

Can We Cope with the Complexity of Reality?

*Why Craving Easy Answers Is
at the Root of our Problems*

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at the Root of our Problems*

*Reflections on science, self-illusions,
religion, democracy and education
for a viable future*

By

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CHAPTER ONE

INTRODUCTION

When I discuss the prospects of humans on earth or the chances of a dignified future worth living – some call it sustainability – with friends and colleagues I invariably get two fractions. One side, usually the larger, has an apocalyptic outlook: everything is getting worse, and fast (and they would quote Rockström et al. 2009 to prove it). The other side, small but vocal, thinks that technical progress will deliver us to nirvana within at the very most ten years (and they would quote Pinker 2018 or Hans Rosling with his Gapminder website (Rosling n.d.) to prove it).

I will argue in this book that both positions, in their isolation, could not be further from the truth because they cannot do justice to the complexity of the world we live in. I will start from the basis I laid in an often-quoted *International Journal for Sustainability in Higher Education*-article from 2002, entitled “‘Sustainability? Never heard of it!’: some basics we shouldn’t ignore when engaging in education for sustainability” (Jucker 2002a), but also from my further work in later years (Jucker 2002b, 2014a, 2014b, 2016, 2019a). I have argued for a wide and complex notion of education and I will reinforce and expand on this notion here.

In this 2002 paper, I wrote:

“All too often proposals for education for sustainability refer to the current state of affairs and its unsustainability in passing, and then move on to the educational small print, often with good intentions and admirable dedication. Yet this approach forgets entirely that the status quo is setting parameters, which render much of what is done in education obsolete. Honest stocktaking can therefore prevent us from fostering the illusion that education will solve all our problems and lead us single-handedly into the desired sustainable society. (...) In other words, if we do not, at the same time, do everything we can to transform our political, economic and social systems into more sustainable structures, we might as well forget about the educational part.” (Jucker 2002a, 9) [non-withstanding that changing these other systems requires, among other things, educational interventions]

Obviously, the world has changed tremendously and at an incredible speed since 2002, for better and worse. Just think for a moment about the advances in neuroscience (Frith 2007; Rippon 2019), medicine (check out the issues of the Journal *nature* at nature.com for an in-depth regular update), mobile technology (the first iPhone was not released until 2007) and renewable energy (UNEP 2019)¹, but also consider the ‘advances’ in biodiversity loss and ecosystem destruction (IPBES 2019)², accelerated climate change (IPCC 2019a, 2019b, 4; Ripple et al. 2019 [signed by 11’258 scientists worldwide]; Lenton et al. 2019)³ and the dissolution of a functioning public sphere in many parts of the world (Taibbi 2018).

This change has been made strikingly visible by the multidisciplinary exhibition *Anthropocene*, by photographer Edward Burtynsky and filmmakers Nicholas de Pencier and Jennifer Baichwal (Burtynsky et al. 2019). By combining art, film, virtual reality, augmented reality, and scientific research, the project investigates human influence on the state, dynamic and future of the Earth. When I recently visited the exhibition, I was struck by the power of the images: Burtynsky manages in a ingenious way to show the scale of our impact on earth and the film is very powerful indeed (ANTHROPOCENE 2019). It is a complex notion with which you leave the exhibition: there is compelling evidence that we entered a new geological epoch, the anthropocene: humankind has altered the

¹ “Renewables are currently the cheapest source of new power generation in most of the world (...).” (UNEP 2019, 29)

² Bearing in mind that “nature is essential for human existence and good quality of life” and that “most of nature’s contributions to people are not fully replaceable, and some are irreplaceable” (IPBES 2019, 2), here is what we managed to do: “The rate of global change in nature during the past 50 years is unprecedented in human history. The direct drivers of change in nature with the largest global impact have been (starting with those with most impact): changes in land and sea use; direct exploitation of organisms; climate change; pollution; and invasion of alien species. Those five direct drivers result from an array of underlying causes – the indirect drivers of change – which are in turn underpinned by societal values and behaviours that include production and consumption patterns, human population dynamics and trends, trade, technological innovations and local through global governance. The rate of change in the direct and indirect drivers differs among regions and countries. (...) In the past 50 years, the human population has doubled, the global economy has grown nearly 4-fold and global trade has grown 10-fold, together driving up the demands for energy and materials.” (IPBES 2019, 3-4)

³ “In our view, the evidence from tipping points alone suggests that we are in a state of planetary emergency: both the risk and urgency of the situation are acute.” (Lenton et al. 2019, 595)

composition of the geological, soil and atmospheric spheres of the planet on a massive scale. However, you cannot help but marvel at the human ingenuity, which lies behind these changes. It is horrific to see the huge, 14,200 ton *Bagger 293* (225 meters long, 46 meters wide, 96 meters high) in operation. This excavator for open cast mining is the third biggest machine on earth. The daily destruction potential of this machine is immense, particularly if you include the climate change impact from digging up and burning coal. Yet this machine is unquestionably an incredible engineering achievement, leaving one wondering what this engineering spirit could do for sustainable production rather than destruction. Moreover, the digging up of raw materials sometimes even generates a visual beauty of its own:



Fig. 1-1: Edward Burtynsky: Uralkali Potash Mine #4, Berezniki, Russia, 2017 (Burtynsky et al. 2018, 144). Photo: © Edward Burtynsky, courtesy Nicholas Metivier Gallery, Toronto.



