

# THE GREAT REBOOT

## Science and the new case for sustainable governance

By Andy Ross

*Altruism: The science and psychology of kindness*

By Matthieu Ricard. Atlantic Books, 2015

*Doughnut Economics: Seven ways to think like a 21st-century economist*

By Kate Raworth. Penguin Random House, 2017

*Enlightenment Now: The case for reason, science, humanism and progress*

By Steven Pinker. Penguin Random House, 2018

*The Uninhabitable Earth: A story of the future*

By David Wallace-Wells. Allen Lane, 2019

*Moneyland: Why thieves and crooks now rule the world and how to take it back*

By Oliver Bullough. Profile Books, 2019

*Quantum Computing for Everyone*

By Chris Bernhardt. MIT Press, 2019

### The Challenge

Altruism can be defined as a willingness to act in consideration of the interests of other people, without the need for an ulterior motive. Matthieu Ricard endorses this view and reminds readers of his book *Altruism* that there is a continuity between altruism and both Christian *agape* and Buddhist loving compassion. As a Buddhist monk as well as a scientist himself, Ricard is eager to emphasize the centrality of altruism in a good life.

Human beings are naturally disposed to behave in an altruistic manner if social pressures are not imposed to deform their natural tendencies. Indeed, the history of civilization shows an average increase in the expression of altruism in human communities as ties between them have grown and the general level of prosperity has risen. Ricard celebrates this natural rise and underscores it with a wide array of facts in his book, which gains weight from their presence.

Enlightenment is a good word for the transformed mental state the Buddha experienced when he performed his historic meditation under the Bodhi tree. The word also denotes well the transformation in the prevailing outlook on humanity and the world that accompanied the rise of European civilizational norms in the years around the eighteenth century, when the continent awakened from its thralldom to dogmatic religion to adopt a secular and scientific outlook, which promoted the role of reason in justifying a democratic polity and in defending a commitment to the concept of inalienable human rights. This is the story that prompted Steven Pinker to call his latest book *Enlightenment Now*.

An enlightened mind in the Buddhist sense is an interior state that may or may not find expression in the external world. By contrast, Enlightenment in the capitalized sense of the eighteenth century was a practical orientation toward the world that resulted immediately in

social and political action. The subsequent course of history offers ample evidence of the fruitfulness of that new stance, as Pinker proves with his detailed, numerate, and formidable case for its importance in improving the state of the species in the last few centuries.

The salient fact about the state of the species today, however, is that although our material wellbeing is incomparably greater than it was before the Enlightenment, all is very far from being well on planet Earth. In our selfish pursuit of ramping up the quality, as we see it, of our Western lifestyle, we have in effect sacked the planet and raped the environment in ways so egregious as to threaten our very survival as a species into the long-term future.

This is the bleak fact Kate Raworth takes up in her breezy tract on the need for a new economics to shape the human future in the twenty-first century, a book she dubs *Doughnut Economics*. The key to understanding her title is a sketch diagram of the Earth and its biosphere as two concentric rings, which she creatively relabels so that the inner ring depicts a “social foundation” bounding a disk of critical human deprivation, while the outer ring depicts an “ecological ceiling” bounding an infinite zone of critical planetary degradation. Her big idea is that classical economics has ignored the outer ring and that our task in this century is to respect the existential importance of this ring for us by striving to live within the “safe and just space for humanity” between the rings.

To be fair, the Enlightenment brought extraordinary progress in classical mathematics and physics, in classical economics and political theory, and in material prosperity across Europe. The historically Christian nations of Europe had recovered the cultural treasures of Greece and Rome (via Islamic civilization) and extended their own imperial reach (via trade and territorial expansion) after the Renaissance, all of which fueled their push to contain religion and to consolidate the role of reason in human affairs. But the Enlightenment also brought unwelcome developments in its wake, including slavery in European colonial possessions, urban poverty and misery in large industrial cities, frequent quarrels and wars between nations, and accelerating depredations on the natural environment.

