# HOW TO SAVE HUMANITY

Essays and answers from the desks of futurists,
economists, biologists, humanitarians,
entrepreneurs, activists and other people
who spend a lot of time caring about, improving,
and supporting the future of humanity.

# HELLO FRIEND

This book is an effort to highlight the most pressing issues facing humanity today and present potential solutions to these challenges in the near future.

In it you will find the knowledge, thoughts, fears, and hopes of scientist, humanitarians, economists,  social entrepreneurs, futurists, and many others who spend a lot of time and efforts towards improving or future.

I hope this book let's you find new ways you can take action on supporting the future of humanity.

With kindness,
Janet Alexandersson

Facilitator of How To Save Humanity
Founder of Basics.Is

When you see a plus sign like the one below you can click on it to learn more about the topic you have just read about and/or the author that wrote that particular piece.

*Astronomer Carl Sagan once said*

**“Extinction is the rule. Survival is the exception.”**

# TABLE OF CONTENTS

# SIMON ANHOLT

**Simon Anholt is an independent policy advisor who helps national, regional and city governments develop and implement strategies for enhanced economic, political and cultural engagement with other countries.**

It's one global crisis after another these days – climate change, violent conflict, pandemics, nuclear proliferation, organised crime, human trafficking, mass migration, racism and intolerance, human rights, to name just a few – each of these problems has been made more dangerous by globalisation, and each of them is now too big and too complex for any individual nation to resolve.

**The problems that unite all of humanity are now much greater than the problems that divide us.**

Yet nations don't collaborate nearly as much as they should, because their leaders are fixated on competition, locked in an unending, destructive struggle to gain more money, growth, power and influence for their country, their businesses, their voters.

The main reason they still do this is because we, their voters, haven't told them to change. In fact, many of us encourage them to be more and more selfish – to grab the best deal they can for us, even if this means making life harder for other people in other countries, even if it pushes humanity and the planet towards disaster.

Things have got to change. Research suggests that about 10% of the world's population isn't happy with this situation, and is much more concerned about global issues than national ones.

10% feels a sense of belonging to humanity as much, if not more, than belonging to a particular race or nation.

10% is seven hundred million people. Those are the people we need to join the Good Country. It's only 10% of the world's population, but if coordinated, it could be one of the most influential movements in history. Can you be part of this movement? Can you help to reach the 10%?

# SETH BERKLEY

**Seth Berkley, MD, a medical epidemiologist by training. He is CEO of Gavi, the Vaccine Alliance and a global advocate on the power of vaccines. He is also the founder and former President and CEO of the International AIDS Vaccine Initiative.**

From growing concerns about climate change and the ever-present threat of nuclear Armageddon, to the seemingly more far-fetched yet nevertheless real risk of a massive asteroid catastrophically striking our planet, today there appears to be no shortage of potential threats to humanity.

**But when it comes the biggest and most probable threat, ironically that is most likely to come from the very same driving force that got us here in the first place — evolution.**

In 2005 distinguished scientist and policy analyst Vaclav Smil attempted to calculate the probabilities of sudden disasters large enough to shift the course of humanity. By his definition, these involved events that were capable of killing up to 100 million people in the next 50 years — events he dubbed “massively fatal discontinuities”. One such event stood out as almost 100 per cent likely: that a viral mutation leads to an epidemic that spreads around the world.

If public opinion is anything to go by, Smil appears to be right on the money. According to a survey of 4000 people carried out in June 2015 by the World Bank, there is a strong belief that the world will experience a global epidemic within the next decade, and that even most developed countries are not prepared for it.

This wouldn't be the first time. In the 1918 Spanish flu pandemic, a new and particularly virulent strain of H1N1 influenza virus emerged, spreading like wildfire and killing as many as 50-100 million people, the equivalent of up to 5% of the world's population at the time. Given that around $10^{23}$ viral infections are believed to take place in the biosphere every single second, it is an evolutionary certainty that this is not the last time we will see an epidemic so contagious and deadly. It is not a question of "if", but of "when".

Today the global industry that churns out hundreds of millions of seasonal flu vaccines every year is in theory poised and ready to produce high volumes of a pandemic flu vaccine if the need ever arises, and if one can be developed in time. But the full-scale pandemic production has never been fully tested and even with the more predictable seasonal flu vaccines it takes as long as six months to produce doses of vaccine in bulk. And that's only for flu. What if the next big pandemic comes in the form of a coronavirus like Middle East Respiratory Syndrome (MERS) or a haemorrhagic fever like Ebola, Marburg or Lassa fever? Or a novel virus, something to which we have never been exposed before? Indeed, strategic terrorists continue to explore use of bioterrorism, which further amplifies the risk.

So the worry now is that nearly a century on from the 1918 Spanish flu, and despite huge advances in biomedical science, we are still not much better prepared for a global pandemic than we were at the end of the First World War. In fact, given the increases in global travel with more than one billion people spending a night outside of their country last year, one could plausibly argue, we are less prepared. The recent Ebola epidemic in West Africa, which left more than 11,000 people dead and more than 28,000 infected, has certainly made that clear.

Vaccines remain the most powerful and cost effective solution. Not only have they helped eradicate smallpox, with polio now very close to being wiped out too, but they also prevent millions of deaths and great suffering through routine immunisation. Yet there is a problem. Since the 1940s more than 340 emerging infectious diseases have been identified, but after more than 200 years of modern vaccinology there are still fewer than 30 human diseases that currently can be prevented with vaccines. Put simply, if this were an arms race, we would be losing. So why is that?

Modern vaccines can be highly sophisticated and capable of protecting simultaneously against multiple strains of a disease. It is also now possible to reverse engineer vaccines, using bioinformatics to analyse the entire genome of a pathogen in order to more efficiently identify potential antigens, a technique known as reverse vaccinology. And we can also engineer hugely complex yet effective biomolecular delivery systems, known as

vectors, where a harmless bacteria or virus is adapted to deliver different “payload” antigens to their targets.

But despite such advances two major problems persist: technology developed in the lab doesn’t necessarily make it to a licensed product, and even when it does, often those who most need a vaccine are the ones who have the least access to it. Again, Ebola is a case in point. Only after the World Health Organization declared the situation in Guinea, Liberia and Sierra Leone an “international health emergency”, we then witnessed the fast-tracking of Ebola candidate vaccines through clinical trials at record speed.

One of those candidate vaccines in particular, rVSV-ZEBOV, showed very promising signs of being highly effective, with great potential to contain outbreaks, provided the appropriate vaccination strategy was employed. This was great news for the prospect of ending the ongoing epidemic in West Africa, and potentially preventing future outbreaks from getting out of control.  But it also meant that had the vaccine been available sooner it could have prevented the situation from escalating in the first place, saving thousands of lives. This was in fact the case because rVSV-ZEBOV had indeed been developed more than a decade before this outbreak occurred. However instead of advancing through clinical trials, it ended up, like so many other candidate vaccines, sitting on a shelf going nowhere.

The simple reason for this is that there was no market for an Ebola vaccine. With a disease such as Ebola, which kills ferociously but occurs sporadically and usually in remote parts of Africa, there is simply no commercial market. Who would buy it? Usually outbreaks involve only a couple of hundred cases and occur every few years in poor rural communities. This leaves little incentive for manufacturers to invest the hundreds of millions of dollars it takes to develop a vaccine and get it clinically approved.

**This ugly truth highlights a fundamental flaw in the development process of vaccines, a flaw that can be summed up with a single word: risk. The reality is that vaccines are not developed based on the risk a pathogen poses to people; rather, the economic risks involved in developing a vaccine determine whether or not an antigen makes it through the pipeline to become a clinically approved product.**

Industry is not to blame for this. Whether you are a government or a multinational biopharmaceutical company, the high costs involved in taking even a promising antigen and turning it into a viable vaccine – one that is available in large quantities –

represent a significant barrier. The only reason the Ebola trials happened at all is that manufacturers, philanthropists, donor governments and research organisations agreed to share the costs, and even then that left a significant funding gap in terms of who would pay for the production of the tens of thousands, if not millions, of doses that would subsequently be needed.

That brings us to the second challenge: even when enough doses have been produced, how do you ensure they get out to those who need them most? This is a perennial problem with vaccines. Typically, when a new vaccine makes it to market it can take more than a decade before the price comes down – if it ever does – to a level where it is affordable for poor countries, which are often those most affected. Even then it can be a struggle to ensure that those living in the world's poorest countries get access.

Indeed, this is one of the reasons why my organisation - Gavi, the Vaccine Alliance - was set up in 2000. Our mission from the beginning was to confront more common – and in terms of headcount far more deadly – infectious diseases, such as hepatitis B, pneumonia, cervical cancer and diarrhoea. These diseases have a massive impact on countries that are often too poor to fully pay for the relatively new lifesaving vaccines that are available, so Gavi was set up to subsidise their purchase and to incentivise manufacturers to develop further new vaccines for use in these countries. One of the ways we achieve this is by addressing market failures directly, using public resources to create long-term predictability for manufacturers by making bulk purchasing commitments on behalf of the poorest countries, and using this purchasing power to bring down prices.

In the case of a global pandemic, however, the rules are different. In all likelihood wealthy governments would step in and pay for doses for their own people, as well as for first responders around the world.

In the case of Ebola, Gavi has stepped in and agreed to potentially fund the purchase of a substantial quantity of the vaccine for West Africa, and help fund the creation of a global stockpile, once a vaccine has been approved. Yet even once the doses are paid for there are still very real logistical challenges in getting them to where they are needed. In West Africa we saw fragile health systems collapse very quickly under the strain of Ebola. And in a country like Liberia which even before the outbreak had barely 50 doctors caring for a population of 4.4 million, how do you ensure everyone gets vaccinated?

Clearly the solution to both vaccine development and access involves being better prepared, being pre-emptive rather than responsive. But how? The first step would be to remove some of the barriers to vaccine development by working out which diseases require special attention. The scientific and medical community will need to identify those that pose the greatest

threats, and estimate how big a risk they pose, so that we may prioritise. That is unlikely to yield any surprises, as there are probably around a dozen known candidates, such as Ebola, Marburg and henapivirus, with understood and well modelled risk factors. These include diseases caused by RNA viruses, which have high mutation rates, and diseases that are endemic in animal populations, especially where animals live in close contact with humans.

We then need to identify any existing antigens for this shortlist and fund research to improve them and our understanding of the biology and mode of transmission, to make it easier to spot epidemics sooner. This would involve ensuring that candidate vaccines with epidemic potential are not left on the shelf but are taken as far forward in the development pipelines as possible, with trial protocols in place and stockpiles ready to flow the moment we need them. By carrying out such measures we can help remove some of the financial risks involved in vaccine production, such as scaling-up facilities to produce doses in bulk.

But to make this possible also means investing in the basics of an infectious disease surveillance system. All countries need to have capabilities to collect routine surveillance information in real-time and use this information locally to improve the health situation in that region. Yet, when it comes to detecting new diseases — whether a result of natural evolution or man-made — surveillance is necessary but not sufficient. Expert epidemiological knowledge and laboratory facilities are both also needed on the ground. These needn't be particularly sophisticated, but should be capable of following-up on any "unusual" reports, dispatching trained staff to potential hotspots to collect and process specimens and carry-out preliminary investigations. All of these need to be connected to a broader network that can be called upon when new pathogens or unusual outbreaks occur. All this should be enabled through a comprehensive global emergency vaccine fund.

Similarly, improving access to vaccines will require investment, in the health systems of poor countries in particular and through increased coverage of routine immunisation in these countries. Currently one in five children are still missing out on their recommended immunisations. That is a concern because that fifth child represents the hardest to reach and most vulnerable children in the world. Whether they live in remote rural regions or urban slums, they have no access to health systems. Reach them and the impact on the number of children who die or are sickened each year will be dramatic. But also, reaching them will help strengthen us all against emerging infectious disease, because the fifth child is often in one of our blind spots.

**As a species we have come so far that we have forgotten our greatest foe. Infectious disease is**

**not a freak asteroid with an infinitesimal chance of occurring, or a nuclear war that could be triggered at the press of a button by a madman.**

Nor is it a slow-motion car crash like global warming. Infectious disease is and always has been an ever-present and continuous threat; it is a continuous battle between our immune systems and the very same world that sustains us. Our bodies know that even if we have forgotten. These bugs will continue to evolve and terrorists will continue to tinker with them thereby threatening humanity, and in the face of that threat vaccines are our best defence. We need to stop waiting until we see evidence of a disease becoming a global threat before we treat it like one. If we want to prevent major outbreaks of disease, then we need to start viewing vaccines as the ultimate deterrent; making sure they are there, and at the same time praying we never have to use them.

# NICK BOSTROM

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# Existential Risk Prevention as Global Priority

## 1. The maxipok rule

### Existential risk and uncertainty

An existential risk is one that threatens the premature extinction of Earth-originating intelligent life or the permanent and drastic destruction of its potential for desirable future development (Bostrom, 2002). Although it is often difficult to assess the probability of existential risks, there are many reasons to suppose that the total such risk confronting humanity over the next few centuries is significant. Estimates of 10–20 per cent total existential risk in this century are fairly typical among those who have examined the issue, though inevitably such estimates rely heavily on subjective judgment.[1] The most reasonable estimate might be substantially higher or lower. But perhaps the strongest reason for judging the total existential risk within the next few centuries to be significant is the extreme magnitude of the values at stake. Even a small probability of existential catastrophe could be highly practically significant (Bostrom, 2003; Matheny, 2007; Posner, 2004; Weitzman, 2009).

Humanity has survived what we might call *natural existential risks* for hundreds of thousands of years; thus it is prima facie unlikely

that any of them will do us in within the next hundred.[2] This conclusion is buttressed when we analyse specific risks from nature, such as asteroid impacts, supervolcanic eruptions, earthquakes, gamma-ray bursts, and so forth: Empirical impact distributions and scientific models suggest that the likelihood of extinction because of these kinds of risk is extremely small on a time scale of a century or so.[3]

In contrast, our species is introducing entirely new kinds of existential risk—threats we have no track record of surviving. Our longevity as a species therefore offers no strong prior grounds for confident optimism. Consideration of specific existential-risk scenarios bears out the suspicion that the great bulk of existential risk in the foreseeable future consists of *anthropogenic existential risks*—that is, those arising from human activity. In particular, most of the biggest existential risks seem to be linked to potential future technological breakthroughs that may radically expand our ability to manipulate the external world or our own biology. As our powers expand, so will the scale of their potential consequences—intended and unintended, positive and negative. For example, there appear to be significant existential risks in some of the advanced forms of biotechnology, molecular nanotechnology, and machine intelligence that might be developed in the decades ahead. The bulk of existential risk over the next century may thus reside in rather speculative scenarios to which we cannot assign precise probabilities through any rigorous statistical or scientific method. But the fact that the probability of some risk is difficult to quantify does not imply that the risk is negligible.

Probability can be understood in different senses. Most relevant here is the epistemic sense in which probability is construed as (something like) the credence that an ideally reasonable observer should assign to the risk's materialising based on currently available evidence.[4] If something cannot presently be known to be objectively safe, it is risky at least in the subjective sense relevant to decision making. An empty cave is unsafe in just this sense if you cannot tell whether or not it is home to a hungry lion. It would be rational for you to avoid the cave if you reasonably judge that the expected harm of entry outweighs the expected benefit.

The uncertainty and error-proneness of our first-order assessments of risk is itself something we must factor into our all-things-considered probability assignments. This factor often *dominates* in low-probability, high-consequence risks—especially those involving poorly understood natural phenomena, complex social dynamics, or new technology, or that are difficult to assess for other reasons. Suppose that some scientific analysis A indicates that some catastrophe X has an *extremely* small probability P(X) of occurring. Then the probability that A has some hidden crucial flaw may easily be much greater than P(X).[5] Furthermore, the *conditional* probability of X given that A is

crucially flawed, P(X |ØA), may be fairly high. We may then find that most of the risk of X resides in the uncertainty of our scientific assessment that P(X) was small (Figure 1) (Ord, Hillerbrand and Sandberg, 2010).

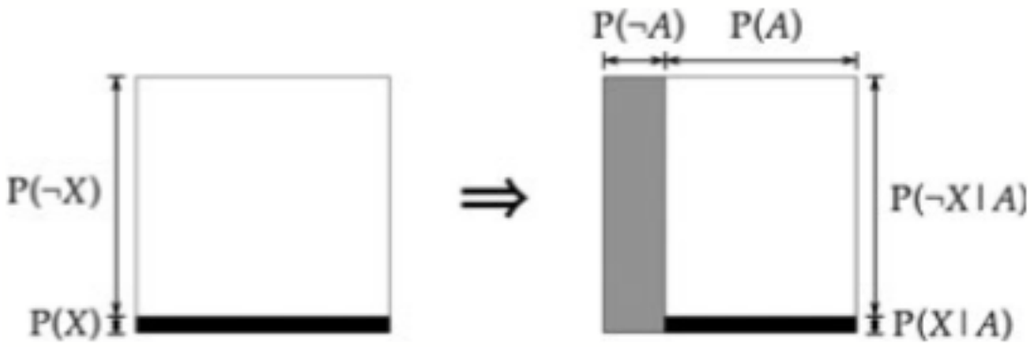



**Figure 1** Meta-level uncertainty.

*Source: Ord et al., 2010. Factoring in the fallibility of our first-order risk assessments can amplify the probability of risks assessed to be extremely small. An initial analysis (left side) gives a small probability of a disaster (black stripe). But the analysis could be wrong; this is represented by the grey area (right side). Most of the all-things-considered risk may lie in the grey area rather than in the black stripe.*

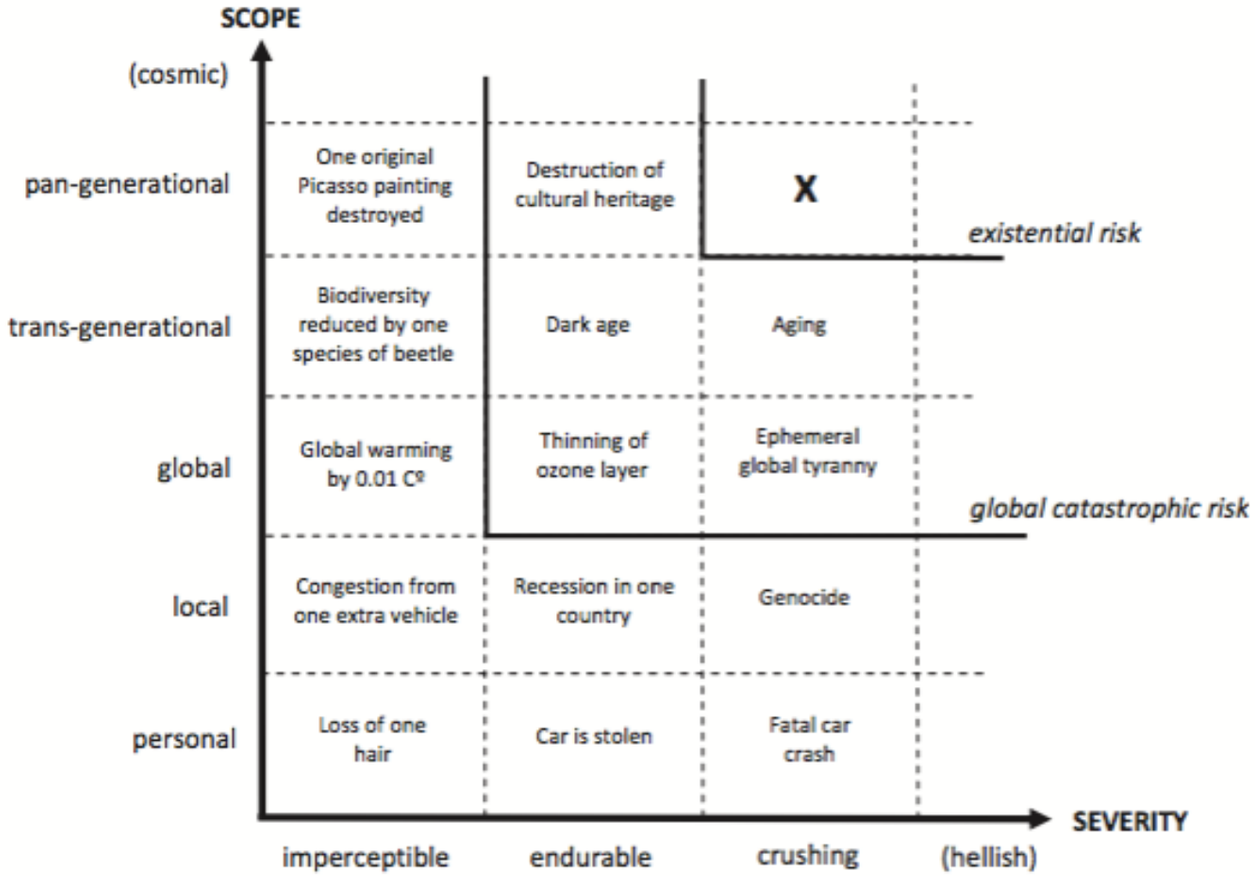
## Qualitative risk categories

Since a risk is a prospect that is negatively evaluated, the seriousness of a risk—indeed, what is to be regarded as risky at all—depends on an evaluation. Before we can determine the seriousness of a risk, we must specify a standard of evaluation by which the negative value of a particular possible loss scenario is measured. There are several types of such evaluation standard. For example, one could use a utility function that represents some particular agent's preferences over various outcomes. This might be appropriate when one's duty is to give decision support to a particular decision maker. But here we will consider a *normative* evaluation, an ethically warranted assignment of value to various possible outcomes. This type of evaluation is more relevant when we are inquiring into what our society's (or our own individual) risk-mitigation priorities *ought* to be.

There are conflicting theories in moral philosophy about which normative evaluations are correct. I will not here attempt to adjudicate any foundational axiological disagreement. Instead, let us consider a simplified version of one important class of normative theories. Let us suppose that the lives of persons usually have some significant positive value and that this value is aggregative (in the sense that the value of two similar lives is twice that of one life). Let us also assume that, holding the quality and duration of a life constant, its value does not depend on when it occurs or on whether it already exists or is yet to be brought into existence as a result of future events and choices. These assumptions could be relaxed and complications could be introduced, but we will confine our discussion to the simplest case.

Within this framework, then, we can roughly characterise a risk's seriousness using three variables: *scope* (the size of the population at risk), *severity* (how badly this population would be affected), and *probability* (how likely the disaster is to occur, according to the most reasonable judgment, given currently available evidence). Using the first two of these variables, we can construct a qualitative diagram of different types of risk (Figure 2).

**Figure 2.** Qualitative risk categories.




(The probability dimension could be displayed along the z-axis.)

The area marked 'X' in Figure 2 represents existential risks. This is the category of risks that have (at least) crushing severity and (at least) pan-generational scope.[6] As noted, an existential risk is one that threatens to cause the extinction of Earth-originating intelligent life or the permanent and drastic failure of that life to realise its potential for desirable development. In other words, an existential risk jeopardises the entire future of humankind.

*Source: Author.*

*Note: The scope of a risk can be personal (affecting only one person), local (affecting some geographical region or a distinct group), global (affecting the entire human population or a large part thereof), trans-generational (affecting humanity for numerous generations, or pan-generational (affecting humanity over all, or almost all, future generations). The severity of a risk can be classified as imperceptible (barely noticeable), endurable (causing significant harm but not completely ruining quality of life), or crushing (causing death or a permanent and drastic reduction of quality of life).*

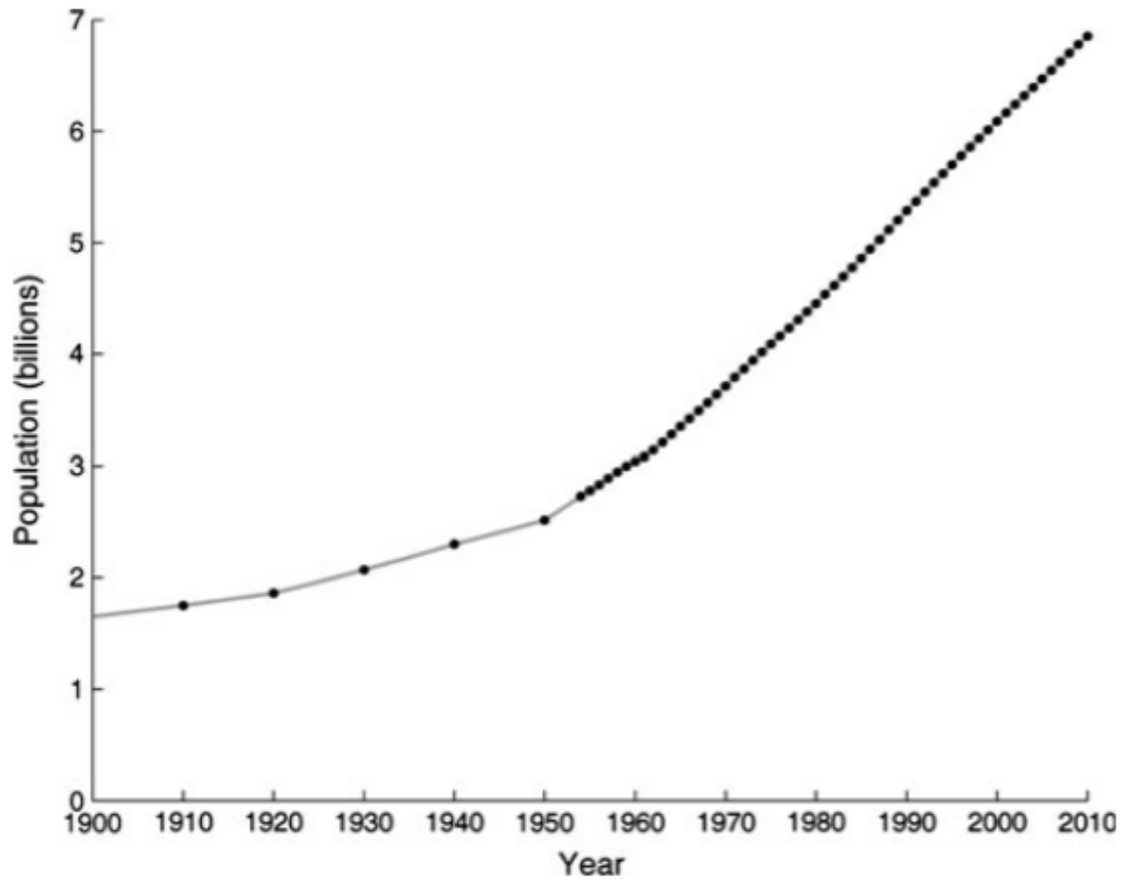
**Magnitude of expected loss in existential catastrophe**

Holding probability constant, risks become more serious as we move toward the upper-right region of Figure 2. For any fixed probability, existential risks are thus more serious than other risk categories. But just *how much* more serious might not be intuitively obvious. One might think we could get a grip on how bad an existential catastrophe would be by considering some of the worst historical disasters we can think of—such as the two world wars, the Spanish flu pandemic, or the Holocaust—and then imagining something just a bit worse. Yet if we look at global population statistics over time, we find that these horrible events of the past century fail to register (Figure 3)

But even this reflection fails to bring out the seriousness of existential risk. What makes existential catastrophes especially bad is not that they would show up robustly on a plot like the one in Figure 3, causing a precipitous drop in world population or average quality of life. Instead, their significance lies primarily in the fact that they would destroy the future. The philosopher Derek Parfit made a similar point with the following thought experiment:

> I believe that if we destroy mankind, as we now can, this outcome will be *much* worse than most people think. Compare three outcomes:

**Figure 3**. World population over the last century.




*Source: Author.*

*Note: Calamities such as the Spanish flu pandemic, the two world wars, and the Holocaust scarcely register. (If one stares hard at the graph, one can perhaps just barely make out a slight temporary reduction in the rate of growth of the world population during these events).*

1. Peace.
2. A nuclear war that kills 99 per cent of the world's existing population.

3. A nuclear war that kills 100 per cent.

2 would be worse than 1, and 3 would be worse than 2. Which is the greater of these two differences? Most people believe that the greater difference is between 1 and 2. I believe that the difference between 2 and 3 is *very much* greater. The Earth will remain habitable for at least another billion years. Civilisation began only a few thousand years ago. If we do not destroy mankind, these few thousand years may be only a tiny fraction of the whole of civilised human history. The difference between 2 and 3 may thus be the difference between this tiny fraction and all of the rest of this history. If we compare this possible history to a day, what has occurred so far is only a fraction of a second (Parfit, 1984, pp. 453–454).

To calculate the loss associated with an existential catastrophe, we must consider how much value would come to exist in its absence. It turns out that the ultimate potential for Earth-originating intelligent life is literally astronomical.

One gets a large number even if one confines one's consideration to the potential for biological human beings living on Earth. If we suppose with Parfit that our planet will remain habitable for at least another billion years, and we assume that at least one billion people could live on it sustainably, then the potential exist for at least $10^{16}$ human lives of normal duration. These lives could also be considerably better than the average contemporary human life, which is so often marred by disease, poverty, injustice, and various biological limitations that could be partly overcome through continuing technological and moral progress.

However, the relevant figure is not how many people could live on Earth but how many descendants we could have in total. One lower bound of the number of biological human life-years in the future accessible universe (based on current cosmological estimates) is $10^{34}$ years.[7] Another estimate, which assumes that future minds will be mainly implemented in computational hardware instead of biological neuronal wetware, produces a lower bound of $10^{54}$ human-brain-emulation subjective life-years (or $10^{71}$ basic computational operations) (Bostrom, 2003).[8] If we make the less conservative assumption that future civilisations could eventually press close to the absolute bounds of known physics (using some as yet unimagined technology), we get radically higher estimates of the amount of computation and memory storage that is achievable and thus of the number of years of subjective experience that could be realised.[9]

Even if we use the most conservative of these estimates, which entirely ignores the possibility of space colonisation and software minds, we find that the expected loss of an existential catastrophe is greater than the value of $10^{16}$ human lives. This implies that the expected value of reducing existential risk by a mere *one millionth of one percentage point* is at least a hundred

times the value of a million human lives. The more technologically comprehensive estimate of $10^{54}$ human-brain-emulation subjective life-years (or $10^{52}$ lives of ordinary length) makes the same point even more starkly. Even if we give this allegedly lower bound on the cumulative output potential of a technologically mature civilisation a mere 1 per cent chance of being correct, we find that the expected value of reducing existential risk by a mere *one billionth of one billionth of one percentage point* is worth a hundred billion times as much as a billion human lives.

One might consequently argue that even the tiniest reduction of existential risk has an expected value greater than that of the definite provision of any 'ordinary' good, such as the direct benefit of saving 1 billion lives. And, further, that the absolute value of the indirect effect of saving 1 billion lives on the total cumulative amount of existential risk—positive or negative—is almost certainly larger than the positive value of the direct benefit of such an action.[10]

**Maxipok**

These considerations suggest that the loss in expected value resulting from an existential catastrophe is so enormous that the objective of reducing existential risks should be a dominant consideration whenever we act out of an impersonal concern for humankind as a whole. It may be useful to adopt the following rule of thumb for such impersonal moral action:

*Maxipok* Maximise the probability of an 'OK outcome', where an OK outcome is any outcome that avoids existential catastrophe.

At best, maxipok is a rule of thumb or a *prima facie* suggestion. It is not a principle of absolute validity, since there clearly are moral ends other than the prevention of existential catastrophe. The principle's usefulness is as an aid to prioritisation. Unrestricted altruism is not so common that we can afford to fritter it away on a plethora of feel-good projects of suboptimal efficacy. If benefiting humanity by increasing existential safety achieves expected good on a scale many orders of magnitude greater than that of alternative contributions, we would do well to focus on this most efficient philanthropy.

Note that maxipok differs from the popular maximin principle ('Choose the action that has the best worst-case outcome').[11] Since we cannot completely eliminate existential risk—at any moment, we might be tossed into the dustbin of cosmic history by the advancing front of a vacuum phase transition triggered in some remote galaxy a billion years ago—the use of maximin in the present context would entail choosing the action that has the greatest benefit under the assumption of impending extinction. Maximin thus implies that we ought all to start partying as if there

were no tomorrow. That implication, while perhaps tempting, is implausible.

## 2. Classification of existential risk

To bring attention to the full spectrum of existential risk, we can distinguish four classes of such risk: *human extinction, permanent stagnation, flawed realisation, and subsequent ruination.* We define these in Table 1 below:

By 'humanity' we here mean Earth-originating intelligent life and by 'technological maturity' we mean the attainment of capabilities affording a level of economic productivity and control over nature close to the maximum that could feasibly be achieved.

**Human extinction**

Although it is conceivable that, in the billion or so years during which Earth might remain habitable before being overheated by the expanding sun, a new intelligent species would evolve on our planet to fill the niche vacated by an extinct humanity, this is very far from certain to happen. The probability of a recrudescence of intelligent life is reduced if the catastrophe causing the extinction of the human species also exterminated the great apes and our other close relatives, as would occur in many (though not all) human-extinction scenarios. Furthermore, even if another intelligent species were to evolve to take our place, there is no guarantee that the successor species would sufficiently instantiate qualities that we have reason to value. Intelligence may be necessary for the realisation of our future potential for desirable development, but it is not sufficient. All scenarios

**Table 1.** Classes of existential risk

| | |
|---|---|
| Human extinction | Humanity goes extinct prematurely, i.e., before reaching technological maturity. [12] |
| Permanent stagnation | Humanity survives but never reaches technological maturity.<br>Subclasses: *unrecovered collapse, plateauing, recurrent collapse* |
| Flawed realisation | Humanity reaches technological maturity but in a way that is dismally and irremediably flawed.<br>Subclasses: *unconsummated realisation, ephemeral realisation* |
| Subsequent ruination | Humanity reaches technological maturity in a way that gives good future prospects, yet subsequent developments cause the permanent ruination of those prospects. |

*Source: Author.*

involving the premature extinction of humanity will be counted as existential catastrophes, even though some such scenarios may, according to some theories of value, be relatively benign. It is not part of the definition of existential catastrophe that it is all-things-considered bad, although that will probably be a reasonable supposition in most cases.

Above, we defined 'humanity' as Earth-originating intelligent life rather than as the particular biologically defined species *Homo sapiens*.[13] The reason for focusing the notion of existential risk on this broader concept is that there is no reason to suppose that the biological species concept tracks what we have reason to value. If our species were to evolve, or use technology to self-modify, to such an extent that it no longer satisfied the biological criteria for species identity (such as interbreedability) with contemporary Homo sapiens, this need not be in any sense a catastrophe. Depending on what we changed into, such a transformation might well be very desirable. Indeed, the permanent foreclosure of any possibility of this kind of transformative change of human biological nature may itself constitute an existential catastrophe.

Most discussion of existential risk to date has focused exclusively on the first of the four classes, 'human extinction'. The present framework calls attention to three other failure modes for humanity. Like extinction, these other failure modes would involve pan-generational crushing. They are therefore of comparable seriousness, entailing potentially similarly enormous losses of expected value.

**Permanent stagnation**

Permanent stagnation is instantiated if humanity survives but never reaches technological maturity—that is, the attainment of capabilities affording a level of economic productivity and control over nature that is close to the maximum that could feasibly be achieved (in the fullness of time and in the absence of catastrophic defeaters). For instance, a technologically mature civilisation could (presumably) engage in large-scale space colonisation through the use of automated self-replicating 'von Neumann probes' (Freitas, 1980; Moravec, 1988; Tipler, 1980). It would also be able to modify and enhance human biology—say, through the use of advanced biotechnology or molecular nanotechnology (Freitas, 1999, 2003). Further, it could construct extremely powerful computational hardware and use it to create whole-brain emulations and entirely artificial types of sentient, superintelligent minds (Sandberg and Bostrom, 2008). It might have many additional capabilities, some of which may not be fully imaginable from our current vantage point.[14]

The permanent destruction of humanity's opportunity to attain technological maturity is a *prima facie* enormous loss, because the capabilities of a technologically mature civilisation could be used to produce outcomes that would plausibly be of great value,

such as astronomical numbers of extremely long and fulfilling lives. More specifically, mature technology would enable a far more efficient use of basic natural resources (such as matter, energy, space, time, and negentropy) for the creation of value than is possible with less advanced technology. And mature technology would allow the harvesting (through space colonisation) of far more of these resources than is possible with technology whose reach is limited to Earth and its immediate neighbourhood.