Fig. 1-2: Edward Burtynsky: Coal Mine #1, North Rhine, Westphalia, Germany, 2015 (Burtynsky et al. 2018, 123). Photo: © Edward Burtynsky, courtesy Nicholas Metivier Gallery, Toronto.

If we turn to the largest machine humans have built on earth, the Large Hadron Collider at CERN (home.cern) with 27 kilometres of circumference, we find it is almost the opposite of *Bagger 293*: a scientific instrument which has enhanced our understanding of the structure of matter and reality tremendously – a truly international, collaborative endeavour where often hundreds or even thousands of scientists from around the world work together to push the frontiers of science.⁴

When the world changes on such a scale, we have to be prepared to change our positions as researchers and educators based on new evidence and new understandings. We might find it as difficult as anybody to let go of old, dearly held convictions. However, I am convinced that as educators

⁴ The paper, which described the successful experiment to prove the existence of the Higgs boson, was co-authored by 5,154 scientists (Castelvecchi 2015). There is an increasing trend towards papers with more than 1'000 authors (1'315 papers from 2014-2019), reflecting the increasingly global nature of research across several fields, often with authors from more than 80 countries (Singh Chawla 2019).

– given that successful education is by its very nature a change in understanding and mental models⁵ – we have to take this never-ending process of learning seriously, adopting an openness to change our positions if warranted by new evidence.

I will just mention two things where I was forced to engage in a process of un-/relearning. I clearly was in the above-mentioned apocalyptic camp, for as long as I can think. I was convinced – in quite a self-castigating way – that modernity, progress and the white western male had put history on a downward path. Coming from a humanities background, it took me a very long time indeed to understand what science and establishing sound evidence meant. In my literary studies and philosophy world, outside reality hardly had a look-in. All that was required was a self-referential loop of texts citing texts citing texts. There was no attempt to refer to some independently corroborated theory or to experimental or empirical evidence. I was entirely caught up in the postmodern fog I will mention later. Little by little, I learnt to understand what a scientific approach actually meant. I started to appreciate Popper (who for me, following in the Critical Theory tradition, had earlier been one of the bad guys). I learnt to value what progress in scientific understanding over the last two centuries had contributed to real improvements in quality of life, medicine, nutrition, housing, public transport and so much more. Even if I am convinced that Steven Pinker severely downplays the scale of ecological destruction and ignores the destructive force of corporate and political power and wealth, I do have to agree with him that the “bleak assessment [of the apocalyptic side] of the state of the world is wrong” (2018, xv). Nobody in his or her right mind would want to turn back the clocks because there is clearly measurable progress:

“We penetrate the mysteries of the cosmos, including life and mind. We live longer, suffer less, learn more, get smarter, and enjoy more small pleasures and rich experiences. Fewer of us are killed, assaulted, enslaved, oppressed, or exploited by the others. (...) We will never have a perfect

⁵ I am borrowing this term from Peter Senge: “Mental models are deeply held internal images of how the world works, images that limit us to familiar ways of thinking and acting. Very often, we are not consciously aware of our mental models or the effects they have on our behavior.” (Senge 1990, 8) Mental models are sometimes called mental representations. According to Ericsson and Pool “all mental representations have in common (...) that they make it possible to process large amounts of information quickly, despite the limitations of short-term memory. Indeed, one could define a mental representation as a conceptual structure designed to sidestep the usual restrictions that short-term memory places on mental processing.” (2016, 61; see also Wikipedia 2019c)

world, and it would be dangerous to seek one. But there is no limit to the betterments we can attain if we continue to apply knowledge to enhance human flourishing.” (Pinker 2018, 453)

It is precisely because of this personal experience of fabricating ‘truth’ literally out of thin air – obviously enhanced by a good measure of impressive-sounding jargon⁶ –, still very wide-spread in much of the humanities and social sciences, that I insist below on the importance of a proper understanding of science for any education, but in particular for an education for a viable future worth living.⁷

The second deeply held belief I really had to unlearn was the romanticising and idealisation of so-called indigenous people. In my (previous) world indigenous people were always the ‘good guys’, historically cheated and fleeced over and over by the bad ‘white guys’. Of course, there is no question that colonialism in all its forms was an utterly destructive and hideous historical development (see, as a comprehensive example, Beckert 2014), and we should do all we can to restore justice to these peoples. Nevertheless, it is a logical fallacy to conclude from this that the victims of this process were by definition good, peaceful and flawless human beings. It is an equal fallacy to conclude that the fact that they were victims of colonialism infers any quality or validity statement on their epistemology, on their world-view. But it was my conviction that their relationship and understanding of nature was oh-so wonderfully holistic and non-destructive. This notion was fuelled by a flood of more than dubious books on the construct of the ‘anti-imperialist’ left, the *native American Indian*. However, an objective, non-emotional and non-emphatic reality-check yields quite different results. Harari provides good evidence in his book *Sapiens: A Brief History of Humankind* that within a few thousand years of the settlement of *homo sapiens* on any continent 50 to 80% of the biggest mammals (and in addition insect, bird and snail

⁶ See as an instructive example Alan Sokal’s experiment with the journal *Social Text* (Sokal 1996), referred to in more detail in chapter two.