Any sustainable future for Western civilization (without prejudice as to whether there is yet such a thing, to recall Mahatma Gandhi’s joke) must involve a radical rethink of the classical economics and democratic politics we have inherited. Neither a moralistic call to become more altruistic nor a rallying cry for reason in human affairs can do much to reduce the urgency of the need for a change of heart on the role of the human project in nature. The big challenge is to answer the question of whether we are here to satisfy our every whim and enrich ourselves at the expense of everyone and everything around us, or whether we need to reimagine our existence in a reality for which scientists have provided a fundamentally new narrative since the Enlightenment.

The new narrative includes a central existential fact that was missing before, namely awareness of just how fragile our occupancy of this planet really is. Continuing the path that we as a species on Earth have been following ever since the Enlightenment will spell our certain doom before the century is out. This is the dire prediction highlighted with shocking clarity and passion by David Wallace-Wells in *The Uninhabitable Earth*, a jeremiad for our times that shocks in part because of the substantial scientific validity of his main claim.

Our modern commitment to the exercise of reason in improving our material well-being and in advancing our social and political interests as bearers of inalienable human rights is effective as a spur to action and plausible in its claim to moral rectitude, but it has led us into peril. The exercise of reason is always based on first principles and a presumption to a certain identity, and the identity of modern human beings is precisely the issue that opens the civilizational juggernaut on planet Earth to utter and humiliating defeat. For the planet as an integral

system of systems reaching throughout the lifenet that adorns the planetary surface, human depredations are potentially a sign of sickness, not health, a symptom of psychopathic narcissism infecting the intelligent apes that claim dominion over the six-zettaton rockball beneath their feet.

To overcome this narcissism, we must learn to go beyond the altruistic and enlightened thinking that led to our planetary dominion and reconsider our deeper identity. Altruism in the service of fellow human beings is no great achievement, and enlightened pursuit of our own power and prosperity is no virtue. Being human seems a given, but it is not, and we can only master the ecological and climate crises we have precipitated if we learn to rise far enough above being human to identify with all life on Earth, both now and into the deep future. Right now, we are failing even to claim our common identity as human beings across the surface of the planet we call home.

One of the most startling symptoms of our collective failure to consolidate a species identity is the inability of governance structures worldwide to coordinate sufficiently with each other to prevent, to punish, or even significantly to hinder the international or offshore operations of greedy or criminal individuals who attempt to secure their excessive gains in complex webs of shell companies, secret foreign bank accounts, and other dubious legal constructions, in order to hide their loot from the attentions of national fiscal authorities. This is the theme taken up to good effect by Oliver Bullough in his revealing journalistic critique *Moneyland*. A worldwide total of monetary assets of unknown magnitude, but certainly in the trillions of dollars, is lurking in the legal limbo created between sovereign states by creative lawyers and accountants and corrupt national officials, a limbo Bullough calls Moneyland.

Relative to the surface world of public life and honorable industry that daily advances our shared civilization, Moneyland is an ill-defined and shadowy presence, lurking like dark matter in the interstices between the clumps of visible matter that make up our globalized world. But its gravitational effects in dragging back and hindering our surface strivings are unmistakable. Only if and when we as a global civilization can muster the righteous zeal to banish Moneyland and outlaw the millions of money-rich parasites it supports is there any real hope that we as a species can master our existential civilizational challenge.

When we do confront this challenge by recalling our deeper identity as appendages of a global organism that works through us to secure a better future for itself, and hence we hope for us, on planet Earth, it will be science we call on to explain ourselves to ourselves. Modern science has moved far beyond the Buddha, or the Enlightenment, or the shreds of doctrine used to distract attention from the unconvincing dogmatism of the economic and political axioms behind the capitalist democracies we live in. So, let us turn first to science and see how it supports our new view of the world.

## **Modern Science**

The Enlightenment began at a time when Galileo and Newton had only recently revolutionized physics, and when chemistry and biology were still in a condition we might politely describe as prescientific. Since then, physics has undergone the twin revolutions heralded by relativistic spacetime and quantum mechanics, chemistry has become a branch of physics, and biology has emerged as a science based on the facts of evolution and genetics, with the wider result that all science is now seen as continuous with physics. As new branches of science such as cosmology and planetary ecology have appeared, together with new mathematical tools such as computer modeling, it is no exaggeration to say that in recent decades we have completely

transformed our understanding of how human beings, both as individuals and as a species, fit into the natural world.

