citizens enjoy their life.’

Crunch

And yet, good as life is, today life is not good. Happy statistics of recent improvement sound as hollow to a laid-off car worker in Detroit or an evicted house owner in Reykjavik as they would to a cholera victim in Zimbabwe or a genocide refugee in Congo. War, disease, corruption and hate still disfigure the lives of millions; nuclear terrorism, rising sea levels and pandemic flu may yet make the twenty-first century a dreadful place. True, but assuming the worst will not avert these fates; striving to continue improving the human lot may. It is precisely because so much human betterment has been shown to be possible in recent centuries that the continuing imperfection of the world places a moral duty on humanity to allow economic evolution to continue. To prevent change, innovation and growth is to stand in the way of potential compassion. Let it never be for gotten that, by propagating excessive caution about genetically modified food aid, some pressure groups may have exacerbated real hunger in Zambia in the early 2000s. The precautionary principle – better safe than sorry – condemns itself: in a sorry world there is no safety to be found in standing still.

More immediately, the financial crash of 2008 has caused a deep and painful recession that will generate mass unemployment and real hardship in many parts of the world. The reality of rising living standards feels to many today to be a trick, a pyramid scheme achieved by borrowing from the future.

Until he was rumbled in 2008, Bernard Madoff offered his investors high and steady returns of more than 1 per cent a month on their money for thirty years. He did so by paying new investors’ capital out to old investors as revenue, a chain-letter con trick that could not last. When the music stopped, $65 billion of investors’ funds had been looted. It was roughly what John Law did in Paris with the Mississippi Company in 1719, what John Blunt did in London with the South Sea company in 1720, what Charles Ponzi did in Boston in 1920 with reply coupons for postage stamps, what Ken Lay did with Enron’s stock in 2001.

Is it possible that not just the recent credit boom, but the entire postwar rise in living standards was a Ponzi scheme, made possible by the gradual expansion of credit? That we have in effect grown rich by borrowing the means from our children and that a day of reckoning is now at hand? It is certainly true that your mortgage is borrowed (via a saver somewhere else, perhaps in China) from your future self, who will pay it off. It is also true on both sides of the Atlantic that

your state pension will be funded by your children's taxes, not by your payroll contributions as so many think.

But there is nothing unnatural about this. In fact, it is a very typical human pattern. By the age of 15 chimpanzees have produced about 40 per cent and consumed about 40 per cent of the calories they will need during their entire lives. By the same age, human hunter-gatherers have consumed about 20 per cent of their lifetime calories, but produced just 4 per cent. More than any other animal, human beings borrow against their future capabilities by depending on others in their early years. A big reason for this is that hunter-gatherers have always specialised in foods that need extraction and processing – roots that need to be dug and cooked, clams that need to be opened, nuts that need to be cracked, carcasses that need to be butchered – whereas chimpanzees eat things that simply need to be found and gathered, like fruit or termites. Learning to do this extraction and processing takes time, practice and a big brain, but once a human being has learnt, he or she can produce a huge surplus of calories to share with the children. Intriguingly, this pattern of production over the lifespan in hunter-gatherers is more like the modern Western lifestyle than it is like the farming, feudal or early industrial lifestyles. That is to say, the notion of children taking twenty years even to start to bring in more than they consume, and then having forty years of very high productivity, is common to hunter-gatherers and modern societies, but was less true in the period in between, when children could and did go to work to support their own consumption.

The difference today is that intergenerational transfers take a more collective form – income tax on all productive people in their prime pays for education for all, for example. In that sense, the economy (like a chain letter, but unlike a shark, actually) must keep moving forward or it collapses. The banking system makes it possible for people to borrow and consume when they are young and to save and lend when they are old, smoothing their family living standards over the decades. Posterity can pay for its ancestors' lives because posterity can be richer through innovation. If somebody somewhere takes out a mortgage, which he will repay in three decades' time, to invest in a business that invents a gadget that saves his customers time, then that money, brought forward from the future, will enrich both him and those customers to the point where the loan can be repaid to posterity. That is growth. If, on the other hand, somebody takes out a loan just to support his luxury lifestyle, or to speculate on asset markets by buying a second home, then posterity will be the loser. That is what, it is now clear, far too many people and businesses did in the 2000s – they borrowed more from posterity than their innovation rate would support. They misallocated the resources to unproductive ends. Most past bursts of human prosperity have come

to naught because they allocated too little money to innovation and too much to asset price inflation or to war, corruption, luxury and theft.