⁷ I could easily complain that I wasted days, months, even years in the first twenty years of my professional life, as a literary studies ‘scholar’: reading all this fiction, most of it based on understandings of human mind and body as well as psychology and social interaction either in direct conflict with scientific evidence (as I know now) or at least seriously under-researched. However, this would clearly be an undifferentiated view: Reading fiction, just as reading any other subjective rendering of the world, gives you nevertheless an insight into how people function, how they construct their personal universe. Diving into these microcosms can also help you understand the world we live in, even if not necessarily in the way the authors might have intended.

species) were driven to extinction: “The extinction of the Australian megafauna was probably the first significant mark *homo sapiens* left on the planet. It was followed by an even larger ecological disaster, this time in America.” (2015, 69): “Within 2,000 years of the Sapiens arrival (...) North America lost thirty-four out of forty-seven genera of large mammals. South America lost fifty out of sixty” (2015, 71) – long before the bad white Western coloniser was born. Another example: there is good evidence that the indigenous people in the Amazon did not just live peacefully in the given environment, but to a large extent restructured the forest with domesticated tree species (Levis et al. 2017). In addition, there is no evidence that indigenous people were particularly kind or peaceful when it came to settling issues with their neighbours: utter cruelty, abduction of children, and rape of women were not the exception, but the norm – which sounds rather similar to our ancestors during the Barbarian Invasions and the middle ages (see Diamonds 2012). It is – I have to admit with embarrassment – just sloppy thinking on various levels. First, believing the beautiful self-declarations and manifestos of leaders of the *American Indian Movement*, for example, without checking their claims against historical and anthropological records, is like believing that a politician’s election manifesto can accurately describe his or her politics, or that a green party voter’s beliefs are reflected in their actual lifestyle.⁸ Second, it is simply silly to assume that these peoples would not have dealt with their environment differently, had they had the superior tools of the technologically most advanced countries. There is no historical evidence to my knowledge that any group of people ever refrained from using the tools at their disposal. Third, as for their better understanding of nature: here is true what is captured by Rippon’s opening motto. Given their limited tools, theories and understanding of what was going on around them, they crafted their own ‘naïve realism’ interpretations, mostly not better or worse than any we encounter in ‘indigenous’ western communities of a similar historical developmental stage. These understandings have mostly been found wanting over time like all the other non-scientific attempts at understanding the world and universe around us. There is simply no sound reason why we should privilege their world-views in any way. As with anything else, these should be judged in relation to current best knowledge, i.e. whether they hold up to a scientific

⁸ A rather interesting study from the German Environment Ministry has found that there is hardly any overlap between personal convictions on green behaviour and *actual behaviour*. In fact, the study found that those who believed that they were acting truly green and sustainably had in reality the second biggest negative ecological impact (Umwelt Bundesamt 2016, table 17, 86).

process “that rigorously vets claims” (Oreskes 2019, 141) against available, peer-reviewed, tried and tested evidence. Doing this shows us that most of their myths and genesis stories are as nonsensical as anything we know from our religious past.⁹

However, it would equally be sloppy thinking to blame indigenous people for the fact that an entire generation of frustrated people from overdeveloped countries romanticised them. After all, the ecological footprints of many indigenous peoples are still a fraction of those of their romanticisers. It is the uncritical idealisation of indigenous peoples, Buddhist monks, black activists, women or other easy projection targets, against which we should develop a healthy immunity.

For the purpose of this book, this leads me to the following conclusion: With a view to all the changes in the political and social sphere and the immense deepening of understanding in many areas over the last few decades, there is a very strong sense that most of us, including those who call themselves progressive and green, simply have not tried hard enough to understand – to really dig down beyond our intuitions, our empathy, our preconceived ideas and our ‘progressive’ certainties. Harald Welzer has put this aptly:

“Time for reality, time to grow up. Being an adult means: to take note of facts even if they contradict one’s own wishes.” (Welzer 2019, 3; my translation)

“Should we not finally subject our lifelong lies to the same suspicion of self-serving Fake News as those of the growth believers and climate deniers and the completely perverted from the far right? That’s exactly the truth Fridays for Future is confronting politics with when they say policy-makers must finally do what is necessary (and not everything else). Thus