The key that unlocked the Enlightenment advances in science was mathematics. Galileo said the book of nature was written in the language of mathematics, and Newton made his greatest advances in natural philosophy with the help of a new mathematical calculus of infinitesimals he had invented. From then on, major advances in mathematics and physics occurred in tandem as the two disciplines fructified each other. The fruits of their union have nourished speedy progress along the learning curve our global civilization has followed in recent centuries. The list of advances is impressive.

From cosmology we have learned that the observable universe began in a big bang some 13.8 billion years ago, and that all the chemical elements from which we are made were cooked up in stellar nuclear furnaces billions of years ago, before clouds of gas and dust orbiting our local star condensed to form the planet Earth some 4.5 billion years ago. All the astronomical evidence suggests that our planet is special only for us in the great scheme of things, and that the billions of galaxies we can see contain countless trillions of similar planets, many with surface conditions like those on Earth.

From geology and evolutionary biology we learn that life as we know it, based on the elaborate chemistry of carbon-based macromolecules, evolved from humble beginnings almost 4 billion years ago, about as soon as the early Earth cooled sufficiently for oceans of liquid water to persist, and has been increasing in complexity and sophistication ever since. Now we have begun to understand how our human communities are embedded in natural ecosystems that form a tangled web of life around the entire planet, spread out in a thin and fragile biosphere between the hot rocks beneath our feet and the cold emptiness of outer space above our heads.

From anthropology and the social sciences, we learn that human beings are intelligent apes that spent most of their evolutionary history adapting to tribal life in small groups scattered along the coastlines and waterways of Africa. Modern life in cities, with high technology in all its forms to mediate our interactions, is a biological novelty that we are still struggling to accommodate in our lifestyles and cultural preferences. Our deep evolutionary inheritance sways our emotions and our behavior in many ways, for example in our frequent difficulties with social justice in economic transactions whenever we let arithmetic obscure the human interaction, and in our struggles to realize the ideal of rational social and political organization in our ritually formalized systems of governance.

From modern psychology and the neurosciences, we learn that our conscious minds, where rational thought and refined emotions play out in electrochemical brainwaves of astonishing complexity, are just surfaces over a deep ocean of unconscious cerebral processing that moves to rhythms bearing no obvious relation to the rational game rules of Enlightenment thought. Those rational game rules are attempts to approximate the deeper truth below, about which the best we can say to date is that it works in mysterious ways. All this implies that we face humbling limits on our ability to act rationally.

The Enlightenment model of rationality is more like a mathematical abstraction than a psychological theory. Indeed, it resembles Euclidean geometry, where nature seems at first glance amenable to ordering with a three-dimensional Euclidean space, but where in fact our efforts to understand nature involve higher-dimensional curved spaces or spacetimes, infinite-dimensional abstract spaces, and fractal geometries to model natural forms. Enlightenment psychology is similarly simplistic: Despite its theoretical elegance and intuitive appeal, it clearly falls a long way short of any realistic model of human mental life.

From the medical and biological sciences, to complete this schematic enumeration of the sciences, we learn of the fragility of our organismic identity in the great web of life at both the microscopic and planetary scales. Each of us hosts vast numbers of tiny organisms that contribute essentially to our life and our health and our inner sense of self. Similarly, each of us relies on vast numbers of other organisms, both human and nonhuman, in the wider world for our survival and our social sense of self. Our sovereign identity is a myth born of solipsistic philosophy that we need to deconstruct all the way down, to our personal phenomenology, if we are to live in peace with nature.

This great harvest from the work of generations of scientists has had the effect that much of the heritage we cite to defend our traditions for the governance of social transactions and human communities now seems irrelevant and obsolete. Ancient Greek principles or medieval English practices regarding democracy, Enlightenment ideas about the ownership of property and the hidden hand of the market, French revolutionary ideas about the inalienable rights of man – all of it needs rethinking. And the basic principles for any new approach must be based on modern science.

The first basic principle is that we humans, who do science and experience our lives along a timeline that begins and ends in nature, are natural through and through, from the sublime peaks of our most exalted spiritual states to the depths of our being as humble creatures in search of food and shelter. In our latest and best cosmic myth, nature can and should be viewed as a colossal quantum computation in which we are embedded like virtual avatars in a computer game world. Our separate personal identity – as any insightful Buddhist could already have told us – is an illusion, at best a fragile surface in an infinite space of physical fields that embraces everything in an entangled multidimensional ball of incalculable complexity.