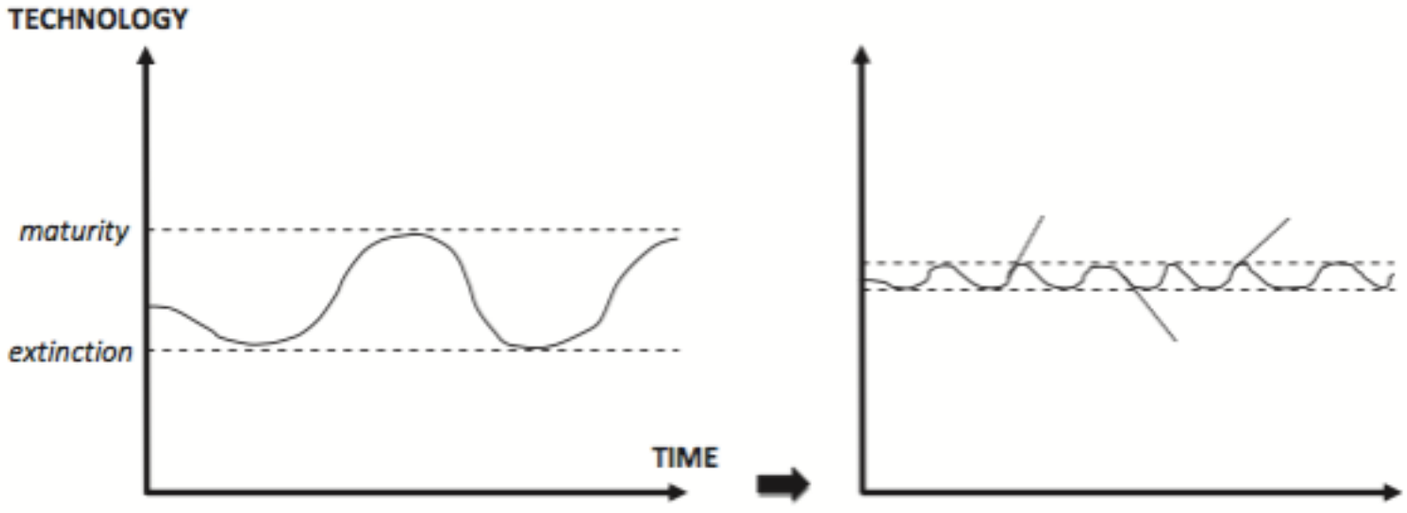
We can distinguish various kinds of permanent stagnation scenarios: *unrecovered collapse*—much of our current economic and technological capabilities are lost and never recovered; *plateauing*—progress flattens out at a level perhaps somewhat higher than the present level but far below technological maturity; and *recurrent collapse*—a never-ending cycle of collapse followed by recovery (Bostrom, 2009).[15]

The relative plausibility of these scenarios depends on various factors. One might expect that even if global civilisation were to undergo a complete collapse, perhaps following a global thermonuclear war, it would eventually be rebuilt. In order to have a plausible permanent collapse scenario, one would therefore need an account of why recovery would not occur.[16] Regarding plateauing, modern trends of rapid social and technological change make such a threat appear less imminent; yet scenarios could be concocted in which, for example, a stable global regime blocks further technological change.[17] As for recurrent-collapse scenarios, they seem to require the postulation of a special kind of cause: one that (1) is strong enough to bring about the total collapse of global civilisation yet (2) is not strong enough to cause human extinction, and that (3) can plausibly recur each time civilisation is rebuilt to a certain level, despite any random variation in initial conditions and any attempts by successive civilisations to learn from their predecessors' failures. The probability of remaining on a recurring-collapse trajectory diminishes with the number of cycles postulated. The longer the time horizon considered (and this applies also to plateauing) the greater the likelihood that the pattern will be ruptured, resulting in either a breakout in the upward direction toward technological maturity or in the downward direction toward unrecovered collapse and perhaps extinction (Figure 4).[18]

**Flawed realisation**

A flawed realisation occurs if humanity reaches techno- logical maturity in a way that is dismally and irremediably flawed. By 'irremediably' we mean that it cannot feasibly be subsequently put right. By 'dismally' we mean that it enables the realisation of but a small part of the value that could otherwise have been realised. Classifying a scenario as an instance of flawed

realisation requires a value judgment. We return to this




*Source: Author.*

*Note: The modern human condition represents a narrow range of the space of possibilities. The longer the time scale considered, the lower the probability that humanity's level of technological development will remain confined within the interval defined at the lower end by whatever technological capability is necessary for survival and at the upper end by technological maturity.*

normative issue in the next section.

**Figure 4.** Collapse recurring indefinitely?

We can distinguish two versions of flawed realisation: *unconsummated realisation* and *ephemeral realisation*.

In unconsummated realisation, humanity develops mature technology but fails to put it to good use, so that the amount of value realised is but a small fraction of what could have been achieved. An example of this kind is a scenario in which machine intelligence replaces biological intelligence but the machines are constructed in such a way that they lack consciousness (in the sense of phenomenal experience) (Bostrom, 2004). The future might then be very wealthy and capable, yet in a relevant sense uninhabited: There would (arguably) be no morally relevant beings there to enjoy the wealth. Even if consciousness did not altogether vanish, there might be a lot less of it than would have resulted from a more optimal use of resources. Alternatively, there might be a vast quantity of experience but of much lower quality than ought to have been the case: minds that are far less happy than they could have been. Or, again, there might be vast numbers of very happy minds but some other crucial ingredient of a maximally valuable future missing.

In ephemeral realisation, humanity develops mature technology that is initially put to good use. But the technological maturity is attained in such a way that the initially excellent state is unsustainable and is doomed to degenerate. There is a flash of value, followed by perpetual dusk or darkness. One way in which ephemeral realisation could result is if there are fractures in the initial state of technological maturity that are bound to lead to a splintering of humanity into competing factions. It might be impossible to reintegrate humanity after such a splintering occurred, and the process of attaining technological maturity might have presented the last and best chance for humanity to form a singleton (Bostrom, 2006). Absent global coordination, various processes might degrade humanity's long-term potential. One such process is war between major powers, although it is perhaps unlikely that such warring would be never-ending (rather than being eventually terminated once and for all by treaty or conquest).[19] Another such erosive process involves undesirable forms of evolutionary and economic competition in a large ecology of machine intelligences (Hanson, 1994). Yet another such process is a space-colonisation race in which replicators might burn up cosmic resources in a wasteful effort to beat out the competition (Hanson, 1998).

**Subsequent ruination**

For completeness, we register a fourth class of existential risks: subsequent ruination. In scenarios of this kind, humanity reaches technological maturity with a 'good' (in the sense of being not dismally and irremediably flawed) initial setup, yet subsequent developments nonetheless lead to the permanent ruination of our prospects.

From a practical perspective, we need not worry about subsequent ruination. What happens after humanity reaches technological maturity is not something we can now affect, *other* than by making sure that humanity does reach it and in a way that offers the best possible prospects for subsequent development—that is, by avoiding the three other classes of existential risk. Nonetheless, the concept of subsequent ruination is relevant to us in various ways. For instance, in order to estimate how much expected value is gained by reducing other existential risks by a certain amount, we need to estimate the expected value conditional on avoiding the first three sets of existential risks, which requires estimating the probability of subsequent ruination.

The probability of subsequent ruination might be low—and is perhaps extremely low conditional on getting the setup right. One reason is that once we have created many self-sustaining space colonies, any disaster confined to a single planet cannot eliminate all of humanity. Another reason is that once technological maturity is safely reached, there are fewer potentially dangerous technologies left to be discovered. A third reason is that a technologically mature civilisation would be superintelligent (or

have access to the advice of superintelligent artificial entities) and thus better able to foresee danger and devise plans to minimise existential risk. While foresight will not reduce risk if no effective action is available, a civilisation with mature technology can take action against a great range of existential risks. Furthermore, if it turns out that attaining technological maturity without attaining singletonhood condemns a civilisation to irreversible degeneration, then if flawed realisation is avoided we can assume that our technologically mature civilisation can solve global-coordination problems, which increases its ability to take effective action to prevent subsequent ruination.

The main source of subsequent-ruination risk might well be an encounter with intelligent external adversaries, such as intelligent extraterrestrials or simulators. Note, however, that scenarios in which humanity eventually goes extinct as a result of hard physical limits, such as the heat death of the universe, do not count as subsequent ruination, provided that before its demise humanity has managed to realise a reasonably large part of its potential for desirable development. Such scenarios are not existential catastrophes but rather existential successes.

## 3. Capability and value

Some further remarks will help clarify the links between capability, value, and existential risk.

### Convertibility of resources into value

Because humanity's future is potentially astronomically long, the integral of losses associated with persistent inefficiencies is very large. This is why flawed-realisation and subsequent-ruination scenarios constitute existential catastrophes even though they do not necessarily involve extinction.[20] It might be well worth a temporary dip in short-term welfare to secure a slightly more efficient long-term realisation of humanity's potential.

To avoid flawed realisation, it is more important to focus on maximising long-term efficiency than on maximising the initial output of value in the period immediately following technological maturation. This is because the quantity of value-structure that can be produced at a given time depends not only on the level of technology but also on the physical resources and other forms of capital available at that time. In economics parlance, humanity's production-possibility frontier (representing the various possible combinations of outputs that could be produced by the global economy) depends not only on the global production function (or 'meta-production function') but also on the total amount of all

factors of production (labour, land, physical capital goods, etc.) that are available at some point in time. With mature technology, most factors of production are interchangeable and ultimately reducible to basic physical resources, but the amount of free energy available to a civilisation imposes hard limits on what it can produce. Since colonisation speed is bounded by the speed of light, a civilisation attaining technological maturity will start with a modest endowment of physical resources (a single planet and perhaps some nearby parts of its solar system), and it will take a very long time—billions of years—before a civilisation starting could reach even 1 per cent of its maximum attainable resource base.[21] It is therefore efficiency of use at later times, rather than in the immediate aftermath of the attainment of technological maturity, that matters most for how much value is ultimately realised.

Furthermore, it might turn out that the ideal way to use most of the cosmic endowment that humanity could eventually secure is to postpone consumption for as long as possible. By conserving our accumulated free energy until the universe is older and colder, we might be able to perform some computations more efficiently.[22] This reinforces the point that it would be a mistake to place too much weight on the amount of value generated shortly after technological maturity when deciding whether some scenario should count as a flawed realisation (or a subsequent ruination). It is much more important to get the setup right, in the sense of putting humanity on a track that will eventually garner most of the attainable cosmic resources and put them to near-optimal use. It matters less whether there is a brief delay before that happens—and a delay of even several million years is 'brief' in this context (Bostrom, 2003).

Even for individual agents, the passage of sidereal time might become less significant after technological maturity. Agents that exist as computational processes in distributed computational hardware have potentially unlimited life spans. The same holds for embodied agents in an era in which physical-repair technologies are sufficiently advanced. The amount of life available to such agents is proportional to the amount of physical resources they control. (A software mind can experience a certain amount of subjective time by running on a slow computer for a long period of sidereal time or, equivalently, by running for a brief period of sidereal time on a fast computer). Even from a so-called 'person-affecting' moral perspective, therefore, when assessing whether a flawed realisation has occurred, one should focus not on how much value is created just after the attainment of technological maturity but on whether the conditions created are such as to give a good prospect of realising a large integral of value over the remainder of the universe's lifetime.

**Some other ethical perspectives**

We have thus far considered existential risk from the perspective of utilitarianism (combined with several simplifying assumptions). We may briefly consider how the issue might appear when viewed through the lenses of some other ethical outlooks. For example, the philosopher Robert Adams outlines a different view on these matters:

> I believe a better basis for ethical theory in this area can be found in quite a different direction—in a commitment to the future of humanity as a vast project, or network of overlapping projects, that is generally shared by the human race. The aspiration for a better society—more just, more rewarding, and more peaceful—is a part of this project. So are the potentially endless quests for scientific knowledge and philosophical understanding, and the development of artistic and other cultural traditions. This includes the particular cultural traditions to which we belong, in all their accidental historic and ethnic diversity. It also includes our interest in the lives of our children and grandchildren, and the hope that they will be able, in turn, to have the lives of their children and grandchildren as projects. To the extent that a policy or practice seems likely to be favorable or unfavorable to the carrying out of this complex of projects in the nearer or further future, we have reason to pursue or avoid it. Continuity is as important to our commitment to the project of the future of humanity as it is to our commitment to the projects of our own personal futures. Just as the shape of my whole life, and its connection with my present and past, have an interest that goes beyond that of any isolated experience, so too the shape of human history over an extended period of the future, and its connection with the human present and past, have an interest that goes beyond that of the (total or average) quality of life of a population-at-a-time, considered in isolation from how it got that way.
>
> We owe, I think, some loyalty to this project of the human future. We also owe it a respect that we would owe it even if we were not of the human race ourselves, but beings from another planet who had some understanding of it (Adams, 1989, pp. 472–473).

Since an existential catastrophe would either put an end to the project of the future of humanity or drastically curtail its scope for development, we would seem to have a strong *prima facie* reason to avoid it, in Adams' view.

We also note that an existential catastrophe would entail the frustration of many strong preferences, suggesting that from a preference-satisfactionist perspective it would be a bad thing. In a similar vein, an ethical view emphasising that public policy should be determined through informed democratic deliberation by all stake-holders would favour existential-risk mitigation if we suppose, as is plausible, that a majority of the world's population

would come to favour such policies upon reasonable deliberation (even if hypothetical future people are not included as stakeholders). We might also have custodial duties to preserve the inheritance of humanity passed on to us by our ancestors and convey it safely to our descendants.[23] We do not want to be the failing link in the chain of generations, and we ought not to delete or abandon the great epic of human civilisation that humankind has been working on for thousands of years, when it is clear that the narrative is far from having reached a natural terminus. Further, many theological perspectives deplore naturalistic existential catastrophes, especially ones induced by human activities: If God created the world and the human species, one would imagine that He might be displeased if we took it upon ourselves to smash His masterpiece (or if, through our negligence or hubris, we allowed it to come to irreparable harm).[24]

We might also consider the issue from a less theoretical standpoint and try to form an evaluation instead by considering analogous cases about which we have definite moral intuitions. Thus, for example, if we feel confident that committing a small genocide is wrong, and that committing a large genocide is no less wrong, we might conjecture that committing omnicide is also wrong.[25] And if we believe we have some moral reason to prevent natural catastrophes that would kill a small number of people, and a stronger moral reason to prevent natural catastrophes that would kill a larger number of people, we might conjecture that we have an even stronger moral reason to prevent catastrophes that would kill the entire human population.

Many different normative perspectives thus concur in their support for existential-risk mitigation, although the degree of badness involved in an existential catastrophe and the priority that existential-risk mitigation should have in our moral economy may vary substantially among different moral theories.[26] Note, however, that it is on no account a *conceptual* truth that existential catastrophes are bad or that reducing existential risk is right. There are possible situations in which the occurrence of one type of existential catastrophe is beneficial—for instance, because it preempts another type of existential catastrophe that would otherwise certainly have occurred and that would have been worse.

**Existential risk and normative uncertainty**

Whereas the first two classes of existential risk (human extinction and permanent stagnation) are specified by purely descriptive criteria, the second two (flawed realisation and subsequent ruination) are defined normatively. This means that the concept of existential risk is in part an evaluative notion.[27]

Where normative issues are involved, these issues may be contentious. Population ethics, for instance, is fraught with problems about how to deal with various parameters (such as population size, average wellbeing, thresholds for what counts as

a life worth living, inequality, and same vs. different people choices). The evaluation of some scenarios that involve fundamental transformations of human nature is also likely to be contested (Fukuyama, 2002; Glover, 1984; Kass, 2002; Savulescu and Bostrom, 2009). Yet not all normative issues are controversial. It will be generally agreed, for example, that a future in which a small human population ekes out a miserable existence within a wrecked ecosystem in the presence of great but unused technological capabilities would count as a dismally flawed realisation of humanity's potential and would constitute an existential catastrophe if not reversed.

There will be some types of putative existential risks for which the main uncertainty is normative and others where the main uncertainty is positive. With regard to positive, or descriptive, uncertainty, we saw earlier that if something is not known to be objectively safe, it is risky, at least in the subjective sense relevant to decision making. We can make a parallel move with regard to normative uncertainty. Suppose that some event X would reduce biodiversity. Suppose (for the sake of illustration) it is known that X would have no other significant consequences and that the reduced biodiversity would not affect humans or any other morally considerable beings. Now, we may be uncertain whether biodiversity has final value (is valuable 'for its own sake'). Hence we may be uncertain about whether or not X would really be bad. But we can say that if we are not sure whether or not X would really be bad (but we *are* sure that X would not be good), then X is bad in at least the subjective sense relevant to decision making. That is to say, we have reason to prefer that X not occur and perhaps reason to take action to prevent X.

Exactly *how* one should take into account fundamental moral uncertainty is an open question, but that one should do so is clear (Bostrom, 2009). We can thus include as existential risks situations in which we know what will happen and we reasonably judge that what will happen *might* be existentially bad—even when there would in fact be nothing bad about the outcome.

We can highlight one consequence of this: Suppose a fully reliable genie offered to grant humanity any wish it might have for its future. Then—even if we could all agree on one such future—we would still face one more potentially serious existential risk: namely, that of choosing unwisely and selecting a future dismally flawed despite appearing, at the moment of our choice, to be the most desirable of all possible futures.

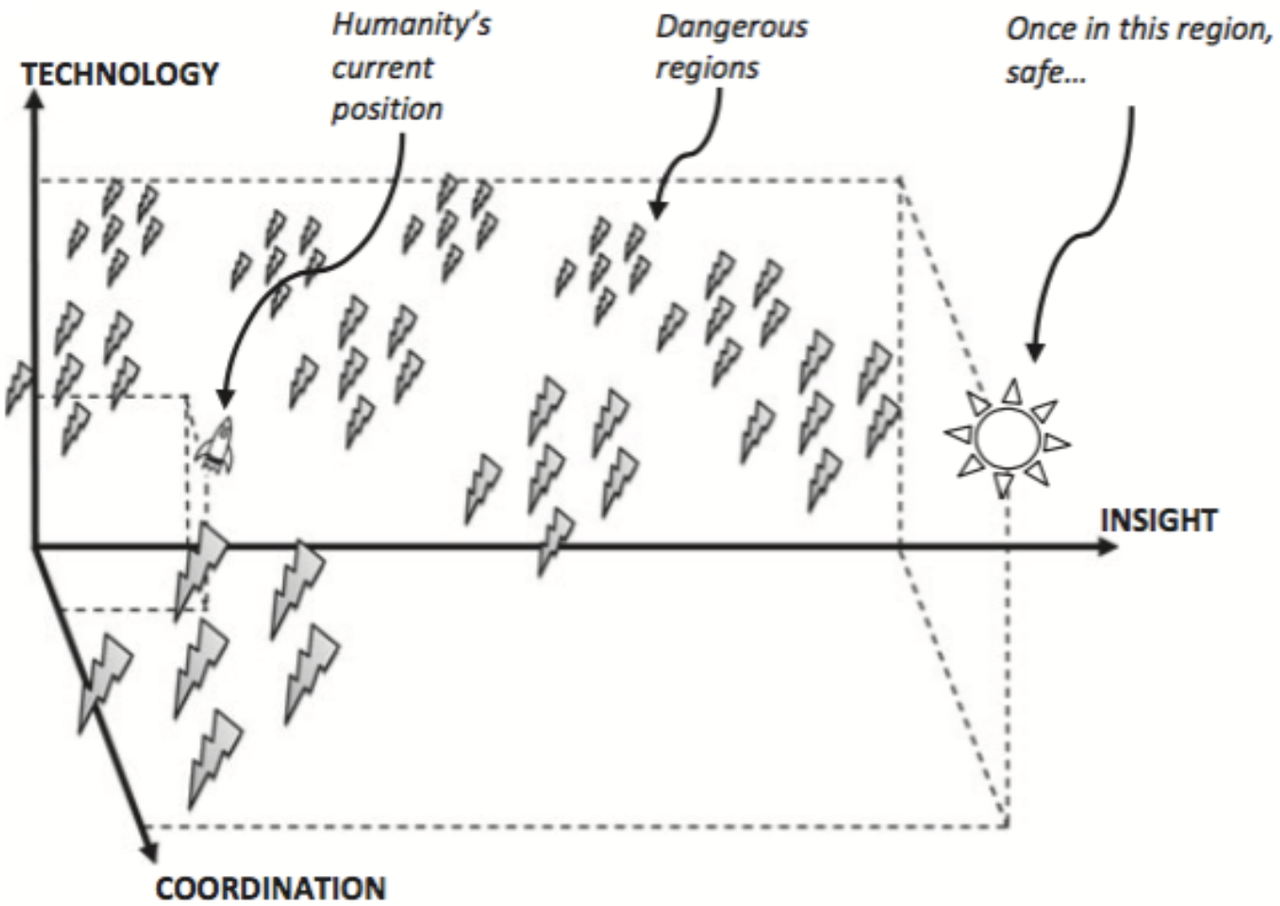
**Keeping our options alive**

These reflections on moral uncertainty suggest an alternative, complementary way of looking at existential risk; they also suggest a new way of thinking about the ideal of sustainability. Let me elaborate.

Our present understanding of axiology might well be confused. We may not now know—at least not in concrete detail—what outcomes would count as a big win for humanity; we might not even yet be able to imagine the best ends of our journey. If we are indeed profoundly uncertain about our ultimate aims, then we should recognise that there is a great option value in preserving—and ideally improving—our ability to recognise value and to steer the future accordingly. Ensuring that there will be a future version of humanity with great powers and a propensity to use them wisely is plausibly the best way available to us to increase the probability that the future will contain a lot of value. To do this, we must prevent any existential catastrophe.

We thus want to reach a state in which we have (1) far greater intelligence, knowledge, and sounder judgment than we currently do; (2) far greater ability to solve global-coordination problems; (3) far greater technological capabilities and physical resources; and such that (4) our values and preferences are not corrupted in the process of getting there (but rather, if possible, improved). Factors 2 and 3 expand the option set avail- able to humanity. Factor 1 increases humanity's ability to predict the outcomes of the available options and understand what each outcome would entail in terms of the realisation of human values. Factor 4, finally, makes humanity more likely to want to realise human values.

How we, from our current situation, might best achieve these




ends is not obvious (Figure 5). While we ultimately need more technology, insight, and coordination, it is not clear that the shortest path to the goal is the best one.

It could turn out, for example, that attaining certain technological capabilities *before* attaining sufficient insight and coordination invariably spells doom for a civilisation. One can readily imagine a class of existential-catastrophe scenarios in which some

**Figure 5.** The challenge of finding a safe path.

*Sources: Author.*
*Notes: An ideal situation might be one in which we have a very high level of technology, excellent global coordination, and great insight into how our capabilities can be used. It does not follow that getting any amount of additional technology, coordination, or insight is always good for us. Perhaps it is essential that our growth along different dimensions hew to some particular scheme in order for our development to follow a trajectory through the state space that eventually reaches the desired region.*

technology is discovered that puts immense destructive power into the hands of a large number of individuals. If there is no effective defense against this destructive power, and no way to prevent individuals from having access to it, then civilisation cannot last, since in a sufficiently large population there are bound to be some individuals who will use any destructive power available to them. The discovery of the atomic bomb could have turned out to be like this, except for the fortunate fact that the construction of nuclear weapons requires a special ingredient—weapons-grade fissile material—that is rare and expensive to manufacture. Even so, if we continually sample from the urn of possible technological discoveries before implementing effective means of global coordination, surveillance, and/or restriction of potentially hazardous information, then we risk eventually drawing a black ball: an easy-to-make intervention that causes extremely widespread harm and against which effective defense is infeasible.[28]

We should perhaps therefore not seek directly to approximate some state that is 'sustainable' in the sense that we could remain in it for some time. Rather, we should focus on getting onto a developmental trajectory that offers a high probability of avoiding existential catastrophe. In other words, our focus should be on maximising the chances that we will someday attain technological maturity in a way that is not dismally and irremediably flawed. Conditional on that attainment, we have a good chance of realising our astronomical axiological potential.

To illustrate this point, consider the following analogy. When a rocket stands on the launch pad, it is in a fairly sustainable state. It could remain in its current position for a long time, although it would eventually be destroyed by wind and weather. Another sustainable place for the rocket is in space, where it can travel weightless for a very long time. But when the rocket is in midair, it is in an unsustainable, transitory state: Its engines are blazing and it will soon run out of fuel. Returning the rocket to a sustainable state is desirable, but this does not mean that any way to render its state more sustainable is desirable. For example, reducing its energy consumption so that it just barely manages to hold stationary might make its state more sustainable in the sense that it can remain in one place for longer; however, when its fuel runs out the rocket will crash to the ground. The best policy for a rocket in midair is, rather, to maintain enough thrust to escape Earth's gravitational field: a strategy that involves entering a less

sustainable state (consuming fuel faster) in order to later achieve the most desirable sustainable state. That is, instead of seeking to approximate a sustainable *state*, it should pursue a sustainable *trajectory*.

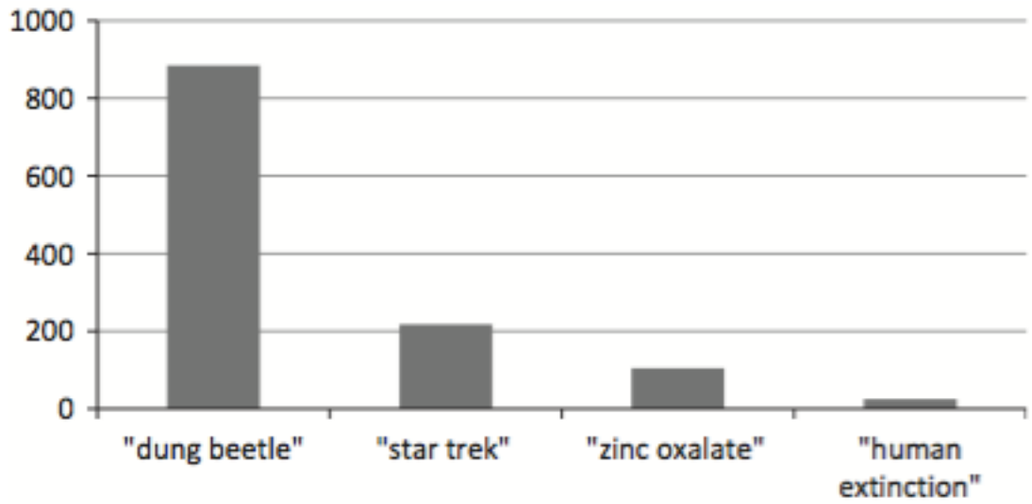
The present human condition is likewise a transitional state. Like the rocket in our analogy, humanity needs to pursue a sustainable trajectory, one that will minimise the risk of existential catastrophe.[29] But unlike the problem of determining the optimum rate of fuel consumption in a rocket, the problem of how to minimise existential risk has no known solution.

## 4. Outlook

We have seen that reducing existential risk emerges as a dominant priority in many aggregative consequentialist moral theories (and as a very important concern in many other moral theories). The concept of existential risk can thus help the morally or altruistically motivated to identify actions that have the highest expected value. In particular, given certain assumptions, the problem of making the right decision simplifies to that of following the maxipok principle.

### Barriers to thought and action

In light of this result, which suggests that there may be a very high value in studying existential risks and in analysing potential mitigation strategies, it is striking how little academic attention these issues have received compared to other topics that are less important (Figure 6).[30]




Many factors conspire against the study and mitigation of existential risks. Research is perhaps inhibited by the multidisciplinary nature of the problem, but also by dee- per epistemological issues. The biggest existential risks are not amenable to plug-and-play scientific research methodologies. Furthermore, there are unresolved foundational issues, particularly concerning observation selection theory and population ethics, which are crucial to the assessment of existential risk; and these theoretical difficulties are compounded by psychological factors that make it difficult to think clearly about issues such as the end of humanity.[31]

**Figure 6.** Academic prioritisation.

*Source: Author.*

*Note: Number of academic papers on various topics (listed in Scopus, August 2012).*

If more resources were to be made available to research existential risks, there is a danger that they would flow, with excessive preponderance, to the relatively minor risks that are easier for some established disciplinary community to study using familiar methods, at the expense of far more important risk areas—machine superintelligence, advanced molecular nanotechnology, totalitarianism, risks related to the simulation-hypothesis, or future advances in synthetic biology—which would require a more inconvenient shift in research focus. Another plausible diversion is that research would mainly be directed at global catastrophic risks that involve little or no existential risk.

Mitigation of existential risk is hampered by a lack of understanding, but also by a deficit of motivation. Existential risk mitigation is a global public good (i.e., non-excludable and non-rivalrous), and economic theory suggests that such goods tend to be undersupplied by the market, since each producer of existential safety (even if the producer is a large nation) could capture only a small portion of the value (Feldman, 1980; Kaul, 1999). In fact, the situation is worse than is the case with many other global public goods in that existential risk reduction is a strongly *transgenerational* (in fact, pan-generational) public good: even a world state may capture only a small fraction of the benefits—those accruing to currently existing people. The quadrillions of happy people who may come to exist in the future if we avoid existential catastrophe would be willing to pay the present generation astronomical sums in return for a slight increase in our efforts to preserve humanity's future, but the mutually beneficial trade is unfortunately prevented by the obvious transaction difficulties.

Moral motivations, too, may fail to measure up to the magnitude of what is at stake. The scope insensitivity of our moral sentiments is likely to be especially pronounced when very large numbers are involved:

> Substantially larger numbers, such as 500 million deaths, and especially qualitatively different scenarios such as the extinction of the entire human species, seem to trigger a different mode of thinking—enter into a 'separate magisterium'. People who would never dream of hurting a child hear of an existential risk, and say, 'Well, maybe the human species doesn't really deserve to survive'. (Yudkowsky, 2008, p. 114)

Existential risk requires a proactive approach. The reactive approach—to observe what happens, limit damages, and then implement improved mechanisms to reduce the probability of a repeat occurrence—does not work when there is no opportunity to learn from failure. Instead, we must anticipate emerging dangers, mobilise support for action against hypothetical future harm, and get our precautions sufficiently right the first time. That is a tall order. Few institutions are capable of operating consistently at such a level of effective rationality, and attempts to *imitate* such proactive behaviour within less perfect institutions can easily backfire. Speculative risk-mongering could be exploited to rationalise self-serving aggressive action, expansion of costly and potentially oppressive security bureaucracies, or restrictions of civil liberties that keep societies free and sane. The result of false approximations to the rational ideal could easily be a net increase in existential risk.[32]

Multidisciplinary and epistemological challenges, academic distractions and diversions, cognitive biases, free-rider problems, moral lethargy and scope-insensitivity, institutional incompetence, and the political exploitation of unquantifiable threats are thus some of the barriers to effective mitigation. To these we can add the difficulty of achieving required levels of global cooperation. While some existential risks can be tackled unilaterally—any state with a space industry could build a global defense against asteroid impacts—other risks require a joint venture between many states. Management of the global climate may require buy-in by an overwhelming majority of industrialised and industrialising nations. Avoidance of arms races and relinquishment of dangerous directions of technological research may require that *all* States join the effort, since a single defector could annul any benefits of collaboration. Some future dangers might even require that each State monitor and regulate every significant group or individual within its territory.[33]

**Grounds for optimism?**

A formidable array of obstacles thus clouds the prospect of a clear-headed and effective response to existential risks confronting humanity. Lest the cause be deemed hopeless, we should also take note of some encouraging considerations.

We may note, first, that many of the key concepts and ideas are quite new.[34] Before the conceptual and theoretical foundations were in place, support for efforts to research and mitigate existential risk could not build. In many instances, the underlying scientific, technological, and methodological ideas needed for studying existential risks in a meaningful way have also only recently become available. The delayed start helps explain the still primitive state of the art.

It is arguably only since the detonation of the first atomic bomb in 1945, and the subsequent nuclear buildup during the Cold War, that any significant naturalistic (i.e., non-supernatural) existential

risks have arisen—at least if we count only risks over which human beings have some influence.[35] Most of the really big existential risks still seem to lie many years into the future. Until recently, therefore, there may have been relatively little need to think about existential risk in general and few opportunities for mitigation even if such thinking had taken place.

Public awareness of the global impacts of human activities appears to be increasing. Systems, processes, and risks are studied today from a global perspective by many scholars—environmental scientists, economists, epidemiologists, demographers, and others. Problems such as climate change, cross-border terrorism, and inter- national financial crises direct attention to global interdependency and threats to the global system. The idea of risk in general seems to have risen in prominence.[36] Given these advances in knowledge, methods, and attitudes, the conditions for securing for existential risks the scrutiny they deserve are unprecedentedly propitious.

Opportunities for action may also proliferate. As noted, some mitigation projects can be undertaken unilaterally, and one may expect more such projects as the world becomes richer. Other mitigation projects require wider coordination; in many cases, global coordination. Here, too, some trend lines seem to point to this becoming more feasible over time. There is a long-term historic trend toward increasing scope of political integration—from hunter-gatherer bands to chiefdoms, city states, nation states, and now multinational organisations, regional alliances, various international governance structures, and other aspects of globalisation (Wright, 1999). Extrapolation of this trend might seem to indicate the eventual creation of a singleton (Bostrom, 2006). It is also possible that some of the global movements that emerged over the last half century—in particular the peace movement, the environmentalist movement, and various global justice and human-rights movements—will increasingly take on board more generalised concerns about existential risk.[37]

Furthermore, to the extent that existential-risk mitigation really is a most deserving cause, one may expect that general improvements in society's ability to recognise and act on important truths will differentially funnel resources into existential-risk mitigation. General improvements of this kind might come from many sources, including developments in educational techniques and online collaboration tools, institutional innovations such as prediction markets, advances in science and philosophy, spread of rationality culture, and biological cognitive enhancement.

Finally, it is possible that the cause will at some point receive a boost from the occurrence of a major (non-existential) catastrophe that underscores the precariousness of the present human condition. That would, needless to say, be the worst possible way for our minds to be concentrated—yet one which, in

a multidecadal time frame, must be accorded a non-negligible probability of occurrence.[38]

## Note

1. One informal poll among mainly academic experts on various global catastrophic risks gave a median estimate of 19 per cent probability that the human species will go extinct before the end of this century (Sandberg and Bostrom, 2008). These respondents' views are not necessarily representative of the wider expert community. The UK's influential Stern Review on the Economics of Climate Change (2006) used an extinction probability of 0.1 per cent per year in calculating an effective discount rate. This is equivalent to assuming a 9.5 per cent risk of human extinction within the next hundred years (UK Treasury 2006, Chapter 2, Technical Appendix, p. 47).

2. The strength of this consideration is to some extent blunted by the possibility of observation selection effects casting an 'anthropic shadow' on available evidence (Cirkovic, Sandberg and Bostrom, 2010).

3. See Smil, 2008.

4. Probability is thus indexed to time. Quantities that depend on probability, such as the seriousness of a risk, can vary over time as new information becomes available.

5. There is ample historical evidence that apparently sound scientific analyses are sometimes crucially flawed.

6. As indicated in the figure, the axes can be extended to encompass conceptually possible risks that are even more extreme. In particular, pan-generational risks can contain a subclass of risks so destructive that their realisation would not only affect or pre-empt future human generations but would also destroy the potential of the part of the universe that lies in our future light cone to produce intelligent or self-aware beings (cosmic scope). Further, according to some theories of value there can be states of being that are much worse than nonexistence or death (e.g., horrible incurable diseases), so one could in principle extend the x-axis as well (hellish severity). We will not explore these conceptual possibilities in this article.

7. This is based on an accelerating universe with a maximal reachable co-moving distance of 4.74 Gpc, a baryonic matter density of 4.55 $10^{-28}$ kg/m3, a luminosity ratio of stars ~100, and 1 planet per 1,000 stars being habitable by 1 billion humans for 1 billion years (Gott et al., 2005; Heyl, 2005). Obviously the values of the last three parameters are debatable, but the astronomical size of the conclusion is little affected by a few orders-of-magnitude change.

8. This uses an estimate by the late futurist Robert Bradbury that a star can power $10^{42}$ operations per second using efficient computers built with advanced nanotechnology. Further, it assumes (along with the cosmological estimates mentioned in the previous footnote) that the human brain has a processing power of $10^{17}$ operations per second and that stars on average last 5 billion years. It does not assume any new star formation. See also (Cirkovic, 2004).

9. For example, if all mass-energy in the accessible universe is saved until the cosmic microwave background temperature ceases to decline (due to the constant horizon temperature of $10^{-29}$ K) and is then used for computation, this would allow up to $10^{121}$ thermodynamically irreversible computations (Krauss and Starkman, 2000). See also (Cirkovic and Radujkov, 2001).

10. We should stress, however, that there are important unresolved issues in aggregative consequentialism—in particular, in relation to infinite values and extremely small chances (Bostrom, 2003, 2009). We will not discuss these issues here, but in section 5 we will discuss the normative status of the concept of existential risk from some other perspectives.

11. Following John Rawls, the term 'maximin' is used in a different sense in welfare economics, to denote the principle that (given certain constraints) we ought to opt for the state that maximises the expectation of the worst-off classes (Rawls, 1971). This version of the principle is not necessarily affected by the remarks in the text.

12. One can refer to this more precisely as ‘early’ or ‘premature’ human extinction. Note that humanity can go extinct without instantiating this category if humanity achieves its capability potential and then goes extinct.

13. We may here take ‘intelligent’ to mean capable of developing language, science, technology, and cumulative culture.

14. It is not required that a technologically mature civilisation actually deploy all of these technologies; it is sufficient that they be available to it, in the sense that the civilisation could easily and quickly develop and deploy them should it decide to do so. Thus, a sufficiently powerful superintelligent-machine civilisation that could rapidly invent and implement these and other relevant technologies would already count as technologically mature.

15. Not strictly never-ending, of course, but a sequence of cycles that goes on for a very long time and ends with human extinction without technological maturity having ever been attained.