⁹ Again, let us be precise. There often seems to be a grain of truth in their world-views; we often find that their musings about ‘mother earth’ speak to us. Yet these ideas are mostly of such a vague, general nature – often just slogans, really – that they have a similar truth value as astrology: they can be applied to anything and everything, without revealing the underlying structure of reality which would allow an objective, independently verifiable or falsifiable understanding. A famous example is the speech by Chief Seattle from 1854 (we know today that parts of the speech were added by 20th century historian and ethnographic writer, A. C. Ballard): “This we know; the earth does not belong to man; man belongs to the earth. This we know. All things are connected like the blood which unites one family. All things are connected.” (Chief Seattle 1854) As Pinker rightly says, “this is the kind of statement that Dennett (quoting a young child) calls a ‘deepity’: it has a patina of profundity, but as soon as one thinks about what it means, it turns out to be nonsense.” (Pinker 2018, 433)

we are in the historically quite remarkable situation that today the children and young people are the realists and act knowledge-based and the adults the illusionists who have lost all contact with their reality.” (Welzer 2019; 13, my translation)¹⁰

What I offer here is an attempt to do this digging, this reality-check, to at least attempt an adult approach to some of the issues which seem most important. I am doing this in the spirit of Daniel Barenboim: irreverent to any political correctness, diplomatic niceties, or any enraged or hurt identity freaks of the right or the left. Just replace ‘artist’ with ‘scientist’ in the following quote: “(...) an artist, to be true to himself, has to have the courage to be totally uncompromising (...).” (Barenboim and Said 2004) Greta Thunberg has stated it razor-sharp: “We have to speak clearly, no matter how uncomfortable that may be.” (2018) Or, in Žižek’s words:

“We have to re-learn to argue in a tough way – even if this means that we are hurting people’s feelings. Their concern, their pain is no measure for the truth. And truth, after all, should be our guide.” (Žižek 2016; my translation)

The only thing I am interested in is truth, i.e. what we – not me personally, but we collectively at this point in time – *can* know and what sound knowledge we should base our political, social and educational approaches on.

This sounds arrogant, but is the exact opposite. It is the “arrogance of ignorance” (Leiva 2012) – amplified in echo chambers and filter bubbles¹¹ –, with its assumption that facts, knowledge and evidence count for nothing, which is harmful. It is obvious: I personally often do not have solutions or even the necessary detailed knowledge – in our days this is not something one person can ever hope to achieve again. But I am convinced that we have the tools and knowledge today to overcome not just the limitations, say, of tradition, upbringing, and cultural conditioning, but also to keep in check the illusions and misconceptions of the very functioning of our cognition and perception. But we can only do this

¹⁰ In other words, Welzer encourages us to adopt a cynical approach: “CYNIC, n. A blackguard whose faulty vision sees things as they are, not as they ought to be. Hence the custom among the Scythians of plucking out a cynic’s eyes to improve his vision.” (Bierce 1906, 27, last entry under C)

¹¹ Both work so well because they bolster up “confirmation bias”, a cognitive distortion we all share to a greater or lesser extent: “people (and scientists, quite often) seek data that are likely to be compatible with the beliefs they currently hold” (Kahneman 2011, 81).

collectively. Therefore, this book clearly aims to go beyond a merely personal opinion. To the best of my knowledge, I have taken great care that any argument I present in these pages is corroborated by evidence from specialist researchers in the relevant fields. It is not my personal opinion, it is my presentation of what I came to comprehend as the current state of understanding. If, based on sound evidence, you take issue with my arguments, I will be more than happy to reconsider. However, if the injunction is because of bad style, or because you feel that the argument lacks beauty, or because the arguments presented hurt your feelings, I'm afraid I won't be impressed. Simply shooting the messenger because you do not like the message, or not making the effort to provide evidence that the arguments presented are not sound, will not push our understanding towards more clarity. For me, this is the basis of any sensible dialogue and for any meaningful educational endeavour. This is the place where we should always start.

Coming to terms with our complex reality *is* hard, it *is* difficult and challenging, the conclusions often tough to accept. What follows will be a challenging read in many different ways. First, we have to tackle some of the barriers humanity faces in understanding our place on the planet and how many of our actions lead to an increasingly unsustainable lifestyle. Second, with Fridays for Future we have to acknowledge how our (however limited) understanding of science and its empirical evidence is not given the priority it deserves to determine the necessary actions. I will argue that we have no option but to persevere. We have to put in the effort. We cannot – lured into ‘business as usual’ by our craving for easy, convenient answers – give up too quickly. As Greta Thunberg (2018) and Niko Paech (2014) argue: the time for excuses is over. Business as usual is not an option any more...