The second principle is that we humans embody something special in the natural universe, indeed something that so far as we know to date could well be unique in all creation, namely a propensity to build a deep and layered kind of order into our immediate environments that seems to be of special and even of transcendent value. Since it is we, the creators of that order, who judge its value, our evaluation may not itself be worth much, but the illusion of value, at least, is convincing, and we are sufficiently in thrall to it to make it impossible for us to desist from doing all we can to preserve and extend it.

In short, we are dedicated to remaking nature in our own image, which is to say we are steadily and systematically refashioning our world to accommodate us more generously and more comfortably. Given the values that drive us at this deepest psychic level, we can be realistically approximated from there on upward as biological machines – unless, as a Buddhist might advocate, we realize the futility of our inborn quest and relax into nirvana.

A biologist might say we are driven by a genetic imperative, namely the drive to be fruitful and multiply, and all our strivings are conditioned by this Darwinian fact of life. But anyone impressed by the primordial universality of the drive we feel toward a nameless holy grail would say the full spectrum of modern science leads us to a wider formulation of the imperative. We are conditioned by modern social life to deprecate racism and sexism, and even speciesism, which already pushes us to the edge of the Darwinian idea that filling the world with more humans is our highest goal, so perhaps our higher duty is to rise above humanism too and even above a chauvinism for carbon-based and silicon-based life to push for life in all its forms, wherever sourced and however implemented. Campaigning for life as we understand it in this wide sense is pushing for something that could well be of special value in all of the universe, the multiverse, nature, and creation. Let this be the second principle.

The third principle for our human accommodation with the planetary reality we face is that our best strategy for realizing our values in nature is to be ever more systematic and always mindful of the facts. A systematic approach is thorough and methodical, thoughtful and consistent, principled as well as practical, and hence inclined to use the best mathematical and other tools at our disposal. The facts are not always obvious, but experience (at least since the Enlightenment) teaches us that a scientific approach to collecting and refining them is best, and that only a full and honest evaluation of all the facts we can gather will enable us to minimize the risk of failure in a natural environment that remains supremely indifferent to our human fate.

These three basic principles may seem far removed from the dismal and grubby world of economics and politics, but they have implications we do well to heed. Making money and casting votes might seem as natural as eating and drinking, but they are recent innovations in evolutionary terms, and both are surrounded in our capitalist democracies by yet more recent conventions that condition the human impact of money and votes on us in ways that no good scientist in possession of the relevant facts would endorse as remotely optimal. But before rushing on to propose a new world order, let us take the time to consider in more detail the most salient problems we hope to solve.

## **Governance Problems**

The salient problems of governance today, considered globally, for human life as a whole, can be packaged under three main themes, namely the economy, the environment, and new technology. These are complex and interrelated themes that ramify into smaller or more specific issues, but they can be treated serially under an inclusion ordering that moves out toward ever widening scope. Together, the unpacked problems spell out the scope of the overall challenge we humans confront when planning for a future life on Earth that does justice to our moral imperative to respect altruistic values and the Enlightenment heritage, so far as this remains possible in view of modern science.

First, the economic problem arises from the fact that people who are naturally different in a host of ways are players in an economic game that recognizes only winners and losers. The rich get richer, the poor get poorer, and the social problem of massive and systemic inequality rears its ugly head. The ideology of libertarianism dictates that we let winners enjoy their gains and deploy them as they see fit, but the countervailing ideology of humanitarianism dictates that we find a way to protect and support the losers. This is a moral conundrum, a classic antinomy.

The sad fact is that in economic transactions, most people are easily tricked and cheated, often in such a way that they regard the outcome as fair and beneficial, in many cases without even noticing the disguised costs or losses involved, so losers end up both paying winners in the marketplace and voting for them in their preference rankings and even in political elections. The tragic result of such double jeopardy is that the agents in those transactions generate and reinforce a fractionation process that creates caste or class societies. In such societies, countless notionally free choices under conditions of imperfect rationality result in the formation of a hierarchical social order, typically to such extremes that further economic transactions need to be actively managed to prevent a collapse into mass destitution, slavery, or some other form of gross inhumanity. The practical problem is how to manage such transactions so as to achieve win-win outcomes.