16. An unrecovered collapse scenario might postulate that some critical resource for recovery is permanently destroyed, or that the human gene pool irreversibly degenerates, or perhaps that some discovery is made that enables tiny groups to cause such immense destruction that they can bring down civilisation and that the knowledge of this discovery cannot be eradicated.

17. Improved governance techniques, such as ubiquitous surveillance and neurochemical manipulation, might cement such a regime’s hold on power to the extent of making its overthrow impossible.

18. Another difficulty for the recurring-collapse hypothesis is to account for the fact that we are in the first technological cycle here on Earth. If it is common for there to be many cycles of collapse and recovery (with similar population sizes) then why do we find ourselves in cycle #1? This kind of anthropic consideration might suggest that extinction or transformation is more likely than one would naively suppose.

19. Even the threat of a war that never erupts could result in much waste, in terms of expenditures on arms and foregone opportunities for collaboration.

20. It is also one reason why permanent stagnation is an existential risk, although permanent stagnation might also preclude survival beyond the time when the Earth becomes uninhabitable, perhaps around a billion years from now due to increasing solar luminosity (Schroder and Smith, 2008).

21. One potentially significant qualification is that the time to reach the maximum attainable resource base could be shorter if intelligent opposition (such as from extraterrestrial civilisations) emerges that hinders our cosmic expansion.

22. There is a minimum entropy cost associated with the erasure of one bit of information, a cost which declines with temperature.

23. We might also have responsibilities to nonhuman beings, such as terrestrial (and possible extraterrestrial) animals. Although we are not currently doing much to help them, we have the opportunity to do so in the future. If rendering aid to suffering nonhuman animals in the natural environment is an important value, then achieving technological maturity in a manner that fails to produce such aid could count as flawed realisation. See McMahan, 2010; Pearce, 2004.

24. There could, from a theological perspective, possibly be a special category of existential risks with a different moral status: catastrophes or apocalypses brought about by divine agency, perhaps as just punishment for our sins. A believer might judge such an event as, on balance, good. However, it seems implausible that mere mortals would be able to thwart God if He really wanted to flatten us, so any physical counter-measures we implement against existential risk would presumably be effective only against natural and anthropogenic existential risks, and we might have no reason to hold back on our naturalistic-risk mitigation efforts for fear of frustrating God’s designs.

25. Although omnicide would at least be impartial, by contrast to genocide which is often racist or nationalist.

26. For example, James Lenman has argued that it is largely a matter of indifference when humankind goes extinct, at least if it does not happen too soon (Lenman, 2002).

27. In this respect, the concept of existential risk is similar to concepts such as 'democracy' and 'efficient labor market'. A black hole, or a jar of sterile pebbles, is neither a democracy nor an efficient labour market, and we can see that this is so without having to make any normative judgment; yet there may be other objects that cannot be classified as instances or non-instances of these concepts without taking a stand (at least implicitly) on some normative issue.

28. Of course, achieving effective global coordination sufficiently strong to continually monitor the entire world population or indefinitely censor any information deemed hazardous by some authority would (at least in the absence of adequate safe-guards) create its own very significant existential risks, such as risks of permanent stagnation or flawed realisation under some repressive totalitarian regime.

29. Ideally, it would do this while achieving the means to commit collective euthanasia, in the fairly unlikely case that, after long and careful collective deliberation, we should decide that a quick end is preferable to continued existence. That might, however, be a beneficial capability only if we had first attained sufficient wisdom not to exercise it erroneously. We should emphasise the need for continued philosophical deliberation and fostering of conditions that would help us find the truth about central normative issues eventually—as well as the need to avoid irrevocable mistakes in the meantime.

30. Scholarly treatments of existential risk per se, or even of human-extinction risk, are rare (e.g., Bostrom, 2002; Leslie, 1996; Matheny, 2007; Wells, 2009). However, a great deal of academic literature bears on individual existential risks or on other specific issues relevant to many existential risks (a few of which are cited throughout this article). In addition, some recent works take a broad look at global catastrophic risks, though without restricting the focus to existential risks (e.g., Bostrom and Cirkovic, 2008; Diamond, 2006; Homer-Dixon, 2007; Posner, 2004; Sunstein, 2009; World Economic Forum, 2011).

31. Relevant issues related to observation selection effects include, among others, the Carter-Leslie doomsday argument, the simulation argument, and 'great filter' arguments; see Bostrom, 2002, 2003, 2008; Carter, 1983; Cirkovic et al, 2010; Hanson, 1998; Leslie, 1996; Tegmark and Bostrom, 2005. For some relevant issues in moral philosophy, see, e.g., Bostrom, 2003, 2009. For a review of the cognitive-biases literature as it relates to catastrophic risk, see Yudkowsky, 2008.

32. A possible way around this problem involves trying to hold the total amount of risk concern roughly constant while allocating a greater proportion of the pot of 'fear tokens' or 'concern chips' to existential risk. Thus, one might advocate that as we become more concerned about existential risk, we ought simultaneously to become less concerned about smaller risks, such as a few thousand people dying in the odd terrorist attack or natural disaster.

33. Such internal control within States will become more feasible with advances in surveillance technology. As noted, preventing States with such capabilities from becoming oppressive will present its own set of challenges.

34. Including the very notion of existential risk (Bostrom, 2002).

35. One could argue that pandemics and close encounters with comets, which occurred repeatedly in human history and elicited strong end-of-the-world forebodings, should count as large early existential risks. Given the limited information then available, it might not have been unreasonable for contemporary observers to assign a significant probability to the end being nigh. Religious doomsday scenarios could also be considered; perhaps it was not unreasonable to believe, on the basis of the then-available evidence, that these risks were real and, more-over, that they could be mitigated through such actions as repentance, prayer, sacrificial offerings, persecution of witches or infidels, and so forth. The first clear-cut scientific existential risk might have arisen with the development of the atomic bomb. Robert Oppenheimer, the scientific leader of the Manhattan Project, ordered a study ahead of the Trinity test to determine whether a nuclear detonation would cause a self-propagating chain of nuclear reactions in Earth's atmosphere. The resulting report may represent the first quantitative risk assessment of human extinction (Manhattan Project, 1946).

36. Some sociologists have gone so far as to fixate on risk as a central thematic of our age; see, e.g., Beck, 1999.

37. Many peace activists opposing the nuclear arms race during the Cold War explicitly fretted about a nuclear Armageddon that could allegedly end all human life. More recently some environmentalists sounding the alarm about global warming use similarly apocalyptic language. It is unclear, however, to what extent the perceived possibility of a species-ending outcome has been a major motivating force in these cases. Perhaps the amount of concern would be roughly the same even in the face of an iron-clad guarantee that any catastrophe would stop short of human extinction.

38. I am grateful for comments and discussion to Seth Baum, Nick Beckstead, Milan Cirkovic, Olle Häggström, Sara Lippincott, Gaverick Matheny, Toby Ord, Derek Parfit, Martin Rees, Rebecca Roache, Anders Sandberg, and Carl Shulman.

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# IAN BREMMER

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I believe that the exponential increase in the pace of technological change is both the greatest hope and the greatest threat to humanity. Politics, economics, war and peace, life: they are all cyclical. The speed of technological change is increasing the speed at which we move from peak to trough and back again. It may also drive the peaks higher and the troughs deeper.

I'm no technophobe, but it's important to understand the risks that necessarily follow from the ever more rapid creation of change because an invention is possible -- rather than because it is needed or because these new tools are useful. As in so many other areas of life, risks of unintended consequences are not given the consideration they deserve. Do we understand what we create before we give it life?

Everyone understands that new technologies are capable of both solving old problems and creating new ones. In a worst-case scenario, we should fear the rise of what we might call the "super-empowered anarchist," the person who bestows himself with enormous power and uses it with malicious intent. It's an idea older than our favorite Bond villains, but the sheer pace and scale of technological change makes this problem a lot less laughable than it used to be. Look at how ISIS uses communications technology and imagine the next generation threat it might pose.

**On the other hand, if technology better integrates the world, the shared vulnerability forces cooperation among peoples and**

**governments on a scale without precedent. That's the best-case scenario, one in which technological change compels global integration to reach its natural potential.**

How can individuals help maximize the opportunity and minimize the risk? By organizing to better understand the implications and con- sequences of technological change, as well as its impact on the centralization and decentralization of power and authority. International public-private partnerships can provide thought leadership that can't be "captured" by state or corporate interests, but they can help governments, companies and individuals better understand where our ingenuity is leading us.

# VALÉRIE CABANES

**Valerie Cabanes is a lawyer, activist and spokesperson of the global movement "End Ecocide On Earth".**

## What is the biggest threat facing humanity?

Humanity is facing a huge threat to its peace and security because it will face within it a violent competition due to the scarcity of its resources and its habitable land. Potentially irreversible, the consequences of human activity — the increase in population, the massive destruction of natural ecosystems and climate change — could put a stop to the stability of the global ecosystem yet supposed to last several thousand years if there had been no industrial revolution. Given the speed of the process observed, humanity, as other living beings, has not sufficient time to adapt and mitigate risks. Only an elite could provide the means, that same elite that has developed, directed and benefited from an ideological and economic system responsible for environmental and climate crisis today. This model was built by knowingly ignoring the value of ecosystems in maintaining life on earth and making us forget that we live in a finite world where all life is interconnected and interdependent.

## What do you think the world will be like in 50 years — best-case scenario vs. worst-case scenario?

Already reaching the critical threshold of 2° of global warming should lead to consequences such as widespread food shortages, unprecedented heat waves, more intense cyclones, a rising sea

level due to melting glaciers, changes in the geographical distribution of plant and animal species and a more severe soil and biodiversity erosion impacting all living beings who depend on them. The United Nations are already expecting that up to 250 million people will have to leave their place of living in 2050 because of climate change consequences, including 60 million in sub-Saharan Africa alone by 2020 ... which means a person every second…

This estimation is based on the optimistic goal that we will not reach a rise in temperatures higher that +2° by 2100.

But the "contributions" to date registered by the States on the table of the COP21 negotiations will lead to a rise of  +3°/+4°. To get an idea, +4° is a situation known by the Earth 125,000 years ago and at that time the oceans were above 6 meters.  According to a recent study by the Potsdam Institute for Climate Impact Research, if climate negotiations fail or the states commitments are not met (due to the fact that there are no binding instruments implemented), thus we finally burn all known fossil fuel reserves on earth, the global temperature will rise to +11° by 2100 and the Antarctica melting would raise sea levels by 40 meters in the 3rd millennium.

And what about biodiversity loss? The loss of biodiversity is the result of over-exploitation of populations of various types of pollution, the destruction of habitats specific to certain species, or the introduction of competing or predatory species ... The consequences of this "erosion" can not be reduced only to a list of species mistreated, since they also lead to the degradation of ecosystems, functions that they perform in the living system — the biosphere — and therefore the services they provide to humanity. Today, the species extinction needs special attention because it is one of the main risks to biodiversity. Since the origin of life, here 3.8 billion years, the Earth has experienced several crises of extinction whose last — currently underway — is linked to the expansion of the human species. The spiraling loss of biodiversity linked to other planet boundaries that we have reached or that we are close to reaching as such massive deforestation, depletion of nitrogen and phosphorus needed for soil cultivation, scarcity of fresh water, ocean acidification, chemical pollution, over-concentration of carbon dioxide in our atmosphere and aerosol pollution and finally the loss of integrity of the ozone layer will have consequences that could be catastrophic for humanity and life in general on Earth.  We are facing a vicious cycle that shows how life on earth is a complex and fragile alchemy.

## How can we best ensure the survival of humanity?

Therefore, reducing our carbon footprint is not a simple environmental necessity; it is now “the greatest Human Rights challenges of our time » as noted by the South African archbishop and hero of the struggle against apartheid, Desmond Tutu. It is

now unacceptable that people and businesses are enriched by climatically criminal activities, and Tutu calls for addressing the causes and instigators of global warming as they fought apartheid in particular by the weapon of moral reprobation, boycotts, civil disobedience, economic disinvestment and repression by international criminal law.

Indeed, how do we ensure future generations the right to live with dignity in a healthy environment? Statements that of Stockholm, Rio or Vienna were already calling to recognize our right to a healthy environment and our duty to bequeath to future generations. But no sanctions are planned for those who threaten this right, it has not even been elevated to a fundamental human right. Isn't it surprising at a time when all signals are red? We cannot say we do not know.

This is why the citizens' movement End Ecocide on Earth was created. What does Ecocide mean? "Eco" comes from the ancient Greek Oikos meaning "house." "Cidere" comes from the Latin meaning "kill". The ecocide is the fact to destroy our house, the only one we have: Earth.

**For us, destroying the global environment, threatening the safety of the planet is a violation of fundamental human rights and should be considered one of the most serious international crimes, like genocide or crimes against humanity. We must recognize nature as a subject of law, in order to protect the lives of present and future generations.**

We must therefore empower the International Criminal Court to prevent major environmental damage by imposing conservatory measures and suspending hazardous industrial projects for the safety of the planet: like drilling in global commons such as the Antarctic, massive deforestation, industrial sites strongly issue of greenhouse gas but also nuclear sites. We need the precautionary principle laid down by Article 15 of the Rio Declaration, to be applied on a global scale.

We ask in fact that those who hold our common destiny in hand, especially those who run the oil sector, the agro-industry, nuclear, and those who fund and speculate in these markets are supervised by international criminal law. They have to be accountable for their decisions when they impact the survival of entire populations by destroying their livelihoods, even if it can offer more comfort to some of us. It is simply immoral and suicidal in the long term.

## What can you and I start doing today to increase the odds for a sustainable future for humanity?

Make conscious political decisions. Join Climate and Environment focused campaigns, projects and actions. Pay attention to your consumption and waste habits, and you'll find lots of opportunities to decrease your carbon and ecological footprint. Few tips to consider: Eat less red meat, change to an almost entirely vegetarian diet, using mostly unprocessed whole foods such as grains, seeds and nuts.  Purchase renewable energy and make your home and household energy efficient.  Buy energy and water efficient appliances. Walk, cycle or take public transport. Recycle, re-use and avoid useless purchases. When at work, telecommute and teleconference to avoid unnecessary travels. Buy local and organic farming production. And of course show your support to the End Ecocide on Earth campaign on www.endecocide.org.

# GERARDO CEBALLOS

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## The Sixth Mass Animal Extinction: Causes and Consequences

Vitus Bering, the famous explorer, led perhaps the most ambitious scientific expedition ever in the 1730s. Commanding 10,000 people, he was in charge of exploring the vast lands of Siberia and the unknown sea between Siberia and Alaska (Ceballos et al., 2015a). In 1741, he was forced to land on what would be later known as Bering Island, where he would die. In his crew was a doctor and naturalist, Georg Steller, who discovered in the calm waters close to the island a massive three-ton marine mammal, similar to a manatee, that latter was named as the Steller sea cow. The new species to science is famous because it became extinct only 27 years after it was discovered. Unfortunately, hundreds of other vertebrates have become extinct because of human activities in the last five centuries.

In a recent paper, my colleagues and I analyze whether the rate of modern extinctions caused by human activities is higher that the normal or natural extinction rate (Ceballos et al., 2015b). This is important because it would let us understand if we are causing a mass extinction. In the history of life on Earth, there have been five mass extinction episodes where very large percentage of species (>60%) became extinct in a short period of time. All mass extinctions have been caused by natural catastrophes, such as the impact of a meteorite.

## Extinction rates

To do the study, we compared the normal – also known as background – extinction rates with the modern ones. In the normal rate, derived from a thorough analysis of thousands of mammal fossil and subfossil records from the last two million years, one would expect to lose two species for every 10,000 species present every 100 years. For example, if there are 40,000 species, we would expect to see eight extinctions in a century. A rate much higher than that would indicate a mass extinction.

We compiled the list of extinct and possibly extinct species from the International Union for Conservation of Nature (IUCN, 2015), an institution that compiles these data. We found that 477 species have become extinct in the last 100 years.

**Under a normal extinction rate, we would have expected to have only nine extinctions; in other words, there were 468 more extinctions than would be expected in the last century! Putting it in a different way, the species lost in the last 100 years would have become extinct in more than 10,000 years under a normal extinction rate.**

## Ecosystem services

Our results are dramatic and tragic. We are losing species much more rapidly now than in the last two million years! At that pace, we may lose a large proportion of vertebrates, including mammals, birds, reptiles, amphibians and fishes, in the next two to three decades. Those species are our companions in our travel across the universe. Losing them has many consequences. Those species are essential to maintain ecosystem services, which are all the benefits that we get for free from the proper function of nature. The combination of the gases of the atmosphere, the quality and quantity of water, soil fertilization, pollination and so on are ecosystem services. By losing species, we are eroding the conditions of Earth that are essential for human well-being.

## What can we do?

There is still time to avert the most tragic consequences of a sixth mass extinction, because this one is caused by us. We need to curb the human population growth, social inequalities, and use more efficient technologies (e.g. shifting from fossil fuels to green energy supplies). We need to shift from an oil and carbon dependent economy to green energy supplies, that have much less impact on the environment (Barnoski and Hadly, 2015). We need to fight climate change, habitat loss, overfishing and overhunting, pollution, and other factors that are causing the

current extinction episode. There are signs that we are starting to go into the right direction such as the US President Obama Clean Power Plan, that is a historic step in the fight against climate change and Francis Pope's *Laudato SI* that calls for action against climate change and social inequities. What happen with civilization and human existence will likely depend of our action in the next three or four decades. Our responses to save vanishing species are a fundamental part of those responses. We are the only species that has the capability to save all endangered animals. Paradoxically, saving them is the only way to save humanity.

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# JAMIE DRUMMOND

**Jamie Drummond co-founded the advocacy organization DATA (Debt, AIDS, Trade, Africa) with Bono, Bobby Shriver, and others in 2002 and ONE in 2004. In 2007, Jamie was elected a Young Global Leader by the World Economic Forum.**

## Does humanity need saving?

Well reports like the NICs 2030 trends analysis certainly indicate that we are about to hit a particularly stressful juxtaposition: increased numbers of people and per capita consumption of increasingly scarce natural resources, especially in the world's most vulnerable regions where a pronounced youth bulge will require attention.  As the world's population moves from 7 to 9 billion, and Africa from 1 to 2 billion, the region will be host to 40% of the world's young people by 2050. The required explosion in access to jobs and access to opportunity they will demand may be increasingly hard to offer.  The only way to provide these is extremely enlightened policy making, political leadership and intelligent investment by a well incentivised far sighted private sector in precisely those regions where these are hardest to come by. On the other hand, increased connectivity and innovation can both offer new solutions and new ways to organise society to maximise what we've got. Or we could just use new technology to play new games based on the latest Game of Thrones series.

And that's the rub. It's not just whether we can come up with great policies and innovations to solve the world's problems – because of course we can. It is whether we will have the global political intelligence to adopt and adapt those innovations and scale them in the right ways in the right places. On this matter grounds for optimism are reduced.

Framed more positively - if we dramatically improve global policy making and implementation over the next few years we could curtail the risk of reversals and improve the lives of humanity's most marginalised – of obvious benefit for them – but also of mutual interest to us all who share an interdependent future on this one world.

How might this be done? At ONE we may have a useful model to offer. Working with innovative partnerships, ONE and our network have helped cancel 100 percent of the debts of 35 of the poorest countries; reformed trade transparency and anti-corruption laws; nearly doubled smart aid to Africa; and supported the piloting then scaling up of life-saving initiatives on HIV/AIDS, tuberculosis, malaria, and child-killing diseases in the developing world.

We've campaigned for these global social change policies by applying a "secret sauce"—a rough recipe composed of a set of "P's" that I'm sharing here in order to expose the strategy to scrutiny, in the hope that it spurs more analysis of a dangerously under-studied subject: what makes for effective advocacy.

In order to improve the lot of humanity, to improve the state of people and planet it is something of a truism to sat that we need better politicians promoting better policies supported for the long term by a better informed and better organised national global and public citizenry. However almost nowhere is this incredibly serious subject - better global advocacy for better global policy - properly studied.

## Wanted: a mega philanthropist who wants to make disproportionate mark by investing in and then scaling academic research on what makes effective public policy advocacy.

Given a disillusion with political leadership, we must seriously examine engagement strategies and tactics to help build broad constituencies for effective and sustained advocacy.

For our part, here's what we've learned at ONE: The Ps.

Policy

Advocacy must start with evidence-based policy ideas. It sounds obvious, but it's revealing how many campaigns avoid disciplining their approach by assessing evidence of what works and what doesn't. We must test firmly held beliefs with evidence. This requires that organizations build a sound network of relations with both think tanks and implementers. For example, when we worked on debt relief, we backed a successful pilot project in Uganda; in our campaigns against AIDS we press for the scaling of pilot programs run by Médecins Sans Frontières or Partners in Health that helped people living with HIV in resource-poor settings adhere to complex drug regimens. Similarly we've campaigned for funds for the Global Alliance for Vaccines and Immunization, which increases access to vaccines tested with support from the Bill and Melinda Gates Foundation.

Like others, we are assessing the evidence on the use of technology to help citizens hold government accountable for service delivery in remote regions, and to poll and get feedback from those citizens. This is an exciting new area, and if the data backs it, it will require significant advocacy for large-scale adoption. Bono, our cofounder, has labelled this adherence to evidence-based activism as “factivism.”

Politically non-partisan

Second, in a democracy you need to deal with power directly—whoever yields it. Yikes, Lefties, that means you have to hang out with people on the Right! To those on the Right: you too have to deal with the other side. And if you don’t like it, grow up or do something less important.

That also means that you have to listen to the other side’s ideas and policy proposals. And you know what? Sometimes their ideas are better than yours. When this strategy delivers compromise between the two sides, the resulting policy is usually long lasting. Examples include the US President's Emergency Plan for AIDS Relief, the UK’s historic commitment to 0.7 percent of gross national income on foreign assistance, and the original Heavily Indebted Poor Countries Initiative. These programs stick around and have been foundational for further improvements because of broad, carefully constructed global coalitions between faith groups, activists, corporates, and foundations.

At ONE we are now particularly experience at managing political strategies not just across the political aisles but also across the Atlantic. We know how to talk with European and African policymakers just as much as American. This is very important when it comes to securing multilateral trade aid transparency and investment agreements.

Popular culture

This third P may annoy you even more: the need to use celebrities and similar creative means to make your issue famous. To take the boring, dry, technocratic proposal (and trust us, few things are as dull as developing-country debt ratios) and scale it, you have to find a way to put it in the primetime spotlight.

Busy politicians pay much more attention when they either are going to get public credit for responding to your campaign or fear public criticism for not responding. Delivery of praise or criticism happens through the media and of course today through social media.

So one strategy is to sugarcoat the substance with celebrity and subtly slip it from the margins to mainstream. Some find this appalling—surely we should do the right thing because it’s the right thing to do, not because it adopts popular culture. But we have to start where most people are: on YouTube Twitter, Instagram, or TV—engage there, and offer to take them on a journey. For example, hundreds of thousands joined ONE in 2005 when Brad Pitt asked them to do so  in an ABC interview with

Diane Sawyer after a trip to Africa. Those who joined then—initially perhaps because of interest in a personality—are today regularly taking action over corruption in the oil and gas sector, and the lack of electricity in rural Africa. That's quite a journey. As Bono has put it: "Celebrity has currency, and I want to use that currency wisely."

Of course we would all prefer to live in a world where politicians do the right thing purely because evidence shows it's the right thing to do and because a critical mass of well-informed active citizens push politicians—not because a famous friend espouses it. But until that day, let's accept the strategic use of celebrity and explore improvements. If you accept this argument, then developing a Master's course on International Economics or Foreign Policy tailored to jaded Hollywood execs and artists, for example, might reap great returns for global justice and stability.

Pragmatism

The fourth P is pragmatism, by which I mean the ability to accept incremental progress. Incremental progress is often a natural result of working with political realities and the grubby reality of doing deals. Imagine this: A politician starts listening to your campaign, because he's read about it in the papers and received a ton of mail. He calls you into his office and wants to do a deal: "I'll promise to do 62.3 percent of what you're demanding, and you have to say it's 100 percent."

This could be a very good development—it means you're in negotiation. But who are you to strike the deal? What makes your negotiation, perhaps on behalf of millions of people thousands of miles away, legitimate? And what is the right compromise, and how much do you celebrate it? These are painfully difficult questions to answer. You should lose sleep over it.

In any given year, most politicians can give you only a piece of what you demand. They actually don't have much power, not even the President of the United States. The stunning realization is that they need your power to get the issue you are working for through the political process, and your power depends on how many people you can prove support you. And that depends on how many people you have worked to recruit.

That is your legitimacy. Politicians will look at the quality of your policy proposal, then the strength of the constituency you have built to back it, check their conscience and yours, then offer you a deal. Sometimes you can push for more; sometimes you need to accept what they offer, then push for the next increment, building trust. And all the while, you need to appeal to the eternal, uncompromising "prophetic" ideals that you—and in fact many politicians—are trying to live up to: equality and justice.

Prophetic

This refers to the fundamental values that make us better humans and bring us out of the mundane, daily grind to ponder what is really right: those demanding, complicated ideals of equality and

justice. We founded ONE 10 years ago in a field by the Liberty Bell in Philadelphia because that symbolic bell has inscribed upon it a text that cries out for justice and liberty for all. This biblical injunction inspired the Abolitionists, the Anti-Apartheid movement, and the Jubilee Debt Campaign. It is the foundational ideal we strive to live up to; but being human, too often we fall short.

So I've laid out the case. What do you think? Maybe this piece might help provoke a debate about how to encourage effective policy change advocacy, measure its impact, and scale it even more effectively.

This subject really matters, for our one human family faces an imminent choice. This year a confluence of historic summits will present options on poverty eradication and sustainable development to the world's political leaders. Either they will seize the opportunity to build on great progress and implement policies to beat back extreme poverty, hunger, and preventable treatable disease—or we will falter and fall back, risking rampant pandemics, corruption, and instability. Regions such as Africa's Sahel are vulnerable to what have been dubbed "the three extremes": extreme poverty, extreme climate, and extreme ideology. As Africa's population as a whole is set to double by 2050, the Sahels will more than triple. Which world we all live in depends increasingly on which world the citizens of the Sahel live in.

These weighty decisions will depend in large part on the skill and strategy deployed by global civic movements to ensure that world leaders pick the right policies for the citizens of the Sahel as well as Silicon Valley. In order to save humanity we need a far better organised and informed global network of citizens, effectively deployed to improve global policy – and ensure better policies are actually implemented.

# NANCY FARESE

**Nancy Richards Farese is a social entrepreneur, photographer and philanthropist, living between the Bay Area and Boston. She is Founder and Board Chair of CatchLight.io, (formerly PhotoPhilanthropy), a San Francisco-based non-profit that harnesses photography's natural narrative power to bring attention to social, political and environmental issues, inviting everyone to participate in the search for positive change.**

**Nancy travels extensively as a social documentary photographer shooting visual narrative for non-profit storytelling and advocacy. She lectures, teaches and blogs on the use of photography as a social tool and the role of visual media innon-profit storytelling.**

**She currently serves on the board of Southwire Company in Carrollton, Ga, and KQED Public Media in San Francisco.**

**Nancy is currently pursuing a Masters in Public Administration at The Harvard Kennedy School of Government.**

# How to Save The World

Many of us find ourselves charged, either by that little voice inside us or the loud voice of external social and philosophical mandates, to “Save The World”.  The concept is inherently futile, given that it’s not clear exactly whose world we’d be saving, and saving my world might infringe on your world, leaving us in the muddle of whose rights are right; whose freedoms take precedent; whose values define the correct path.  Like most platitudes, it is vague enough to be inspirational, and allows us to pull the covers up tightly over the multitude of complexities below.

**However, for all its vagueness, “Save The World” suggests two very useful concepts. First, there are real problems that the world needs to be saved from.  And, secondly,  the implied “we” suggests that all of us are empowered, indeed charged, with the responsibility of action.**

What does this mean? It could be that we each move through the world thinking every day about global impact, social justice and problem solving. But we don’t…, because we’re human. And the best of us appreciate that we have neither the moral authority nor the moral humility to decide priorities and pathways for everyone else. The answer? “Brighten the corner where you are”, as the poet William Carlos Williams teaches.

So we begin at home. One example: After years of sharing the terror and loss of civil war in her homeland of Liberia, Vaiba Flomo joined a group of women leaders in her neighborhood to protest the mindless violence of war.  Other women stepped forward; they reached across the city, and across the aisle, uniting Muslim and Christian women in the shared purpose of peace. Wearing all white, the women gathered daily at highway intersections for massive sit-ins, eventually crossed international borders to get the attention of the United Nations, and eventually, a peace settlement was signed.

So we offer our expertise. Another example: From the time Sasha Chanoff, a refugee officer with the International Organization for Migration, helped resettle 32 widows and orphans who had survived a Congolese death camp to safety in the US, he began to devote his life to improving methods of support and resettlement for refugees.  RefugePoint now helps permanently relocate this fragile population to places where they can rebuild their lives in safety and with hope.

So we document and show to the world models of people solving problems.  Our example at Catchlight is grounded in a belief of the unique power of photography as an entry point for understanding the critical social issues of our time. With new tools for the capture and distribution of digital images, we work as a translational force between photographers and policy

makers, issue advocates, and the general public who are engaged and open to action.

**My advice is to follow the words of Howard Thurman, who tells us, “Don’t ask what the world needs. Ask what makes you come alive, and go do it.  Because what the world needs is people who have come alive”.**

We are blessed to live in extraordinary times where everything is possible, and everything is challenging. But we’re surrounded by models of people who started “in their little corner”, and are indeed changing the world for the people whose lives they touch.

So start anywhere; just start now. We need you.

# MARCEL FUKAYAMA

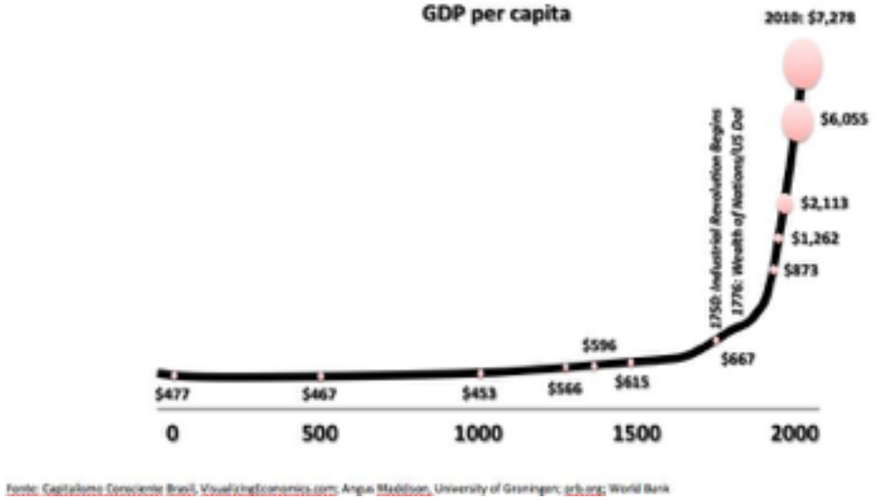
**Marcel Fukayama is a Brazilian social entrepreneur. He is the CEO of CDI Global to use technology for social change, the Co-Founder of Sistema B in Brazil to support the growth of the community of B Corps and Co-Founder of Din4mo Intelligence for Social Businesses.**

## The best companies FOR the World

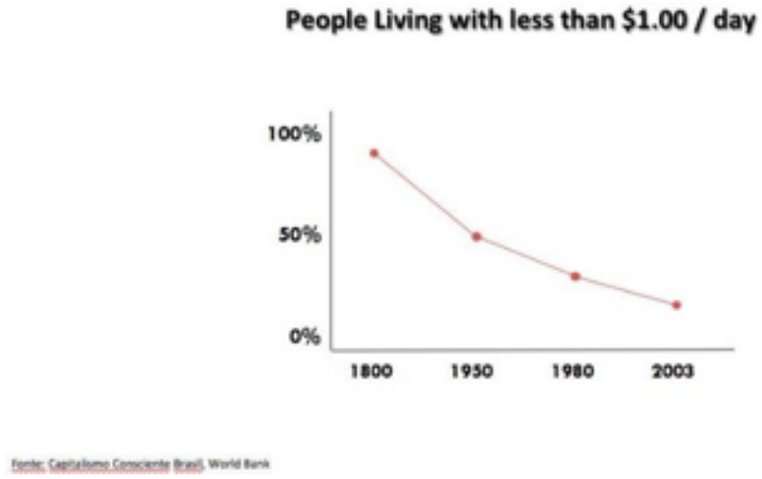
*A generation of entrepreneurs that are reinventing the Capitalism by using business as a force for good*

We live a new era on Earth. In one hand, we have people, money, technology as we have had ever before. In other hand, global challenges have been even more complex. Urban mobility, chronic diseases and climate changes have affected humanity on daily basis in different aspects and effects. Scientific studies have called it as the **anthropocene**: the era when human activities have had a significant impact on Earth's ecosystem.

One of the keys accelerators of this era is the **Capitalism**. Since the start of the anthropocene, during the Industrial Revolution, the GDP per capita have been multiplied by 10. The capitalism is definitely the most successful production and consumption model and wealth generator. However, although the number of people living with less than US$ 1.00 have dropped since then, what we have seen globally is even higher concentrated and cumulative capital. In order to overcome so many complex challenges, we do have to evolve the model.




Fonte: Capitalismo Consciente Brasil, VisualizingEconomics.com; Angus Maddison, University of Groningen; ork.org; World Bank




Fonte: Capitalismo Consciente Brasil, World Bank

The private sector is the most influential and impactful sector on society. Companies have the potential to change behaviors, create new culture and habits contacting directly billions of people. That said, increasing global movements have used this impact sector as a vector to change.

One of them, the Conscious Capitalism, co-founded by Raj Sisodia and John Mackey (Whole Foods' co-founder), believes that companies will reach a new grade of counsciousness when four perspectives are incorporated:


Fonte: Capitalismo Consciente Brasil

- Purpose: the usage of core-business and organizational mission for something significant;
- Stakeholders: a broader view of value creation: not only focused on shareholders;
- Leadership: responsible leaders to conduct the change;
- Culture: a new way to think and act.

Another global movement was created by people that use business as a force for good. The B Corporations are redefining success in business. There are over 1,300 certified companies in 41 countries using their core-business to both make profits and make difference, competing to be not the best companies in the

World, but the best for World. That is a whole new sector on economy of companies that have a high level of performance, transparency and accountability.

To become a B Corp, there are 3 steps. The first one is to go through a deep impact evaluation on dimensions as the governance, business model, environment, community and workers. Achieving a minimum of 80 points – in a range of 0 to 200 points – the company is eligible to become a B Corp and move to the second step, which is promote a change in governing docs with the objective of assuming commitments and responsibilities as creating social and shared value, not only value to shareholders, but to all stakeholders. The third step is to make it public and sign the declaration of interdependence.

B Corps have proven competitive advantage, high exposure and access to new markets. These companies are more likely to:

- **Attract new impact investors:** according to JP Morgan and Aspen Institute of Development Entrepreneurs (ANDE), there are about US$ 16 trillion in asset for investment. Only 0.01% is currently for impact investing. That's a huge important to grow this new class of investment. Through the B Analytics platform, the movement organized data from over 1,200 companies and over 80 fund manager have used the platform for best decision taken. There currently US$ 3 bi under management for investment in B Corps.
- **Compare performance:** The B Impact Assessment (BIA) is free, confidential and useful tool measure B Corps impact - what really matters. It allows companies to compare themselves against more than 20,000 other businesses and get quick ideas for how they can improve their performance;
- **Continuing development:** B Corps have to recertify each 2 years and the bar raises periodically. The BIA is a great roadmap for companies to identify gaps and develop their business model considering externalities;
- **Attract and engage talents:** The millennial generation will be the 50% of the workforce in 5 years. "We" are moved by much more than just financial return. We are focused on building a purpose-driven career and B Corps are the best environment to attract, engage and retain talents;
- **Network:** The global community of B Corps has created a B Marketplace: B Corps making business with other B Corps. B Corps also have access to new markets, which a great business value proposition;
- **Community:** Who leads an organization nowadays knows pretty much dilemmas and challenges. It's quite a lonely journey. Building a strong and powerful community supports entrepreneurs on facing so many questions. It's a supportive group that shares best practices, knowledge and such a great information.

**Guayaki** is one of the first 25 global founding B Corps, Guayaki developed a disruptive business model – it is regenerative and inclusive. The more they sell yerba mate, more hectars of the *Mata Atlantica* is regenerate and more income is generated to local communities involved in the zero-carbon-emission production. That may sound like a music to the new economy, but in fact in 15 years Guayaki has regenerated over 20,000 hectares of the local forest in the triple border of Brazil, Argentina and Paraguay and plans to regenerate more 40,000 in the next 10 years.

**Patagonia** disrupted the market a few years ago when they announced on Black Friday's New York Times advertisement saying to customers to not buy that jacket – as it has to resist for 10 years, so you can repair yours. They have been known as stewards of the environment and they have not only raised the bar in stimulating conscious consumption, but also on 100% traceability of their TIER 1 of providers.