This is the reason why I am equally convinced that we need to talk about the issues I address below, particularly if they are considered taboo. In fact, I have chosen religion and overpopulation for precisely this reason, as I will explain in the relevant chapters. These topics can serve as insightful examples for what it means to take complexity and available evidence seriously. Of course, talking about it is not enough. According to change theory, we need to find ways to engage people's “elephants” (=emotions), not just their “riders” (=reason) (Heath 2011, 4-33). This is what we need to do in our educational practice. However, in order to change this practice, I can see no other way than to reason, to consciously switch from the automatic, often unconscious, but fallible “System 1”, to the analytic, critical, but also exhausting “System 2” (Kahneman 2012, 69-90, 415). There is no substitute for it, and there are no excuses not to do

this.¹² We have no choice, but to battle against extremely strong traditions, ideologies and entrenched, but erroneous mental models. We have to stand up against the wide-spread ridiculing of modernity, Enlightenment and science both on the left and the right of the political spectrum. We have to fight against cultural relativism which endorses human oppression and abuses of women in other cultures in ways which are intolerable and clearly incompatible with human rights. In short, it is our duty as educators not just to stand up against, but also to free ourselves from all forms of stupidity and tyranny (physical or by words). Education can, as history shows, change and transgress people's "self-imposed immaturity", as Immanuel Kant stated so aptly already in 1784 (Kant 1784). We have to reignite the appeal of the Enlightenment to reason, because by now we really do know from overwhelming evidence that emotions and intuition are very poor guides to sensible long-term action (Bloom 2018; Kahneman 2012). Or to quote the German feminist philosopher Svenja Flaßpöhler, a fierce critique of the undifferentiated nature of the #MeToo-movement (see 2019, 18-23; and Flaßpöhler 2018): "If feelings replace arguments, debate becomes impossible. It stifles everything." (2019, 18; my translation) We have to keep the debates going, otherwise learning and education is impossible.

I do not want to fall into the trap of individualising issues which are clearly collective challenges to be solved collectively (see below, chapters five & six). Nevertheless, I do think that there is an important element of self-responsibility here: This is about us, and our failure to do our homework, individually and collectively. Dee W. Hock, the 'father' of the VISA-card and an interesting proponent of democratic, co-creative leadership (Hock n.d.), phrases this with reference to a managerial role, but it has equal value for what concerns us here:

"The first and paramount responsibility of anyone who purports to manage is to manage self – one's own integrity, character, ethics, knowledge,

¹² At a recent conference, a speaker encouraged us not to rely on reason, but to use emotions and value the deeply held beliefs of people. This is correct in so far as we have to start from the fact that most people are guided by strong emotions and beliefs (i.e. Kahneman's System 1, see below). However, most of these are demonstrably false. It is clearly our job as educators to find ways to make them understand how these emotions are constructed by their cognitive system and cultural socialisation, why their belief-systems are at odds with reality (see Welzer above), and how they can arrive at an understanding of the world that is coherent with current knowledge (i.e. encourage them to use what Kahneman calls System 2, see below).

wisdom, temperament, words, and acts. It is a never-ending, difficult, oft-shunned task. The reason is not complicated. It is ignored precisely because it is incredibly more difficult than prescribing and controlling the behavior of others.” (Hock 2005, 48)

Self-responsibility in the end comes down to our capacity to differentiate, our willingness to apply a complex and evidence-based approach. Such a reasoned approach will not side with either the apocalyptic or the blue-eyed ‘technology is nirvana’-side. Inspired by Flaßpöhler (2019), I will use the terms differentiation or to differentiate throughout. I do not use these terms in the business sense of product differentiation in marketing, or in the biological sense of cellular differentiation or the geological sense of planetary differentiation. I borrow the term from systems theory where it is used to deal with the complexity of systems. For the purposes of this book differentiation is used when talking about the process of understanding. It means the attempt to be thorough, scrupulous, comprehensive, concise, discerning and penetrating in the analysis of the complexity of any given phenomenon. This immersion into the depth of understanding an issue almost by definition means that one person alone cannot do it. The opposite of differentiation is shallowness (see Carr 2010): superficiality, laziness, as in not bothering to question traditional ‘wisdom’ or belief-systems. Differentiation requires time, research, reflection, self-criticism and listening to and learning from others. Flaßpöhler gives the following example for differentiation:

“An enlightened society must be capable of differentiation. There is a difference, if a child has two fathers, two mothers, or a father and a mother. I am not talking about what is better or worse, but there is a difference. Why is it impossible to say this? Why can we not analyse this? There is a fear to be labelled as reactionary, if we go into differentiation. But this leads to the absurd stupidity of today’s debates, where I am suddenly a reactionary, right-wing feminist. As an intellectual my central competence is in differentiation. That is my job.” (Flaßpöhler 2019, 23; my translation)

Another example: a differentiated approach would not just blanket-label modernity as fundamentally destructive (see as an example Baumann and Lyon 2013), but it would differentiate between, on the one hand, the scientific approach chosen, and the contributions of politics, social movements, corporations, non-scientists and scientists alike, in making advances in the understanding of humans and the workings of the world, and, on the other hand, abuses of power and authority for personal and collective gain.

History has shown that as individuals and as humankind we are capable of the most amazing emergent developments – there is virtually no limit. And, over the last 250 years, we have developed the reliable tools of science to verify what works, beyond our fallacy-prone intuitions and traditional explanations. Even if the challenges seem almost insurmountable, as in the case of climate change or re-inventing democracy, there is no question that we can do it, if we focus our collective minds and political will on it (as the Corona crisis has shown). If learning and even excellence is within reach for every one of us (Ericsson and Pool 2016); if we managed to end slavery, destroy Hitler and render Stalinism obsolete; if we succeeded in putting humans on the moon, and managed to phase out numerous substances that deplete the Ozone Layer (Montreal Protocol; see Solomon 2019), there is no *a priori*, inherent, insuperable barrier to a better future. This is corroborated by history: there was never a time in history where so many people had such a high quality of life and access to freedom as today.