In the Spain of Charles V and Philip II, the gigantic wealth of the Peruvian silver mines was wasted. The same ‘curse of resources’ has afflicted countries with windfalls ever since, especially those with oil (Russia, Venezuela, Iraq, Nigeria) that end up run by rent-seeking autocrats. Despite their windfalls, such countries experience lower economic growth than countries that entirely lack resources but get busy trading and selling – Holland, Japan, Hong Kong, Singapore, Taiwan, South Korea. Even the Dutch, those epitomes of seventeenth-century enterprise, fell under the curse of resources in the late twentieth century when they found too much natural gas: the Dutch disease, they called it, as their inflated currency hurt their exporters. Japan spent the first half of the twentieth century jealously seeking to grab resources and ended up in ruins; it spent the second half of the century trading and selling without resources and ended up topping the lifespan league. In the 2000s the West misspent much of the cheap windfall of Chinese savings that the United States Federal Reserve sluiced our way.

So long as somebody allocates sufficient capital to innovation, then the credit crunch will not in the long run prevent the relentless upward march of human living standards. If you look at a graph of world per capita GDP, the Great Depression of the 1930s is just a dip in the slope. By 1939 even the worst-affected countries, America and Germany, were richer than they were in 1930. All sorts of new products and industries were born during the Depression: by 1937, 40 per cent of DuPont’s sales came from products that had not even existed before 1929, such as rayon, enamels and cellulose film. So growth will resume – unless prevented by the wrong policies. Somebody, somewhere, is still tweaking a piece of software, testing a new material, or transferring a gene that will make your and my life easier in the future. I cannot know who or where he is for sure, but let me give you a candidate. In the week I wrote this paragraph, a small company called Arcadia Biosciences in northern California signed an agreement with a charity working in Africa to license, royalty-free to smallholders, new varieties of rice that can be grown with less nitrogen fertiliser for the same yield, thanks to the over-expression in the roots of a version of a gene called alanine aminotransferase borrowed from barley. Assuming the varieties work in Africa as well as they do in California, some African will one day grow and sell more food (for less pollution), which in turn means that he will have more money to spend, earning the cost of, say, a mobile phone, which he will buy from a Western company, and which will help him find a better market for his rice. An employee of that Western company will get a pay rise,

which she will spend on a new pair of jeans, which were made from cotton woven in a factory that employs the smallholder's neighbour. And so on.

As long as new ideas can breed in this way, then human economic progress can continue. It may be only a year or two till world growth resumes after the current crisis, or it may for some countries be a lost decade. It may even be that parts of the world will be convulsed by a descent into autarky, authoritarianism and violence, as happened in the 1930s, and that a depression will cause a great war. But so long as somewhere somebody is incentivised to invent ways of serving others' needs better, then the rational optimist must conclude that the betterment of human lives will eventually resume.

The declaration of interdependence

Imagine you are a deer. You have essentially only four things to do during the day: sleep, eat, avoid being eaten and socialise (by which I mean mark a territory, pursue a member of the opposite sex, nurse a fawn, whatever). There is no real need to do much else. Now imagine you are a human being. Even if you only count the basic things, you have rather more than four things to do: sleep, eat, cook, dress, keep house, travel, wash, shop, work ... the list is virtually endless. Deer should therefore have more free time than human beings, yet it is people, not deer, who find the time to read, write, invent, sing and surf the net. Where does all this free time come from? It comes from exchange and specialisation and from the resulting division of labour. A deer must gather its own food. A human being gets somebody else to do it for him, while he or she is doing something for them – and both win time that way.