The practical problem has another side. The propensity of people to trick and cheat not only their peers but also their own higher authorities, by stashing their loot out of official sight,

requires a political response. Outside of Europe at least, legal jurisdictions end at national borders, and in the United States they often end at state borders. In consequence, the wealthy residents of Moneyland have an easy time of undermining the economic pillars of the global order and wasting assets that could find better uses. The obvious response is to push harder for an extension of legal jurisdictions to provide consistent global coverage for all financial transactions. Technology is forcing this change anyway, as the online digital world expands to swallow ever more financial and other human transactions. We need global governance not only to banish tax cheats but also to tackle all the other damaging expressions of human failings the online world encourages – and to tackle environmental issues.

The second big problem, the environmental one, arises from the economic fact known as the tragedy of the commons. The managers of economic assets naturally work toward minimizing known internal costs, with the natural consequence that they tend to ignore unknown or external costs. In this respect, economic activity can be said to raise entropy, also known as universal disorder, in the process by which local order (in pursuit of added value, accumulated wealth, or extracted profit) is deliberately raised at the expense of raising remote disorder (in the form of devalued assets, lost potential wealth, or hidden costs). In a small and simple system, such raised entropy is soon visible, for example as overgrazed common land in the classic tragedy, but in bigger and more elaborate enterprises the entropy cost can be pushed arbitrarily far away, at least for practical purposes. The economic aspect of the environmental problem is that the tragedy eventually becomes so big and expensive to fix that it is impossible both to ignore and to resolve.

The relentless efficiency of centuries of pursuit of enlightened self-interest has raised the order of our local domain, both for individuals and for the species, and raised the entropy of our more remote surroundings, which as we expanded toward planetary dominion suddenly became our local domain too, our own back yard, ruined in advance of our occupation by our own previous depredations. To earlier human generations, the planetary surface seemed effectively infinite, and hence the wider commons seemed to provide an inexhaustible sink for our emissions, our excretions, our refuse, our refugees, and all the old stuff we threw out to make way for the next new thing. But now the scale of our footprint is planetary, and we have hit a hard limit on the capacity of our convenient sink. The atmosphere and the oceans are beginning to resemble the stale air in a crowded bedroom and the waste water in a communal bathroom.

The environmental problem has dimensions beyond those on which a monetary metric can be imposed. Many environmental issues can be forced into a raster of costs and benefits, where financial incentives and punitive taxes can be deployed by sufficiently enlightened governors to right wrongs and steer or nudge behavior. But many are not, and these include some of the biggest ones, such as species extinction, changing climate and weather patterns, or rising sea levels, which present an incalculable balance of losses and opportunities and where the scale of the potential loss as a whole becomes existential for our future as a species. In the long term we're all dead, of course, and perhaps an acceleration of human extinction is not something to worry about, but only fools will deliberately hasten their own demise.

The third problem, the impact on us all of the onrush of new technology, may seem to be hardly a problem at all. As we increasingly enjoy the benefits of 5G connectivity and the internet of things, as we appreciate the artificial intelligence, AI, embedded into everyday products, as we discover the potential of augmented reality, AR, to enhance our view of the world around us, we can only feel grateful, surely, to be alive at a time of such thrilling progress. Yet the advances have a downside, where our increasing dependence on electronics to support our daily lives creates not only acute risks, such as the vulnerability of all the

interconnected systems we rely on every day to untold damage at the hands of irresponsible or hostile hackers, or the inordinate demands that online systems make on our emergency responses if things don't quite go the way foreseen by the system architects, but also slow or chronic risks, such as those due to the massive environmental footprint of the background infrastructure for pervasive digital systems, or the deleterious impact on human health and autonomy of increasing reliance on digital systems for everything, or – more alarmingly – the control question of who is in charge of it all.

Three related risks within the scope of this control question arise in turn. The first is the risk of sheer loss of control, as embedded systems proliferate and become ever more interconnected, so that networks outreach the scope of potential controllers at local, national, or regional levels and drive up the problem of control to a global level, where organized human governance may simply be nonexistent. The second risk arises immediately, as AI systems are deployed to provide their own governance of technical networks at global level, and as those systems in turn are fireproofed to outsmart any attempt by humans to hack or override them. And third, as a further consequence, as AI systems escape human governance yet continue to drive scientific and technological progress, the appearance of artificial life, AL, will in future challenge human sovereignty on Earth as never before.