In this fight for a better future, we have to get our priorities right:

“Given the immense and complex problems of power, wealth, exploitation and oppression, we need the best, most accurate knowledge there is to solve them, from a wide range of disciplines. What we most often tend to do in our circles, though, is to give in to the craving to wish us back into a pre-modern simplicity where wishful thinking was thought to help. No: let us firmly arrive in the 21st century. Or, in other words: if we want eco-justice [or sustainability] to succeed we need five things:

- we need to remember Horkheimer and Adorno [see below] and fight oppression on all levels: within ourselves, between us and as exploitation of nature;
- we need to take Kant seriously and truly have the courage to emerge “from [our] self-imposed immaturity”;
- we need to be absolutely sure that our arguments are scientifically sound and watertight, and don’t rest on superstition, unreason or belief;
- we need to be the role models in everything we *do*; the preaching to others we can leave to our brothers stuck in medieval mindsets;
- we need to be sure that we pick the right friends (science rather than unreason) and the right enemies (corporations, power, wealth rather than science, modernity and the enlightenment).” (Jucker 2016, 39)

There might well be myriad pressing issues for each of us as a person. However, faced with climate change and other urgent challenges (such as equality and justice within and between societies¹³), we as a society, as

¹³ In their thoroughly researched book *Spirit Level* Wilkinson and Pickett show that

humankind, have to address the most important issues, the ones where we can make a real, long-term difference for the biggest number of people. No single book can deal with all of them. I therefore focus here on those topics, which do not receive the attention they deserve if we are to respond to our existential crisis on the basis of the “best available science” (Thunberg 2019b).

Globally, there is a frantic search for quick fixes to complex problems such as climate change, immigration, technological change or political disintegration. This book is a warning not to repeat mistakes of the past. Climate change is a colossal danger to the future of human life on this planet. We simply cannot afford to get it wrong. We need to complement any calls for urgent action with equally urgent calls for thoroughness and best available evidence. This is why the book addresses five fundamental questions:

- What are our tools and methodologies for understanding reality which can make us confident that we get the answers right? (chapter two)
- What are the world-views and mental models, which are clearly *not fit* to help us arrive at sound solutions? (chapter three)
- What are the most pressing problems we *also* need to solve so that we stand a chance to win the battle against climate change? (chapter four)
- What are the political structures we need so that the best available solutions are actually implemented and that traditional impediments to change – like manipulation of the people, structures of power and wealth – are overcome? (chapter five)
- How can education contribute to all of this? (chapter six)

The reasoning will at times be provocative: take it as a proposition for debate. My goal throughout was to write *not* in the spirit of ‘I know’, but in the dedicated spirit of ‘let us not fool ourselves’, ‘let us really get down

equal societies consistently score significantly better than unequal ones. Almost all problems which turn our modern societies into “social failures” are more common in unequal societies: “level of trust, mental illness (including drug and alcohol addiction), life expectancy and infant mortality, obesity, children’s educational performance, teenage births, homicides, imprisonment rates, social mobility” (Wilkinson and Pickett 2010, 18-19). The conclusion from their book: “The evidence shows that reducing inequality is the best way of improving the quality of the social environment, and so the real quality of life, for all of us. (...) this includes the better-off.” (2010, 29)

to understanding our complex reality, even if the best shot is a limited attempt’.

Greta Thunberg says: “You are not mature enough to tell it like it is.” (2018) The book aims to provide tools so that we *can* grow up and get out of our echo chambers. However, even if we tell it as it is, we will not create a meaningful future without a perspective. Therefore, I give you a sketch of a vision of the future – a vision which can only be attained if we all do our individual homework, but also put the democratic and economic structures in place to make sure that abuse by power, wealth and free-riders cannot happen or is at least minimised.

Vision of a sustainable society

Without wanting to endorse Max Horkheimer and Theodor W. Adorno (and the Frankfurt School of Critical Theory) as a whole, I nevertheless think that they have defined the three dimensions of human liberation succinctly:

- (1) freedom from oppression within oneself,
- (2) freedom from oppression through other people (or corporations or states or organised crime etc.),
- (3) absence of exploitation of nature (1986, 61).

You could also describe this as a situation where (virtually) no hierarchies between people exist and where there is no abuse of power, or indeed no power structures that allow such an abuse. In such a world, there would be no exploitation of nature, or other species, or other people elsewhere in the world, or future generations, to facilitate our lifestyle. In other words, there is no way that our lifestyle would be beyond what a just and equitable share of global biocapacity would allow (Global Footprint Network 2020). Yet Horkheimer and Adorno’s vision importantly also focuses on the world within. In this vision there is also no oppression from within: no belief systems or traditions or social structures or social media (Turkle 2011), or peer or family pressure (Frank 2020) to force us into an acceptance of subjugation which undermines self-determination, free will, freedom from fear and the true development of our human potential. To me this is the vision of becoming truly human, of a truly human society, without the shackles of slavery, religion, inequality, injustice, wealth, aristocracy, economic exploitation, capitalism, communism, nationalism, patriarchy, sexism, ...