**Natura Comestics** joined the global movement in the end of 2014 to become the largest B Corp in the World and first publicly traded company to certify. With an annual US$ 3 billion in revenues, they created in 45 years a network of over 1.7 million sales consultants in 14 countries. In the event to announce the certification, Natura introduced to the market a 35-year long-term vision called Natura 2050. A plan raising significantly their responsibilities as being one of the pioneers companies to publish integrated balance report – including the environmental profit & loss. "Natura has chosen to participate in the planet's regeneration", said one of the co-founders Guilherme Leal. That is a redefinition of the role of business on society.

A few months later of the publicly traded Natura become B Corp, **ESTY** become the first B Corp to go public. In May 2015, the ETSY's IPO at NASDAQ introduced a clear message to Wall Street that is possible to both make money and difference. The largest marketplace of handcrafts has generated income and sustainability to several communities around the World generating over US$ 1 billion in annual sales. ETSY is also known for their score's improvement: from 80.5 to 105 points in the recertification through a hackathon engaging all workers to understand their weaknesses and develop a plan to strengthen and improve their practices.

**Initiatives as Conscious Capitalism and B Corporations take time to succeed. It's about a major shift and generational change, which may not be worth and effective as the system is perverse. We do have to change the rules of the game.**

On the one hand, a great highlight of the global movement of B Corps is that over 28 American states joined the movement and created a new type of company: The Benefit Corporation. This requires legally and formally a new grade of accountability,

governance and transparency of companies. The father of the civil rights, Martin Luther King, said: *"A movement that moves only people is a revolt. A movement that changes people and institutions is a revolution".*

On the other hand, B Corps have worked with universities to create new mindsets, systematize businesses cases and develop academic programs. The successful companies in the future are to be created by this current generation of youth.

Having these perspectives, it is possible to point that the evolution of capitalism is unavoidable. That may sound like a very ambitious vision, but being at the mountaintop, much progress has been achieved and, at same time, so much to do in this journey. We are all cathedral builders and absolutely aligned with this long-term goal to use the most impactful sector as a vector to change our society, rescuing values and exemplarity.

# TAMRA GILBERTSON

**Tamra Gilbertson is one of the founders of Carbon Trade Watch, and the former Coordinator of the Environmental Justice Project of the Transnational Institute (TNI). She is a founding member of the Durban Group for Climate Justice. She has training in photography, film-making and journalism as well as a Masters in Public Health. She is currently pursuing a PhD in Environmental Sociology at the University of Tennessee.**

## The Answer is Now!

*"Do you want to go back to the dark ages?" – "Are you being realistic?" – "But the economy will naturally fix it, right?" – "The power is too big and we can't change the elites now can we?" – "We all want everything so we should just enjoy it while it lasts!" – "We are exactly where we need to be and change will happen inevitably." – "Isn't it already too late?" – "Technology will save us" –"But the governments are pledging good things so positive change will happen from above anyway, right?" – "Are you against everything?" – "But then what is the solution?"*

The list above includes some of the phrases many of us working for social and environmental justice frequently hear. Sometimes they are offered with kindness and hope, other times they are stated with harshness and despair. Either way these reactions clarify that people do want to see change in the world and demonstrate how we are at a critical moment to bring about these  changes. For me, whether the phrases are said with kindness or harshness is not what is important. The importance lies in whether we are asking the right questions.

I have had the honor to work with incredible activists, communities, scholars, thinkers, farmers, women, students, fishers and Indigenous Peoples who have shaped my thinking and

framed my understanding. Here, I would like to share some ideas and thoughts from discussions and debates during this incredible journey to over 55 countries throughout 15 years of environmental and climate justice research.(1)

**Framing the Problem**

Since the 70s and 80s there has been a greater push towards viewing environmental problems within a neoliberal framework. The 90s was perhaps a pivotal moment in applying this model globally when the UN Framework Convention on Climate Change and the UN Convention on Biodiversity were established. As a result, climate change, biodiversity loss, water, agriculture, and even human beings are used increasingly as objects to be mitigated and controlled through a neoliberal approach.

The entire formulation distracts from effective solutions – trapping us within a framework that sees environmental and social problems in primarily financial terms in order to redefine the problem to fit the assumptions of neoliberal economics. There is no evidence that the environmental and climate change problems we face today, a complex social and economic problem of this scale, can be effectively tackled by indirect economic "incentives" of the sort offered by capitalism. Some of the purported "solutions" include: biodiversity offsetting, carbon trading, Payments for Ecosystem Services (PES), Reducing Emission from Deforestation and forest Degradation (REDD+) and all forms of "bio-banking" promoted in the framework of building a "green" economy. The knowledge systems that are currently being applied to address climate change tend to reproduce the ingrained privilege of the wealthy minority that caused the environmental and socials harms to begin with. Solutions to the world's most pressing environmental, climate and social problems is not a question of which financial mechanisms to use but a question of power. Therefore, the "alternative" cannot be a single solution, but rather a multitude of solutions based on regionally defined needs.

This short article aims to address environmental, climate change and social justice using an intersectional framework with the understanding that all of these pressing concerns are inherently linked. Racism, classism, sexism and homophobia are a few examples of social inequalities that are exacerbated inside imperialist, hegemonic power structures. Struggles to change these core problems require a profound engagement with power and inequalities, therefore a starting point is to recognise that it is impossible to talk about environmental or climate justice without including race, class and gender, for example.

Learning from existing and local solutions requires drawing on a multitude of locally adapted technologies and practices that do not always fit with the grand schemes promoted by the hegemonic elite. In planning a transition away from fossil fuels, and the unsustainable industrial and agricultural practices that they enable, a broad range of formulations hold far more promise

than a strict neoliberal framework. The following five proposed areas include measures to address the problems that we face today: Fossil fuels and Energy; Education and Debate; The State, Labor and the Elite; Food Sovereignty and Agriculture; and Solidarity, Support and Organizing.

**Restructuring Fossil fuels and Energy**

Stopping climate change and environmental destruction requires first and foremost a rapid phase out of fossil fuel use. This is an enviable reality, yet plans continue for exploration, extraction, transportation and refining. Current consumption in a whole host of sectors, from manufacturing to industrial agriculture, need to be reviewed and reassessed. Any strategy to tackle climate change needs to plan for a rapid transition away from how energy is produced and used. There is no precedent for achieving such a change that involves a neoliberal approach.

Although subsidy shifts, regulation and direct public investment will not, in and of themselves, stimulate the necessary changes to solve the problem, they can help reverse the current commitment to fossil fuels. Subsidies are especially important. Around US$5.3 trillion per year, or 6.5 per cent of global GDP (based on 2015 projections), is currently spent on energy subsidies, with the majority of this finance used to artificially lower or reduce the real price of fossil fuels like oil, coal and gas or electricity.(2) Further, a significant proportion of energy subsidies goes into funding infrastructure projects to ensure that fossil fuels keep flowing. Pipelines, highways, and railroads are just a few examples.

Military budgets are another critical area that requires scrutiny. The US, for example, which spends more on defense than all other nations combined, budgeted US$598.5 billion for defense in 2015. Even if one ignores the handouts of hundreds of billions of dollars given to large private banks, there is not a lack of money to be spent on tackling climate change. Yet instead of moving money into climate change mitigation, government agencies use the threat of climate change to fortify support for military budgets in an endeavor to close borders and finance wars, thus stimulating xenophobia towards climate refugees and adding to the racist, anti-immigrant backlash in both the US and Fortress Europe. A better approach would be for the military to start by cleaning up its own act. The DOD is the largest single consumer of fossil fuels in the US and responsible for more than 900 of the 1,300 Environmental Protection Agency Superfund toxic clean-up sites.(3)

Another necessary shift is to end subsidies and incentives for deforestation provided by national governments, export credit agencies, the World Bank and others. These include subsidies to pulp mills, industrial monoculture tree plantations, funding for genetically modified (GM) research, mining in forested areas, commercial logging, agrofuel incentives and other agencies of displacement and ecological degradation.

For a just transition to occur it is critical to recognize that there are communities in the world that currently under-use energy, and others that do not want nor require an energy transition. State subsidies would have a far greater positive impact if they were diversified across community-led initiatives which avoid public-private partnerships. As currently distributed, fossil fuel subsidies rarely flow to those most in need of energy. Based on 2012 data, according to World Energy Outlook, “Worldwide 1.3 billion people – a population equivalent to that of the entire OECD – continue to live without access to electricity. This is equivalent to 18% of the global population and 22% of those living in developing countries. Nearly 97% of those without access to electricity live in sub-Saharan Africa and developing Asia.”(4)

Bottom-up assessments of energy demands contrast sharply with the modeled (and usually inaccurate) projections commonly used to justify fossil fuel subsidies and investments. Such assessments suggest the importance of focusing on smaller, locally-owned, decentralized energy provision, rather than foreign-backed projects that encourage energy exports, financialized “solutions”, and economic accumulation in metropolitan centers

**Education and Debate**

Boosting debate and education on environment, climate and social justice today could make a huge difference on how the next generation tackle these problems. Including radical education on inequalities, imperialism, neocolonialism and inter-linking them to current environmental, agriculture and climate change problems would be a good start inside and outside the classroom. In addition, valuing knowledges outside of elite and privileged knowledge should be a priority.

When environmental and social justice education does exist it is enshrined in a scientific and conservationist framework that excludes important social justice factors like confronting environmental racism and encouraging intersectional probing. Science plays a central role in environmental education which fosters solutions based on technological ‘fixes’ ultimately justifying the continued burning of fossil fuels on a massive scale.

In critiquing science from a feminist perspective, Lorraine Code argues that many of the epistemological ideals that inform science have androcentric roots and that once subjected to feminist scrutiny these ideals require reconstruction.(5) She argues that it is not that the sciences are only androcentric or male-centered in the information they seek, but that their institutions and authority are fundamentally sexist. Science embodies a systematic gender bias where women, and their interests, perspectives, and insights become marginalized. Further, Audre Lorde (1984) referred to the sciences as the “master's tools,” that will unavoidably subvert efforts to transform them into emancipatory, non-oppressive tools. This feminist critique can be mirrored in theorizing how capitalism requires the destruction of Nature, demonstrating how attempts

to use capitalists-based solutions to transform environmental destruction inevitably fails.

Education in the developing world continues to be limited, and this is especially true for girls and women – critical perspectives necessary in the fight for a healthy and just planet. Further, many rural areas in both the global North and South provide limited educational opportunities, and certainly not environmental, climate and social justice education. For example, in places like Florida, US, it can even be illegal to talk about climate change.

Further, when these most pressing problems are debated in public they are often framed within capitalist male-dominated rhetoric which focuses primarily on increasing financialization and liberalization. The most common example in the media is the parroting of the business-model discourse promoting business-as-usual green capitalism through phrases that encourage a "green economy" and "earth-friendly" consumerism. The harsh reality is that we cannot buy our way out of climate change no easier than we can buy our way out of a patriarchal and racist society. We cannot write a check and make it stop, just as we cannot expect that investing in an eco-rural project that creates gentrification will not exacerbate local poverty.

Changing the way people understand and discuss environmental and climate justice starts with education not only in the classroom but in how we think and speak about the environment, our cities, regions and communities. Opening space for shared debate and exchange, as well as education on environmental and climate justice, is a critical part of this path and perhaps the greatest hurdle we face.

**The State, Labor and the Elite**

Regulation

Before the advent of market-based mechanisms, environmental policy was organized through regulation. Advocates of market-based approaches often refer to these methods as "command-and-control" approaches, calling to mind Communist-style bureaucracies stomping on innovation and freedom. In fact, 'regulation' encompasses a whole range of instruments, from efficiency standards for electrical appliances and buildings to feed-in tariffs for renewable energy. For example, one of the most serious shortcomings of a primary market-based mechanism to address climate change is carbon trading partially due to its tendency to undermine existing legislation. The intersection between the Integrated Pollution Prevention and Control (IPPC) Directive, the main EU legislation to control air pollution, and the EU-ETS is a case in point. The IPPC sets energy efficiency requirements and gas concentration limits on a range of installations, some of which were also covered by the EU ETS. To make the two systems compatible, the terms of the IPPC were relaxed. Several examples can be found with plans to introduce Reducing Emissions for Deforestation and forest Degradation (REDD). In Brazil, for example, the Forest Code was re-written to pave the way for REDD projects, reducing forest protection and

negatively influencing land rights specifically for Indigenous and forest dwelling people.

Legal action

Environmental and climate crimes are exactly that: crime. It is time to start enforcing existing policy and holding the corporate-elite liable. Harm to the environment and the atmosphere should be heavily weighted and punished. For example, in the US the majority of crime today is racially motivated and focused on street crime, while violent crime has dramatically decreased in the US over the past 30 years, the prison population has increased from 450,000 in the 1980s to over 1,450,000 today. The US has the largest prison population in the world with the increasing phenomenon of the "high school to prison-pipeline" whereby 1 in 15 men of color will face a prison sentence in his lifetime. Shifting the focus of crime away from racially motivated street crime to mostly white-male corporate and environmental crime is an important step toward a more justice-based society.

Litigation can provide an important arena for environmental action that does not require international banking. Green criminologists and environmental lawyers serve an important function in supporting fence-line communities willing to stand up against elite powers. Moreover, recognizing the importance of including environmental justice implications with human rights legislation is being acknowledged in various legislatures. In March 2015, five communities of the Achuar tribe set a significant precedent for legal action against US oil giant Occidental Petroleum by obtaining economic compensation on the grounds that the company had seriously polluted their territory, causing premature deaths and birth defects, and damaging the ecosystem that sustains them. More action against the corporate elite and holding them accountable is just one of the ways to bring justice to our communities.

Public investment

Public investment for cleaner energy infrastructure capable of breaking industrialized societies' fossil-fuel dependence is crucial, and, as explained above, will not be forthcoming within a neoliberal framework. Such investment should proceed with considerable caution, however, if it is to avoid throwing money at damaging projects. Unfortunately, the majority of private research on energy alternatives is skewed towards solutions that perpetuate climate change.

Although more public money for renewable and alternative energy is desirable plans must proceed with caution. Renewable energy can be extremely harmful even on a "small" scale. The broader issue is the economic and hegemonic system with which the renewable energy lies. If local communities do not own and benefit from the energy produced, are affected negatively by its production, and ecosystems destroyed, it should not be considered renewable or alternative. Therefore, creating new language that re-defines "renewable" and "sustainable" is an important step. This includes large hydroelectric dams, large-scale wind farms, agrofuels, and plans for large-scale photo-

voltaic projects. Being clear about community-led and beneficial renewable and alternative energy projects reduces the ability for large corporations to co-opt local initiatives.

Encouraging public incentives for new energy alternatives and infrastructure cannot be a blank cheque. Public ownership means little without public control – and, under present 'governance' models, this is severely lacking. With state energy companies run as commercial enterprises, and private energy companies consolidating their market shares in most industrialized nations – affording them considerable lobby influence over public investment decisions – little scope currently exists for a genuine publicly-controlled, publicly-led, renewable and just energy production model. For such reasons, any increase in public finances to change the energy system should be community-led and accompanied by democratization of governance.

In confronting environmental and climate justice it is important to include plans for energy transitions, but in this dialogue we exclude the millions of people who live outside of a capitalist economy and may reject the proposition of becoming wage-laborers. Instead of reexamining the fundamentals of an economic and political system that has led to climate change, neoliberal hegemony adjusts the problem of climate change to fit these structures. Therefore, acknowledging and respecting the rights of the peoples – small-scale farmers, fishers, Indigenous and forest-dwelling peoples for example – who live outside of a capitalist society starts by not forcing people to become a part of a system that would enslave them. Further, listening to and acknowledging that their knowledges and livelihoods do not fit with the "energy transition" dialogue is a good step towards learning how a just energy transition might function.

**Food Sovereignty**

Food sovereignty is without-a-doubt one of the most crucial points of action. Communities fighting for food sovereignty, including local production, cultural rights to food, pesticide free production and rights to seeds hold critical knowledge. Local production of healthy foods is one of the key elements to bring about positive change, not only for nutrition and health, but for the future of humanity and all non-human beings.

Industrial agriculture is fossil fuel dependent. The FAO estimates that food systems use 30% of the world's available energy, with more than 70% occurring beyond the farmgate, and produce over 20 percent of the world's greenhouse gas emissions (around 31 percent if land-use change is included).(6) Further, around 33% percent of climate change has been attributed to the entire food system chain. (7) The problems with the industrial food chain are multidimensional which include:

- petroleum for machinery
- land-use change
- reduction of energy and increased pollution in large-scale factory-farming

- pesticides and fertilizers are petroleum based
- transportation for non-local and out of season foods require vast amounts of petroleum
- petroleum based plastics used in packaging and extending shelf-life
- increased waste and non-biodegradable garbage from unnecessary food packaging

Large-scale industrial agriculture is responsible for water scarcity, pesticide poisoning, human health illnesses and risks, biodiversity loss, and other numerous forms of environmental degradation. Industrial agriculture mostly produces grains for biofuels and feed for animals used in meat production that contributes to the problems mentioned above. Meat production involves energy loss, making industrial animal agriculture more resource intensive than other forms of food production.(8) Further, the pesticides used in heavy industrial agriculture are associated with elevated cancer risks for workers and consumers of the products. Recently, certain pesticides including Monsanto's Roundup have come under scrutiny for the links to endocrine disruptors, responsible for a host of hormonal changes and metabolic diseases.(9)

While small-scale local farming requires support for land tenure and land rights in the majority world, in the global North however, the question is more related to subsidies. Over 30% of farming subsidies in the US are rewarded to the wealthiest top 2% of industrial farmers and over 80% to the top 30%.(10) Subsidies for corn in the US topped US$84.4 billion between 1996-2012 of which 88% is genetically modified and 80% of the GMO varieties are controlled by Monsanto.(11) Corporations like Monsanto threaten the planet with harmful pesticides and limit the use of non-GM, genetically diversified seed varieties.

According to the FAO, women produce more than half of all the food grown on a global scale.(12) In general, most of this food comes from home gardens or from family and community plots. In sub-Saharan Africa and the Caribbean, women produce up to 80 percent of basic foodstuffs. In Asia, women provide from 50-90 percent of the labour for rice cultivation. In Southeast Asia and the Pacific as well as Latin America, women's home gardens represent some of the most complex and healthiest agricultural systems known in the world.(13) Women in the rural areas are almost exclusively responsible for family nutrition, from childhood gestation throughout critical periods of growth. Food preparation often involves strenuous labour including collecting wood and carrying water. Importantly, women produce, prepare, provide, store and manage food and family nutrition almost exclusively through unpaid labour both in the global North and the South. In addition, women spend a significant part of their household income – much higher than men – on buying additional food for the family.(14)

Proliferating seed diversity is a crucial role of women worldwide, as keepers of the knowledge and guardians of seed genetic

diversity for food, medicine, cultural and other uses. From generation to generation, women pass on this vital knowledge to their daughters. Supporting women-led local seed exchange projects is a powerful way to support women and seed diversity while at the same time defying corporate power. Without a diversity of seed varieties we risk the survival of this planet by losing important plants which provide sustenance, nutrition and healing to all beings.

**Organise, Support and Solidarity across borders**

The examples of subsidy-shifting, regulation, taxation and legal action highlighted above can be useful tools for tackling climate change if adopted cautiously and backed up by popular action. Ultimately, though, environmental and climate justice remain political questions: therefore action and organizing are essential. Indigenous Peoples' and forest communities defending their rights is an important contribution towards measures to ensure community-based and traditional forest management, protection of forests and territorial rights.

Alternative futures cannot be designed in a boardroom or academic classroom and then placed into a rigid one-size-fits-all plan. The voices of those living alongside exploitative infrastructure projects – from plantations to factories – are among the most powerful when it comes to addressing the question, "What is your alternative?"

In the South as well as the North, community-level or popular strategies have historically proven successful as a means to achieve social and environmental change. In fact, the planet would be far worse off today if community resistance was not a current and historical factor. Often communities take action to protect environmental resources as strategies for survival. The legacy of this resistance holds lessons for all who aim to address climate change, and it is essential that environmentalists and other activists-scholars who promote climate and environmental justice recognise this longer and broader history of community-based and popular struggles. This broader context of struggle includes the activities of a range of groups, social movements and networks. Actions by groups, especially IPs and forest-dwelling communities, to protect community forests and other local commons are a powerful force against climatically destabilizing land clearance, commercial logging, industrial fish farming, tree plantations and industrial agriculture.

Networks against trade liberalization, privatization and commodification help slow growth in unnecessary transport and protect local subsistence regimes against threats from fossil fuel-intensive sectors. Popular movements against fossil fuel extractions, including movements against oil wars, gas and oil pipelines, fossil fuel extraction, power plant pollution, liquefied natural gas (LNG) expansion, coal mining and mountain top removal, tar sands extraction and airport and highway expansion, all help curb extraction of fossil fuels.

Popular movements in both the North and South against fossil fuel pollution from electricity generating and other industrial installations contribute to building solidarity and stopping dangerous pollution that causes climate change. Initiatives to set up small, community-led renewable energy sources for local benefit build resistance by providing more sustainable direct energy. Often they provide a cheap alternative to fossil fuel-oriented centralized generating systems particularly in many areas of the South. Insofar as these approaches defend local resilience, promote community solidarity and organization, such strategies are crucial not only in slowing climate change but also in adapting to it.

Numerous initiatives, networks, organizations and popular movements exist today. There are no short cuts around the difficult work of political organizing and alliance-building. There are no back roads or techno-fixes around the historical and international policies that have created climate change.

**No aspect of the debate on climate change can be disentangled from discussions about colonialism, racism, gender, women's rights, imperialism, exploitation, land grabs, agriculture and the democratic control of technology.**

Capitalism will never address these critical issues because the struggle for environmental and climate justice has to be part of the larger fight for a more just, democratic and equal world. Therefore, the question is not "What is the alternative"? But rather, "When do we start"? And that is a question that I have two answers to: 1) We have already started so please get involved! and 2) Right Now!

(1) Sections of this article are inspired by Chapter 5 of the following two books: 1) Lohmann (2006) Carbon Trading: a critical conversation on climate change, privatisation and power", What's Next, Development Dialogue, no. 48, Uppsala, Sweden. 2) Gilbertson and Reyes (2009), "Carbon Trading: how it works and why it fails", Dag Hammarskold Foundation, Critical Currents no. 7, Uppsala, Sweden.

(2) IMF (2015), "Counting the cost of energy subsidies", IMF Survey Data. http://www.imf.org/external/pubs/ft/survey/so/2015/NEW070215A.htm

(3) Alexander Nazaryan (2014), "The US Department of Defense is one of the World's Biggest Polluters", Newsweek, 17 July 2014. http://www.newsweek.com/2014/07/25/us-department-defence-one-worlds-biggest-polluters-259456.html See also: EPA Polluting Violators Map: http://ofmpub.epa.gov/apex/cimc/f?p=cimc:73:0:::::

(4) IEA (2015), "Energy Access Database", World Energy Outlook Data. http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/

(5) Code, Lorraine (1993), "Taking Subjectivity Into Account," Feminist Epistemologies, Elizabeth Potter and Linda M. Alcoff (eds.), New York: Routledge.

(6) http://www.fao.org/post-2015-mdg/14-themes/energy/en/

(7) http://www.sustainabletable.org/982/agriculture-energy-climate-change

(8) https://www.organicconsumers.org/old_articles/Organic/IndustrialAg502.php

(9) CEO briefing, “A Toxic Affair: How the chemical lobby blocked action on hormone disrupting chemicals”

(10) Vorley W, Keeney D, eds. Bugs in the System: Redesigning the Pesticide Industry for Sustainable Agriculture. London:Earthscan Publications, 1998.

(11) See for example: http://farm.ewg.org/progdetail.php?fips=00000&progcode=corn, and http://phys.org/news/2013-06-gmo-corn-soybeans-dominate.html

(12) Food and Agriculture Organization of the UN: http://www.fao.org/docrep/x0262e/x0262e16.htm

(13) Ibid.

(14) Ibid.

# JAMES B. GLATTFELDER

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## At the Dawn of Human Collective Intelligence

It is an interesting idiosyncrasy of our times that we have become increasingly accustomed to the ongoing success of the human mind in probing reality and understanding the world we live in. Indeed, the relevance of this ever growing body of knowledge, describing the universe and ourselves in greater and greater detail, cannot be overstated. But today, even the most breathtaking technological breakthroughs, fostered by this knowledge, can hardly capture the collective attention span for long. It is as if we have come to expect our technological abilities to steadily accelerate and reach breakneck speeds.

On the other hand, we have also become very accustomed, and alarmingly indifferent and unconcerned, about the state of human affairs.

**As a species, our recent terraforming activities have fundamentally transformed the biosphere we rely on, resulting in considerable impact for us individually. In a nutshell, we have devised linear systems that extract resources at one end, which, after being consumed, are disposed of at the other end. However, on a**

**finite planet, extraction soon becomes exploitation and disposal results in pollution.**

Today, this can be witnesses at unprecedented global scales. Just consider the following: substantial levels of pesticides and BPA in vast populations and even remote populations (like Inuit women whose breast milk is toxic due to pollutants accumulating in the ocean's food chain), increase of chronic diseases, antimicrobial resistance, the Great Pacific and the North Atlantic garbage patches, e-waste, exploding levels of greenhouse gases, peak oil and phosphorus, land degradation, deforestation, water pollution, food waste, overfishing, dramatic loss of biodiversity,. . . The list is constantly growing as we await the arrival of the next billion human inhabitants on this planet.

Compounding this acute problem is the fact that today's generations are living at the expense of future generations, ecologically and economically. For instance, we have reached Earth Overshoot Day in 2015 on the 13th of August. Each year, this day measures when human consumption of Earth's natural resources, or humanity's ecological footprint, approximately reaches the world's biocapacity to generated those natural resources in a year. Since the introduction of this measure in 1970, when the 23rd of December marked Earth Overshoot Day, this tipping point has been occurring earlier and earlier. Moreover, just check the Global Debt Clock, recording public debt worldwide, to see an incomprehensibly and frighteningly high figure, casting an ominous shadow over future prosperity. Yes, the outlook is very dire indeed.

## The Two Modes of Intelligence

In essence, we have an abundance of individual intelligence, fueling knowledge generation and technological proficiency, but an acute lack of collective intelligence, which would allow our species to co-evolve and co-exists in a sustainable manner with the biosphere that keeps it alive. This is the true enigma of our modern times: why does individual intelligence not foster collective intelligence? Take, for instance, a single termite. The biological capacity for cognition is very limited. However, as a collective swarm, the termites engineer nests they equip with air-conditioning capabilities, ensuring a constant inside temperature allowing the termites to cultivate a fungus which digest food for them they could otherwise not utilize. Now take any human. Amazing feats of higher cognitive functioning are manifested: self-awareness, sentience, language capability, creativity, abstract reasoning, formation and defense of beliefs, and much, much more. Remarkably but regrettably, multiplying this amazing potential and capacity times a few billion results in our current sate of affairs.

It is interesting to note that all biological systems do not feature centralized decision making. There are no architect or engineering termites overseeing construction, no CPU in our brains responsible for consciousness. This decentralized and bottom up approach appears to result in the emergence of

collective intelligence, in other words, in self-organization, adaptivity, and resilience. Indeed, this incredible robustness of biological complex systems is most probably the reason why we still can continue with “business as usual” despite the continued devastating blows we have delivered to the biosphere. In stark contrast to these natural systems, all human systems, from political to economic, are all characterized by centralized governance. This top down approach to collective organization appears to systematically lack adaptivity, resilience, and, most importantly, sustainability.

## The Zeitgeist and Beyond

We truly live in tumultuous times. Next to the increasing external pressures just outlined, we are also exposed directly to our own destructiveness. In a global environment where ignorance, myopia, denial, cynicism, indifference, callousness, alienation, disenchantment, and superficiality reign it is not surprising to witness the rise of fundamentalism and violence in all corners of the world. Neither is it really surprising that many people then try and escape this angst short-term by distracting consumerism and numbing materialism overall. Which then leads to the next predicament:

> This is a strange, rather perverse story. Just to put it in very simple terms: it’s a story about us, people, being persuaded to spend money we don’t have, on things we don’t need, to create impressions that won’t last, on people we don’t care about.

(Tim Jackson’s 2010 TED talk.)

> The reality of the society we’re in, is there are thousands and thousands of people out there, leading lives of quiet screaming desperation, where they work long hard hours, at jobs they hate, to enable them to buy things they don’t need, to impress people they don’t like.

(Nigel Marsh’s 2011 TED talk.)

> Huge swathes of people, in Europe and North America in particular, spend their entire working lives performing tasks they secretly believe do not really need to be performed. The moral and spiritual damage that comes from this situation is profound. It is a scar across our collective soul. Yet virtually no one talks about it.

(David Graeber, “On the Phenomenon of Bullshit Jobs”, 2013.)

Our collective psyche is suffering under the current zeitgeist. In just a few decades the complexity and uncertainty of the lives we lead has dramatically increased and we now struggle even harder to find meaning. So, was this it? Are we simply yet another civilization at the precipice of its demise? Are we just a very brief, albeit spectacular, perturbation in the billion year history of life on Earth, which will undoubtedly adapt and continue for billions of years until our sun runs out of fuel?

## At the Dawn

Perhaps things are not as they seem. Maybe the chaotic paths to destruction or survival really are only separated by the metaphorical flapping of the wings of a butterfly. In the case at hand, a mere flicker in the minds of people—for instance, a radical and contagious thought or idea—could alter the course of history.

Indeed, perhaps acquiring collective intelligence is not as hard as we might imagine. What is missing is possibly a subtle change in the way we perceive and think of ourselves and the world we inhabit; a change that would initiate a true shift in our behavior which could lead to adaptive, resilient, and sustainable human systems and interactions. Maybe the difficulty lies in the simple fact that we all first need to focus on ourselves for the common ground to emerge which would allow global change to flourish on.

One of the earliest and strongest constraints everyone of us as child is confronted with is the imprinting of local and static sociocultural and religious narratives, mostly emphasizing external authority. To resist this initial molding requires a very critical and open-minded worldview, not something every human child comes equipped with. What would happen if we would replace these obviously dysfunctional foundational stories that we have been telling our children? What if we, as a species, agreed to convey ideas to the next generation which do not simply depend on the geographic location of birth but represent something more functional, universal, and unifying? Ideas that also stress self-responsibility and self-reliance?

Modern neuroscience heavily emphasizes the plasticity of the human brain. This neuroplasticity reflects how the brain's circuits constantly get rewired due to changes not only in the environment, but crucially also in response to inner changes within the mind. Cultivating different thought patterns results in different neural networks. As a consequence, we should never underestimate how untainted young brains, exposed to novel empowering ideas, could result in a generation of "new" humans, significantly different from the last one. Possibly some of the following ideas could meet this challenge—ideas capable of transforming the inner space of the mind and thus having the power to emanate into the outer world.

## Cultivating a Responsible, Dynamic, and Inclusive Mindset

First, acknowledge that you are not the center of the universe. The local "reality bubble" you live in is arbitrary and infused with ideas relevant to the past. Your way of life is not representative or defining for the human species. Foreign ideas, beliefs, and ways of life are as justified as your own ones. The way you perceive reality depends on the exact levels of dozens of neurotransmitters and the biologically evolved hardwiring in your brain. In effect, what appears as real and true is always contingent and relative. Reality could be vastly richer, bigger, and more complex than anyone ever dared to dream. And never forget to appreciate the amazing string of measurable coincidences that had to conspire for you to read this sentence: from the creation of space, time, and energy,

to the formation of the first heavy elements in the burning cores of stars which then got scattered into the cosmos when they exploded as supernovae and started to assemble into organic mattter, which could store information and spontaneously began to replicate, sparking the evolution of life, which gradually reached ever higher and higher levels of complexity until a lump of organic matter, organized as a network of dozens of billions of nodes and roughly 100 trillion links, became self-aware.

Secondly, place yourself into the center of your universe. You alone are in charge of your life and solely responsible for your actions. You have the freedom in your mind to choose how you respond to internal urges and external influences. You can strive to cultivate a state of happiness and gratitude in your mind, regardless of the circumstances outside of your mind. Embrace change and accept that impermanence is an immutable fact of life. Let go of the illusion of control.

Finally, cultivate a dynamic and inclusive mindset. Assume that all people act to the best of their possibilities and capacities. Face the fact that you can be very wrong in the beliefs you deeply cherish and avoid the illusion of knowledge. Be open to the possibility that other people could be right. Allow your beliefs and ideas to be malleable, adaptive, and self-correcting. Try and strike a healthy balance between critical thinking and open-mindedness.

Can we dare to imagine a future, when we teach our children to be empathetic but critical thinkers? When we teach them to be independent and not to seek acknowledgment form others but only themselves? When we teach them not to fear and discriminate against what is perceived as different and foreign; not to fear change and frantically cling on to the status quo, but to face the never ending challenges of life with confidence and trust? Imagine the collective intelligence that could emerge from a "swarm" of such individuals, emphasizing social inclusion next to cultivating a deep feeling of connectedness to the matrix of life and a profound appreciation of being an integral part of the enigma of existence. Simply by leaving out one generation's worth of flawed and harmful imprinting, and by filling the arising void with radically functional and dynamic ideas and concepts, has the power to change everything.

## The First Rays of Light

What if we already are in the middle of the transition and have not yet realized that it is happening? Despite the fact that we are still fueling dysfunctional collective ideas, perhaps we are already witnessing the beginning of a profound paradigm shift towards collective intelligence.

Take the recent emergence of decentralized financial and economic interactions that are slowly disrupting the status quo. For instance, the nascent rise of the blockchain ledger in a trustless peer-to-peer network enabling unthinkable new ways of human economic cooperation. Or the impact of free-access and free-content collaborative efforts providing us with unrestricted availability of nearly unlimited knowledge and constantly evolving, cutting-edge software. Or peer-to-peer lending, crowd-funding, and crowd-sourcing with the capacity to leverage the

network effect created by a collective of like-minded people. And not to forget the success of shareconomies, offering a radically different blueprint to the way business has been conducted in the past. All these new technologies are based on bottom up, dynamic, decentralized, networked, unconstrained, and self-organizing human interactions. It is impossible to gauge the future impact of these systems today. Similarly, imagine trying to asses the potential of a new technology, called the Internet, in the early 1990s. No one had the audacity to predict what today has emerged form this initial network, then comprised of a few million computers, now affecting every aspect of modern human life.

We are truly living in a brave new world of unprecedented potential, where future utopias or dystopias are only separated by a thought, an idea, a behavior able to replicate and trigger self-organizing and adaptive collective action. So, where will you be at the dawning of human collective intelligence?

# GOPI GOPALAKRISHNAN

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## The Future Needs a Combo Deal

The fruits of development that humankind has reaped in the past few decades are not distributed equally or equitably. This situation needs to be corrected urgently if the quality of life of the future generations living in all parts of the globe, particularly in the underserved remote and rural areas of developing countries, is to improve. How effectively and smartly we can do this in the present will tell on how well the future generations will live.

The Cold War that ended two decades ago took more than just a toll on human lives. It injected ideological divisions in social programs that resulted in improvident use of resources. The hangover from these divisions continues to this day. While ensuring public health was generally ascribed to be the responsibility of the government, especially when it concerns poor segments that need to be extended safety nets, the ideology driven strategies also prescribed what channel must be used to deliver this care. In there lies the source of all misery.

In low resource settings, it is unconscionable to divide existing meagre resources further. Which is, however, what exactly has happened for none other than ideological compulsions. The public sector has been found inefficient in a number of countries due to its inability to generate adequate resources for addressing the challenges and the monopolistic structure which drains it of all empathy for the people. Since monopolies concentrate power,

the most affected by its inefficiencies are the weak and powerless who do not have the ability to negotiate the system.

**Two parts, two needs**

The vacuum such a situation leaves behind is often filled by the private sector, both the formally qualified in the cities and the informally qualified commonly seen in villages. In a country like India, currently over two thirds of the health care is delivered by the private sector—it is the primary source for 70% of the urban families and 63% of rural. The formal private providers in the cities have created a range of competencies and resources that match with global standards but predominantly serve the better-off segments mainly with secondary and tertiary care that maximises profits. When the poor have no other option but to access this private sector for their care, it exacts a heavy price in which an estimated 6% of the lower income groups get pushed below the poverty line each year. There is a crying need for demand side financing such as insurance and vouchers so that a strong safety net is thrown around the urban poor.

The situation is more critical in villages, where the majority of the population lives. The resource constraints are more pervasive. The private sector is a main factor here too, within that the informal providers dominate: they often prescribe irrational drugs and unnecessary procedures but they also have excellent rapport with the communities which in fact serves as the foundation for building their business. At the village level, the nearest available formally qualified providers are very often in the public sector who however lack a good relationship with the community.

**Need is combining resources and competencies**

This is where a cohesive strategy is the need of the hour to answer two questions: is there any way that the public sector can use instruments such as insurance and demand side financing to pay for the poor's access to care in private facilities in urban areas? And can the social skills of the private sector be combined with the medical skills of the public sector to address needs in rural areas?