The interactions of these three main problems (economic, ecological, and technological) give rise to governance problems that will almost certainly overwhelm any foreseeable human capacity to orchestrate effective solutions within the paradigms that presently constrain thinking in economics and politics. Capitalist democracies seek to solve problems by means of mechanisms based on money and votes, but both, in the modern world, are increasingly being implemented in terms of bits of information. In the world we are now living in, information flows not only provide the raw data for a unified scientific model of the human project on planet Earth but also implement the strategies for enrichment and governance that drive the human project forward. This new world of bits goes fundamentally beyond the old paradigms in forcing a new understanding of how to drive it forward.

If this new role for bits is not yet clear, recall that money and votes are tokens of value and preference. Monetary transactions generate a trace of mutual human evaluations at a fine level of granularity, and these changing evaluations, recorded as credits or debits, are translated or understood at the human level as rights and duties within a social frame. In this way, the moral architecture of a society is reflected with high fidelity in its monetary articulation. This reflection of an ethical system is composed of bits, of classical bits. Similarly, the voting and social preferences of a community are also reflected in a dynamically changing pattern of bits, as recording by polling organizations, both inside and outside formal government control, and public membership of political parties, professional associations, trade unions, religious communities, hobby clubs, coffee circles, and so on. In principle, then, though emphatically not in fact, a capitalist democracy can be modeled mathematically as a function recording the temporal evolution of a rather large bit vector. This is the principle behind many high-level models of an economy or a society.

For those who recall the history of classical physics, this vision may not seem too remote from that of the cosmos as celestial clockwork, with the suggestion that a sufficiently precise knowledge of the position and movement of all the particles that make up our world would enable us to model and predict the course of history, at both planetary and personal level, with arbitrary precision. We all know how that vision failed, as it must, with the development of quantum mechanics, introducing uncertainty and entanglement, as a radical generalization of classical mechanics, as well as the discovery of incompleteness in mathematics, and with it the limits of computability and a new understanding of randomness and chaos.



Our best models of nature today are based on quantum computation, where the elementary bits of classical computing are replaced by qubits. Chris Bernhardt provides an elegantly minimal introduction to this approach in *Quantum Computing for Everyone*, which will appeal to any reader with a modicum of patience, a liking for logic, and an advanced competence in high-school mathematics. This is not everyone, although it may include everyone who can fully appreciate the rest of my argument in this essay.

## Rebooting Governance

In the new quantum paradigm, the natural world that confronts us is a largely invisible vista of virtual states coded in qubits, which our human actions reduce locally to bits, with unknowable remote consequences, leaving a subtly altered virtual vista of remaining qubits to realize our further futures. This vision of nature at the computational level as a quantum realm is a work in progress, and it falls a long way beyond my scope here to sketch out more than the most basic consequence of living in a qubit world for how we go about solving our governmental challenges, but this consequence looms so large that appreciating it is key to understanding and motivating the reboot of our governance model mooted here.

Crudely outlined, our interactions with virtual vistas of qubits reduce them step by step to a growing heap of classical bits, which we experience as the factual course of our history. We can picture a qubit as a bubble, in a superposition of the classical states 0 and 1, which pops when we measure it to reveal a classical 0 or 1 bit. We humans are on a journey, moving forward in time, popping qubits as we go and making choices that may be good or bad on every step of the way.

Capitalist democracy can be seen as the embodied calculus by which we collectively seek to optimize our moral trajectory as we do so. The three salient problems of governance, in economics, ecology, and technology, appear now as issues that are proving intractable from within the paradigms of classical computation, of classical economic and political models. Those legacy paradigms lead to solution strategies that already seem ineffective and may turn out to be plain wrong in the new view.

Our great economic challenge is to optimize resource allocation, which in human terms implies reducing or managing inequalities of income or wealth. Our great ecological challenge is to optimize our environment, which implies finding ways to reduce or manage climate change and species loss. And our great technological challenge is to find ways to deploy artificial intelligence and all its fruits well enough not to orchestrate the emergence of artificial life in toxic or hostile forms but instead to lead us toward a better future.