With John Lennon's "Imagine" in the ear (Lennon 1971), it seems easy to imagine such a world where the aims of the French Revolution become reality: "liberty, equality, brother- and sisterhood"; a world where a person is a human being and not a refugee; where woman and girls are equals in a true sense with men and boys, and not pressed into a state of dependency through moral laws which have long lost their validity; where all people respect the fundamental values of an open, democratic, secular society, based on knowledge and understanding, and not on myths or oppressive belief systems such as religions, autocratic rules, and power structures based on status and wealth.

A note on style and form

If I take seriously the insights into the limitations of our subjective perception and cognition, which are elaborated in chapter two, I *must attempt* to do both at the same time: on the one hand, I must label and make transparent that I cannot but say 'I' because the book as a whole is clearly and distinctly my perspective and my understanding. On the other hand, given the evidence that our own perception is prone to error and that reliable knowledge and understanding only flows from the accumulated, best collective knowledge we have in any given field, it is evident that I cannot claim the presented insights as mine. 'Translating' this knowledge into 'my narrative from my own heart and head' would be grossly misleading you, the reader. It would also be hubris. Giving you the evidence as much as possible 'straight from the horse's mouth', from the specialist scientists in the field, seems to me the best possible way to make transparent and palpable that arriving at an understanding of our complex world is in our days *always* a collective, multi-voice endeavour, which is necessarily inter- and transdisciplinary. In this book, I map this collective endeavour to understand the territory with numerous quotations. To me, this is far more honest than translating what these scientists found into my own words – whether in an 'I' or 'We' narrative. Too much would be lost in translation. I know that this is unusual, but I think that we should heed Greta Thunberg's insistence on honesty, on the need "to speak clearly" (2018). Given the urgency of our predicament in the face of climate change, biodiversity loss and overpopulation we need to find new forms of talking and writing to each other, reflecting truth and honesty.

We live in a dramatically complex reality and understanding this reality takes a lot of conscious effort. Kahneman's System 1 thinking, our craving for easy answers, for an easy style, for a neat, light and sweet narrative will never allow us to understand this reality in an adequate way.

CHAPTER TWO

SCIENCE *VERSUS* OBSCURANTISM: ... AND UNDERSTAND WE MUST

In our world of over-abundance of ‘information’, via search engines, social media, traditional media, advertising, books, videos, podcasts and much more, it is admittedly not an easy thing to move from mere words, images and sounds on a (web)page to knowledge and understanding. Yet over the last 250 years, what I call the scientific approach has become a truly unique tool – different in quality from any other tool we had before – for understanding how the world (including humans) works. The scientific approach is the best epistemology – i.e. theory of knowledge, especially with regard to its methods, validity, and scope, and the distinction between justified belief and opinion – that we have.¹⁴ Why is it so different? Why should we prefer it to any other approach? What makes us so sure that it is the best tool on offer? There are a number of reasons, which really have convinced me that we have no other option.

2.1 Don’t believe me, go check the available evidence for yourself

Here is the first:

“Science is born from this act of humility: not trusting blindly in our past knowledge and our intuition. Not believing what everyone says. Not having faith in the accumulated knowledge of our fathers and grandfathers.

¹⁴ I call this epistemology the “scientific approach” rather than the “scientific method”, since, as Oreskes rightly states, “there is now broad agreement (...) that there is no (singular) scientific method” (2019, 55). Rather, what I call the “scientific approach” is a meta-method, which primarily consists in the willingness to accept and transcend one’s own limitations to knowledge and understanding, and to acknowledge the openness of knowledge to changes and corrections over time. In Oreskes’ view “open, critical, and communal vetting of evidence” is crucial to producing reliable knowledge (2019, 66).

We learn nothing if we think that we already know the essentials, if we assume that they were written in a book or known by the elders of the tribe.” (Rovelli 2016b, 229)

If we are serious about the above notion of freedom, access to knowledge and understanding should be, at least in principle, absolutely free, with no barriers or pre-requisites. It should not depend on your social status, on your wealth, on your hierarchical position in relation to power, on your race, sex, age, or anything else. It should also not depend on other people – such as those you might depend on for your livelihood –, regulating access or indeed filtering and transmitting knowledge to you. You should have free access not just to the knowledge itself, but also to the evidence it is based on. No authority should ever be in a position to tell you: “It is just as I say, believe me!”¹⁵ You have every right in the world to reply as suggested by the Royal Society of London or Horace:

“A real scientist wants to make her own, independent check on the measurements reported by someone else: ‘*Nullius in verba*’ is the motto of the Royal Society of London: ‘Don’t believe what people tell you, however authoritative they may be.’ [Footnote 8: *Nullius addictus iuratae in verba magistri*: ‘I am not bound to swear allegiance to the word of any master.’ Horace, *Epistulae*.]” (Frith 2007, 6)