In sum, the experience of running programmes over the past 50 years should guide us to start revising the paradigm which will develop an unwavering focus on the outputs to be delivered to meet the 'here and now' needs and creatively calibrate the processes to achieve them. The philosophical acceptance that all resources in a country are national resources to be harnessed should underline this approach so we can efficiently deliver a service delivery response to the current needs. Until recently, the absence of metrics prevented the public sector from engaging with the private sector more gainfully. With the advent of frugal technologies such as a simple mobile phone, this shortcoming can largely be corrected. Creative use of these technologies will give an evidence base and arm's length metrics that will enable

harnessing of all resources in a way that can withstand judicial scrutiny.

**What are the steps we take now so we can move toward a way of optimising resources? A good point to start from is to know what resources we have and, using the experiences with them so far almost along the lines of a game theory, understand the characteristics of these resources.**

The senior levels of government should architecture a master plan that will combine the efficacy of these resources in order to create a service delivery structure that will reach out and deliver to communities living anywhere. Independent metrics will be an integral part of this master plan so the government's primary responsibility of regulation and monitoring can be fulfilled effectively. When all these pieces fall into place, we will have a winner not only for now but for the generations to come.

# AUBREY DE GREY

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## Humanity present and future: a distinction blurred by progress against aging

An essential first step in considering the question “how to save humanity?” is to decide what one means by “humanity”. This might at first seem like a trivial issue, but it is not remotely so: very different definitions exist, which lead to very different answers to the question.

The key source of this ambiguity lies in whether humans who have not yet been conceived, and therefore might never be, depending on events both within and beyond the control of humans who are alive today, should be counted as part of “humanity”. To some, it is obvious that they should be, just as those long dead must be. But hang on: is that conclusion compatible with how we actually behave? To some, it clearly is not, because that would mandate creating as many babies as possible, even at the cost of quality of life of both us and them, in the same way that we expend great resources on the prolongation of life of those in ill-health.

I do not propose to offer arguments on either side of this question here: there are strong ones on both sides. However, it can readily be seen that the two options lead to dramatically different conclusions concerning what is the greatest threat to humanity. If

future humans matter just as much as present ones, existential risks (events that would eliminate the entire human race) must be viewed as the key topics to address with regard to saving humanity, since so many lives are involved. But if not - if "humanity" is viewed as consisting only of only humans alive today - then there can be no doubt that the defeat of aging far surpasses all existential risks in its importance, simply because as things stand it is a certain cause of death of everyone, whereas risks such as asteroid impacts or massive nuclear war are of relatively low probability within the timeframe prior to which aging will do us all in.

**My personal position is that we should indeed view humans alive today as the definition of "humanity", and thus that the way to save humanity is to consign aging to history as soon as possible. So, how do we go about it?**

The scientific debate on this topic has been massively hindered for decades, as it continues to be, by two issues of dogma - one scientific, one societal. On the scientific side, there is a desperate tendency to cling to the biologically bankrupt concept that there is such a thing as "aging itself", distinct from the diseases and disabilities that predominate in old age. This misconception leads to huge unjustified overoptimism with regard to the prospect of developing cures for age-related diseases, rather as if they were like infections. But it also creates similarly crazy overpessimism concerning the prospect of biomedical elimination of all age-related ill-health, and the maintenance into arbitrary old age of the mental and physical function typical of a young adult. In reality, these two goals are inseparable: every aspect of ill-health that mainly affects people who were born a long time ago, whether we call it a disease or not, is part and parcel of the same problem, the accumulation of molecular and cellular damage.

That is the ultimate driver of my work and that of SENS Research Foundation. Once we develop a panel of damage-repair interventions that jointly eliminate or obviate all the changes which eventually contribute to age-related decline, we will truly have saved humanity as (in my view) it is properly defined.

# ERNEST MADU

**Dr. Ernest C. Madu is an internationally respected authority on sustainable health systems. He is the Founder of the Heart Institute of the Caribbean (HIC), Jamaica, the premier center of excellence for cardiovascular care in the Caribbean.**

In 1906, the Italian Economist and Sociologist, Vilfredo Pareto made the famous observation that 20% of the population owned 80% of the property in Italy. More than a century later, the so called Pareto principle persists in the distribution and access to global resources. A review of GDP patterns across the world shows that 20% of countries control more than 80% of Global GDP. The United Nations Development (UNDP) Human Development Report of 1992 showed that while the richest 20% of countries controlled 82.70% of world GDP, the poorest 60% of countries had access to just about 5% of the global GDP.

The UNDP's Human Development Index (HDI) measures yearly average achievements in life expectancy, knowledge and living standards across nations. In recent years, this indicator has fallen in most developing countries. Interestingly, this drop is occurring at a time of increased efforts from the international development community to advance the Millennium Development Goals, which aim at cutting extreme poverty in half by 2015 and increasing access to health care and education, among other goals.

In 2008, the UK based Save the Children developed the Child Development Index (CDI), which combines performance measures specific to children in the areas of education, health and nutrition. CDI measures show that the poorest countries of the world demonstrate the highest levels of deprivation in essential primary health care and education services. The under-five mortality rate in Sub-Saharan Africa in 2008 was 144 per 1,000 live births, more than double the global average of 65 per 1,000 live births. In the

same year, roughly 50 percent of the 8.8 million deaths among children under the age of five occurred in the same region. On average, 24,000 children under the age of five die every day, most from preventable causes, with under-nutrition contributing to about one-third of these deaths. The poorest and least economically developed countries of the world contribute more than 90% of the global child deaths under 5 years.

According to a 2005, United Nations Global survey, an estimated 100 million people worldwide were homeless and about 1 billion people lacked adequate housing. While poor urban housing conditions are a global problem, conditions are worst in poorer and less economically developed countries. Habitat estimates that approximately 600 million people live in life- and health-threatening homes in Asia, Africa and Latin America. An estimated 783 million people do not have access to clean water and almost 2.5 billion do not have access to adequate sanitation. Millions of children are denied primary education. About half of the world's 2.2 billion children live in poverty, and 300 million go to bed hungry each night.

Low income countries and vulnerable communities face severe pressure from inequitable distribution of global resources and limited access to life enhancing interventions. The Global Burden of Disease (GBD) Project developed the concept of disability-adjusted life expectancy (DALE), as a summary measure of a population's health, free of major disability. The majority of countries with the lowest DALE are at the bottom of access to global resources. Disability-adjusted life expectancy remains low in poor countries due to limited access to global resources and continuing strife occasioned by struggles for limited resources. Remarkably, these same countries bear an overwhelming burden of the adverse effects of globalization. The burden of disease in these societies is estimated to be about 5 times greater than that of established market economies. Obesity and Diabetes promote hypertension and cardiovascular disease and are 2 strong surrogates of disease burden. Of the estimated 1 billion overweight or obese individuals worldwide, the majority are domiciled in the bottom 20% of countries in terms of global wealth. The World Health Organization estimates that by the year 2025, there will be 333 million diabetics globally with 70% of that number residing in the poorer countries of the world with access to less than 20% of the resources for care.

While life expectancy in the richest 20% of the world has increased over the past 30 years, the reverse is sadly true in the poorest countries of the world. Hundreds of armed conflicts are raging worldwide and these conflicts are deeply rooted in real or perceived inequity in distribution and access to global resources. This gross imbalance in the access to and distribution of the global common wealth is a real and present threat to global peace and security and ultimately threatens human survival. According to United Nations High Commissioner for Refugees (UNHCR), an estimated 60 million people worldwide had been displaced by conflict by the end of 2014 – including 38.2 million displaced within their own countries.

The struggle for resources and conflict can be mitigated through good governance and equitable and fair distribution of resources and access. Theoretically, it would be assumed that with billions of dollars in aid ostensibly sent from wealthy countries to poorer nations each year, poverty would be reduced; increased growth would occur and battle for resources would abate. The converse however is the case; poverty levels continue to escalate almost unabated while growth rates have steadily declined in the poorest countries and millions remain at risk and vulnerable. Of course, the reality is that deep rooted corruption often with active participation from wealthy "donor" nations ensures that much of the so called "aid" dollars end up in private pockets or are wasted on ill considered projects mainly designed to benefit the wealthy "donor" nations perpetuating the status quo to the detriment of vulnerable and underserved millions.

**The long term consequence of over reliance on so called "aid" has trapped many poorer nations in an unending vicious cycle of worsening poverty, deepening corruption, insecurity, aid dependency and market distortion; perpetuating underdevelopment and further widening the gap in resource access and distribution.**

**Ignorance, mismanagement and blatant disregard for the principles of good governance compound the problem.**

The current global imbalance in resource distribution has created an exploitive system, as citizens from the poorest nations are either totally excluded or expend considerable financial and emotional capital to access products and services from the richest nations of the world. To bridge the accessibility gap, poorer nations must make sustained investments in relevant education and appropriate technology. Investment in innovative business models that grow local capacity breaks the perpetual cycle of dependence on foreign aid and supply.

To save humanity, we must rethink our approach to global development. We must question existing paradigms and be willing to reconsider the current approach that has led to an unjust, lopsided and inequitable distribution and access to global commonwealth. Anti-poverty programs must be revitalized to reflect our common humanity with a focus on results, investment and sustainable development. Education is the anchor upon which all globally competitive nations and societies stand, and it is essential to mitigating such handicaps as poverty and poor health. It enables and enhances the understanding, application and proper utilization of new methods and technologies, creating and spreading knowledge, opportunity and wealth – key elements that poor families need but lack.

Development, prosperity and security are often a good reflection of the levels of education and employment rates in a society. Higher literacy and employment rates offer a more secure future devoid of abject poverty and disease. The risks to vulnerable populations around the world cannot be adequately addressed without proper recognition of the link between risks to survival and the levels of literacy, good health and employment in the adult population. The health status, literacy and employment levels of the population are a direct reflection of the national economic status and the quality of governance. A more equitable distribution of resources and prosperity improves outlook and dignity for citizens. This must be at the foundation of our response in seeking global peace and security.

Economic development brings prosperity and offers opportunity for individuals to provide better lives for themselves and their families. Economic development strengthens institutions and offers a social network that protects the disadvantaged and the vulnerable. There is an inverse relationship between GDP growth and populations at risk. Sequential growth and even distribution in national GDP result in sequential and balanced reduction in the populations at risk. Economic prosperity leads to improved access to clean water, better education, housing and healthcare services and ultimately an upward mobility for children born in poverty breaking the cycle of disease and deprivation.

The World Development Indicators Report 2009 notes that “Income from work is the main determinant of living conditions and well being. Breaking the cycle of poverty involves creating local wealth and new cycles of opportunity through decent and productive employment”. Creating local growth and prosperity can be accomplished through investment in education and people focused development programs. Such investments are catalysts for delivering vulnerable populations out of poverty.

To save humanity, we must reject the vicious cycle of poverty and ensure that our investments encourage education and skills acquisition. A new paradigm must break the pattern of charity for sustenance and focus instead on education, employment, sustainable development and economic improvement. We have a great opportunity in the 21st century to address the global imbalance in the distribution of global wealth and resources to ensure global peace and security.

# SÉBASTIEN MAROT

**Sébastien Marot is the founder and Executive Director of Friends-International working with marginalized children and youth to support them to become functional productive citizens.**

## NO SHORTCUTS

Reading the news can only make us pessimistic about the future: it is all about religious and territorial wars, famine, rising youth unemployment, migrants dying whilst in search of a better future, the climate changing dramatically…

Is there hope for humanity? Can we save it, can we build a truly sustainable future for all of us?

I believe we can, however it does mean a dramatic change in how we think and act.

We need to **face complexity**, look at **long-term** solutions that are **bold and new** and we need to do this **together**.

Our world is a world of soundbites and newsflashes, short message services and 140 character limits. We are surrounded by these simplistic messages, offering simplistic solutions to what are complex and interwoven issues. In my field of child welfare and development, I am constantly told that we need to simplify our message because people cannot absorb the information.

To be honest, I find this insulting.  People are curious and do want to understand. Simplistic solutions are not real solutions; they bring the wrong answers and approaches to a problem, which actually creates more harm. One example is how many organizations in my field are harnessing the power of pity to fund their activities. We have all seen the blunt and disturbing adverts,

often featuring big-eyed, fly-covered children, beseeching us to "give $1 and save a life today." Do we really believe this? Probably not, but we do feel better for doing it; we have done our bit to change the world for the better, for at least one child, so we can rest easy once more, shut out the continual bombardment of other calls for our charitable response...

Of course we know that the reality is more complex. Take one area of recent mass media obsessive attention: the trafficking of children for sex. The truth is not in the shocking headline or the two minute news report. The truth is that a child is not simply trafficked in the sex trade. The child is a victim of a series of issues possibly including domestic violence, poverty, sexual abuse, alcohol and drugs, which in turn are the consequences of another set of factors… Giving a dollar to the anti-trafficking cause is not going to solve the issue or make it go away – what will solve this problem is in-depth, long-term work with the child, his or her family and the community.

There are no shortcuts here.

**We also need to break away from the misconception of needing short-term profits and immediate results. We are constantly being taught in our MBAs, from the media, from our environment and from advertisements that it is good to have more and more, and the time to have more is less. How can we break this cycle of 'instant gratification'?**

Here are some possibilities we must explore:

- Businesses must think long term and should not be chained to short-term returns – real investment needs to look at the long-term profit and the non-monetary profit (such as human and environmental impacts). New models are possible: we at Friends-International run social businesses that are both good for people (we run training businesses resulting in employment for young people, within a framework of social stabilization for them, their families and their communities) and, importantly, are also profitable. Solutions are tried throughout the world and investors need to listen.

- Politicians mainly think about their next election: this is a classic short-term mistake – how can you possibly solve pressing social issues such as youth unemployment with a short-term view? Politicians need to think of the global good beyond the next election. They also should look outside of "party-lines" to find solutions, and communicate this approach to the public in a transparent manner. No more false and empty promises!

- Donors need to think beyond the current benchmark of three year "investments" in projects. You do not rebuild someone's life over three years; most of the time it takes much longer to

nurture positive change. From little acorns, big oak trees grow - but not in three years!

- Organizations must also look and plan long-term: they must aim for truly-sustainable impact, not superficial short-term solutions (as much use as a band aid on a gaping wound!), and not 'run after' money (this has a 'stop and go' effect on development, and is harmful to those they should be helping).

The real solutions are complex and thus long term: to repeat, there are no short-cuts.

Many of the solutions must still be found and reinvented: creativity and innovation must be inherent in our practice.

- The traditional model of development based on charity is clearly not working – it can work only as a response to a certain situation, such as an emergency or natural disaster, but charity creates short-term solutions or dependency, which is not sustainable.

- We are witnessing too many examples of development going 'boing'! Put simply, situations where there is a waste of money, efforts, resources and even misuse of funds or manipulation of truth. These unfortunately recurrent examples shatter public faith in the sector.

- Everyone is after easy solutions, the "just add water" approach: one day it is micro-finance that will solve all ills, then social enterprise. The reality is that complexity is necessary: there is not one solution, but a mix that must be adapted everywhere with everyone.

- People are afraid of making mistakes: organizations think that mistakes will lead to the end of funding; individuals think that mistakes will lead to being shunned by others. On the contrary. Mistakes need to be celebrated as a source of learning to improve and do better - during my time in development I have made many, many mistakes, but I always tried to use them to better our work. From helping just 17 young people in 1994, our work is now reaching close to 100,000 young lives, supporting them to build their futures – that was built on mistakes and lessons learned.

Once again, no short-cuts: we're in this long term… and we are in it together.

Indeed, alone we cannot achieve much, and for global endeavors like saving humanity, well, we need to work together. Again, easy to say, but everyone knows this is a challenge…

- We seem unable to work together on so many levels, and what we usually share as human beings is often what prevents us from working together: mistrust and even hatred of the other, and our ego-centric search for wealth and fame at the expense of others.

- We are constantly given the wrong role models: we glorify "success" which is measured as gathering of wealth by people with psychopathic traits or with inflated egos. We need to

rethink success and stop making stupid people famous,  instead we should celebrate and rally around the everyday heroes that make real positive change.

- In parallel, we are constantly pushed into a state of passivity and into a fake sense of comfort: psychologically we are wired to react in denial, and with a lack of clear information and clear options, we are pushed into a feeling of powerlessness (“what can I do? It is out of my hands”). This is reinforced by the media and marketing that feeds us bad news (good news does not sell). It encourages the ‘armchair activist’ approach, shielding us from the true complexity of issues by giving us the false feeling that we have played our role by picking up our mobile and punching in a few numbers from our comfortable armchairs.

- There is also a significant part played by religious faith that can reinforce a passive attitude (acts of/will of gods), or worse, which actually welcomes the impending doom and the end of the world, and is even pushing for it.

Luckily, examples of people getting together to bring positive change do exist and have been extremely strong and effective. One such example is Iceland’s reaction to the current Syrian refugee crisis. The Icelandic Government announced they would make places for only 50 Syrian refugees as they were afraid of an adverse public reaction to bringing more in, no doubt fueled by the overall fears apparent in European political circles over the numbers of those seeking refuge. However, this was not a view that was shared by the Icelandic people. Over 10,000 of them offered to open their homes to refugees and forced the Government to revise its position! This is what we are talking about: the strength of acting together and the strength of community, showing us pointers toward the common good.

It is with this in mind that we at Friends-International moved beyond the traditional ‘top down’ child protection initiative, in favor of what we saw as an innovative approach: give back the power to the people and the communities to be the protectors of their children. So, the ChildSafe Movement was born.

With ChildSafe, we have created a movement that has broken geographical boundaries and reached out to millions across the globe because it has a universal message: Let’s keep our children safe; Let’s learn how to best protect them; Let’s do it together; Let’s do it everywhere: when we travel, at work, if we volunteer, when we are at home… Everyone can ‘Join The Movement’!

**Without descending into cliché, children actually are the future of humanity, and we owe them (and their children) a future. If we want a sustainable future for humanity, we need to nurture them. We need to protect them. Together, we need to participate actively in that process. ChildSafe enables us to do that, without taking short cuts!**

We have no choice but to work together to survive. Alone, we may feel powerless, but as a community we are stronger than anything and can achieve anything.

Together we can change societies, and make change for the common good.

We **can** save ourselves.

# RAGHUNATH MASHELKAR

**Dr. R.A. Mashelkar, FRS, is the National Research Professor at CSIR-National Chemical Laboratory, the President of Global Research Alliance and Chairman of National Innovation Foundation. He has also been the President of Indian National Science Academy and Director General of Council of Scientific Research.**

## Saving Humanity : More from Less for More People

### Global Challenge: Inequality of Access

This essay is based on a basic premise that one of the ways of saving humanity with even rising societal inequalities is to create the magic of `access equality despite income inequality'.

The "Base of the Economic Pyramid" comprises 2.6 billion people worldwide -- a majority of whom live in Asia and Africa - subsisting on less than US $ 2 a day (PPP). Everyone needs access to essential services, be they education, health, financial services, communication and so on. Then only can one achieve the basic level of human empowerment. Then only can one participate in economic development productively. Presently BoP members are not just excluded from the benefits of economic growth, but also from the ability to contribute to it.

As emerging economies continue to design special policies and programs that focus directly on the needs of the economically excluded, they cannot simply wait for a "rising tide to lift all boats". One cannot simply address the income inequality exclusively through standard policy levers like tax and transfer mechanisms, subsidies, welfare and entitlements. An agenda which also facilitates the provision of access to essential goods

and services at affordable prices and increases the purchasing power of the BoP will better enable this segment to participate economically, and will reduce the challenge of income inequality, which can be overcome only in decades.

**We need to achieve three objectives simultaneously and rapidly. First, improving the access to essential services. Second, increasing the purchasing power. And third, also reducing the income inequality.**

We can well begin to achieve these three objectives, if we do something that looks impossible at first sight. And that is to create access equality despite the income inequality. And how can we do that? By using inclusive innovation.

### Inclusive Innovation

Inclusive innovation is any innovation that leads to affordable access of quality goods and services creating livelihood opportunities for the excluded population, primarily at the base of the economic pyramid, and on a long term sustainable basis with a significant outreach.

The objective of a truly inclusive type of innovation would not be just to produce low performance, cheap knock-off versions of rich country technologies so that they can be marketed to poor people. That is getting `less for less'. Inclusive innovation gets `more from less'. This will mean that we will have to harness truly sophisticated science or technology or truly creative non-technological innovation to invent, design, produce and distribute reach price-performance envelope that leads to quality goods and services that are affordable for the majority of the people.

### A Paradigm Shift in the Development Path

Inclusive innovation forces us to measure opportunity by the ends of innovation—what people actually get to enjoy—as opposed to just an increase in their means. In important ways, this rationale invokes a return to the traditional case for innovation—its ability to produce break-through improvements in the quality of life—alongside the usual objective of competitiveness.

Inclusive innovation essentially expands what even meager incomes can afford. It lays down a parallel track of development for the BoP that relies less on redistribution of gains, and more on the direct expansion of the bundle of goods and services against which we traditionally measure purchasing power—and at an ever-accelerating rate.

**Affordable to `extremely' affordable**

True inclusive innovation will create not jut affordable but `extremely' affordable goods and services.

- Can we make a Hepatitis-B vaccine priced at US$20 per dose available at a price that is 40 times less?
- Can we make an artificial foot priced at US$10,000 available at a price that is 300 times less?
- Can we make a high quality cataract eye surgery available, not at US$3,000, but a price that is 100 times less?
- Can we make an ECG machine available, not at US$10,000 but a price that is 20 times lower?

Incredible as it may sound, all such `extreme reduction' targets have been met.

The strategy to achieve such goals can be sub-divided into six categories.

1. **Product innovation:** Examples include the Tata Nano, a low-cost car produced in India based on a no-frills strategy, and the ChotuKool low cost refrigerator designed for people in rural India without access to stable electricity and priced at only US$ 69.
2. **Manufacturing process innovation:** For example, decentralized 'inclusive' textile manufacturing in India based on low-energy, non-damaging cotton-to-cloth conversion, providing affordable cloth for the local villagers who create it but at also high enough quality to be exported to Italy, France, Norway, the UK and the US.
3. **Business model innovation:** An example here is M-PESA in Kenya as a simple low-price mobile payment company that has become virtually ubiquitous in the country, but which has been slow to develop successfully elsewhere due to regulatory impediments.
4. **Delivery system innovation:** One example is the Indian low cost Medical Emergency Services, which brings together the discipline of emergency medicine, with the disciplines of call centers, IT and operations research. This has changed the nature of emergency management in India based on a private–public partnership combining the efficiencies of the private sector without losing the benefits of the public sector support.
5. **Workflow innovation:** Examples include Aravind Eye Care in India for low cost cataract surgery in which, instead of increasing the number of surgeons, ways to increase a surgeon's productivity were found by perfecting an assembly line technique of surgery that increased productivity by a factor of ten. This was inspired by McDonalds' espousal of delivering the same quality of products in diverse regions through highly trained staff by an assembly line operation. Another example is

the Narayana Hrudayalaya Cardiac Care Centre, also in India, which provides heart surgery at a much lower price due to business process and workflow innovations, and which has now opened a unit on the Cayman Islands to serve the nearby American market at a fraction of the cost of US-based operations but no loss of quality.

6. **Grassroots innovation:** One example here stems from the identification by India's National Innovation Foundation (NIF), set up in the year 2000, of an innovation for a rural washing machine that can work without electricity because it is pedal driven. The original idea came from a school girl in Kerala who wanted to be able to wash her and her family's clothes whilst also studying. Inspired by this example, the MIT D-Lab in the USA has also created a portable pedal powered washing machine with an estimated prototype price of US$ 127.

**Towards an Inclusive Business**

An "inclusive innovation strategy" promotes the sustainable production, dissemination, and absorption of inclusive innovations by connecting excluded populations to a nation's innovation ecosystem.  Given the BoP's immense aggregate purchasing power,  inclusive business can be a sustainable business for private firms.

Inclusive business provides great opportunities.  First, firms can benefit from seeking alternatives to high-cost traditional innovative processes, which are based on the principle of 'More from More'. Second, they benefit from innovating over constraint-induced hurdles, rather than avoiding those challenges by lowering product quality or changing the target market. Third, the mindset matters: accomplishing these tasks requires a frugal attitude, which tries to achieve 'More from Less'.

**Inclusive Business : New Mindsets**

If inclusive business innovation models have to thrive, and in turn drive accelerated inclusive growth, what kind of leadership qualities will be required?

Conventionally, the business leaders believed in doing well and doing good.  That means one made a lot of profits, and then set aside a small fraction of it for some public good. No, we have to shift to another model.  And that is 'doing well by doing good'. That means a fundamental commitment to 'doing inclusive business'. This requires paradigm shift is thinking and action.

First, inclusive business CEOs must develop a deep commitment to inclusive growth, which will force them to think of unserved customers, be they rural poor, who don't have access to telephones or urban poor, who don't get emergency medical services.  Companies often start by asking: "Given that we need to cater to the unserved, what should our cost structure be?

Second, inclusive business CEOs must have clear vision with a human dimension: for example, helping poor Indians travel safely and affordably with their families; using connectivity to improve people's work and lives; and enabling patients to buy cheap medicines.

Third, inclusive business CEOs must establish ambitious goals and clear time frames for achieving them.  Companies should ask: "What is our on-the-moon project?"  Or, as they do in India's boardrooms: "What is our Nano project?"

Fourth, inclusive business leaders must force project teams to work within self-imposed boundaries that stem from a deep understanding of consumers.  That will result in novel, outside-in view of innovation.  The language inside their organisations should be about consumers as people, suppliers as partners, and employees as innovators.

And finally, inclusive business CEOs must continuously ask "What if we change the way we operate to reduce costs and focus on return on capital employed, not just on operating margins?  If we reduce prices enough and make our products available to the poor, won't there be explosive growth as they quickly find uses for and buy our offerings?

**Global Spread of Inclusive Innovation Paradigm**

India's Mahindra & Mahindra sells small tractors to American hobby farmers, challenging John Deere's market share. China's Haier has undercut Western competitors in a wide range of products, from air conditioners and washing machines to wine coolers. Haier sold a wine cooler for half the price of the industry leader. Within two years, it had grabbed 60% of the American market.

In fact, anticipating this trend, Jeffrey Immelt, the CEO of General Electric recently said `If we do not come up with innovations in poor countries  and take them  global, new competitors from the developing world – the Mindray, Suzlon and Goldwind will. That is a bracing prospect.'

GE's Vscan, a portable ultrasound device was developed in China. As against the standard ultrasound machine, costing around $ 20,000, Vscan costs just $ 1500!  It is now a big hit in rich and poor countries alike. The same is true of what GE healthcare in Bangalore did for electrocardiogram (ECG) machines.  Their team created a portable high quality ECG machine for just $ 600, as against the standard $ 10,000 machine.  This has become a big hit too.

This trend will surely not only continue but accelerate. As west moves from times of `abundance' to times of `austerity', as the middle class is squeezed and governments curb spending, affordable access and more so `affordable excellence' will

become the norm rather than the exception. The recent challenge of refugees and migration in EU has accentuated the problem and importance of securing access equality despite income inequality has become even more urgent because that will be the key to avoid the social disharmony that will ensue otherwise.

**Finally**

Mahatma Gandhi had two famous tenets: “I would prize every invention of science made for the benefit of all” and “Earth provides enough to satisfy every man’s need but not every man’s greed”. The first tenet referred to affordability. The second tenet referred to sustainability. Both of these are so relevant for solving all the problems that the world is facing today. But with growing aspirations, the resource poor want quality too.

It is clear that inclusive innovation if firmly anchored on the solid foundation of quality, affordability and sustainability,  will certainly lead to a design a sustainable future for the mankind and save the humanity.

# GUY MCPHERSON

**Guy McPherson is Professor Emeritus of Natural Resources and Ecology & Evolutionary Biology at the University of Arizona.**

The evidence is gaining increasing clarity: We've reached a crossroads unlike any other in human history. One path leads to despair for Homo industrialis. The other leads to extinction, for Homo sapiens and the millions of species we are taking with us into the abyss. Collectively, we've clearly chosen both of the above. Not only does industrial civilization teeter on the brink, but extinction of our species will soon follow.

Consider, for example, the following overview of the global situation:

> Fact: This planet has not harbored humans at 3.3 C or higher above baseline (i.e., the beginning of the industrial revolution). The number may be much lower. The jury is still out.

Fact: Humans are animals that depend on myriad other species for survival. As with all other animals, humans require clean air, potable water, healthy food, and the ability to maintain body temperature to sustain themselves.

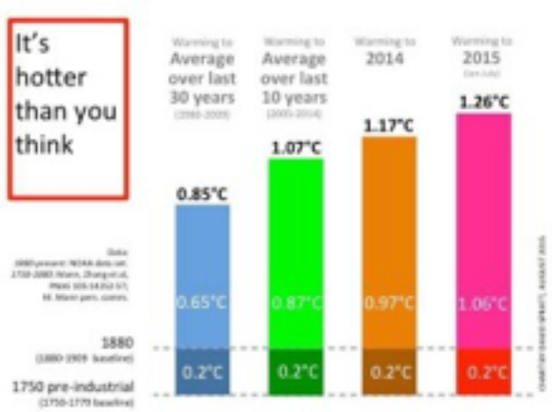
Fact: Humans will die without a living planet that continuously supplies the elements listed above.

Fact: So far, all humans born into the physical realm have died. There is no rational basis for expecting any human to avoid this fate.

Fact: The Sixth Mass Extinction is under way.

> Fact: All species have gone extinct or will go extinct. There is no rational basis for expecting Homo sapiens to avoid this fate.

Earth is officially at 0.85 C above baseline. The actual, unofficial global-average temperature is at least 0.1 C higher than the official figure. The ongoing El Niño will take Earth well beyond 1 C, the1990 Rubicon from the United Nations Advisory Group on Greenhouse Gases. As David Spratt points out in this video from October 2014, 0.5 C  was a more reasonable target. But those days are long behind us.




The rate of evolution via natural selection trails the rate of climate change by a factor of 10,000, according to a paper in the August 2013 issue of *Ecology Letters*. Clever as we are, we will not evade the Sixth Mass Extinction in the absence of myriad non-human organisms to supply the necessities of human life.

"Dramatic emission reductions (35%–80%) in anthropogenic aerosols and their precursors projected by Representative Concentration Pathway (RCP) 4.5 result in ~1 °C of additional warming," according to an analysis published in the 20 May 2013 issue of *Journal of Geophysical Research: Atmospheres*. Instead of taking the cherry-picking, conservative approach assumed by academic scientists and the Intergovernmental Panel on Climate Change's RCP, I'll use the upper end of the conservative projection: Reducing industrial activity by 35% results in ~1 C global-average temperature rise, and eliminating global industrial activity results in an attendant ~3 C global-average temperature rise.

In other words, the absence of solar dimming associated with reflective particles could cause an abrupt rise in global-average temperature beyond that which has supported the existence of humans in the past (about 4 C, the number at which a headline from 2008 in *The Guardian* conservatively concludes human extinction). A large majority of the rise in temperature will come much more rapidly than the initial 0.85 C. Assuming the least-conservative end of the very conservative spectrum offered by the journal literature and the Intergovernmental Panel on Climate Change takes Earth well beyond the temperature at which human life has been harbored on this planet. Earth only gets hotter from there.

On the other hand, nobody knows the global-average temperature at which humans will become extinct. We've not yet completed this trial. By the time we complete the trial, there will be nobody left to record it. The lesson will come after the exam.

The industrial economies of the world are inextricably linked. If Europe goes down the tubes because the derivatives bubble pops on that continent, then there will be consequences throughout the world. There's a reason the Federal Reserve System of the United States gives money directly to foreign countries.

The rapid rise in global-average temperature I've described in this scenario occurs within days after collapse is complete. Sans methane and its exponential rise in Earth's atmosphere. Sans 10-year "lag" in maximum heating from atmospheric carbon dioxide. Sans nuclear facilities melting down catastrophically.

I'm not suggesting all humans will die within days after the ongoing collapse of industrial civilization is complete. Rather, that process is likely to require months, or perhaps a few years. But it's difficult for me to envision Earth with humans in 2030, notwithstanding the IPCC's fantasy technology.

Contrary to conventional "wisdom," we cannot sustain this unsustainable set of living arrangements indefinitely. Industrial civilization will end. Those of you believing somebody has the system under control are deluded. Nobody is in charge of the system, which teeters on the brink. Only you are responsible for yourself.

Shortly after civilization reaches its overdue end, habitat for humans will disappear. Between now then, every year will be worse than the one before, except for the few who benefit from oppression abroad, obedience at home, and destruction of the living planet. Obedience at home is exemplified by thoughtless people still on their hamster wheels.

Preppers take heart: Bunkers of beans will see you through a few years if you avoid fires, floods, superstorms, bitter cold, infectious diseases, and numerous other hazards. After that, it's microbes and bacteria for ten million years or so.

Everybody take heart: **We get to live**. It's quite an amazing deal. Let's get on with it.

But enough about the dire situation in which industrial civilization and the humans within it find themselves. Let us consider, and focus upon, the very definition of humanity. These definitions are taken from the Merriam-Webster Online Dictionary:

1: the quality or state of being humane (i.e., marked by compassion, sympathy, or consideration for humans or animals)

2a: the quality or state of being human

2b: plural: human attributes or qualities

3: plural: the branches of learning (as philosophy, arts, or languages) that investigate human constructs and concerns as

opposed to natural processes (as in physics or chemistry) and social relations (as in anthropology or economics)

4: the human race: the totality of human beings

Sure, that fourth definition matters. We're selfish creatures, after all, interested primarily in persistence. Unfortunately for our species, we're really, truly interested in persistence of our own selfish selves, and not so much interested in our own species. Ergo, the self-induced, greed-inspired, utterly human, generally predictable (but specifically chaotic) predicaments in which we are currently marinating.

**As a society, we will not willingly halt the industrial economy. We would much rather reduce the planet to a lifeless pile of rubble than diminish -- much less halt -- economic growth. But, soon enough, we'll run out of options and industrial civilization will draw its last breath.**

I'd like to consider the other three definitions, too. I'll admit that we could argue all day about the each of the definitions. But let's take them one at a time, as given by Merriam and Webster.

Are we capable of being humane? How deeply do you have to drill into your memory to come up with a time you saw a large group of people acting compassionately, sympathetically, considerately toward other humans or animals? On the other hand -- and please excuse my eternally optimistic outlook as it bubbles to the surface yet again -- it's probably quite easy to recall the last time you saw an individual human being displaying those same characteristics. Probably it was you, earlier today. There's plenty of evolutionary theory to explain altruism among individuals in small groups, even if the individuals do not share grandparents. That same evolutionary theory becomes tenuous, verging on useless, when group size becomes sufficiently large. Throw in all the attributes of industrial civilization, nearly all of which reward competition and individualism over cooperation and teamwork, and suddenly we're trapped beneath an avalanche of self-generated hubris.

If we manage to retain the quality or state of being humane -- that is, if we are to retain some semblance of compassion, sympathy, or consideration for humans or animals -- we must jump off the imperial train before it crashes in a heap at the bottom of the precipitous fall. There is no question that the train left the station and fell off the cliff. There is no legitimate hope for saving the industrial economy or habitat for the 7.3 billion humans on Earth, but there is great hope for saving the "quality or state of being humane" for a relatively short period of time in relatively small groups of humans.

On, then, to the second definition of humanity: the quality or state of being human. What makes us human? The question is, of course, easy to address on the surface and nearly impossible to address in depth. DNA tells us whether we're human, that is, whether we're of the genus *Homo* and the species *Homo sapiens*, as opposed to one of the myriad other organisms on the planet. We'll leave the easy question to gene jockeys, and take up the more difficult and deeper question: What makes us human, beyond DNA?

I'm hardly the first person to ponder that question. My predecessors include dozens of authors, including a passel of philosophers dating at least to Plato and Lao Tzu. I defer, as I often do, to Nietzsche (particularly in *Human, All Too Human*). Nietzsche recognized humans as tragically flawed organisms that, like other animals, lack free will. Unlike Descartes, Nietzsche thought our flaws define us, and therefore cannot be overcome. We are far too human for that. Although we are thinking animals -- what Nietzsche termed *res cogitans* -- we are prey to muddled thoughts, that is, to ideas that lack clarity and distinctness. Nietzsche wasn't so pessimistic or naive to believe *all* our thoughts are muddled, of course. Ultimately, though, incompetence defines the human experience.

It's a short, easy step from Nietzsche's conclusion -- we are flawed organisms -- to industrial civilization as a product of our incompetence. But the same step can be taken for every technology, with industrial civilization as the final, fatal blow. In other words, progress means only that we accelerate the rapidity with which bad things happen to societies. American exceptionalism thus becomes one more victim of an imperial train wreck.

If this second definition of humanity contributed to the tragedy of industrial civilization -- and it's difficult for me to believe it didn't -- is it, like definition number one, worth saving? Will completion of the ongoing industrial collapse retain our inherent, all-too-human flaw?

This question is analogous to John Stuart Mill's famous line from *Utilitarianism*: "It is better to be a human being dissatisfied than a pig satisfied." We simply don't have a choice in the matter (and neither did Mill's pig). We're tragically flawed regardless of industrial civilization's lifespan. In this case, the termination of industrial civilization neither benefits nor harms our humanity.