Self-sufficiency is therefore not the route to prosperity. 'Which would have advanced the most at the end of a month,' Henry David Thoreau asked: 'the boy who had made his own jack-knife from the ore which he had dug and smelted, reading as much as would be necessary for this – or the boy who had attended the lectures on metallurgy at the Institute in the meanwhile, and had received a Rodgers' penknife from his father?' *Contra* Thoreau, it is the latter, by a mile, because he has far more spare time to learn other things. Imagine if you had to be completely self-sufficient (not just pretending, like Thoreau). Every day you must get up in the morning and supply yourself entirely from your own resources. How would you spend your day? The top four priorities would be food, fuel, clothing and shelter. Dig the garden, feed the pig, fetch water from the brook, gather wood from the forest, wash some potatoes, light a fire (no matches), cook lunch, repair the roof, fetch fresh bracken for clean bedding, whittle a needle, spin some thread, sew leather for shoes, wash in the stream,

fashion a pot out of clay, catch and cook a chicken for dinner. No candle or book for reading. No time for smelting metal, drilling oil, or travel. By definition, you are at subsistence level and frankly, though at first you mutter, Thoreau-like, ‘how marvellous to get away from all the appalling hustle and bustle’, after a few days the routine is pretty grim. If you wish to have even the most minimal improvement in your life – say metal tools, toothpaste or lighting – you are going to have to get some of your chores done by somebody else, because there just is not time to do them yourself. So one way to raise your standard of living would be to lower somebody else’s: buy a slave. That was indeed how people got rich for thousands of years.

Yet, though you have no slaves, today when you got out of bed you knew that somebody would provide you with food, fibre and fuel in a most convenient form. In 1900, the average American spent $76 of every $100 on food, clothing and shelter. Today he spends $37. If you are on an average wage you knew that it would take you a matter of tens of minutes to earn the cash to pay for your food, some more tens of minutes to earn the cash to buy whatever new clothing you need and maybe an hour or two to earn the cash to pay for the gas, electricity and oil you might need today. Earning the rent or mortgage payment that ensures you have a roof over your head might take rather more time. But still, by lunchtime, you could relax in the knowledge that food, fuel, fibre and shelter were taken care of for the day. So it was time to earn something more interesting: the satellite television subscription, the mobile phone bill, the holiday deposit, the cost of new toys for the children, the income tax. ‘To produce implies that the producer desires to consume’ said John Stuart Mill; ‘why else should he give himself useless labour?’

In 2009, an artist named Thomas Thwaites set out to make his own toaster, of the sort that he could buy from a shop for about £4. He needed only a few raw materials: iron, copper, nickel, plastic and mica (an insulating mineral around which the heating elements are wrapped). But even to get these he found almost impossible. Iron is made from iron ore, which he could probably mine, but how was he to build a sufficiently hot furnace without electric bellows? (He cheated and used a microwave oven.) Plastic is made from oil, which he could not easily drill for himself, let alone refine. And so on. More to the point, the project took months, cost a lot of money and resulted in an inferior product. Yet to buy a £4 toaster would cost him less than an hour’s work at the minimum wage. To Thwaites this illustrated his helplessness as a consumer so divorced from self-sufficiency. It also illustrates the magic of specialisation and exchange: thousands of people, none of them motivated by the desire to do Thwaites a favour, have come together to make it possible for him to acquire a toaster for a

trivial sum of money. In the same vein, Kelly Cobb of Drexel University set out to make a man's suit entirely from materials produced within 100 miles of her home. It took twenty artisans a total of 500 manhours to achieve it and even then they had to get 8 per cent of the materials from outside the 100-mile radius. If they worked for another year, they could get it all from within the limit, argued Cobb. To put it plainly, local sourcing multiplied the cost of a cheap suit roughly a hundred-fold.