The model of enlightened human nature that underlies capitalist economics and democratic politics depends for its validity on two premises that we now know to be false, namely, first, that people can deploy potentially unlimited rationality in pursuit of their goals, and second, that their respective goals, when realized to the extent possible at market equilibrium, will cohere harmoniously together to realize a society that can achieve sustainable peace with itself and with nature. We now know that people can be fooled into throwing away their money and their votes to mad or bad ends and cannot be trusted to pursue goals that advance the common good.

Letting everyone just do what they want is not a recipe that guarantees a good outcome. But, of course, the system restrains most people from doing what they want. Most consumers earn enough to provide their families with enough to get by, but not much more. Only a few people get to do what they want on a scale that seriously affects the common good.

Recall that money is stored value. For a business to accumulate capital and then invest it in a project is in effect to regiment the people who created that value in the service of the project. We tend to regard rich investors as free to choose projects independently of the wishes or dreams of those who generated the wealth thus invested, which suggests that in the realm of money, at least, we accept absolute dictatorships. Once the money is mine, I can dispose of it as I please, regardless of what others think or feel. This freedom is amplified in business corporations, which are not organized as democracies. Within such a corporation, decision-making power is strictly hierarchical, and the CEO is the dictator. More generally, property rights in capitalist societies are essentially dictatorial in nature.

By contrast, votes in the political realm are expressions of preference for certain general policies with regard to the choices made on behalf of the public. A democratic polity aims to give due weight to the votes of each and every voter. Militating against that aim is the pragmatic fact that a democratic government is made up of members selected on the basis of some kind of merit, be it one of qualifications or experience or class background or family connections, who then proceed to govern with very little democratic input, which may be limited to the enforced endorsement of a majority within a cabinet or parliament. Still, ultimately, democratic political rights are rooted in public affirmation via the voting system, which means they are essentially popular in nature.

In a world where money and votes are all reducible to bits, this contrasting treatment of money and votes in a capitalist democracy is remarkable. But it is partly illusory, because spending money is equivalent to voting, and in a state where most voters have decent incomes their money votes have far more practical importance than their political votes. In all capitalist democracies, money is power, and political power follows the money, either directly, as in America, or indirectly, as in Europe, where all politicians are expected to pursue policies that advance the general prosperity.

When we compare economic and political power structures, we see that a functional government even in a democratic state must have at least the freedom of maneuver of a board of directors in a business corporation. In business, any viable corporation that aims to make profits must respect the money votes of its customers or of the consumers of its products, as well as steering them by means of promotional advertising, and any CEO who wishes to remain in post must respect the wise counsel of his board of directors. In politics, any government that aims to survive through more than one crisis must not only do what voters demand but also be able, if necessary, to act against the evident wishes of its voters, and to use propaganda and misinformation to help it do so. In other words, effective democratic governments and long-lived business corporations share a great deal of their functional DNA (to use a popular metaphor).

This convergence of economic and political paradigms may come as no surprise. Economics on this view is no more than a technocratic variant of politics, or politics pursued by other means. As scientists, we can stand back and say the strategic deployment of information is the underlying concept for understanding both kinds of organization.

The environmental problem might seem to be more immune to the problem of politicization, since the scientific results of climate science and ecosystem biology are generated and published in accordance with best scientific practice. Unfortunately, the general public does not always think in accordance with best scientific practice, and politicians can again exploit public ignorance of the facts to spread misinformation and propaganda. As recent public debates shown all too clearly, a false but soothing narrative can gain mind share at the expense of the hard facts.

As for the promise and peril of new technology, no one can doubt the power of the promoters of wild new ideas across the tech sector to sell their illusory visions, both to venture capitalists and to the general public, in defiance of a sober perspective on what we all need to secure a decent human future. Here again we find false advertising and misinformation, where tempting visions of future delights go insufficiently contested and crowd out the duller but wiser counsel of those who take a longer view.

All this suggests that the classical paradigm of the information society, where revealing more information is better, where a marketplace of such information can be expected to result in the emergence of a better master narrative, and where simply asking people what they want is the best way to steer Spaceship Earth on its cosmic voyage, is an unpromising basis for solving the three big challenges. We need something new to catalyze the reboot of our global society.