The third definition of humanity reads, "the branches of learning (as philosophy, arts, or languages) that investigate human constructs and concerns as opposed to natural processes (as in physics or chemistry) and social relations (as in anthropology or economics)." The branches of learning are defined by the culture. In the present case, arbitrarily dividing knowledge into natural sciences and the humanities has contributed to the division we see at all levels of human interaction. Echoing C.P. Snow's conclusion in his eponymous two cultures, Edward O. Wilson's argued forcefully in *Consilience* that the separation of learning,

hence knowledge, into two groups is a huge blow to meaningfully understanding the human experience. C.P. Snow was, of course, echoing Plato and Lao Tzu.

Shouldn't we be trying to integrate knowledge, instead of compartmentalizing it? In an effort to serve the culture of death that is industrial society, we have taken the worst possible approach: We developed our entire educational system around the twin pillars of compartmentalization and ignorance. Throw in a huge, ongoing, forceful dose of opposition to integration and synthesis, and we're left with a tsunami of incompetence. We probably stood no chance of overcoming the all-too-human incompetence described by Nietzsche, but we purposely designed an educational system to reinforce the incompetence on a massive scale.

It's easy to blame industrial civilization -- i.e., the dominant culture -- for the sorry state of our educational system, and therefore for our lack of relevant humanity. A truly comprehensive approach to learning would focus on humans as part of the world, rather than apart from the world. It would strive for integration and synthesis. It would assume the learner is one part of an ecosystem, but not a superior part. It would be as unique to a specific location as climate, topography, and the durable culture that assumes its place in that place.

About that fourth and final definition, the one that absorbs our tender existential psyches: Nobody who ever gave the matter serious thought could honestly reach the conclusion that "the totality of human beings" was destined to last forever. But we would welcome the demise of industrial civilization if we had even a token amount of "compassion, sympathy, or consideration for humans or (non-human) animals." Our persistent, ridiculous, and all-too-human attempts to prop up this civilization reveals our stunning lack of humanity.

Taking the broad, hence radical, view indicates that humanity is at a crossroads. Let's save what's left of it, shall we?

# KAMAL MEATTLE

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## GLOBAL WARMING – A BANE, YET AN OPPORTUNITY

Little did we know that our footsteps towards our convenience and industrial advancements will result in climate terror. Though, Earth had started showing alarming signs about 12,000 years ago when, due to abrupt climate spikes (called) interstadials, large animals like mighty mega-fauna of the last ice age; short-faced bears and cave lions, including woolly mammoths became extinct during late Pleistocene age. Gradually, such dramatic climate drifts, affected flora, fauna and humans. Droughts, hurricanes, floods, cyclones and other climatic havocs are surely proofs of this.

Earth continues to experience a rise in its fever by 2°C every year, while narrowing the possibilities for us to fix the consequences of global warming.

**The fact is that Global Warming is now a part of Earth's reality and we are losing out on time.**

If we await a miracle, then we can be hopeful, but we cannot time it.

But if we really want to lead a healthy and happy life, then we need to wake up.

Being indifferent to this huge problem won't help us in bringing down the rate of diseases and deaths due to natural calamities, or pollution. We need to be pro-active to protect our heritage; preserve flora and fauna; and stay healthy, well and unafraid.

This is a universal truth. Global warming doesn't discriminate between a common man and a celebrity as it affects all and spares none.

We have been the director, producer and the scriptwriter of this sad story, so we need to take care of it.

But one cannot escape from this mess, only by planting trees.

Air pollution contributes to global warming and is capable of overpowering the efficiency of trees in bringing climatic harmony.

In the peak winter in New Delhi, the capital of India, there is a temperature inversion and instead of warm air riding up it travels horizontally towards a cooler zone, that is, where there is green cover of trees.

Along with that warm air, the PM 1 and 2.5 (Particulate Matter) travels with the natural air currents and contaminates the air of these green patches and parks with high tree cover.

One good example is Lodi Gardens; a large public park spread over 80 acres of land, located in Lutyens Delhi, home to all the senior Ministers and Bureaucrats. It may be mentioned here that Delhi NCR has the unfortunate title of being the most polluted city on Earth.

It has a rich composition of 154 species of plants, of 252 species that are recorded so far and approximately 5,400 trees, which altogether attract migratory birds during winter. The garden, literally a botanist's treasure trove, has the National Bonsai Park located in it. Despite such richness, the high count of PM 1, 2.5 and Ozone, in the winter months, is really shocking.

People go to the Lodi Garden for a morning /evening walk to exercise, but with the exercise they breathe poisonous air that leads to lung and heart disease. In fact the trees that have leaves coated with dust and pollution cannot effectively and efficiently do photosynthesis, to produce oxygen.

We have to take a holistic approach, and relook at all the causal dimensions like deforestation; unbridled usage of resources; burning of fossils; industrial practices; human behavior and others that have triggered global warming.

A study has found that buildings consume 40% of the World's Energy (30% of India's energy consumed by the buildings); and produce 40% Green House Gases and waste, across the globe. This is a clear indication of the dire need of implementing sustainable technology.

Starting with the abysmal situation of water consumption - one-third of Earth's largest groundwater basins are under threat as we, humans, are draining water heavily and rapidly. Eight, of thirty

seven big aquifers are distressed causing insufficient replenishment to offset usage.

In India, which is a home to 4% of the world's water resources, only eighteen percent of the rural population has access to the treated water.

Water management and harvesting should be mandated. Chennai has set a good example.  We need a Bureau of Water Efficiency on the lines and pattern of the Bureau of Energy Efficiency, set up by Government of India.

Another important aspect is the hygiene and cleanliness of water.

Yamuna, a river flowing by Delhi, now has zero dissolved oxygen, as a result of waste and defecation dumped into it, boosting the growth of microbial organisms that affects health of humans, animals and plants. Eighty percent of India's sewage water flows to the river, yet sixty seven percent of households do not consider treating it, before drinking it, perhaps because they do not have tap water supply or cannot afford to purify the same..

Rainwater harvesting is one of the effective ways of conserving water. Countries that receive a good amount of shower of wealth from the skies should harvest it.

Across the planet, >1.3 billion people have no access to electricity, and about 2.6 billion have no access to modern cooking facilities. More than 95 percent of those people are located in sub - Saharan Africa or in developing Asia, and 84 percent are in the rural domain.

African, Arab Countries, and India, have a geographical advantage of a large number of sunny days and hours, which gives them a potential to produce more solar power. But it's not only about the geographical advantage; it's more about the will to do so.

A 2010 study is very revealing. On a count of ten, it has ranked countries based on their march towards generating electricity by capturing solar power. The study states that Italy, generates more of its energy from solar than any other nation, with 7.8 percent of its energy coming from solar.

China, a major solar panel manufacturer, has grown its solar capacity by an astounding 6,000% from less than one-third of a Giga watt of capacity to 18.3 GW. The government has had to repeatedly raise its renewable energy targets: from a plan of 20 GW by 2020 to 20 - 30 GW by 2020 to the current target of an astounding 70 GW of solar by 2017. Other countries that have performed really well in converting solar energy into electricity are USA, Spain, France, Japan, Australia, Belgium and UK.

India has an installed capacity of producing electricity of 166 -102 GW from wind power; 19.7 GW from hydroelectric power; 22.5 from bio-power and 22GW from solar power. Renewing renewable is the answer. The goal is to generate 100 Gigawatts from Solar in the future.

PV power requires storage to be effective unless the system is connected to a national grid with power obtained from other sources, for night use.

India has > 780 million cows producing over 4 million tones of cow dung every day. The challenge is to collect the dung for to produce Gobar Gas (Methane) and Manure through bio-reactors. Methane can be used for cooking (in villages) and generating electricity by reforming it and producing Hydrogen as fuel for "Fuel Cells".

Another powerful combo, which can be promoted more, is the solar-based LED lighting systems. LED bulbs use only 2-17 watts of electricity which is 1/3rd of energy that CFLs consume and there is no possibility of mercury contamination.

Such systems have already penetrated the markets, but still marketing has to be done extensively. They are helpful in reducing the energy consumption, on the demand side.

This is how we can act smart not only to save resources but also minimize CO2 emissions as we don't have to depend upon coal to generate electricity.

It's true that coal-based electricity is a common method used widely, and India is no exception to this because 60% of its electricity comes from it. What is even worse is that this method is the largest source of man-made carbon-dioxide emissions, which intensifies the problem of air pollution. Nobel Laureate Al Gore has clearly demonstrated the correlation between temperature increase and rising CO2 levels over the years.

Let's talk about the element which is fundamental to the survival of every living being, "Air".

One can stay alive: for weeks without food; for a few days without water, but not more than 10 minutes without breathing. Now the question is: Breathing what – Air or with it, the Pollutants – PM 1, 25 and Ozone?

Yes, air pollution has become epidemic in most of the countries, even though India tops the charts. Therefore, it is imperative that one breathes clean and oxygenated air.

A human brain weighs only 2% of our body's weight but takes in 20% of total oxygen supplied to the body. As compared with others, our brain cells are extremely sensitive to the availability of oxygen, deprived of which they quickly begin to die. Additionally, deficiency of good air quality can lead to an array of health hazards like headaches, lung impairment, Asthma, eye irritation, COPD, cardiac arrests and more. Assuming that by creeping into closed rooms one can actually escape from the effects of air pollution, then it's wrong.

The fact is: Air pollution takes place both inside and outside; in fact, indoor air is up to 10 times more polluted than the ambient. It has high impact on children, preventing the development of their lungs and brain. Children in pre-natal stage are affected the most. And the deadly pollutants like VOCs, PM 1 and 2.5; Ozone,

Sox, NOx, High bacteria and Fungus levels, never let one be Healthy, indoors or outdoors!

An average increase in PM 2.5 of 6 ug / m3 per day, over two days, raised risk of Out of Hospital Cardiac Arrests (OHCA) by 4.6%. Increase of Ozone by 20 ppb over 1 to 3 hours, also increased OHCA risk, with a peak of 4.4%.

As per recent WHO report, India accounts for 1.3 million deaths annually due to indoor air pollution. Indoor air pollution is the second highest killer in India after Blood Pressure, as per Global Burden of Diseases report.

Moreover, high PM (1, 2.5 & 10) and Ozone levels are affecting the health and life of Delhi's inhabitants to an extent that makes it unfit for living between Diwali and Holi in March each year.

These are like X -Rays, invisible but harmful.

Every family wishes their children to lead a healthy and happy life. Those Delhi-residing families aspirant about their children to become someone like Sachin Tendulkar, David Beckham, Sania Mirza or any other sports star will have to grapple with the city's unfortunate situation, Air Pollution.

Delhi's air is prone to air pollution because of the burning of paddy crops; extensive use of fireworks during Diwali in November each year; huge number of trucks passing the city fed on dirty diesel; 7.5 million vehicles on its roads of which 50% run on diesel; burning of waste, and more.

The level of pollutants – PM 1 and 2.5 is still soaring with Ozone.

We ensure that two or three liters of water that we drink every day are pure, while we breathe 11,000 liters of air (23,000 breaths) a day, but are least bothered about its quality?

Moreover, we spend 90% of our time indoors, be it at home or office. If we fix our air quality indoors, then we will be able to gain a respite and rest from fighting against the outdoor air pollution.

Our lungs are as large as a tennis court, of ~260 sqm surface area, which absorbs oxygen from the 3-5 liters of air we breathe in each breath. The PM 1 and 2.5 particles are pumped into the bloodstream along with oxygen. A quick check to measure the efficiency of one's lungs is to measure one's blood saturation level (SPO2) with an electronic pulse-oximeter, which is available for around Rs 2,500, online. If one's personal reading is less than 95%, then be advised to consult a pulmonary specialist.

Diagnosing is one part and resolving this problem is another.

Fortunately, there are simple solutions to this that also benefit in the long run. That panacea is known as "Plants". There are some air-purifying plants that can help you breathe easy.

"We Grow Fresh Air TM " at Paharpur Business Centre (PBC) and we do it with the help of >1,200 air-purifying plants, that not only detoxify the indoor air, but also enrich it with oxygen, thereby reducing the incidences of health hazards and absenteeism due

to sick days, while up-scaling the human productivity level by ~ 15%.

The miracle doers are: Mother-in-Law's Tongue which produces oxygen during night time, while Money Plant and Areca Palm produce oxygen during day time. These common houseplants detoxify the indoor air. Money plant is especially good to remove Trichloroethylene, Benzene Formaldehyde. These are found in air, carpets, paper towels plastics etc.

Indoor Air Quality at PBC conforms to ASHRAE & WHO standards. It also helps in reducing energy consumption to a huge extent by reducing the load on HVAC (Heating Ventilating and Air Conditioning) system.

Fortunately, this technology can be replicated in other buildings even, including homes.

In Delhi, to reduce pollution, we could take more corrective actions. All the vehicles should perform a Pollution Check (PUC) regularly. A bar code sticker could be printed and affixed to the wind screen to be read with a bar code reader to determine if the vehicle can be refueled or not. A red light could flash if the bar code does not meet the specs, and record the same. A penalty could also be imposed on the Petrol Pump in case they refuel vehicles which are not authorized or are irregular in this.

This check can also become a good resource of funds if a centrally-controlled database of all the vehicles that have done PUC is created which can be further sold to the companies and advertisement agencies for their promotional activities. Paperless CRM software can be created. Funds generated through it can be used for certain developmental initiatives like setting up air quality monitoring stations; preparing breathing chambers for people to come and breathe fresh air for few hours and more.

Fuel specifications should be revised. Diesel is adulterated with Kerosene. Hence, kerosene shouldn't be sold in Delhi and direct subsidy be paid via UID (Adhaar) cards to the eligible only. Petrol is adulterated with cheap Methanol. Centre for Science and Environment submitted a finding to the Hon Supreme Court of India in the 1990's showing that if one mixed up to 15% Methanol with Petrol, the Sample would pass the quality test for Petrol.

Most importantly, fuel supply standard should be upgraded to Euro VI. Subsequently, the vehicles having engine non compliant to Euro VI fuel should be upgraded else banned.

There are no vacuum nozzles at the fuel dispensers to remove the vapor from petrol and condense it – this will reduce evaporation losses and reduce pollution.

The Delhi Govt. could consider levying a cess equal to the difference between Petrol and Diesel Prices in Delhi with the highest price in India – i.e. at Mumbai of about Rs 7 per liter. This cess could be deposited in an Escrow account that can be used for paying for the higher quality diesel and sold at the normal price in Delhi only – a case of cross subsidy.

A lot can be done in small and big measures.

What defines the opportunity better is that 2/3rd is India is yet to be built (as per Mc Kinsey report); hence we can make a head-start. Needless to say, there is a dire need for clean and green technology, and new-skilled people.

Together, we can do a lot to not to let the climate change define our future, but we need to change our mindset first that somebody else will do it. We need to take a stand and NOW is the best time to act!

# MICHAEL METCALFE

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## We Need Money for Global Issues like Aid. Can We Just Print It?

When it comes to dealing with global issues the international community is capable of setting itself ambitious targets. The United Nations' Millennium Development goals — eight ambitious targets ranging from halving extreme poverty to reducing child mortality and combatting HIV – were one example. The United Nation's Green Climate Fund which aims to raise $100 billion a year by 2020 to help fund the transition towards renewable energy resources is another.

Funding these lofty global ambitions from national public budgets is another matter. For all the successes of the Millennium Development goals, raising national and international aid budgets so that they would amount to 0.7% of a country's gross national income was a feat achieved by few countries. Looking ahead doubts are already being raised as to whether the Green Climate Fund will suffer the same funding challenges.

The question remains  whether the global economy can fund these issues like international aid that can potentially benefit all? One answer may come from the response to another challenge the global economy faced in the form of the financial crisis.

**A simple premise for a complex problem**

Central bankers have long viewed sovereign money creation as a sacred policy tool, to be used prudently lest it stoke inflation. That sanctity, however, has now been challenged and questioned by the policy response of choice to the financial crisis: quantitative easing, which increased the stock of money in the economies of the US, UK and Japan by $4.7 trillion, more than three times the total physical stock of dollar notes in circulation.

Before the crisis such an expansion would have been unthinkable. At the time many fretted this would inevitably lead to high inflation as seen previously in less controlled episodes of monetary creation.

With hindsight we know this panic was misplaced. Markets and investors responded positively to the new policy measures.

**The system is already creating money**

That confidence was based on two pillars. The first was that, after years of keeping inflation under control, central banks were trusted to take the money-printing away if inflation became a threat. Secondly, inflation simply never became a threat. Consumer price inflation in the US and elsewhere remained below or close to long-run averages.

Some still quibble that this is simply definitional; that inflation is mismeasured or yet to come. So imagine instead of relying on the official statistics, we could simply scrape millions of actual retail prices from the internet in real time. Thanks to MIT's billion prices project and the company it spawned, PriceStats — with whom I also have the privilege of working — we can do just that. It shows no conspiracy; there was and there still is little inflation in the US, online or offline. This lack of inflation is of course partly explained by the ongoing weakness of growth. Spare capacity has kept wages in check while tepid bank lending has meant the newly created money has not moved around the economy as fast as it could have, and overall, the velocity of money has been weak.

Nevertheless, the experience of quantitative easing has demonstrated clearly that under the right economic conditions and with a credible inflation-targeting central bank, the creation of money by sovereigns is an accepted policy tool to fight disinflation.

This is not as surprising as it first looks. This was in fact one of the few points of economic policy that both Keynes and Friedman agreed upon[1] more than half a decade ago. But this has been long forgotten in the face of a plethora of mismanaged money printing schemes that have led to hyperinflations in several countries.

Sovereign money creation finally has good empirical data to support the theory it can be an accepted policy tool under the right conditions. The fact that the once sceptical and famously inflation-fearing European Central Bank (ECB), the sole G3 central

bank not to embrace the policy so far, is now discussing the possibility of implementing an asset purchases programme speaks volumes towards this point.

**Bringing the focus back to aid**

So how could this relate to aid? Consider the following: Many corporations, my own included, run a scheme whereby they will match, therefore doubling, employees' charitable donations up to a certain amount. Some governments have run similar schemes for their citizens for specific appeals. For example, The UK government matched the first £5million donated by the public in the Philippines appeal in late 2013. Could we take this up one more level?  Could the central bank, the governments' banker, match the governments' overseas aid contributions up to certain amount by printing money?

Here's how "print aid" might work. Provided it saw little domestic inflation risk or credibility issues from doing so, the central bank would be mandated to match the government's overseas aid payments up to a certain limit. Governments have been aiming (and failing) to get overseas aid payments to 0.7% gross national income (GNI) for decades, so let's set the limit at half of that, 0.35% GNI. As an example, if the government gave 0.2% GNI in a year, the central bank would top this with a further 0.2% to make a total of 0.4%; assuming it saw no domestic inflation risk from doing so.

The mechanics in terms of what the central bank would do are not so different. Some central banks can create money by offsetting account items. Another possibility, as suggested by Andrew Jackson and Ben Dyson in their book, Modernising Money, would be for the government to issue perpetual bonds that pay no interest, and for the central bank to then purchase these bonds in the required amount. Because the bonds never mature, they should not add to national debt. The difference between this and the current quantitative easing programmes today are small, because when a bond held by the central bank matures at present the proceeds are reinvested to buy another bond, usually of much longer duration.

Other alternatives would be for the central bank to create money to buy bonds of countries receiving aid, social impact bonds or bonds linked directly to aid goals. The International Finance Facility for Immunisation, launched by the GAVI alliance for example, uses long-term donor pledges to issue highly rated bonds to raise funds for vaccinations.

These options highlight that "print aid" is technically possible. But because this is a step toward overt money finance of fiscal spending, is it much riskier, particularly for inflation, than what has already been done?

There are three reasons to think it is not. First, "print aid" retains the elements of defined policy framework inflation targeting that made current quantitative easing schemes so credible.  Second, because the money created will be spent overseas in very poor

countries through the channels of aid into items like vaccines, education and infrastructure, the impact on prices in the country doing the printing would likely be minimal, unless it led to rapid currency depreciation.  This is unlikely though for the third reason; printing is also on a very different scale to what has gone on before under the quantitative easing programs.

**How "print aid" could already be making a difference**

If such a matching scheme had been in place over the past four years in the US, UK and Japan, central bank balance sheets would have expanded by an additional US$240 billion, thanks to supplementary money created to match aid payments. This is a modest number compared to the US$4.7 trillion monetary expansion that occurred over the same period, but the extra US $240 billion would have made a massive impact on overseas aid. Even though this is the printing of just three central banks, the global aid over this period would have been up by almost 40 percent — a 40-year high. This would have been a more fitting close to the Millennium Development Goals and a far better platform from which to build the post-2015 agenda.

**What we've learned is that the risks to money creation are much more manageable than we ever thought, and the potential benefits from creating modest amounts of money for aid, could be massive. However, such opportunities of controlled risk and high reward rarely last long and the window of opportunity for this idea could also be a short one.**

Today money creation by central banks is an accepted policy tool and there is a consensus to urgently push for more overseas aid to help define the post-2015 agenda. Now might be the only time these two disparate trends coincide, such that we could actually afford the aid we have always aspired to.

So can we print money for overseas development aid? The question we should be asking ourselves is, "Why not?'"

*For more background on the use of money finance as a policy option and the differences with the current QE programmes see "Debt, Money and Mephistopheles: How Do We Get Out of this Mess?" Adair Turner. G30 Occasional Paper 87 May 2013.*

# VIK MOHAN

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## A holistic approach to marine conservation.

Many of the biggest threats facing humanity require systems-level approaches and solutions. Increasingly, the threats we face are interconnected, and traditional single sector approaches cannot adequately tackle the multiplicity of root causes to the problems we experience. It would be difficult to envisage improvements in maternal health in the absence of safe water and food security, for example. Communities reliant on wood for charcoal will be unable to engage in forestry conservation if they lack alternatives to using charcoal as fuel.

Living along the beautiful, arid southwest coast of Madagascar are the Vezo, or “the people of the sea”. The situation facing these seminomadic fishing communities provides a powerful example of a complex, interconnected web of threats. In a country where 92% of the population lives on less than $2 per day (1) these are some of the poorest and most isolated communities in the country. Heavily reliant on marine resources because of a lack of economic alternatives to fishing, they are witnessing rapidly declining fish stocks. Poor access to health care and a lack of health education inevitably means these communities suffer poor health. In particular, a lack of access to family planning services means that women and girls are unable to space their births or delay their first pregnancy. This, combined with inadequate access to safe birthing facilities is contributing to high infant and

maternal mortality(2). In addition, with a fertility rate of approximately seven live births per woman, the population is doubling every ten to fifteen years, fuelling the overfishing that is contributing to the decline in fish stocks and degradation of the marine environment. This marine environment, and the food security that it represents to these communities, will be further threatened by ocean acidification and increases in ocean temperature. In an area where no settlement is more than a few metres above sea level, more frequent extreme weather events and rising sea levels are likely to impact heavily on these already vulnerable communities.

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With the support of marine conservation organisation Blue Ventures, these communities are trying to address these challenges in a holistic way. Initially focussing on the most pressing issue they faced, communities are implementing short term closures of their octopus fishery. Octopus is the most economically important fishery in the region, and growing overexploitation of octopus had led to a dramatic decline in stocks. The octopus is a rapidly growing animal, with populations recovering quickly if afforded protection during periods of rapid growth in their life cycle. These short term closures have resulted in huge increases octopus catches, and catalysed more ambitious fisheries and marine management efforts. This has culminated in the development of a locally managed marine area (LMMA), a cooperative endeavour between 24 coastal villages that prohibits the use of destructive fishing practices and supports the formation of permanent and temporary marine reserves.

To complement this commitment to sustainable use of marine resources, Blue Ventures has worked with communities to develop community based aquaculture. In addition to providing an alternative livelihood to fishing, this serves to reduce pressure on finite marine resources. These aqua farmers have developed the technical expertise to grow seaweed or sea cucumber, have been trained in how to run their own businesses and are given access to markets to sell their products.

The final component of this approach is community health care, focussing primarily on reproductive health services (family planning and maternal health). Local women have been trained as community health workers, offering basic health services to women and couples in their villages, with support from a midwife. Smart phones are used to guide their clinical decision making, as well as ensuring that they can get support when they need it. These women rapidly become highly respected and valued members of their communities, and provide health services at a fraction of the cost of employing doctors.

All of this work is underpinned by a programme of community outreach and education. Media as diverse as theatre, radio, peer-led education and sporting events have been used to provide communities with the knowledge and skills to manage their marine resources sustainably and make their own reproductive health choices.

These are not parallel programmes, run by separate organisations working within siloes that are defined by the limits of their expertise. This is one, integrated programme, albeit implemented thanks to strong sector specific partnerships, but with one overarching vision, strategy and programme of implementation. The benefits of working in this way are several. Sharing resources and opportunities across projects creates efficiencies that make this approach more effective and cost effective than traditional, vertical programmes. Integrated education and outreach events are able to cover topics as diverse as the benefits of fisheries closures, modern family planning methods and how to grow sea cucumber. A more diverse audience is therefore reached with these messages, men learning about the benefits of family planning, for example, and women being able to engage in fisheries management. Importantly communities are able to see more clearly than ever the links between reproductive health, family size, food security and biodiversity conservation. These links are now so well understood that 84% of the community now think

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that there will not be enough resources to go round if they do not use family planning(3).

All of these benefits could have been predicted prior to programme implementation. As time goes on, however, we have started to notice changes we did not anticipate. Offering health services to communities, in response to an unmet need, has demonstrated to these communities our desire to support them. This has in turn strengthened their support for our community based conservation efforts. Women, being able to space their pregnancies for the first time, now have time that they can use to generate income by engaging in community aquaculture. With fewer children, families are able to spend more on each child's education. The ability to contribute to household income appears to be raising the status of women within the family. We believe that this, coupled with the sense of agency that comes from being able to exert control over their fertility, is causing women to take greater interest in natural resource management. This in turn is further strengthening support for community based conservation.

Collectively, this generates greater and more sustained improvements human and ecosystem health, food security and socioeconomic status than could have been achieved had only one of these challenges been addressed. As a result of these improvements in wellbeing, we hope that these communities will be better placed to adapt to the changes in climate that they are likely to face.

Globally 500 million people rely on small scale fisheries for their livelihoods, many facing the same multiplicity of challenges we are witnessing in Madagascar. Coastal populations are increasing, global fisheries are overexploited and coastal communities are among the most vulnerable to climate change. We urgently need to address these mutually reinforcing threats, on a scale never previously attempted, if we are to safeguard the livelihoods and wellbeing of coastal communities, as well as adequately protect coastal biodiversity. We believe that this holistic approach can serve as a model for the benefit of communities and marine ecosystems throughout the coastal tropics.

(1) http://www.worldbank.org/en/news/feature/2013/06/05/madagascar-measuring-the-impact-of-the-political-crisis

(2) World bank indicators. http://data.worldbank.org/indicator

(3) Blue Ventures, unpublished data

# BRIAN MULLANEY

**Over the past 20 years, Brian Mullaney has helped provide free surgery for more than 1,000,000 children. He co-founded Smile Train in 1999. After serving as Smile Train CEO for 10 years, he stepped down in 2011 to launch WonderWork, a charity that provides free surgery for children who are blind, burned or have clubfoot. To raise awareness about these problems, Mullaney helped produce an Oscar-winning movie called Smile Pinki which has been seen by 25 million people and two viral videos about blindness and burns which have been viewed by 5+ million people.**

## The Tragedy Of Easy Problems.

Imagine if there was a miracle surgery that could give your blind daughter her eyesight back.

But you couldn't afford it. And every hospital that you brought her to, begging for help, turned you away. So she remained blind as the years passed by.

I met such a father recently in Ranchi, India.

After years of watching his daughter suffer, he saw a tiny newspaper ad offering free surgery for the poor. He and his daughter Priya traveled 150 kilometers to reach our partner hospital. The surgery Priya waited six years for took just 15 minutes. The next morning, when she opened her eyes and could see, her father cried. So did we.

A one-of-a-kind fairy tale?

Hardly. In the bed next to Priya was another blind girl who had been waiting 8 years for the same surgery. In fact, the entire hospital was filled with kids who'd been waiting years for all kinds of life-saving surgeries. Just like hundreds of hospitals I've visited over the past 20 years.

In the developing world today, more than 50 million children and adults are suffering and dying needlessly because they can't afford the simple, inexpensive surgery that could save them.

Lack of access to surgery for the poor is the biggest global health problem no one has ever heard of. According to the World Health Organization, 2 billion people in the world have no access to basic surgical care.(1)

Harvard's renowned Dr. Paul Farmer sums it up: "Surgery is the neglected stepchild of global health."(2)

6 million children born with water on the brain or hole in the heart(3)(4) are dying as they wait for surgery they'll never receive.

2 million children born with clubfoot(5) will never be able to stand or walk properly because they don't have $250.(6)

15 million severely burned(7) children will go through life horribly disfigured because they can't afford a $500 surgery.

And 20 million blind children and adults, *half of all the blind in the world*,(8) will remain blind for the rest of their lives because they can't afford a cataract surgery that costs just $35.(9)

Why is it so hard to provide these simple surgeries?

Some say it isn't because it is so hard but because it is so easy.

Prajwal Ciryam, a Fulbright scholar, calls it, "the tragedy of easy problems."(10)

Proven, affordable, and scalable solutions to global health problems are neglected because people are inherently more attracted to difficult, unsolvable problems. It's why "glamorous" diseases attract more funding than mundane problems like cataract surgery, which was pioneered in 1949.

The sad part is that these "easy" problems continue to cause massive amounts of completely unnecessary suffering.

Tens of millions of lives could be saved within a very short amount of time if we devoted attention to even just a few of these proven, low-cost surgical solutions. The infrastructure to provide these surgeries already exists today in 90% of developing countries including experienced, qualified surgeons and fully-equipped operating rooms. And the funding needed is very modest.

For instance, it would cost just $700 million dollars to restore eyesight of 20 million blind children and adults. In 2012, the U.S. government spent $700 million on AIDS - every two weeks. The Gates Foundation just spent $500 million on its new headquarters for 500 employees.

In 1999, I co-founded Smile Train, a children's charity focused on one of the most mundane problems ever: cleft lip and palate. The cure for clefts is a simple surgery that takes as little as 45 minutes and costs as little as $250.

Our strategy was to raise the money ourselves. We mailed almost half a billion fundraising letters. We ran ads in every major newspaper in America. To raise awareness, we even produced an Oscar-winning film that was seen by millions.

Millions of donors responded with more than $1 billion in donations which we used not to send Americans on missions but to empower local surgeons in developing countries. With modest grants, these local hospitals quickly ramped up the number of children they help to unprecedented heights. Smile Train's surgeries soared from 2,000 a year to 120,000 a year. To date, Smile Train has provided more than one million free surgeries for children in 90 of the poorest countries in the world.

If a tiny charity like Smile Train (60 employees),(11) can tackle the 200,000 year-old problem of clefts, imagine what the global health community could do if it ever took an interest in mundane surgeries.

50 million desperate children and adults are waiting, hoping and praying that one day they will.

# ROBIN MURPHY

**Dr. Robin Murphy is the Director of Center for Robot-Assisted Search and Rescue (CRASAR)and the founder of Roboticists Without Borders.**

The biggest threat facing humanity is our love-hate relationship with technology. For example, we have the opportunity to revolutionize how we prevent, prepare, respond to, and recover from disasters through the use of informatics. Informatics includes software, mobile devices, unmanned systems, smart sensors, and social networks. We simultaneously love the technologies like social media and UAVs and deploy them everywhere, violating privacy and overwhelming decision-makers with data, and hate the technology because data-mining and UAVs can be used for military operations.

In 50 years, the world could be a fantastic place where there are no emergencies, where big events are predicted and prepared for and when the unexpected happens, everyone knows what to do and does it well.  But in 50 years, the world could be in the same situation where agencies and stakeholders remain isolated and don't get the right information fast enough to make decisions that enable the greatest good. Or the world could be in a worse situation where information is in the hands of the few and information is monetized, effectively giving only the wealthiest nations resilience to disasters.

**The survival of humanity depends on our ability to come to grips with ourselves and our technology.** We are one of the few species on Earth that makes and uses tools; it is a defining trait of humans. Unfortunately we allow tools use and development to be dictated ad hoc by corporate providers rather than by civilian

governments systematically and rationally pursuing what can be done for the greatest good.

**You and I can start by realizing that it is you and I who are responsible for the use of the technology to create a sustainable future.** We need to move beyond simple “yes” and “no” to a more informed state of mind. **We need to hold our officials accountable for using technology poorly and for the equally unethical acts of not using technologies that could save lives and reducing suffering.** It’s more than signing petitions, we have to vote and become active in the legislative process.

# JOSHUA PEARCE

**Joshua Pearce is an associate professor in the Departments of Materials Science & Engineering Department of Electrical & Computer Engineering at Michigan Technological University where he is the director of the Michigan Tech Open Sustainability Technology Lab Michigan Tech Open Sustainability Technology Lab.**

## Sharing Free Knowledge to Save Humanity

Anyone paying attention to global conditions knows humanity has severely under-invested in both social justice and sustainable development. A quick review of global environmental conditions and extreme wealth concentration results in a rather bleak outlook for the sustainability of the world's major ecological and democratic political systems. A few lucky individuals amass unprecedented fortunes by hijacking ideas and knowledge itself as “intellectual property” and the concomitant productivity gains. This not only slows technological progress in the scientific fields of the future like nanotechnology, but it also encourages rent seeking for the resultant monopolies that bleed wealth and political power from the middle class. Worst of all it keeps knowledge out of the hands of the people that need it the most: billions of people are mired in abject poverty. Even the majority of people in the rich countries find their economic situations uncomfortably precarious. Everyone suffers the consequences of our current system of knowledge distribution in the forms of environmental degradation and climate destabilization. There is a clear need to do a better job of caring for our common home.

The future, however, is not entirely bleak. People that genuinely care about the future of humanity like the authors of this book and even those in positions of great wealth and power, have

begun to make the transition to more resilient and sustainable technologies and equitable means of knowledge sharing. Billionaire Elon Musk, the CEO of Tesla, freed his company's intellectual property related to electric vehicles attempting to accelerate more rational use of technology. Others have started to aggressively free knowledge and start ambitious projects to move civilization itself towards an open source ecology. As our whole society begins to make the slow turn toward sustainability, swarms of individuals, families, NGOs, entrepreneurs, and small businesses have already rounded the corner. Until recently, they had to develop the sustainability knowledge alone in their own community – essentially reinventing the sustainable wheel again and again. This is hard work and frustratingly slow in the face of looming catastrophes.

Fortunately, global communication technologies have matured and the Internet now provides a way around this lack of collaboration and access to critical information for sustainable development for all. The solution is found in the rapid innovation created with the use of *open source appropriate technology* (OSAT).

Here, “open source” refers to the methods created by the vibrant and burgeoning free and open source software movement. This movement gave us thousands of free programs and Linux, which essentially runs the Internet itself - providing the foundation for the massive companies you use every day (I.e. Google, Amazon, etc.).

“Appropriate technologies”, on the other hand, are easily and economically utilized from readily available resources by local communities to meet their needs. What is appropriate varies by where you live as these technologies must satisfy the boundary conditions set by environmental, cultural, economic, and educational resource constraints of the local community. Often, and particularly in the developing world, these technologies are small scale, elegant, and simple yet provide for people's needs without destroying the capacity of the Earth to support life.

OSAT harnesses the power of distributed peer review and transparency of process. All of us are smarter than any of us and when we get together to share knowledge the results are impressive. Appropedia is an excellent example of OSAT development. Appropedia is a wiki-based website, like Wikipedia, where a large number of participants create and modify the content directly from their web browsers. All the information (e.g. designs, plans, how tos, instructions, advice and journal experiences, etc.) developed is free for others to use to solve their own sustainability problems. Wikipedia grew exponentially, and is now one of the top ten sites on the Internet with content created by thousands of volunteers objectively beating the efforts of multi-billion dollar international companies.  In the same way,

OSAT shared on Appropedia an other sites hosting peer to peer (P2P) libre knowledge is becoming a true rival to the paradigms of the development of technology that have dominated civilization since the industrial revolution. A new revolution, built on a dispersed network of innovators, inventors, researchers and “makers” working together to create a just sustainable world is being created.

If you want to help in this effort to save humanity, you can join as you are probably already a maker if you are reading this book. Nearly every family's refrigerator is plastered with our children's wonderful creations. Children relish “making” naturally, but growing up many lose some of this joy of creation as economics has favored purchasing mass-manufactured products over making them ourselves. Thus many of us have become impotent consumers rather than vibrant makers. For a long time, this seemed to be the only way. However, these monetary calculations are changing. As DIY tools for digital fabrication have proliferated over the Internet, you can now make surprisingly sophisticated “products” in the comfort of your own home for yourself and your community.

**This open source hardware is becoming mainstream simply because of economics. In the process this knowledge will not only save us, but change us into more sharing, more creative, happier and wealthier people.**

For example, costs of 3-D printers recently plummeted because of the open sourcing of a 3-D printer that could print most of itself called a RepRap (short for self-replicating rapid prototyper). The RepRap's brain is an Arduino, an inexpensive open source electronic prototyping platform developed by another group. Since then hundreds of people have shared their variations of both technologies and the innovation churn has become staggering.  $2,000 RepRaps can out-perform what $20,000 proprietary commercial 3-D printers could do only a few years ago. There are dozens of companies like RepRapPro and Lulzbot selling pre-assembled open source RepRaps and they can also be built for less than $500 in parts from free plans. Perhaps most importantly, they can print OSAT as the Field Ready recently demonstrated in Haiti.