As I write this, it is nine o'clock in the morning. In the two hours since I got out of bed I have showered in water heated by North Sea gas, shaved using an American razor running on electricity made from British coal, eaten a slice of bread made from French wheat, spread with New Zealand butter and Spanish marmalade, then brewed a cup of tea using leaves grown in Sri Lanka, dressed myself in clothes of Indian cotton and Australian wool, with shoes of Chinese leather and Malaysian rubber, and read a newspaper made from Finnish wood pulp and Chinese ink. I am now sitting at a desk typing on a Thai plastic keyboard (which perhaps began life in an Arab oil well) in order to move electrons through a Korean silicon chip and some wires of Chilean copper to display text on a computer designed and manufactured by an American firm. I have consumed goods and services from dozens of countries already this morning. Actually, I am guessing at the nationalities of some of these items, because it is almost impossible to define some of them as coming from any country, so diverse are their sources.

More to the point, I have also consumed minuscule fractions of the productive labour of many dozens of people. Somebody had to drill the gas well, install the plumbing, design the razor, grow the cotton, write the software. They were all, though they did not know it, working for me. In exchange for some fraction of my spending, each supplied me with some fraction of their work. They gave me what I wanted just when I wanted it – as if I were the *Roi Soleil*, Louis XIV, at Versailles in 1700.

The Sun King had dinner each night alone. He chose from forty dishes, served on gold and silver plate. It took a staggering 498 people to prepare each meal. He was rich because he consumed the work of other people, mainly in the form of their services. He was rich because other people did things for him. At that time, the average French family would have prepared and consumed its own meals as well as paid tax to support his servants in the palace. So it is not hard to conclude that Louis XIV was rich because others were poor.

But what about today? Consider that you are an average person, say a woman of 35, living in, for the sake of argument, Paris and earning the median wage, with a working husband and two children. You are far from poor, but in relative

terms, you are immeasurably poorer than Louis was. Where he was the richest of the rich in the world's richest city, you have no servants, no palace, no carriage, no kingdom. As you toil home from work on the crowded Metro, stopping at the shop on the way to buy a ready meal for four, you might be thinking that Louis XIV's dining arrangements were way beyond your reach. And yet consider this. The cornucopia that greets you as you enter the supermarket dwarfs anything that Louis XIV ever experienced (and it is probably less likely to contain salmonella). You can buy a fresh, frozen, tinned, smoked or pre-prepared meal made with beef, chicken, pork, lamb, fish, prawns, scallops, eggs, potatoes, beans, carrots, cabbage, aubergine, kumquats, celeriac, okra, seven kinds of lettuce, cooked in olive, walnut, sunflower or peanut oil and flavoured with cilantro, turmeric, basil or rosemary ... You may have no chefs, but you can decide on a whim to choose between scores of nearby bistros, or Italian, Chinese, Japanese or Indian restaurants, in each of which a team of skilled chefs is waiting to serve your family at less than an hour's notice. Think of this: never before this generation has the average person been able to afford to have somebody else prepare his meals.

You employ no tailor, but you can browse the internet and instantly order from an almost infinite range of excellent, affordable clothes of cotton, silk, linen, wool and nylon made up for you in factories all over Asia. You have no carriage, but you can buy a ticket which will summon the services of a skilled pilot of a budget airline to fly you to one of hundreds of destinations that Louis never dreamed of seeing. You have no woodcutters to bring you logs for the fire, but the operators of gas rigs in Russia are clamouring to bring you clean central heating. You have no wick-trimming footman, but your light switch gives you the instant and brilliant produce of hardworking people at a grid of distant nuclear power stations. You have no runner to send messages, but even now a repairman is climbing a mobile-phone mast somewhere in the world to make sure it is working properly just in case you need to call that cell. You have no private apothecary, but your local pharmacy supplies you with the handiwork of many thousands of chemists, engineers and logistics experts. You have no government ministers, but diligent reporters are even now standing ready to tell you about a film star's divorce if you will only switch to their channel or log on to their blogs.