As advertised above, an apparently arcane but fundamentally important idea from quantum computation can help us out here. Our information society is based on bits, which are really qubits, and qubits interact in a way that has no classical precedent. Once we appreciate the importance of that new interaction, we can see how it offers a metaphor we can use to describe our problems more fruitfully. If the classical account of our big challenges makes them look insoluble, then a new way to describe them can only be welcome.

Entanglement is the new idea. Qubits A and B can be entangled with each other, for example so that if qubit A is measured to be in state 1, we know without making another measurement that qubit B is in state 0. The full quantum story of such entanglements is distracting and unhelpful here, but one point is key. The entanglement is not a matter of measurement triggering a causal chain running from A to B, but a matter of fact concerning A and B, yet it is not a matter of prior facts about A and B either, since the 0 state of B first becomes a fact when the 1 state of A is measured. A useful view is that A and B are two sides or aspects of one and the same thing, which becomes more fully realized with our measurement.

The reality we live in changes as we move forward in time. The constellation of facts we face evolves in lockstep with our own evolving interface to those facts. In consequence, simply becoming aware of more facts when facing a problem is in general unhelpful. We end up drowning in a torrent of irrelevant bits that fail to cohere into a guiding narrative.

Faced with a qubit reality, we need to be selective about which facts to measure, or which qubits to pop, and to base our choice on how they will help us continue an evolving master narrative that puts the new facts into a coherent perspective. Decide on a story, work out its implications, and pop just the new facts that can help to continue the story. In general, what we don't know will entangle with other stuff and evolve into qubits that superpose 0 and 1 in some complex way, but that need not bother us so long as the facts we do pop continue to support our evolving master narrative.

If this account still seems impossibly remote from the challenges confronting capitalist democracy, consider how it contrasts with an account within the classical bit paradigm. In a classical world, we tend to regard things, and bits, as separate from each other, so that what we do to or with X need have no effect on Y, or that what I do need not affect what you do, and so on. Our world crumbles into a kind of malleable dust that we can form as we like. In a quantum world, by contrast, hidden connections can be arbitrarily pervasive, both in the stuff we manipulate and between us as complex agents in the world. A proper awareness of these connections will change the kinds of narrative we are ready to accept.

Essentially, the diagnosis this analysis suggests is that those of us who accept the worldview of capitalist democracy have lost the plot. That old master narrative is based on a deep illusion.

When proper account is taken of the pervasiveness of entanglement in nature, we cannot in general expect that X has no effect on Y, or that what I do has no effect on what you do.

This is not just a matter of there being causal linkages between X and Y or between you and me, but is rather a matter of underlying ontology, of the nature of things in our world. Things that seem separate can share a deep common identity. We need to apply this metaphor from physics far more widely than we have been accustomed to applying it. When we do so, the links between, say, the excessive enrichment of the chosen few in the corporate world and the intensifying immiseration of the toiling masses, or the continuing growth of energy-hungry industries and the accelerating ruination of the natural environment, or the development of AI/AR/AL and the loss of meaning in the lives of people bypassed by their deployment, all seem entirely natural, and indeed become our default expectations regarding the unfolding of the great story we are enacting in the drama of modern civilization.

The great moral behind the mooted reboot of governance in both the economic and political fields is that we can expect pervasive entanglement to be the default reality we live in. We and our worlds, as things change step by step with the popping of new facts, will continue to reveal new facets of our deeper identity – with each other, with things, and with the wider world as a whole. Only in a first approximation, when we take our first baby steps in popping qubits all around us, can we take it that the facts are separate from each other. Our classical logic, so central to scientific practice and the legal system as we have known them, can all too easily degenerate into sophistry.

Recalling the need for altruism in human affairs, the importance of Enlightenment values in our systems of governance, and the huge size of the challenges we face today, a look back on our own deeper identity as facets of a living planetary organism might help. Our challenges become issues regarding the internal organization of a planetary machine for exporting our entropy to the cold depths of outer space. All humans alive – in the past, present, and future – are members of a family with a common purpose. With this truth, suitably flashed out, as our master narrative, our challenges look more tractable.

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