Chapter 13
Climate Change: Anticipated Risk or Heralded Catastrophe? Questions from a Thwarted Public Enquiry

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Introduction

Our contribution to the multidisciplinary approach of the "Societies Under Threat" issue deals with climate change, and especially how this global threat for the entire humanity is formulated in the global public sphere.

Many comments have been made on the apparent cognitive dissonance that seems to be consubstantial to this major threat, probably the most systemic and radical that humanity is confronted with. Even if the science is more and more precise on the breath and scope of the problem, the radical and rapid action needed is not happening or happening far too slowly and inconsistently with the message that science community is sending.

One way to look at it, is to analyze the constitution and the effort of the scientific community to generate action, and the relationship between the knowledge produced in relation of the active (or inactive) response of the decision makers (the politics) or the public (attitudes and behavior) more generally.

As actors involved in the field of climate change, we look at these efforts and the responses elaborated in the political realm as an enquiry in John Dewey sense. We consider in this essay the way that the scientific community has tried to produce knowledge and convey messages to a set of interlocutors, framing them in different ways as a way to co-constitute an active public. This process of knowledge production has been embedded in the political process itself both the mobilization of social actors as well as the shaping of the creation of the institution (The Paris Agreement on Climate change). The multiple interactions through this "community of enquiry"

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have been mobilized to resolve the uncertainty attached to the complex phenomenon of global warming and the inaction caused by this uncertainty.

From this point of view, the understanding of the phenomenon of global warming portrayed first as a risk and increasingly as a major threat of a looming catastrophe for human species has been and is at the core of this social enquiry.

This is not a theoretical question. Very recently, at the end of 2018, the international scientific community working on climate change published its Special Report on 'the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways' (IPCC, 2018). The report based on the research of a network of international scientists is intended first for decision-makers (the IPCC is an intergovernmental body) but, beyond, for the public worldwide: institutions, media, economic actors, and citizens…

This report is particularly important because it gives answers to the two main questions posed by governments in the final hours of the 2015 Paris Agreement negotiation: first, would a limitation of global temperature to 1.5 °C, compared to pre-industrial temperatures, be possible economically and technically? And secondly, would there be a significant difference between an increase of 1.5 °C compared to the agreed-upon 2 °C target?

To better understand the novelty and the importance of this report we have to remember that before Paris, 2 °C seemed manageable and "only" a 4 °C increase was seen as the horizon of some kind of catastrophe. The Special Report, as cautious as it is on formulations, is clear about the fact that 1.5 °C *is the limit* beyond which drastic changes in the climate and therefore for human societies and economies will occur—and that there is a huge difference with a 2 °C change. That is why the nickname of the Report is "IPCC 1.5". The horizon of the drastic changes has therefore moved closer and closer.

The scientific warning is clear. But, having in mind the previous period the following questions remains: based on pure scientific knowledge could we forecast a "Catastrophic Scenario"? How do we accurately represent and convey the challenge of climate change and the gravity of the situation? Is it useful to portray climate change beyond 1.5 °C as a catastrophe? And what would this catastrophe look like? Over time, scientists and experts have been divided on these questions.

Some thought that insisting on the really dramatic consequences of going beyond 1.5 °C was needed to create understanding, organization and awareness. Others thought that the representation of the potential catastrophe would discourage any effort. With a growing acceptance of the need for strong and urgent action, this divide on how to name the future's scenario is at the heart of many interrogations.

The scientific establishment of climate change theory is a long story. Three recent narratives from very different backgrounds and with different purposes shed light on this story: science historians Naomi Oreskes and Erik Conway in *Merchants of doubt* (2010), "ecosocialist" Ian Angus with *Facing the Anthropocene* (2016), and the writer-journalist Nathaniel Rich in *Losing Earth* (2018). First, in this long story, it is important to keep in mind that the so-called "greenhouse effect", as well as the relation between fossil fuel consumption and global warming, are discoveries of the 19th century. Second, the constitution of Earth System science is concomitant with the

scientific advances of many disciplines during the end of the 19th century and the very beginning of the 20th century (physics, chemistry, geology, glaciology, etc.). After the Second World War, with increasing data processing capabilities, the invention of the computer and the digital revolution, what were previously assumptions turned into a real and robust corpus of consolidated and established relationships between the major elements and phenomena driving the shape and evolution of our planet's climate and ecosphere, and thereby its habitability for the Human species.

More surprisingly also, these narratives show that there were early warnings through science-based policy advisories to the governments (especially in the United States, USSR Russia and some European governments, specially in United Kingdom) (see Hansen, 2009). The debate was also brought to the international level at an early stage. The first climate conference in Geneva in February 1979 asking for "urgent action" (sic) also echoes the first US congressional hearing on carbon-dioxide buildup in the atmosphere where Gordon Mac Donald "*testified that the US should "take the initiative" and develop through the United Nations, a way to coordinate every nation's energy policy to address the problem*" (Rich, 2018). It was in 1980… 39 years ago!

There was, during the 70s and the 80s, a growing awareness of the global nature of the climate challenge. The 1985 Montreal Protocol on Substances that Deplete the Ozone Layer was perceived at that time as a success of international cooperation and a strong signal that the overall climate issue could be dealt with on time… But at the end of the decade with the election of George W. Bush in the US, the mainstreaming trend toward collective action in the international public debate was thwarted.