My point is that you have far, far more than 498 servants at your immediate beck and call. Of course, unlike the Sun King's servants, these people work for many other people too, but from your perspective what is the difference? That is the magic that exchange and specialisation have wrought for the human species. 'In civilized society,' wrote Adam Smith, an individual 'stands at all times in

need of the co-operation and assistance of great multitudes, while his whole life is scarce sufficient to gain the friendship of a few persons.' In Leonard Read's classic 1958 essay 'I, Pencil', an ordinary pencil describes how it came to be made by millions of people, from loggers in Oregon and graphite miners in Sri Lanka to coffee bean growers in Brazil (who supplied the coffee drunk by the loggers). 'There isn't a single person in all these millions,' the pencil concludes, 'including the president of the pencil company, who contributes more than a tiny, infinitesimal bit of know-how.' The pencil stands amazed at 'the absence of a master mind, of anyone dictating or forcibly directing these countless actions which bring me into being.'

This is what I mean by the collective brain. As Friedrich Hayek first clearly saw, knowledge 'never exists in concentrated or integrated form but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess'.

The multiplication of labour

You are not just consuming the labour and resources of others. You are consuming others' inventions, too. A thousand entrepreneurs and scientists devised the intricate dance of photons and electrons by which your television works. The cotton you wear was spun and woven by machines of a type whose original inventors are long-dead heroes of the industrial revolution. The bread you eat was first cross-bred by a Neolithic Mesopotamian and baked in a way that was first invented by a Mesolithic hunter-gatherer. Their knowledge is enduringly embodied in machines, recipes and programmes from which you benefit. Unlike Louis, you number among your servants John Logie Baird, Alexander Graham Bell, Sir Tim Berners-Lee, Thomas Crapper, Jonas Salk and myriad assorted other inventors. For you get the benefit of their labours, too, whether they are dead or alive.

The point of all this cooperation is to make (Adam Smith again) 'a smaller quantity of labour produce a greater quantity of work'. It is a curious fact that in return for this cornucopia of service, you produce only one thing. That is to say, having consumed the labour and embodied discoveries of thousands of people, you then produce and sell whatever it is you do at work – haircuts, ball bearings, insurance advice, nursing, dog walking. But each of those thousands of people who work 'for' you is equally monotonously employed. Each produces one thing. That is what the word 'job' means: it refers to the simplified, singular production to which you devote your working hours. Even those who have several paying jobs – say, freelance short-story writer/neuroscientist, or

computer executive/photographer – have only two or three different occupations at most. But they each consume hundreds, thousands, of things. This is the diagnostic feature of modern life, the very definition of a high standard of living: diverse consumption, simplified production. Make one thing, use lots. The self-sufficient gardener, or his self-sufficient peasant or hunter-gatherer predecessor (who is, I shall argue, partly a myth in any case), is in contrast defined by his multiple production and simple consumption. He makes not just one thing, but many – his food, his shelter, his clothing, his entertainment. Because he only consumes what he produces, he cannot consume very much. Not for him the avocado, Tarantino or Manolo Blahnik. He is his own brand.

In the year 2005, if you were the average consumer you would have spent your after-tax income in roughly the following way:

- 20 per cent on a roof over your head
- 18 per cent on cars, planes, fuel and all other forms of transport
- 16 per cent on household stuff: chairs, refrigerators, telephones, electricity, water
- 14 per cent on food, drink, restaurants etc
- 6 per cent on health care
- 5 per cent on movies, music and all entertainment
- 4 per cent on clothing of all kinds
- 2 per cent on education
- 1 per cent on soap, lipstick, haircuts, and such like
- 11 per cent on life insurance and pensions (i.e., saved to secure future spending)
- and, alas from my point of view, only 0.3 per cent on reading

An English farm labourer in the 1790s spent his wages roughly as follows:

- 75 per cent on food
- 10 per cent on clothing and bedding
- 6 per cent on housing
- 5 per cent on heating
- 4 per cent on light and soap

A rural peasant woman in modern Malawi spends her time roughly as follows:

- 35 per cent farming food
- 33 per cent cooking, doing laundry and cleaning
- 17 per cent fetching water
- 5 per cent collecting firewood
- 9 per cent other kinds of work, including paid employment

Imagine next time you turn on the tap, what it must be like to walk a mile or more to the Shire River in Machinga province, hope you are not grabbed by a crocodile when filling your bucket (the UN estimates three crocodile deaths a month in the Machinga province, many of them of women fetching water), hope you have not picked up a cholera dose in your bucket, then walk back carrying the 20 litres that will have to last your family all day. I am not trying to make you feel guilty: I am trying to tease out what it is that makes you well off. It is having the hard work of living made easy by markets and machines and other people. There is probably nothing to stop you fetching free water from the nearest river in your home town, but you would rather pay something from your earnings to get it delivered clean and convenient from your tap.