In the same way as aggressive mass-scale sharing improved 3-D printers, people are sharing free and open source information and digital designs of everything from inexpensive science learning aides and medical marvels to tools for organic farmers and things for your home. The collections of hundreds of thousands of designs are growing exponentially. Every new design that is shared makes owning a DIY 3-D printer or other form of digital production tool (e.g. a laser cutter) that much more valuable and

drops the costs for everyone.

A recent study showed a typical American family can print 20 common household products from a pound of plastic for $18 using free information, saving between $300 and $2,000 in purchases. There was nothing special about the 20 products (e.g. kitchen gadgets). They were just things university students wanted to solve their problems and an insignificant fraction of the other free designs already swarming the Internet. The 3-D printed products were better than what is available in any store as they can be customized and personalized. These 20 things could be printed in a weekend and literally pays for the 3-D printer in cash savings for the people. This kind of distributed manufacturing (even if it is not a solar-powered 3-D printer) is also good for the environment. They solve sustainability problems  the market is ignoring (like glasses for poor kids or inexpensive solar racking), because the people that need them most live in poverty. But that is if you use commercial plastic, which normally costs ~$16/ pound. There is an open source recyclebot, which turns recycled plastic into 3-D printer feedstock for only a nickel per pound in electricity! No modern robber-baron and his sweat shops can compete with that – and it is even really good for the environment. The list of printable materials is expanding rapidly, providing makers with even more flexibility to solve problems in their communities. For example, there is already a sub-$1,200 RepRap that can print metal. Makers are not stopping there. By combining inexpensive open source electronics from companies like Sparkfun, 3-D printed mechanical components can be turned into incredibly valuable products: everything from quad-copters for emergency rescues to submersible robots to test water quality. Even expensive lab equipment can be made for pennies. These products are better than anything on the market or they are personalized items that never existed before.  This free knowledge helps drive an incredible return on investment for future innovation, while giving humanity a fighting chance at solving problems in any given location. It also puts wealth (perhaps without money) back in the hands of the bulk of humanity.

In the not so distant future, you will run your waste plastic and aluminum cans through the dishwasher, shred and extrude them in a recyclebot to turn them into 3-D printer feedstock. You will power the whole thing with sustainable solar photovoltaic equipment on your roof. The marginal cost will drop to about zero for you to print a lot of the products you need using free designs on your RepRap 3-D printer (including its upgrades!). This will help you solve some of your problems, save you money, and perhaps make you happier. The fun part will, of course, be the making – creating your own designs, automating them with open source electronics, decorating the sad products of one-size-fits-all mass production, developing derivatives and mash ups of other's work, personalizing gifts and getting the joy back from child-like creation. You will share your designs and the knowledge of how to make and use them freely with others for fun and have access to increasingly sophisticated knowledge about everything (again, for

free).  Plus, everything you share could help someone else pull themselves out of the misery of scarcity to do the same – perhaps somewhere else in the world where they are less fortunate than you. This feels good too.

I can not wait to see what the refrigerator's of the future look like as an entire global generation of makers are born into households with access to shared and completely free knowledge. Then we will not only save humanity, we allow it to thrive.

# IQBAL QUADIR

**Iqbal Quadir is the founder of Grameenphone in Bangladesh as well as the founder and director emeritus of MIT Legatum Center.**

## More Selfishness, Please

Prevailing wisdom says that to save humanity, to improve the world, to lift the powerless, we need to be selfless, constantly sacrificing for the greater good. We are told that this is what so many of our great leaders did and that these noble qualities are the ones we should aspire to embody. I have come to a different conclusion.

My view is that rather than selflessness, it is more selfishness—specifically, self-interest—that can save humanity. The assumption behind the long-admired attribute of selflessness is that we are in a position where we can exercise our self-interest. The unfortunate reality of the world is that only a minority of humanity is able to fully exercise self-interest. The real self-interest of billions never sees the light of day, as they are able to act upon self-interest only in a very limited space—that proverbial sliver between a rock and a hard place. Most people do not get to fully utilize their energy, initiative, and ingenuity to improve their own economic lives. They are stuck in survival mode, and so their self-interests have no room for expression, their natural desire to improve their lives finds no path forward, and they are incapable of moving the insurmountable barriers that block their efforts. If this situation were to improve, the world would be more stable, peaceful, and prosperous. A world accommodating the self-interests of more people would be a better place.

I fully appreciate the pejorative connotations of being selfish, but we need to think harder, beyond surface-level meaning, about selflessness and selfishness. When I describe someone "acting selfishly," I mean that she is pursuing her self-interest. Self-interest is a complex matter—entire treatises have been written on the concept—and I am avoiding its most narrow definition. To me, if someone is working to provide for her family, she is acting in her self-interest, an instance where the line between self-interest and altruism blurs considerably. A more inclusive definition of self-interest is useful, because in our effort to save humanity we may need to make selfless sacrifices and contribute philanthropically, but to expect everyone to always be selfless is counterproductive. Instead we have to understand the natural human inclination toward self-interest. And rather than quelling that urge, we need to make use of it. If we waste this massive source of energy, we are only working against overall progress.

**To be clear, our aim is to find a strategy that helps all of humanity, not just the two or so billion at the bottom of the economic ladder who are not in a position to fully exercise their self-interests. To that end, we should identify what we need to do so that they can use their energy, initiative and ingenuity to help themselves and, in turn, help us all.**

In modern English the opposing words noble and villain—the one often associated with selflessness, the other more aligned with selfishness—hide a curious etymological history and traces of prejudice. Nobility comes from the Latin nobilis (well-known, famous, prominent), a title given to those who were essentially warlords. In the feudal era, villein was used to describe a peasant who was legally tied to a nobleman's land, a serf. In a simple agricultural economy, the "villains" were the producers, while the "nobles" fought among themselves—supposedly to protect the "villains" from other nobles. The overall economic and political progress was achieved only when the "villains," namely, the numerous, with greater and greater economic empowerment, were able to entice the nobles to pursue mutually beneficial economic interests. The vying of "villains" for better lives was what gave vitality to their economies and eventually saved European communities from the whims of a few noblemen. The word villain—after an etymological evolution that has literally vilified those the word once denoted—no longer connotes the story of how the pursuit of self-interests led to improvement of the overall system.

The last thousand years of European economic history also show a path toward progress with contemporary applications. The various productivity tools developed over the last millennium—early instances include plows, mills, presses, clocks—economically empowered average citizens. These innovations, by making people more productive, improved the living standards from which flowed many other positive developments: the arts,

literature, checks and balances, better governance, peace and prosperity. As each tool was introduced, not only did income and the power of the "villain's" voice increase, but the tool created new, previously unattainable choices for an individual to exercise her self-interest. As more and more self-interests take shape, different opinions, approaches, and ideas emerge, and the community as a whole benefits from diversity.

This model of economic empowerment works because it leads to mutual gains among multiple stakeholders. The average citizen advances by being more productive, which in turn helps her pay for the tool that allowed the increase in productivity. At the same time, an entrepreneur is able to establish a business to supply the tool. This win-win relationship based on commercial interest (i.e., citizen-entrepreneur combinations) also benefits the authorities, usually through taxes. Over time, interlocking economic arrangements emerge among governments, entrepreneurs, and citizens. This arrangement—even at an individual level—allows groups to check one another, maintain balance, and grow together economically. The system becomes responsive to the needs of citizens because it ultimately depends on their productivity. With entrepreneurs depending on citizens' demand and governments on taxes, citizens' voices and perspectives matter.

This economic interdependence is affected by tools that have been emerging since the plows and presses of ancient time. In the last century, for instance, bicycles and sewing machines had a similar effect, empowering individuals throughout the world, not just in the more industrialized West. Over the last half-century, the digital revolution has been unfolding in Western countries, precipitating the spread of new, modern tools. The last two decades have brought a huge increase in processing power and a staggering new array of uses for digital technologies, while prices have decreased geometrically. This has made digital tools increasingly useful and, at the same time, affordable to people in low-income countries.

A prominent example is the cell phone, which is allowing people to earn more by saving time and labor, to better coordinate commercial activities, and to be involved in more efficient and innovative production and distribution. Overall, this leads to greater economic—and political—power for individuals. With the spread of cell phones, economic growth is increasing in low-income countries, information is flowing better, and governments are becoming more accountable.

This is giving rise to an overall innovation ecology, albeit slowly, making entrepreneurial efforts easier. After spreading around the world simply on the basis of their communication value, cell phones are now taking on additional roles and giving rise to new industrial organizations. They are contributing to more efficient movement of money (bKash, Bangladesh), people (SafeBoda, Uganda), goods (Sendy, Kenya), and agricultural information (esoko, Ghana). They are widening the distribution of music (Bozza, Nigeria), education (Bridge International, Kenya), solar

panels (M-Kopa, Kenya, and Tanzania), and pharmaceuticals (M-Pedigree, Ghana).

The spread of such productivity tools—furthering people's self-interests—could help the bottom two billion people generate an extra trillion dollars. This would effectively double their current economic output (the lowest billion on the world's economic ladder make one dollar a day or $365 billion annually; the next billion make two dollars a day or $730 billion annually) and would far exceed the total annual distributions of the world's charities and aid. This sort of contribution is entirely feasible. Increasing the productivity of the bottom two billion by merely 5 percent annually would generate a trillion extra dollars in fifteen years. And low-income people clearly want to use their energy, initiative, and ingenuity—in their own self-interest. The ubiquity of cell phones, an alien device in most countries only two decades ago, is proof of this desire.

People who are economically empowered and economically anchored are free to use their minds to protect their economic interests and become better at deciding what is actually good for them. This in turn contributes to greater cooperation and peace. Self-interest needs to become operational before a fully cooperative, inclusive system can take shape. So, how can we contribute to saving humanity? Each of us can contribute by making the productivity tools that emerge out of cutting-edge research and global economies of scale more available. Combined with people's own energy, initiative, and ingenuity, these tools of productivity can unleash everyone's self-interest and thus help build a more peaceful and prosperous world.

# MARTIN REES

**Lord Martin Rees is a British cosmologist and astrophysicist. He is an emeritus professor of cosmology and astrophysics at the University of Cambridge and the UK's Astronomer Royal.**

***Abstract from Talk by Martin Rees given at Harvard School of Government on November 6, 2014***

I'll start with a flashback to 1902. In that year the young HG Wells gave a celebrated lecture at the Royal Institution in London. He spoke mainly in visionary mode. "Humanity", he proclaimed, "has come some way, and the distance we have travelled gives us some earnest of the way we have to go. All the past is but the beginning of a beginning; all that the human mind has accomplished is but the dream before the awakening." His rather purple prose still resonates more than a hundred years later -- he realised that we humans aren't the culmination of emergent life.

But Wells wasn't an optimist. He also highlighted the risk of global disaster: "It is impossible to show why certain things should not utterly destroy and end the human story .. and make all our efforts vain .... something from space, or pestilence, or some great disease of the atmosphere, some trailing cometary poison, some great emanation of vapour from the interior of the Earth, or new animals to prey on us, or some drug or wrecking madness in the mind of man".

I quote Wells because he reflects the mix of optimism and anxiety – and of speculation and science – which I'll try to offer in this lecture. Were he writing today he would have been elated by our expanded vision of life and the cosmos -- but he'd have been even more anxious about the perils we might face. The stakes are indeed getting higher: new science offers huge opportunities, but its consequences could jeopardise our survival. Many are

concerned that it is 'running away' so fast that neither politicians nor the lay public can assimilate or cope with it.

My own expertise is in astronomy and space technology. So you may guess that I'm kept awake at night by worry about asteroid impacts. Not so. Indeed this is one of the few threats that we can quantify. Every ten million years or so, a body a few kilometers across will hit the Earth, causing global catastrophe – there's a few chances in a million that this is how we'll die. But there are larger numbers of smaller asteroids that could cause regional or local devastation. A body (say) 300 metres across, if it fell into the Atlantic, would produce huge tsunamis that would devastate the East Coast of the US, as well as much of Europe. And still smaller impacts are more frequent. One in Siberia in 1908 released energy equivalent to 5 megatons.

Can we be forewarned of these impacts? The answer is yes. There are plans to survey the million potential earth-crossing asteroids bigger than 50 metres and track their orbits precisely enough to predict possible impacts. With forewarning of an impact, action could be taken to evacuate the most vulnerable areas. Even better news is that during this century we could develop the technology to protect us. A 'nudge', imparted a few years before the threatened impact, would only need to change an asteroid's velocity by a millimeter per second in order to deflect its path away from the Earth.

If you calculate an insurance premium in the usual way, by multiplying probability by consequences, it turns out to be worth spending a billion dollars a year to reduce asteroid risk.

Other natural threats – earthquakes and volcanoes – are less predictable. But there's one reassuring thing about them, as there is about asteroids: the annual risk they pose isn't getting bigger. It's the same for us as it was for the Neanderthals – or indeed for the dinosaurs.

## THREATS FROM NOVEL TECHNOLOGY

Those of us with cushioned lives in the developed world fret too much about minor hazards: improbable air crashes, carcinogens in food, low radiation doses, and so forth. But we are less secure than we think. We (and our political masters) don't worry enough about scenarios that have thankfully not yet happened – events that could arise as unexpectedly as the 2008 financial crisis, but which could cause world-wide disruption, and deal shattering blows to our society.

We live in an interconnected world increasingly dependent on elaborate networks: electric-power grids, air traffic control, international finance, just-in-time delivery, globally-dispersed manufacturing, and so forth. Unless these globalised networks are highly resilient, their manifest benefits could be outweighed by catastrophic (albeit rare) breakdowns -- real-world analogues of what happened in 2008 to the financial system. Our cities

would be paralysed without electricity. Supermarket shelves would be empty within days if supply chains were disrupted. Air travel can spread a pandemic worldwide within days. And social media can spread panic and rumour, and psychic and economic contagion, literally at the speed of light.

The issues impel us to plan internationally. (For instance, whether or not a pandemic gets global grip may hinge on how quickly a Vietnamese poultry farmer can report any strange sickness.) And, by the way, the risk that pandemics cause societal breakdown is far higher than in earlier centuries. English villages in the 14th century continued to function even when the black death halved their populations. In contrast, our societies would be vulnerable to breakdown as soon as hospitals overflowed and health services were overwhelmed– which would occur when the fatality rate was still a fraction of one percent. But the human cost would be worst in the shambolic but burgeoning megacities of the developing world.

Advances in microbiology offer better prospects of containing such disasters. But the same research has downsides too. For instance, in 2012 researchers at Wisconsin, and also at Erasmus University in Holland, showed that it was surprisingly easy to make an influenza virus both virulent and transmissible. When they published they were pressured to redact some details. And the Wisconsin group has been experimenting on H1N1, the virus that led do the catastrophic 1918 epidemic. Last month the US government decided to cease funding and impose a moratorium on so-called 'gain of function' experiments. The concern here was partly that it would be aiding terrorists, but partly also that if such experiments weren't conducted everywhere to the very highest safety and containment standards, there would be a risk of bioerror.

It is hard to make a clandestine H-bomb. In contrast, millions will one day have the capability to misuse biotech, just as they can misuse cybertech today. In the 1970s, in the early days of recombinant DNA research, a group of biologists led by Paul Burg formulated the 'Asilomar Declaration', advocating a moratorium on certain types of experiments, and setting up guidelines. In retrospect, this move was perhaps over-cautious, but it seemed an encouraging precedent. However, the research community is far larger, far more broadly international, and far more influenced by commercial pressures. Whatever regulations are imposed, on prudential or ethical grounds, they could never be enforced worldwide – any more than the drug laws can. Whatever can be done will be done by someone, somewhere.

In consequence, maybe the most intractable challenges to all governments will stem from the rising empowerment of tech-savvy groups (or even individuals), by bio or cyber technology that becomes potentially ever more devastating – to the extent that even one episode could be too many. This will aggravate the tension between freedom, privacy and security.

The results of releasing dangerous pathogens are so incalculable that bioterror isn't likely to be deployed by extremist groups with

well-defined political aims. But such concerns would not give pause to an eco-fanatic, empowered by the bio-hacking expertise that may soon be routine, who believes that ‘Gaia’ is being threatened by the presence of a few billion too many humans. That’s my worst nightmare.

The global village will have its village idiots and they’ll have global range.

**LOOKING BEYOND 2050**

These concerns are relatively near-term. Trends beyond 2050 should make us even more anxious.  I’ll venture a word about these – but a tentative word, because  scientists have a rotten record as forecasters. Ernest Rutherford, the greatest nuclear physicist of his time, said in the 1930s that nuclear energy was ‘moonshine’. One of my predecessors as Astronomer Royal said, as late as the 1950s, that space travel was ‘utter bilge’.  My own crystal ball is very cloudy.

In the latter part of the 21st century the world will be warmer and more crowded – that’s one of the few confident predictions. But we can’t predict how our lives might then have been changed by novel technologies. After all, the speedy societal  transformation brought about by the smartphone, the internet and their ancillaries would have seemed magic even 20 years ago. So, looking several decades ahead we must keep our minds open, or at least ajar, to prospects that may now seem science fiction.

The physicist Freeman Dyson foresees a time when children will be able to design and create new organisms just as routinely as his generation played with chemistry sets. I’d guess that this is comfortably beyond the ‘SF fringe’, but were even part of this scenario to come about,  our ecology (and even our species) surely would not long survive unscathed.

But what about another fast-advancing technology: robotics and machine intelligence? Even back in the 1990s IBM's 'Deep Blue' beat Kasparov, the world chess champion. More recently ‘Watson’ won a TV gameshow. Maybe a new-generation ‘hyper computer’ could achieve oracular powers that offered its controller dominance of international finance and strategy.

Advances in software and sensors have been slower than in number-crunching capacity. Robots still can't match the facility of a child in recognising and moving the pieces on a real chessboard. They can’t tie your shoelaces or cut your toenails.  But machine learning and sensor technology are advancing apace.  If robots could observe and interpret their environment as adeptly as we do they would truly be perceived as intelligent beings, to which (or to whom) we can relate, at least in some respects, as we to other people. And their greater processing speed may give them an advantage over us.

But will robots remain docile rather than ‘going rogue’? And what if a hyper-computer developed a mind of its own. If it could infiltrate the internet – and the internet of things –it  could manipulate the rest of the world. It may have goals utterly

orthogonal to human wishes – or even treat humans as an encumbrance.

Indeed, as early as the 1960s the British mathematician I J Good pointed out that a super-intelligent robot (were it sufficiently versatile) could be the last invention that humans need ever make. Once machines have surpassed human capabilities, they could themselves design and assemble a new generation of even more powerful ones.

Ray Kurzweil, now working at Google, is the leading evangelist for this so-called ‘singularity’. He thinks that humans could transcend biology by merging with computers, maybe losing their individuality and evolving into a common consciousness. In old-style spiritualist parlance, they would 'go over to the other side'. But he’s worried that it may not happen in his lifetime. So he wants his body frozen until this nirvana is reached. I was once interviewed by a group of 'cryonic' enthusiasts -- in California (where else!)-- called the 'society for the abolition of involuntary death'. They will freeze your body, so that when immortality’s on offer you can be resurrected. I said I'd rather end my days in an English churchyard than a Californian refrigerator.. They derided me as a 'deathist'. ( I was surprised to find that three Oxford professors were Cryonic enthusiasts. Two had paid the full whack; a third has taken the cut-price option of just having his head frozen).

In regard to all these speculations, we don’t know where the boundary lies between what may happen, and what will remain science fiction -- just as we don’t know whether to take seriously Freeman Dyson’s vision of bio-hacking by children. There are widely divergent views. Some experts, for instance Stuart Russell at Berkeley, and Demis Hassabis of Deep Mind think that the AI field, like synthetic biotech, already needs guidelines for ‘responsible innovation’. But others, like Rodney Brooks, think these concerns are ‘misguided’, and too far from realisation to be worth worrying about. And the whole concept is philosophically contentious. – John Searle has an article in a recent NYRB dismissing the entire concept that a machine could have a mind of its own.

Be that as it may, it’s likely that before 2100, our society and its economy will be transformed by autonomous robots, even though these may be ‘idiot savants’ rather than displaying full human capabilities.

## TRULY EXISTENTIAL RISKS?

Are there conceivable events that could snuff out all life? Promethian concerns of this kind were raised by scientists working on the atomic bomb project during the Second World War. Could we be absolutely sure that a nuclear explosion wouldn't ignite all the world's atmosphere or oceans? Before the Trinity bomb test in New Mexico, Hans Bethe and two colleagues

addressed this issue; they convinced themselves that there was a large safety factor. And luckily they were right. We now know for certain that a single nuclear weapon, devastating though it is, can't trigger a nuclear chain reaction that would utterly destroy the Earth or its atmosphere.

But what about even more extreme experiments? Physicists were (in my view quite rightly) pressured to address the speculative 'existential risks' that could be triggered by powerful accelerators in Brookhaven and Geneva that generate unprecedented concentrations of energy. Could physicists unwittingly convert the entire Earth into particles called 'strangelets ' – or,  even worse, trigger a 'phase transition' that would shatter the fabric of space itself? Fortunately, reassurance could be offered: indeed I was one of those who pointed out that cosmic rays of much higher energies collide frequently in the Galaxy, but haven't ripped space apart. And they have penetrated white dwarf and neutron stars without triggering  their conversion into 'strangelets'.

But physicists should surely be circumspect and precautionary about carrying out experiments that generate conditions with no precedent even in the cosmos – just as biologists should avoid release of potentially-devastating genetically-modified pathogens.

So how risk-averse should we be?  Some would argue that odds of 10 million to one against an existential  disaster would be good enough, because that is below the chance that, within the next year, an asteroid large enough to cause global devastation will hit the Earth. (This is like arguing that the extra carcinogenic effects of artificial radiation is acceptable if it doesn't so much as double the risk from natural radiation.) But to some, this limit may not seem stringent enough. If there were a threat to the entire Earth, the public might properly demand assurance that the probability is below one in a billion -- even one in a trillion -- before sanctioning such an experiment.

But can we meaningfully give such assurances? We may offer these odds against the Sun not rising tomorrow, or against a fair die giving 100 sixes in a row; that's because we're confident that we understand these things. But if our understanding is shaky – as it plainly is at the frontiers of physics -- we can't really assign a probability, nor confidently assert that something is stupendously unlikely. It's surely presumptuous to place extreme confidence in any theories about what happens when atoms are smashed together with unprecedented energy.  If a congressional committee asked: 'Are you really claiming that there's less than a one in a billion chance that you're wrong?' I'd feel uncomfortable saying yes.

But on the other hand, if a congressman went on to  ask: "Could such an experiment disclose a transformative discovery that  -- for instance – provided a new source of energy for the world?" I'd again offer high odds against it.  The issue is then the relative likelihood of these two unlikely event – one hugely beneficial, the other catastrophic. Innovation is often hazardous , but if we don't take risks we may forgo disproportionate benefits. Undiluted

application of the ‘precautionary principle’ has a manifest downside. There is ‘the hidden cost of saying no’.

And, by the way, the priority that we should assign to avoiding truly existential disasters depends on an ethical question posed by (for instance)  the philosopher Derek Parfit, which is this. Consider two scenarios: scenario A wipes out 90 percent of humanity; scenario B wipes out 100 percent. How much worse is B than A? Some would say 10 percent  worse: the body count is 10 percent higher. But others would say B was incomparably worse, because human extinction forecloses the existence of billions, even trillions, of future people – and indeed an open-ended post-human future.

Especially if you accept the latter viewpoint, you’ll agree that existential catastrophes deserve more attention. That’s why some of us in (the other) Cambridge – both  natural and social scientists –have inaugurated a research programme (the Centre for the Study of Existential Risks) to address these ‘existential’ risks,  as well as the wider class of extreme risks I’ve discussed. We need to deploy the best scientific expertise to assess which alleged risks are pure science fiction, and which could conceivably become real; to consider how to enhance resilience against the more credible ones; and to warn against technological developments that could run out of control. And there are similar efforts elsewhere: at Oxford in the UK  here at MIT and in other places.

Moreover, we shouldn’t be complacent that all such probabilities are miniscule. We’ve no grounds for assuming that human-induced threats worse than those on our current risk register are improbable: they are newly emergent, so we have a limited timebase for exposure to them and can’t be sanguine that we would survive them for long– nor about the ability of governments to cope if disaster strikes. Indeed we have zero grounds for confidence that we can survive the worst that future technologies could bring in their wake.

**Technology bring with it great hopes, but also great fears.  We mustn’t forget an important maxim: the unfamiliar is not the same as the improbable.**

# DAVID SADDINGTON

**David Saddington is a Climate Change Communicator and social entrepreneur. He has worked with governments and institutions around the world to implement climate education reforms and change the way we think about climate change.**

Climate change is the biggest threat facing humanity. Climate change not only directly threatens human society with the physical risk of extreme weather events and sea level rise but also indirectly impacts society by acting as an amplifier on other issues. Climate disruptions are therefore vast and put pressure on economies, health, security, migration, agriculture, water resources and so much more.

**Think about your day-to-day routine and I would be very surprised if climate change isn't already affecting it in some way. Our lives are intimately and inextricably connected with every corner of the planet and the global supply chain which governs our way of life is already being affected by the changing climate.**

**How can we tackle this global challenge?**

We can start this transition by keeping fossil fuels in the ground and taking no-regret choices which cut emissions but also make social and cost savings too. In order to fend off catastrophic climate changes however we need to really accelerate the adoption of low carbon energy generation and sustainable living.

We need nations, cities and communities to start investing in sustainable infrastructure and lifestyle changes and also focus on research, development and training in order to take maximise the opportunities of a low carbon economy.  Although a few are stating to embrace this most of us are still a long way off. The scales are tipping towards a green society but we need to speed it up! The first step is thinking outside of a fossil fuel mind-set and rejecting a continuation of the carbon status quo.

The worst scenario is catastrophic. If we stick to the current emission reduction pledges as part of the Paris COP21 agreement we will still breach the threshold that marks dangerous levels of planetary warming,. If however, we fail to meet these emission reduction targets the entire world faces massive disruption and upheaval as we struggle to cope with living in a much warmer world.

## Change the way you talk about climate change

We need to start thinking deeper about climate change. For too long climate change has been presented as a risk that is both distant in time (its worst impacts are a long way into the future) and space (it is an issue which is affecting remote parts of the world). Tackling climate change has therefore become a topic of environmental altruism under ‘save the planet’ ethics rather than a priority in everyday life, business and politics. We need to instead recognise climate change as an integral issue that is happening now and affecting us all.

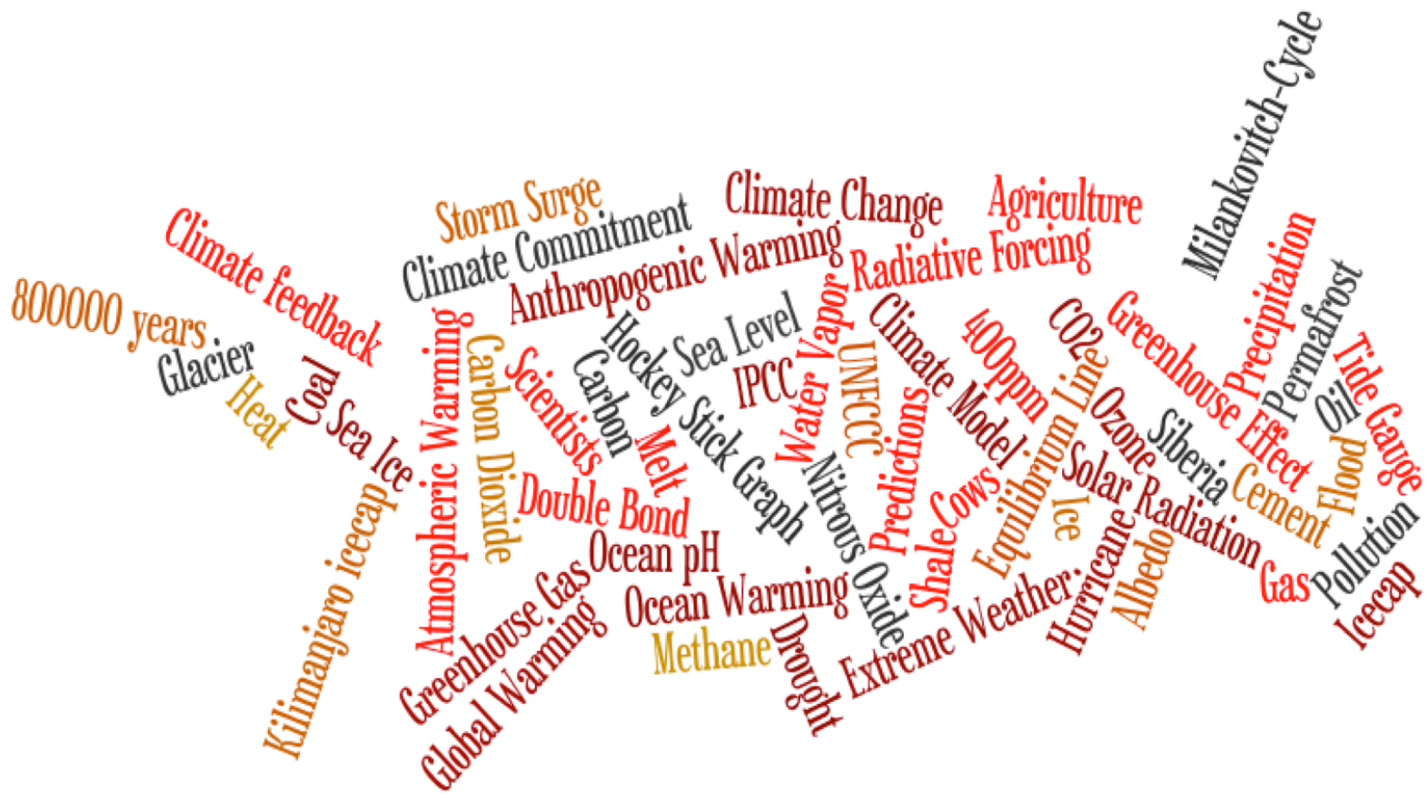


Figure 1: The most common words that we use to talk about climate change. These buzzwords frame climate change as a very scientific and abstract issue which is distant in time and space. This creates a detachment between climatic changes and everyday life.

To move towards this pragmatic view of climate change we need to start talking about it differently. In developed countries we need to start talking about the indirect impact of climate change: How is climate change affecting global supply chains which will ultimately impact on the price of your food? How is climate change wound up in issues of conflict and national security? How

is tackling climate change also linked to improvements in local environmental health? The list goes on…The risks that climate change poses to our way of life are immense but not always immediately visible so we need to start talking more about how fundamental tackling climate change is and how it is in the best interest of us all to do something about it. Climate change and sustainability discussions should be integrated into everything we do; whether that be choosing how to get to work, what investment decisions to make or outlining national economic and energy policies.

You and I today can start engaging people in these re-energised conversations about climate change and get people talking about the issue in a pragmatic way.  Climate silence is a big issue as people don't feel comfortable talking about climate change; in terms of taboo conversation topics it's up there with chatting about money and sex. These climate conversations at first don't even need to have a purpose beyond merely getting people engaged and re-energised about the topic of climate change. The topic of climate change needs to transform from a dull scientific issue to a current social issue, which will affect us all.

Once we start having these conversations we need to start acting. We are currently in a global state of quantitative easing narcosis and we aren't looking at long-term economic prospects. Climate disruption is an immense challenge to society but it also offers a way of doing things differently which includes a low carbon circular economy and greater social responsibility. The sooner we recognise the co-benefits of transformation the sooner we can start implementing some bold green initiatives.

**Resources:**

2014 TEDx Talk: 'Why I Don't Care About Climate Change'
https://www.youtube.com/watch?v=7vnzKPq390Q
2015 TEDx Talk 'Find Your Wild Side To Tackle Climate Change'
https://www.youtube.com/watch?v=aWrI1_-lek4

# CALEB SCHARF

**Caleb Scharf is currently the director of the multidisciplinary Columbia Astrobiology Center. His research interests include the study of exoplanets, exomoons, and the nature of environments suitable for life.**

## The Long View Is The Best View?

There is a standard lore about current existential threats: Enhanced atmospheric carbon dioxide traps more solar heat to power climatological and meteorological regimes not seen for millions of years. More humans need more fresh water, more food, and more energy, all of which stretch resources and land uses. Population density and global movement drive our own charming brands of aggression and competition, not to mention the microscopic causes of disease. And all of these things are exacerbated by diminished biodiversity and other ecological shifts that can have complex and unpredictable consequences.

There's also a standard lore for how to mitigate all of these problems: Stop burning so many hydrocarbons, deploy sustainable development, safeguard water and food resources, stabilize geopolitical and social unrest by addressing inequities and injustices, and preserve and conserve wildernesses.

All of these efforts are good, proper, and rational. But do they go far enough? Is there a deeper issue that our species needs to finally pay attention to?

I think that there is. What I'm about to write is likely to at first sound like the argument of a fossilized denizen of academia (which I'm pretty sure I'm not). But you should read on, because what I'll end up suggesting could be an essential component of

how we set our world up over the next fifty years in order to ensure our survival well beyond that.

The backdrop to this proposal is literally universal. In the course of the past couple of thousand years we've managed to piece together a rational view of the world that places us on a speck of stellar detritus whirling through a vast and ancient cosmos. At least a billion trillion other stars share the gulf of the visible universe with us, and with them at least as many planets again.

**As one of these cosmic grains, the Earth has passed through an enormous variety of states during the 4.5 billion years since it formed. What we experience today is just one very thin slice of the environmental, geophysical, and astrophysical conditions that our planet has, and will, go through.**

Earth billions of years ago was a place of iron-rich oceans and an atmosphere with no oxygen, yet it had life. At various times the planet has been in a global freeze, a snowball state with ice sheets extending perhaps as far as equatorial regions. At the opposite extreme, even just a hundred million years ago there were periods of great global warmth and staggering biodiversity, that included dinosaurs, newly developed flowering plants, and our own mammalian ancestors.

Through all the changes that have taken Earth from one state to another we see the litter of extinctions and evolution in the fossil and genomic record. Sometimes not just a species or two are removed from the tree of life, but entire phyla. And these variations will go on for at least a billion more years from today. Some will be driven by subtle orbital wobbles, or episodic volcanism, destructive asteroid collision, or just the natural chaos of a large, complex, and self-interacting planetary environment.

And here's the critical point. Irrespective any rapid changes we produce in the global environment, our species will always be exposed to a multitude of planetary shifts and variations outside of our control and capable of radically re-writing the world we exist in.

Let me put this slightly differently. Imagine that since the rise of modern humans about 200,000 years ago, we'd actually followed a different trajectory. Maybe we'd remained a sparse population, and perhaps our industrial revolution had come in a form that didn't take us onto the path of a global hydrocarbon economy. In this parallel – perhaps utopian - reality, would we still be asking questions about how to save humanity?

We would, and for precisely the reasons I outline above – living on a planet is inherently perilous and any rational, inquisitive species will eventually discover this truth. Acknowledging that fragility is critical, and deciding to find ways to mitigate the risk is logical, and here on Earth it is a luxury afforded to only one species across 4 billion years of history – us.

Humans tend to think in quite linear terms. We want to go from A to B so we look for the shortest, straightest path. Yet even that optimal path is often tortuous. For example, weaning ourselves off energy that contributes to rapid climate change is no simple task in a complex global economy with enormously diverse socioeconomic motivations. But that effort should be seen as one facet of a far larger challenge – the challenge of existing on a planet in the first place, in a narrow window of time where conditions just happened to be conducive for our type of species.

The versions of us in that parallel utopia, without rapid climate change or overpopulation, would be concerned about what to do when phenomena truly outside human control come to visit – short term or long term. I don't know exactly what they'd come up with. They might plan for new ice ages, or design the recovery protocol after asteroid impacts or super-volcanoes. They might construct repositories of seeds and genes on the Moon. They might take building viable colonies across the solar system very seriously indeed – constructing the ultimate safe rooms should existential catastrophe strike.

Instead of a 10-year, 50-year, or even 100-year plan, these parallel humans would be working on a million-year plan. Their ultimate goal? A way to outsmart the cosmos itself.

Can we learn something from this fantasy reality? I think we can. From the perspective of humans on that hypothetical other Earth, our present challenges could seem trivial and pathetic. You're messing up the environment? Well good grief, just change the way you do things, it's not that hard! And therein lies an important lesson. We're in a rut of thinking about our self-created doomsday scenarios as colossal problems. That predisposes us to be pessimistic about the chances of success – and that's a problem in itself.

But compared to other stuff the universe can throw at us these issues are simple – because solving most of them comes down to choices we can make this afternoon or tomorrow morning. My proposal is that we could use that kind of perspective, to make good use of the old adage of '…in the grand scheme of things…' We actually need to remind ourselves that the problems of the Anthropocene are not that bad compared to what else the universe could throw at us. And smaller problems are more manageable problems.