This approach to knowledge should make us sceptical about the following:

- Gurus, doctors, dieticians, sects or politicians who claim that they single-handedly and for good solved a long-standing mystery.
- All religions of the world, because they rely on an authoritarian knowledge model: we, the church, clergymen, the holy book, tell you the truth, and you have no option but to believe us (see chapter three).
- Everybody who tries to convince you that there is a short, simple, black-and-white answer to any problem we face. Think of “Brexit

¹⁵ Glenn Strachan has helpfully pointed out that I should clarify why I try to avoid the word ‘believe’. In this book, I tend to use it as shorthand for blind faith in unsubstantiated stories and opinions, for ‘not evidence-based’. Yet Glenn rightly insists that some people use the term quite in line with what this book is all about. They accept that knowledge is emergent and can change and the word ‘believe’ is a shorthand summing-up of the position: ‘As far as I can tell this is the case, but I know that this might change’ (Glenn Strachan, Email to the author, November 8, 2019).

will solve all our problems.” / “The wall to Mexico will solve all our problems and make America great again.” / “All women are victims and all men are rapists.” / “All women are there to obey and pleasure men.”¹⁶, etc.

Whenever someone or a group or a self-help book or a so-called expert tells you “I know, you can trust me, I have found out what the others didn’t, I will solve all your problems, I have all the answers”, you can safely ignore them. Unless what these people say has been independently tested, corroborated by many people, unless it has stood the test of time, the likelihood that there is much valuable insight in the proclaimed truth is very slim. We have learnt from history, that finding solutions to complex problems simply does not work this way. Even Einstein wouldn’t have been the impressive scientist he was, if it weren’t for hundreds of thousands of experiments testing every possible claim and prediction of his General Theory of Relativity, trying to prove it wrong. He himself would never have said: “believe me”. He would have said “Go check for yourself!”

It might be worth reclaiming the term ‘expert’ here, as Glenn Strachan suggested.¹⁷ Many populist politicians – in particular the ‘leave’-campaign in the UK, but also notoriously Donald Trump – have invested a great deal of effort into rubbishing the notion of experts. Below in chapter five, we will see why this is an ingenious ploy by totalitarian politicians to make people follow them blindly. We need a differentiated approach. We must arrive at a clear understanding of what we ourselves can know and cannot know, but we also need to humbly acknowledge that without the careful and collaborative efforts of many scientists the world over, we individually cannot know very much. We need a clear distinction between ‘false’ experts, who have not tested their assertions, on the one hand, and genuine experts on the other, who have put in the hard work to support their assertions, to build and evaluate their understanding on the basis of the best available evidence.

I like to call this triangulation. It works for any problem we might investigate, linear, non-linear, wicked, or seemingly not open to a scientific

¹⁶ It took Switzerland until 1985 to revoke its old marriage law, which guaranteed the husband’s role as head of the family by allowing him to prevent his wife from working, to choose the couple’s place of residence, and to manage the savings his wife had accrued before the marriage as well as her inheritance. It also prevented a wife from opening a bank account without her husband’s approval (The New York Times 1985, Section A, 6).

¹⁷ Glenn Strachan, Email to the author, November 8, 2019.

approach. If you cannot confirm a claim by arriving at the same conclusions from various angles, through different, methodologically independent experiments, through tests by different people, you know it is not a truth, but at the very most, a hypothesis in need of further research and proof.

2.2 The limits of human cognition

Here is the second reason why I am convinced that we have no better tool than the scientific approach which deliberately goes out of its way to corroborate anything by external, objectively verifiable methods, also with the help of machines and independent measurements. The mere fact that our cognition and our perception, the way our brain constructs our conscious understanding of the world is so prone to errors, misconceptions, illusions and plain delusion, means that no approach to knowledge which places too much faith into subjective readings of the world can muster much confidence. I know that this statement sounds harsh, but there is no flattering way of putting it. If we look at history, this seems blatantly obvious. If you just think of some of the most monstrous examples, say Stalin, Hitler or any of the world's religions, you immediately see that it is easily possible to make millions of people believe totally absurd things with utmost conviction, and then to make them act on these convictions, i.e. displace and kill millions of their own countrymen, exterminate six million jews or wage wars against non-believers.

There is a wealth of thoroughly tested results from neuroscience, psychology and memory research, which should make us very humble indeed, whenever we – or anybody else, for that matter – individually claim to know something for sure.

In pulling together the experimental evidence in his field, Chris Frith aims to show how our conscious cognition system works. Our perceptual senses, the nervous system and the computations going on in our brain construct and treat any thought, emotion, or pain before it enters our consciousness. Frith does not bemoan this fact. In his and others' view, it is simply a necessary set-up, developed through evolution, to be able to live and navigate in a world replete with myriad stimuli. However, in order to appreciate how we work and how perception of the world is constructed we need to understand these processes: "By seeing through these illusions created by our brain, we can begin to develop a science that explains how the brain creates the mind" (Frith 2007, 17):