So this is what poverty means. You are poor to the extent that you cannot afford to sell your time for sufficient price to buy the services you need, and rich to the extent that you can afford to buy not just the services you need but also those you crave. Prosperity, or growth, has been synonymous with moving from self-sufficiency to interdependence, transforming the family from a unit of laborious, slow and diverse production to a unit of easy, fast and diverse consumption paid for by a burst of specialised production.

Self-sufficiency is poverty

It is fashionable these days to decry ‘food miles’. The longer food has spent travelling to your plate, the more oil has been burnt and the more peace has been shattered along the way. But why single out food? Should we not protest against T-shirt miles, too, and laptop miles? After all, fruit and vegetables account for more than 20 per cent of all exports from poor countries, whereas most laptops come from rich countries, so singling out food imports for special discrimination means singling out poor countries for sanctions. Two economists recently concluded, after studying the issue, that the entire concept of food miles is ‘a profoundly flawed sustainability indicator’. Getting food from the farmer to the shop causes just 4 per cent of all its lifetime emissions. Ten times as much carbon is emitted in refrigerating British food as in air-freighting it from abroad, and fifty times as much is emitted by the customer travelling to the shops. A

New Zealand lamb, shipped to England, requires one-quarter as much carbon to get on to a London plate as a Welsh lamb; a Dutch rose, grown in a heated greenhouse and sold in London, has six times the carbon footprint of a Kenyan rose grown under the sun using water recycled through a fish farm, using geothermal electricity and providing employment to Kenyan women.

In truth, far from being unsustainable, the interdependence of the world through trade is the very thing that makes modern life as sustainable as it is. Suppose your local laptop manufacturer tells you that he already has three orders and then he is off on his holiday so he cannot make you one before the winter. You will have to wait. Or suppose your local wheat farmer tells you that last year's rains means he will have to cut his flour delivery in half this year. You will have to go hungry. Instead, you benefit from a global laptop and wheat market in which somebody somewhere has something to sell you so there are rarely shortages, only modest price fluctuations.

For example, the price of wheat approximately trebled in 2006–8, just as it did in Europe in 1315–18. At the earlier date, Europe was less densely populated, farming was entirely organic and food miles were short. Yet in 2008, nobody ate a baby or pulled a corpse from a gibbet for food. Right up until the railways came, it was cheaper for people to turn into refugees than to pay the exorbitant costs of importing food into a hungry district. Interdependence spreads risk.

The decline in agricultural employment caused consternation among early economists. François Quesnay and his fellow 'physiocrats' argued in eighteenth-century France that manufacturing produced no gain in wealth and that switching from agriculture to industry would decrease a country's wealth: only farming was true wealth creation. Two centuries later the decline in industrial employment in the late twentieth century caused a similar consternation among economists, who saw services as a frivolous distraction from the important business of manufacturing. They were just as wrong. There is no such thing as unproductive employment, so long as people are prepared to buy the service you are offering. Today, 1 per cent works in agriculture and 24 per cent in industry, leaving 75 per cent to offer movies, restaurant meals, insurance broking and aromatherapy.

Arcadia redux

Yet, surely, long ago, before trade, technology and farming, human beings lived simple, organic lives in harmony with nature. That was not poverty: that was 'the original affluent society'. Take a snapshot of the life of hunter-gathering human beings in their heyday, say at 15,000 years ago well after the taming of

the dog and the extermination of the woolly rhinoceros but just before the colonisation of the Americas. People had spear throwers, bows and arrows, boats, needles, adzes, nets. They painted exquisite art on rocks, decorated their bodies, traded foods, shells, raw materials and ideas. They sang songs, danced rituals, told stories, prepared herbal remedies for illnesses. They lived into old age far more frequently than their ancestors had done.