**It's risky of course. Evolution has gifted us with laziness when it comes to existential threats that aren't about to eat us in the next thirty seconds. But at this point I think a different approach is worth a shot, because we're running out of time to stave off the worst of what's coming.**

To infiltrate 7 billion human minds and help them see from this perspective won't be easy. Taking a high concept and embedding

it in the human psyche will take a massive dose of clever psychology and persistent clarity of purpose. But humans are great meme carriers, and we live at a time where our technology – ironically a product of our voracious use of planetary resources – provides precisely the kind of tools necessary to accomplish this.

Am I suggesting brainwashing the human race? Well, yes and no. We're already being brainwashed quite nicely by political and corporate interests, some benign, some not. Many of us in fortunately wealthy nations are willing to spend a lot of time watching videos of cats or toddlers doing something amusing or gross. A bit of cosmic re-education doesn't seem so bad by comparison.

# PAUL STAMETS

**Paul Stamets is an American mycologist, author and advocate of bioremediation and medicinal mushrooms.**

## Mycological Strategies for Surviving 6x

### The 6th Great Extinction is Happening Now

We are fully engaged in 6x – the 6th greatest extinction of life on this planet known thus far. But this extinction is unique. It is not caused by a celestial event like an asteroid impact or the more earthly eruption of volcanoes or the release of methane hydrate trapped in the ocean's sediments. 6x is uniquely caused by an organism - Us. Not only we are the cause, we are likely to be one of its victims.

Some can argue that extinction events are natural. Indeed they are. 99+% of all species that have existed are now extinct. But we are the first species to be cognizant that our actions are causing this extinction. If we are (or are to be?) truly intelligent organisms, we must work together as a global chorus to prevent our impending demise. Our descendants and this planet will ultimately be the judge of how intelligent we really are. Unfortunately, this judgment may well be beyond the lifetimes of those reading these words but not beyond the future generations.

Here are sobering some of the facts that we are in a crisis of historic proportions. There are an estimated 8.3 million species on Earth.  We are losing nearly 30,000 per year and may lose ~ 3,000,000 over the next century. And this is if the trends are linear. Many conclude that the extinction rates are accelerating due to

climate change caused by our growing population. Sadly, in a century, we may lose more than 1/3 of the species on this planet and we are losing species faster than we can identify them. This loss of biodiversity is a direct threat to our health and food safety, including the very soils that give us life.

Nature is bound by forces, which mystics, philosophers and religions seek as ‘universal truths’.

Universal Truths in nature are sometimes obvious but can be easily missed. One Universal Truth is that matter and life are network based. The organization of galaxies, dark matter, neurons, roots, computer networks, social media, music and mycelium are all structured similarly, conforming to string theory and interlacing with each other through the orders of magnitude of existence.

From these networks, matter organizes and life emerges. This is the way of Nature.

Networks allow for sharing resources, rapid adaptation, epigenesis and evolution. The interconnectedness of nature holds all living organisms in elaborate networks where alliances of organisms benefit.  They create collaborative communities and in common, stave off disruption, whether  from pathogens, catastrophia or the ebb and flow of the universe.

We are not one organism. Only recently scientists have well established that we are composed of more than 100 trillion non-human cells (mostly bacteria) compared to the 10 trillion human cells. This consortium gives us a host of collaborations and defenses that help maintain the equilibrium of ever changing communities resident within the human biome. Called the “microbiome”, this new field of study has excited medical communities as genomics explore what has been largely hidden from  medical science. Understanding the microbiome has implications for improving health, preventing and curing disease.

Quorum sensing in bacterial networks helps an organism in a population of many to behave and learn as one. Only now are we getting the sense that quorum sensing is happening at the most fundamentally subtle levels between species of organisms. In essence, the common language we share with all organisms is composed of a molecular flow of nutrients and messaging molecules that we constantly exchange with one another.

**Matter begets life. Life first appears as single cells. Single cells become multicellular. Multiple cellular organisms grow linearly, and then fork, branch and networks, the foundation of communities, are born. For this reason, I believe we will find network-based organisms throughout the universe. This is the way of Being.**

We are all connected by the flow of matter. Life forms are just one assemblage. When we “die”, we decompose into our cellular constituents. But do we truly die and cease being? I do not think so. We all share in the same consciousness, limited only by perceptive and cognitive constraints. Our matter is liberated from its human form, decomposed by fungi, bacteria, and protozoa, to be returned to the networks which ultimately gave us birth.

Planet Earth coalesced out of stardust around 4.5 billions years ago. Life began to emerge in its simplest forms about 3.8 billion years ago.  As single celled Archaea organisms, the simplest forms of life emerged and diverged into the kingdoms that we know today. Fungi and algae first marched onto land around a billion years ago. Plants paired with fungi arrived  around 700 million years ago. This symbiosis not only allowed terrestrial plants to thrive but lead to a more oxygen rich environment supporting the evolution of animals.

Between 750 million and 570 million years ago, the Earth underwent a great cooling and the majority of planet was covered with a sheet of ice, save for a few occasional slivers along the equatorial regions. Algae, bacteria and fungi thrived under the miles of ice, warmed by geothermal vents and subglacial volcanoes.

Around 650 million years ago, humans shared a common ancestry with Fungi. Episthokontha is a new super-kindom to recognize that common heritage, joining animal(us!) and fungi kingdoms. Around 570 million years ago, and perhaps much earlier, the fossil record reveals that multicellular organisms flourished. At around that time, debatably plus or minus a few hundred million years, life surged onto land, made possible by the cooperation of fungi and plants forming a holy union. Without fungi, the vast majority of terrestrial plants that we know today could not exist.

From 420-380 million years ago, a giant fungus dominated the landmasses of Earth, reaching heights in excess of 10 meters, weighing tonsand by far the tallest of all organisms on land. Known as Prototaxites, this fungus would have attracted lightning strikes and would have been a rich site for rapid evolution. Around 300 million years ago, all landmasses coalesced into the super continent of Pangaea.

Then, 252 million years ago, between the Permian and Triassic (the “P-T boundary”), a great cataclysm visited the earth, resulting in a massive extinction of species. Scientists debate the cause: a cosmic impact from an asteroid? Volcanoes erupting in Eurasia? Methane hydrate bursts from the ocean? I do not see these as mutually exclusive. An asteroid impact could have triggered volcanic eruptions and the emission of toxic methane hydrates. We do know the Earth was shrouded in dust, sunlight was cut off, the majority of plants and animals died and the fungi inherited the Earth. Those organisms that paired with fungi (whose mycelial networks do not need light), had a better chance of survival. At least 10 millions year would pass before biodiversity levels returned to pre-extinction levels.

Eventually the continents of Pangaea delinked, drifting apart, as Gondwanaland formed 200 million years ago. The species of Earth, no longer lived on common ground. Rapid species evolution ensued as species differentiated, emerging down along diverging branches on the tree of life.

As the Earth continued its voyage around the sun for another 185 million more years, another asteroid hit the Earth, killing the dinosaurs, along with hundreds of thousands of species. This extinction event set the stage for our emergence. Again, the Earth became shrouded in dust, sunlight was cut off, fungi re-inherited the Earth, and those organisms that paired with fungi would be more likely to survive the ecological holocaust. Small creatures did survive – including our vole-like ancestors. Paleobiologists have identified one primary fungus, the now extinct Reduviasporonites, that surged to the forefront and decomposed the decimated forests.

With the passing of each generation of life, fungi built soils by decomposing the deceased. This created the foundation of the food webs for the descendants to come. These networks, through eons of experience and governed by natural selection, have learned how to host communities of plants, algae, bacteria, protozoa and archaea. Of the hundreds of billions of microbes comprising a single gram of healthy soil, 75% of them are fungi. In forest ecosystems 10-40% of the biomass of the topsoil are fungal cells. Hence the majority of organic carbon in soils comes from or is sequestered by fungi. Even more so today, this fungal scaffolding remains critical for the multidirectional flow of nutrients via its mycelial networks. Moreover, we are just learning that these networks send electrical signals, so we are likely understating their innate abilities.

**I believe habitats and inhabitants share immune systems and mycelium is the cellular bridge that governs the two.**

Within the mycelial matrix are cavities that hold water, secrete toxin-decomposing enzymes and mineral-harvesting acids, release nutrients and  ultimately balance microbial populations beneficial to the host ecosystems.These “mycobiomes”, that are essential for the emergence of ecosystems, give rise to the forests, plants, animals and other creatures so that their biomass can fuel the fungi.

The network design of mycelium gives it center stage in the design of our food webs. The lessons of evolution have repeatedly shown that alliances with fungi can help us survive. With our knowledge base today, albeit limited, we now know enough to engage fungi to help ecosystems become sustainable.

Today, we only have 10-15% of the forest debris that nature has needed to build the food webs for sustainable ecosystems. Widespread deforestation, factory farming, the use of chemical fertilizers and herbicides, GMO’s, population expansion, industrialization and concomitant pollutants are on-going threats

that imperil our ecosystems and the foundation of our foodwebs. And this is at a time when unprecedented waves of humans (needing water, sustenance and shelter) walk the Earth

What do I recommend? From a pragmatic point of view and knowing that if it is not practical and economical, then any suggestions will face insurmountable obstacles. So, I make these recommendations, which I believe are both ecologically rational and economically sustainable. I emphasize solutions using mycelium's innate network design, which will yield immediate and long-term benefits.

## Myco Practices for Protecting our Biospheres

1) Mushroom cultivation centers should be located in every community for recycling debris and re-invented as environmental healing arts centers. These would teach children and adults on mycological solutions and augmenting synergistic relationships with plants using mycorrhizal, endophytic, and saprophytic fungi. Link all these centers ("I.A.M.S -"Institutes of Applied Mycology") via www.fungi.net so that a worldwide web-based network can share knowledge.

2) Grow mushrooms and mycelium as fungal foods for people, animals (cows, chickens, pigs, fish and insects).

3) Use mycelium created from growing mushrooms to filter water of E. coli, cholera, listeria, and other pathogens; phosphates, fertilizers, endocrine disruptors; heavy metals, and petroleum based toxic wastes,

4) Using mycelium and commensal bacteria, to generate biofuels, enzymes, mycoattractants and medicines.

5) Create genomic culture libraries of as many fungi as possible to protect our fungal heritage for future generations

6) Integrate fungal platforms for enhancing permaculture, no-till farming, forestry and aquaculture practices.

7) Grow mycelial mats that service bees by providing essential myconutrients that enhance bees' host defenses of immunity by up-regulating cytochrome P450 enzymes to destroy exposed toxins, providing antibiotics, polyphenols, complex sugars and other myconutrients for strengthening disease resistance. Mycoattractant fungi can be deployed to stave off Varroa mites. These elements can be put into play to help to combat Colony Collapse Disorder (CCD),which threatens to eliminate honeybees.

## In conclusion:

We are on this Earthship together. Respecting the Earth, learning from evolution, and putting into practice ecologically rationale myco-remedies can help make the course change needed to prevent the 6th greatest extinction on this planet. We have the

wisdom and must muster the courage to chart a new course. The solutions are literally underneath our feet.

## Resources:

**Books:**

See Mycelium Running: How Mushrooms Can Help Save the World and Growing Gourmet & Medicinal Mushrooms  by Paul Stamets, Ten Speed Press.

Paul Stamets TED & TEDMED talks:

2008 TED talk:

http://www.ted.com/talks/paul_stamets_on_6_ways_mushrooms_can_save_the_world.html

2011 TEDMED  talk:

http://www.youtube.com/watch?v=pXHDoROh2hA

Fantastic Fungi: Paul Stamets with Louie Schwartzberg

http://www.youtube.com/watch?v=2wzBPSbTGYM

**Stamets Websites:**

www.fungi.com

www.youtube.com/paulstamets

www.facebook.com/paulstamets

http://www.linkedin.com/pub/paul-stamets/10/729/142

# ALEX STEFFEN

**Alex Steffen is an American futurist who writes and speaks about sustainability and the future of the planet.**

The future that my parents' generation warned us about forty years ago looks an awful lot like our present. The ice caps are melting, deserts are spreading, the planet is thick with people, most of the world's primeval forests are gone, the seas are in crisis, and pollution, famine and natural disasters kill millions of people a year. Compared to the world we might have had, had the progress of the early 1970s continued steadily through the following four decades, we live on a half-ruined planet.

That half-ruined planet, though, is our home. People old enough to remember the first Earth Day can well grieve for that other, healthier Earth we might have had if only older generations had made different choices. Kids born today won't have that luxury. This world is the only one they'll ever know: they'll have to make the best of it; life goes on.

1970 is the same distance in time away from us now as 2050: that's how close the future is. The 2050s, we know, will be a watershed era: the decade when, if we're smart, human population will have peaked, a bright green model of sustainable prosperity will be widespread and human damage to the climate and biosphere will have begun to be repaired. In an amount of time about equal to that from the first Earth Day, we have to remake the world. We'll know whether we've done well enough by 2050. If we fail, the resulting descent towards greater and greater catastrophe, will likely cause immeasurable human suffering and the end of civilization; it could include perhaps a general extinction of most life on Earth. The final outcome will almost

certainly be ripped from our control at some stage. (It would be far better to tackle the planetary crisis while we have a chance at controlling the outcome).

Even if we do reach a safe plateau towards the middle of the century, with a stable human population, a new model of prosperity and a planet-wide effort to halt and reverse ecological destruction, much will still have been lost. Unfortunately, even a "win" may look like a ruined planet to the eyes of those used to the one we have now. Climate commitment means that no matter what we do, more climate change is a given (even if we avoid triggering any massive climate tipping points). Living on a planet of children (the median age in the least developed countries is only 19, for instance) and in a world where billions are struggling to rise out of poverty, means that even if reinvention happens fast and models spread quickly, entire forests, fisheries, rivers, mountains of topsoil, and myriad creatures will be devoured by human needs in the meantime. In the best case realistic scenario, we're going to do a huge amount of damage to the planet even as we transform ourselves into a global society that provides prosperity with essentially no impacts.

Some older environmentalists (most prominently, James Lovelock) have suggested that the fact that no future now awaits us in which our planet is not greatly depleted means the game's over. Lovelock in particular seems to enjoy saying it's too late to do anything to save humanity, but he's not alone among his generation. These "it's too late" doomers look ahead and see a world full of deserts and empty oceans, dying forests and dead coral reefs, and they say, "we tried to warn you…" and walk away.

**The problem is, the children of 2050 will look at that future world, with all its problems, and see home: and they'll look at the choices they have in front of them, and see the future. And since the choices we make in the next forty years will decide what choices our descendants are left with — a thriving society engaged in centuries of restoration and planetary repair, or a gradual desperate retreat towards the poles — giving up now because we don't like the choice set we face is pathetic cowardice.**

In fact, it's worse: the writing off of the future (especially on the part of those who bear the responsibility of cultural authority) actually directly supports the work of those who are destroying the future; those that are stripping every last shred of profit from the planet's biosphere while they still can. The idea that there is no future is a club used to beat people into submission and acquiescent participation in the unthinkable.

The planetary crisis we face may be made up of machinery and market failures and sheer masses of humanity struggling to live,

but I'm more and more convinced that it is not at its core really a material crisis at all. Rather, the planetary crisis is a crisis of vision; we see a growing and darkening void where our future ought to be. The average person, presented with accurate information about the state of the world, can see no way forward at all. The path we're on appears to end in darkness and a swift, cataclysmic drop. Most folks, entirely understandably, choose not to look.

That void in our future vision, I believe, is not accidental. In the 40 years since the first Earth Day, a whole set of industries has grown large attacking scientists and conservationists; falsely complexifying issues; spinning the news of environmental crimes; launching astroturf front groups; endowing think tanks; bribing politicians; obfuscating the need for systemic change by pushing funding towards NGOs that advocate the most limited of personal actions; and by promoting (in the most direct financial sense) cultural work that promotes cynicism and a disdain (if not a hatred) for idealists, from talk radio to teabagging. In a twist on the old axiom that tyrants don't care if they are hated so long as their subjects don't love each other, these industries don't care if the future they're offering us looks dark, so long as no other futures we can imagine look brighter. Despairing consumers still buy, and they cause less trouble for the investing class. "We have an economy," as Paul Hawken says, "where we steal the future, sell it in the present, and call it G.D.P." Keeping the future dark hides the crime.

There is a vicious political fight for the future happening right now. Having realized that they're steadily losing the war to convince people there are no problems, those profiting from the status quo have now turned to fear, uncertainty and doubt. They're trying to convince the public that it is both too expensive to make changes that probably won't work and too soon for drastic measures (I personally think that the political use to which geoengineering is being put is very much a part of this effort, but that's a story to take up again another time). The dark, unknowable future has been turned into a weapon against action in the present.

The irony is, we already have the ability to solve or at least address the planet's most pressing problems. We don't have every solution we'll need, not yet. We do, though, have the technological capabilities, the design genius, the scientific ingenuity, the entrepreneurial zeal, the policy acumen, the community-building skill, and the educational and cultural wisdom. It is not that we are not capable of sustainable prosperity. We have never had more or better ability to build a better world. What we seem to lack is a belief that we can actually use those powers to change anything, and we lack that belief precisely because the future has been ripped out of our cultural debate.

That's why if we care about the planet, the most important thing we can do is start showing how good a future we still can have.

That's why, right now, optimism is a political act, and a radical one at that.

I think, what we need today, is mass movement planetary futurism. I don't mean futurism in the cheesy sense — the what-color-is-your-rocket-car sense — I mean futurism in the best sense: of people who understand that the future is not an alien world or a land-of-make-believe, it's where we are right now, with a brief passage of time. Utah Phillips used to like to say that the past didn't go anywhere. Well, the future's already here. We're making it, as we speak, and we make it better when we consider what the effects of our actions might be over a longer range of time.

Human beings make the future every day. Making the future — setting in motion future events — might almost be considered part of the definition of humanity. The problem is that today, when powerful men sit down and make decisions, they generally make those decisions as if the future didn't exist, as if the consequences of their actions were beyond anticipation, as if they bore no responsibility for foresight. The future's not welcome in the room.

We need millions of people ready to put the future back in the room. We need millions of people ready to demand that their governments, their companies, their communities and their cultural institutions confront the reality of the futures they make every day.

In 2010, any institution which is not looking forty years ahead and at least considering the long-term impacts of its work is probably engaged in actions that wouldn't bear the full light of day. We need to sunlight them. We need to hold them up against absolute standards, hard numbers and firm time lines (I prefer carbon-neutrality by 2030, myself, but again, that's an argument for another time). We need to demand forty-year goals and bold immediate commitments. We need to be the voices for the children of 2050 who otherwise currently have no rights in our halls of power. 2050 is right around the corner: we need to fight for it in every discussion of practical action, in every institution on the planet.

And we need to be ready to envision the alternatives, and explore them with people struggling to make better decisions here in the present. Because the reality is that change is not only in the interests of future generations, it's in our own interest. Almost all the things we need to do to safeguard the best possible set of choices for the children of 2050 are things we'd want to do for other reasons, anyway:

- build better cities, so people can live in vibrant walkable communities and green homes, served by ecological infrastructure and a mix of transportation choices;

- foster a culture of bright green innovation, helping to generate meaningful work for the billions who will need it, by spreading new approaches like adaptive reuse, product-service systems and so on;

- develop new technologies and material and new clean energy industries;
- redesign our products and manufacturing to remove the toxic chemicals that are poisoning us and recover materials to eliminate waste;
- preserve farmland and forests, securing working sustainable foodsheds and needed ecosystem services;
- protect and restore wild places and biological hotspots on land and in the sea, helping prepare them for climate adaptation as best we can, saving as much biodiversity as possible, and reconnecting us with the beauty of the planet.

Even if climate change magically ceased to be a problem tomorrow, these are all things we'd want to do for other reasons anyway; places that do them will become far more economically robust and systemically rugged than those that don't.

There will be opposition. We will meet people filled with anger and fueled by misinformation. Many of the men (and they are still mostly men) making these decisions are good people. A few are evil sociopaths, actively obscuring the future to hide their own knowing crimes, but most are people you'd find decent dinner company, people you'd welcome into your family. Some are among the most principled and conscientious people you'll find anywhere. But many look only backwards.

Many, I believe, are secretly terrified of what they'd see if they looked ahead. The people most deeply traumatized of all in our society may be the older men who've devoted their entire lives, in grinding hard work and out of love for the people around them, to building companies and communities and systems they thought represented a pinnacle of human endeavor and free enterprise, but which instead — they would now find, if they could bring themselves to admit the possibility — have become components of what is quite possibly the most destructive way of life ever made by human beings. To have done right and well your whole life and yet find yourself ethically indicted in the end, to have your accomplishments turn to ash, to arrive late expecting security and respect, and find neither: I don't think those of us who are younger can fully understand what a soul-wrenching experience that must be.

As the air goes out of the most destructive parts of our economy — as the oil runs out, as the sprawl financing dries up, as the world runs out of big trees to cut and big fish to catch — economic fear gets added to the mix as well. How will they survive? Even when they see a glimmer of a bright green economy, it looks full of jobs demanding different skills than the ones they've spent a lifetime honing. I think a lot of them refuse to see a bright green future — attack even the possibility of its existence, yell at those who even suggest its necessity — because they see no place for themselves in it, and hear a ringing condemnation of the legacies they're preparing to leave woven into every fiber of the innovations we need.

I honestly have no idea how to reach out to these good people. We know, though, that they are the ones often at the table when the future is made, and though we will eventually prevail since time and numbers are on our side, spending another couple decades butting heads with these guys will at best slow our progress. Merely defeating them politically also wastes a huge creative resource: their talent and experience. Many of the people most angrily denying the future are those who understand how the systems we now need to retrofit, redesign, replace and adapt actually work — because they built them — and, if convinced that this new work needs to be done, they have oceans of insight and institutional knowledge to bring to bear on the problem. No one knows how to hack a system better than the person who's been in charge of protecting it from change…if only we can win them over to the side of change.

Whether or not we can bring around the oldest generation, the fundamental need is clear: we need, now, to put the future back in the room.

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# KEVIN SURACE

**Kevin Surace is an American technology innovator and serial entrepreneur and the CEO of Appvance which invented a platform that automates software testing 10X faster than before.**

During my lifetime we saw many and varying threats to our existence. The cold war being the most prominent for decades. This concern (nuclear annihilation) has not completely dissipated, but instead the bad actors have changed. By the 2000's we clearly faced climate change with awareness if not action. As I write this, the climate is certainly in serious trouble with world temperature records being broken annually, many feet of ocean rise inevitable this century, and drastic changes to rainfall across the globe. This will not destroy humanity, but could give it a good kick in the pants. Even though solar and win have made great strides in recent years, the vast majority of power and transport is still fossil fuel based and will be for decades to come.

My biggest concern of late is the rapid progress in robotics, drones, and artificial intelligence. These advances will save humans from almost all labor tasks and free us up to accomplish wonderful art and other creative and inventive endeavors. However the rapid advance of these technologies, and likely ability for them to begin to think and progress on their own is troublesome.

The Fermi paradox is a simple one where we assume that there are trillions of planets, many billions of years older than ours, and thus statistically life must exist on millions of them even if it is rare. Thus there have to be civilizations which are millions of years more advanced than ours who have visited us many times and should be detectable through many means. Yet after decades of searching we come up empty. So if they are not here or there,

there must be a great filter, where life simply doesn't get past it. Civilizations progress until they hit the great filter and then die off.

**It is becoming increasingly clear that humans will develop highly sophisticated autonomous robots, weapons, drones, vehicles, machines and other devices which will learn and progress act on their own. While there will be some laws against them, it will surely happen somewhere. And they will eventually be far smarter and stronger than humans. Some of this will be obvious within 10 years.**

Thus the question. Is the great filter ahead of us in the not too distant future? Where autonomous machines turn against us simply because we are no longer needed? Sounds like science fiction, but it isn't. Think about military drones today. A human tells them where to go and who to fire on. But in some battles, large ones, it would be better to tell them where to go and program them ahead of time to kill the enemy. So now they are autonomous…they can kill without direct human intervention when they see the right target. Less chance of missing due to human delay. Likely? How about its likely its already happening. Take that a step further and you don't need to tell them where to go, they are tied into satellites and figure it out for themselves. A step farther than that, we create robots to build the drones, whenever the drones say they need more. Less human intervention. All seems like a great way to save labor, and its all well intentioned. Until the whole system sees all humans as its enemy because we can pull the plug.

Climate change is clearly going to reduce the human population and create unlivable areas. There will be famine and floods and food and water shortages. But humans will survive that. There will almost certainly be a rogue nuclear bomb detonated here and there over the coming decades and humans will survive that. And there will be amazing robots who cook our meals and clean our homes and build our autonomous vehicles. Until they no longer need us.

Is that the great filter? Is that where every biological civilization ends? It creates beings far smarter than its people? We cannot be sure. But we can be aware that a level of AI and robotics is around the corner that can be used for good as well as turn on us. How will we keep them from turning? Is there a master kill switch? Will all countries adhere to an AI standard which keeps humans in control for thousands of years? Is this the beginning of the end? Will we even see it coming? Will other civilizations someday search for us only to find no response? Only time will tell.

# ALEX TABARROK

**Alex Tabarrok is a professor of economics at George Mason University and co-author of the economics blog Marginal Revolution.**

## Open the Borders!

To paraphrase Rousseau, man is born free, yet everywhere he is caged. Barbed-wire, concrete walls, and gun-toting guards confine people to the nation-state of their birth. But why? The argument for open borders is both economic and moral. All people should be free to move about the earth, uncaged by the arbitrary lines known as borders.

Not every place in the world is equally well-suited to mass economic activity. Nature's bounty is divided unevenly. Variations in wealth and income created by these differences are magnified by governments that suppress entrepreneurship and promote religious intolerance, gender discrimination, or other bigotry. Closed borders compound these injustices, cementing inequality into place and sentencing their victims to a life of penury.

The overwhelming majority of would-be immigrants want little more than to make a better life for themselves and their families by moving to economic opportunity and participating in peaceful, voluntary trade. But lawmakers and heads of state quash these dreams with state-sanctioned violence—forced repatriation, involuntary detention, or worse—often while paying lip service to "huddled masses yearning to breathe free."

Wage differences are a revealing metric of border discrimination. When a worker from a poorer country moves to a richer one, her wages might double, triple, or rise even tenfold. These extreme

wage differences reflect restrictions as stifling as the laws that separated white and black South Africans at the height of Apartheid. Geographical differences in wages also signal opportunity—for financially empowering the migrants, of course, but also for increasing total world output. On the other side of discrimination lies untapped potential. Economists have estimated that a world of open borders would double world GDP.

Even relatively small increases in immigration flows can have enormous benefits. If the developed world were to take in enough immigrants to enlarge its labor force by a mere one percent, it is estimated that the additional economic value created would be worth more to the migrants than all of the world's official foreign aid combined. Immigration is the greatest anti-poverty program ever devised.

And while the benefits of cross-border movements are tremendous for the immigrants, they are also significant for those born in destination countries. Immigration unleashes economic forces that raise real wages throughout an economy. New immigrants possess skills different from those of their hosts, and these differences enable workers in both groups to better exploit their special talents and leverage their comparative advantages. The effect is to improve the welfare of newcomers and natives alike. The immigrant who mows the lawn of the nuclear physicist indirectly helps to unlock the secrets of the universe.

We must ask ourselves what moral theory justifies using wire, wall, and weapon to prevent people from moving to opportunity? What moral theory justifies using tools of exclusion to prevent people from exercising their right to vote with their feet?

No standard moral framework, be it utilitarian, libertarian, egalitarian, Rawlsian, Christian, or any other well-developed perspective, regards people from foreign lands as less entitled to exercise their rights—or as inherently possessing less moral worth—than people lucky to have been born in the right place at the right time. Nationalism, of course, discounts the rights, interests, and moral value of "the Other", but this disposition is inconsistent with our fundamental moral teachings and beliefs.

**Freedom of movement is a basic human right. Thus the Universal Declaration of Human Rights belies its name when it proclaims this right only "within the borders of each state." Human rights do not stop at the border. Today, we treat as pariahs those governments that refuse to let their people exit. I look forward to the day when we treat as pariahs those governments that refuse to let people enter.**

Is there hope for the future? Closed borders are one of the world's greatest moral failings but the opening of borders is the world's

greatest economic opportunity. The grandest moral revolutions in history—the abolition of slavery, the securing of religious freedom, the recognition of the rights of women—yielded a world in which virtually everyone was better off. They also demonstrated that the fears that had perpetuated these injustices were unfounded. Similarly, a planet unscarred by iron curtains is not only a world of greater equality and justice. It is a world unafraid of itself.

# STEFAN WOLFF

**Stefan Wolff is Professor of International Security at the University of Birmingham, England, UK. He specialises in the management of contemporary security challenges and has extensively written on international intervention and ethnic conflict resolution. Wolff is also the founding editor of the journal Ethnopolitics and an associate editor of the journal Civil Wars.**

## THERE IS NO GOOD NEWS ABOUT ETHNIC CONFLICT AND CIVIL WAR...OR IS THERE?

Ethnic conflict and civil war are generally not the most cheerful of topics, nor are they normally associated with good news. Yet, not only is there at least some good news to be told about fewer such conflicts now than two decades ago but there is also good news in the sense that we have come to a better understanding of what can be done to further reduce the number of ethnic conflicts and civil wars and the human suffering they inflict.

Three things stand out: leadership, diplomacy, and institutional design. What I will focus on in my talk is why they matter, how they matter, and what we can do to make sure that they continue to matter in the right ways—that is, how all of us can contribute to developing and honing the skills of local and global leaders to make peace and to make it last.

But let's the start at the beginning. Civil wars have made news headlines for many decades, and ethnic conflicts in particular have been a near-constant presence as a major international security threat since the end of the Cold War. For nearly two decades, the news has been bad and the images have been haunting.

In Georgia, after years of stalemate we saw a full-scale resurgence of violence in August 2008 that quickly escalated into a five-day war between Georgia and Russia, leaving Georgia more deeply divided than ever. In Kenya, contested presidential elections in December 2007 quickly led to high levels of inter-ethnic violence and the killing and displacement of thousands of people. In Sri Lanka, a decades-long civil war between the Tamil minority and Sinhala majority reached a bloody climax in 2009, after possibly as many as 100,000 people had been killed since 1983. In Kyrgyzstan, over the last few weeks unprecedented levels of violence occurred between ethnic Kyrgyz and ethnic Uzbeks. Hundreds have been killed and over 100,000 displaced, including ethnic Uzbeks fleeing to neighbouring Uzbekistan. In the Middle East, conflict between Israelis and Palestinians continues unabated and has hardened positions on both sides so that it becomes ever more difficult to see how a sustainable solution could be achieved. Darfur may have slipped from the news headlines, but the killing and displacement there goes on as well and the sheer human misery it creates is hard to fathom. And in Iraq, finally, tensions are on the rise again and the country has yet to form a government more than four months after parliamentary elections.

But this talk is to be about good news—so are these now pictures of the past?

Notwithstanding these gloomy images from the Middle East, Darfur, Iraq and elsewhere, there is a longer-term trend that does represent some good news. Over the past two decades since the end of the Cold War, there has been an overall decline in the number of civil wars. Compared to the high in the early 1990s with just over 50 civil wars, we have 30% fewer such violent conflicts today.

The number of people killed in civil wars is also lower today than it was a decade or two ago. But this trend is less unambiguous. The highest level of deaths on the battlefield was recorded between 1998 and 2001 with around 80,000 soldiers, policemen and rebels killed every year. The lowest number of combatant casualties occurred in 2003, with just over 20,000 killed in all civil wars ongoing in that year. Despite the up and down since then, the overall trend clearly points downward for the past two decades.

The news about civilian casualties is also less bad than it used to be. From over 12,000 civilians deliberately killed in 1997 and 1998, a decade later the figures stand at 4,000—a decrease by more than two-thirds. This decline would be even more obvious if we factored in the genocide in Rwanda. But then, the slaughter of about 800,000 civilians in just a few months is an “accomplishment” that is hard to surpass.

These figures however only tell part of the story. They exclude people that died as a consequence of civil war—from hunger or disease, for example. They also do not properly account for civilian suffering more generally. Torture, rape, and ethnic cleansing all have become highly effective, if often non-lethal

weapons in ethnic conflicts. To put it differently, for the civilians who suffer the consequences of such violence, there is no good war and no bad peace. Thus, even though every civilian killed, maimed, raped or tortured is clearly one too many, the fact that the number of civilian casualties is clearly lower today than it was in the 1990s is a piece of good news.

## So —we have fewer conflicts today in which fewer people get killed, and the big question, of course, is why?

In some cases, there is a military victory of one side. This is a solution of sorts, but rarely one without human costs and humanitarian consequences. The defeat of the Tamil Tigers in Sri Lanka is perhaps the most recent example of this, but we have seen similar military solutions in the Balkans, the South Caucasus, and across most of Africa. At times, these so-called solutions are complemented by negotiated settlements or at least ceasefire agreements and the deployment of peacekeepers, but hardly ever do they present a resounding success: Bosnia and Herzegovina perhaps more so than Georgia, but for many parts of Africa, a colleague of mine once put it this way: the ceasefire on Tuesday night was reached just in time for the genocide to start on Wednesday morning.

But let's look at the good news again. If there is no solution on the battlefield, three factors can account for the prevention of ethnic conflict and civil war or for sustainable peace afterwards: leadership, diplomacy, and institutional design.

Take the example of Northern Ireland. Despite centuries of animosity, decades of violence, and thousands of people killed, 1998 saw the conclusion of a historic agreement, variously known as the Good Friday or Belfast Agreement. Its initial version was skilfully mediated by Senator George Mitchell. Crucially for the long-term success of the peace process in Northern Ireland, he imposed clear conditions for participation in the negotiations, central among them a commitment to exclusively peaceful means. Subsequent revisions of the Agreement were facilitated by the British and Irish governments who never wavered in their determination to bring peace and stability to the region. The core institutions put in place in 1998 and their modification in 2006 and 2008 were highly innovative and allowed all conflict parties to see their core demands and concerns addressed. The Agreement combines a power-sharing arrangement in Northern Ireland with cross-border relations that link Belfast and Dublin and thus recognise the so-called Irish dimension of the conflict. Importantly, there is also a clear focus on both the rights of communities and the rights of individuals. The provisions in the Agreement are clearly complex, but so is the underlying conflict. Perhaps most importantly, local leaders repeatedly rose to the challenge of compromise—not always fast and enthusiastically, but rise in the end they did. Whoever could have imagined Ian Paisley and Martin McGuiness jointly governing Northern Ireland as First and Deputy First Minister?

Is Northern Ireland a unique example? Or is this explanation perhaps confined to democratic, developed countries more generally? By no means. The ending of Liberia's long-lasting violence in 2003 illustrates the importance of leadership, diplomacy, and institutional design as much as the successful prevention of full-scale civil war in Macedonia in 2001 and the settlement of the conflict in Aceh in Indonesia in 2005. In all three cases, local leaders were willing and able to make peace, the international community stood ready to help them negotiate and implement agreements, and institutions have lived up to the promise that they held on the day they were agreed.

Focusing on leadership, diplomacy, and institutional design also helps explain failures to achieve peace or to make it last. The hopes that were vested in the Oslo Accords did not lead to an end of the Israeli-Palestinian conflict. Not all issues that needed to be resolved were actually covered in the Accords, but for some of them the parties simply promised to revisit them at a later stage. Yet neither did local leaders grasp this opportunity nor did international diplomacy sustain its engagement. Rather, local and international leaders soon disengaged and became distracted by the second intifada, the events of 9/11 and the wars in Afghanistan and Iraq.

The Comprehensive Peace Agreement for Sudan, signed in 2005, turned out to be less comprehensive than envisaged and its provisions may yet bear the seeds of renewed full-scale war between North and South. In addition to institutional failures, changes and shortcomings of leadership and more-off--than-on diplomatic engagement account for this. Unresolved boundary issues, squabbles over oil revenues, the ongoing conflict in Darfur and escalating tribal violence in the South, as well as generally weak state capacity across Sudan all complete a rather depressing picture of the state of affairs in Africa's largest country.

A final example: Kosovo. The failure to achieve a negotiated solution for Kosovo and the violence, tension, and de-facto partition that resulted from this have their reasons in a lack of imagination when it came to designing institutions that could have addressed the concerns of Serbs and Albanians alike. Yet here too, the intransigence of local leaders to settle for nothing less than their maximum demands played a role in a less than stable outcome. And an international diplomatic effort that was from the beginning hampered by western support for Kosovo's independence was clearly less than conducive to achieving a self-sustaining peace. By the same token, the very fact that there is a high-level, well-resourced international presence in Kosovo, as well as elsewhere in the region, explains why things have not been worse over the past two years. Equally important, local leaders on both sides have displayed relative restraint. So even in situations where outcomes are less than optimal, local and international leaders have a choice and can make a difference for the better: a cold peace is still better than a hot war.

Good news is also about learning the right lessons. So what then distinguishes the Israeli-Palestinian conflict from that in Northern

Ireland? Or the civil war in Sudan from that in Liberia? Both successes and failures teach us several critically important things we need to bear in mind if we want the good news to continue.

# THANK YOU FOR CARING ABOUT THE FUTURE

Come join in discussions on how to save humanity and how to shape the future we are heading into.