They had a way of life that was sufficiently adaptable to work in almost any habitat or climate. Where every other species needed its niche, the hunter-gatherer could make a niche out of anything: seaside or desert, arctic or tropical, forest or steppe.

A Rousseauesque idyll? The hunter-gatherers certainly looked like noble savages: tall, fit, healthy, and (having replaced stabbing spears with thrown ones) with fewer broken bones than Neanderthals. They ate plenty of protein, not much fat and ample vitamins. In Europe, with the help of increasing cold, they had largely wiped out the lions and hyenas that had both competed with and preyed upon their predecessors, so they had little to fear from wild animals. No wonder nostalgia for the Pleistocene runs through many of today's polemics against consumerism. Geoffrey Miller, for example, in his excellent book *Spent*, asks his readers to imagine a Cro-Magnon mother of 30,000 years ago living 'in a close-knit clan of family and friends ... gathering organic fruits and vegetables ... grooming, dancing, drumming and singing with people she knows, likes and trusts ... the sun rising over the six thousand acres of verdant French Riviera coast that her clan holds.'

Life was good. Or was it? There was a serpent in the hunter-gatherer Eden – a savage in the noble savage. Maybe it was not a lifelong camping holiday after all. For violence was a chronic and ever-present threat. It had to be, because – in the absence of serious carnivore predation upon human beings – war kept the population density below the levels that brought on starvation. '*Homo homini lupus*', said Plautus. 'Man is a wolf to man.' If hunter-gatherers appeared lithe and healthy it was because the fat and slow had all been shot in the back at dawn.

Here is the data. From the !Kung in the Kalahari to the Inuit in the Arctic, two-thirds of modern hunter-gatherers have proved to be in a state of almost constant tribal warfare, and 87 per cent to experience annual war. War is a big word for dawn raids, skirmishes and lots of posturing, but because these happen so often, death rates are high – usually around 30 per cent of adult males dying from homicide. The warfare death rate of 0.5 per cent of the population per year that was typical of many hunter-gatherer societies would equate to two billion people dying during the twentieth century (instead of 100 million). At a

cemetery uncovered at Jebel Sahaba, in Egypt, dating from 14,000 years ago, twenty-four of the fifty-nine bodies had died from unhealed wounds caused by spears, darts and arrows. Forty of these bodies were women or children. Women and children generally do not take part in warfare – but they are frequently the object of the fighting. To be abducted as a sexual prize and see your children killed was almost certainly not a rare female fate in hunter-gatherer society. After Jebel Sahaba, forget the Garden of Eden; think Mad Max.

It was not just warfare that limited population growth. Hunter-gatherers are often vulnerable to famines. Even when food is abundant, it might take so much travelling and trouble to collect enough food that women would not maintain a sufficient surplus to keep themselves fully fertile for more than a few prime years. Infanticide was a common resort in bad times. Nor was disease ever far away: gangrene, tetanus and many kinds of parasite would have been big killers. Did I mention slavery? Common in the Pacific north-west. Wife beating? Routine in Tierra del Fuego. The lack of soap, hot water, bread, books, films, metal, paper, cloth? When you meet one of those people who go so far as to say they would rather have lived in some supposedly more delightful past age, just remind them of the toilet facilities of the Pleistocene, the transport options of Roman emperors or the lice of Versailles.

The call of the new

None the less, you do not have to be starry-eyed about the Stone Age to find aspects of modern consumer society obscenely wasteful. Why, asks Geoffrey Miller, ‘would the world’s most intelligent primate buy a Hummer H1 Alpha sport-utility vehicle’, which seats four, gets ten miles to the gallon, takes 13.5 seconds to reach 60 mph, and sells for $139,771? Because, he answers, human beings evolved to strive to signal social status and sexual worth. What this implies is that far from being merely materialist, human consumption is already driven by a sort of pseudo-spiritualism that seeks love, heroism and admiration. Yet this thirst for status then encourages people to devise recipes that rearrange the atoms, electrons or photons of the world in such a way as to make useful combinations for other people. Ambition is transmuted into opportunity. It was allegedly a young Chinese imperial concubine in 2600 BC who thought up the following recipe for rearranging beta pleated sheets of glycine-rich polypeptides into fine fabrics: take a moth caterpillar, feed it mulberry leaves for a month, let it spin a cocoon, heat it to kill it, put the cocoon in water to unstick the silk threads, carefully draw out the single kilometre-long thread from which the cocoon is made by reeling it on to a wheel, spin the thread and weave a fabric.

Then dye, cut and sew, advertise and sell for cash. Rough guide on quantities: it takes about ten pounds of mulberry leaves to make 100 silkworm cocoons to make one necktie.

The cumulative accretion of knowledge by specialists that allows us each to consume more and more different things by each producing fewer and fewer is, I submit, the central story of humanity. Innovation changes the world but only because it aids the elaboration of the division of labour and encourages the division of time. Forget wars, religions, famines and poems for the moment. This is history's greatest theme: the metastasis of exchange, specialisation and the invention it has called forth, the 'creation' of time. The rational optimist invites you to stand back and look at your species differently, to see the grand enterprise of humanity that has progressed – with frequent setbacks – for 100,000 years. And then, when you have seen that, consider whether that enterprise is finished or if, as the optimist claims, it still has centuries and millennia to run. If, in fact, it might be about to accelerate to an unprecedented rate.

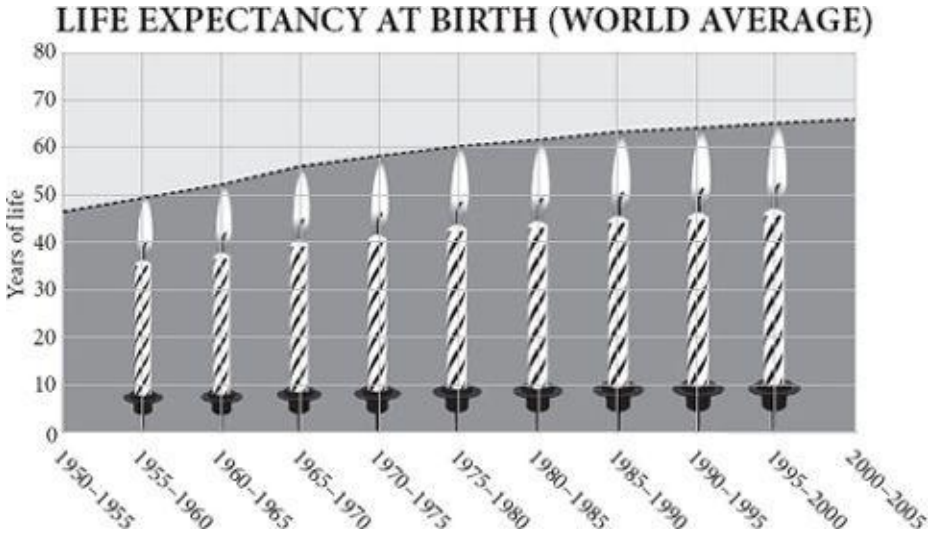
If prosperity is exchange and specialisation – more like the multiplication of labour than the division of labour – then when and how did that habit begin? Why is it such a peculiar attribute of the human species?

Chapter Two

The collective brain: exchange and specialisation after 200,000 years ago

He steps under the shower, a forceful cascade pumped down from the third floor. When this civilisation falls, when the Romans, whoever they are this time round, have finally left and the new dark ages begin, this will be one of the first luxuries to go. The old folk crouching by their peat fires will tell their disbelieving grandchildren of standing naked mid-winter under jet streams of hot clean water, of lozenges of scented soaps and of viscous amber and vermilion liquids they rubbed into their hair to make it glossy and more voluminous than it really was, and of thick white towels as big as togas, waiting on warming racks.

IAN MCEWAN
Saturday



One day a little less than 500,000 years ago, near what is now the village of Boxgrove in southern England, six or seven two-legged creatures sat down around the carcass of a wild horse they had just killed, probably with wooden spears. Each took up a block of flint and began to fashion it into a hand axe,