Nevertheless, all these scientific efforts, science-based policy advisories and international public debate led to the creation in 1988[1] of a very original institution: the IPCC. The IPCC is a very particular body that has configured and still configures the relationships between science, politics and policies, economic interests and citizenship—which constitute the core of a possible global collective action.

Since its creation and through its Assessment Reports and a few special reports, the IPCC has tried progressively to construct the scope and reduce the uncertainties about climate risks, and to establish and quantify the contribution of human activity to climate change. It has done this through a simple and robust method: producing state of the art climate science based on research that had been published and peer reviewed. The IPCC works through organizing the debate between different published works, in a comprehensive way, settling on methods and results that embrace the whole scope of scientific research on the matter. It then compares scenarios, trying to anticipate what future evolutions could look like, the probabilities that these evolutions will happen and the risks that these entail.

[1]The same year, one of the fathers of climate change theory, Jim Hansen, was testifying to the US Congress. He told them that there was an evident correlation between human activities, in particular emissions of greenhouse gases, including CO_2, and the modification of the climate system. In April 2013 after 46 years of working at NASA's research center, and being the most famous scientist to have called for action, Jim Hansen quit to spend more time on advocacy and action, including testifying against the government.

That is why these reports have been crucial to all the major achievements in terms of international coordination and action and have paced the milestones of the political process. The IPCC's first Assessment Report (AR) in 1990 preceded elaboration and signature of the United Nations Framework Convention on Climate Change (UNFCCC) at Rio's Earth Summit in 1992. The 1995 Report supported the adoption of the Kyoto Protocol; the 2007 Report (AR4) prepared the (failed) negotiation of a global agreement in Copenhagen; the 2014 Report (AR5) presided over the negotiation of the Paris Agreement; and in 2018 the 1.5 Special Report is opening the next phase.

The intention of the IPCC was to overcome the difficulty for policymakers to grasp the extent of the climate problem and, in a way, the above mentioned achievements is proof of a certain success. Nevertheless, the science-based diagnosis and recommendations were always formulated very cautiously; for internal scientific reasons (due to the fact that causal attribution of phenomenon is nothing but simple), and because of the sensitivity of the IPCC to the anti-scientist critics and pressures from some governments and lobbies.

The IPCC's approach, then, has been to portray climate change as a "risk", describing underlying drivers and establishing the possible ranges of probabilities, through a 'scientific consensus' approach. It is founded and based on the gathering of a vast array of climate scenarios, producing families of views to establish which (best) estimates of global warming seem to get consensus, and exclude the dissenting ones or the ones producing extremes results—the "tails" (Weitzman, 2011).

Time to Panic: From Risk and Catastrophism—a Critique to Risk Approach

The risk approach was broadened by Ulrich Beck with the "risk society" allowing to think the need of protection in a world of global uncertainties. Still the idea of the individual or collective capacity to mediate risk and to organize responses is at the core of his thought;

The scope of environmental and in particular climate risks has generated a revision of this conceptual framework. Ulrich Beck insist on giving a scientific status of the ecological threat but for some authors (Bourg, 2013) unable to size the challenge posed to humanity. Either by qualifying the risk of being transcendental to humanity because of potentially annihilating the mere conditions of existence, or considering that the risk concept gives a false perception of security when what is looming may well be, if unmitigated, unmanageable, these authors prefer the notion of threats.

Threat gives effectively the dimension of exteriority, potentially outside of the realm of human outreach, it connects with fear and the domain of emotions whereas risks refers to rationality.

The critics of risk approach came from three different lenses—the scientific, the economic, and the philosophical and ethical lens, giving birth to what we can call the "catastrophist" approach, shifting from risk to threat.

"Catastrophists" have been saying: "we need to speak about the catastrophe, not risk—or better a set of risks—, because showing how severe the outcomes will be, will motivate people, governments and institutions to take the necessary action." The shift from the notion of risk to the notion of catastrophe or catastrophic change is an attempt to invoke a moral, collective and global obligation for action.

Early on, some members of the scientific community began to criticize the IPCC approach as too conservative and failing consider many uncertainties. From the scientific point of view, the criticism was that the IPCC was underestimating the depth and scope of climate change. These critiques proved to be right in a lot of cases (Brysse, Oreskes, O'Reilly, & Oppenheimer, 2013). Concentrating on the middle ground of the scenarios—the median probabilities—and not the tails of extremes, the real risk and the reality were undervalued. It seems that the IPCC assessments, which incorporate the work of hundreds of scientists (258 main authors on the last assessment, not even counting the contributing authors) are inevitably structured to reach consensus and to avoid emphasizing dramatic outcomes.

Critics said that the possibility of moving towards catastrophic disruptions cannot be set aside, given that there are still some major unknowns in the climate system that would probably be irreversible: the saturation of the soils' capacity to absorb carbon, of ocean's capacity to absorb heat, or of the Earth's surface's capacity to reflect solar radiation, the degassing of the permafrost, the melting mechanism of the ice caps…

In particular, after the 18th Conference of the Parties to the UNFCCC (COP 18) in Doha, a group of climate experts warned that the IPCC was not adequately projecting the threats that rising carbon emissions represent. They stressed that the IPCC's overly conservative reading of the science and its dismissal of models that forecast major disruptions as outliers could lead governments and the public to be blindsided by the rapid onset of the flooding, extreme storms, drought, and other impacts associated with catastrophic global warming. Additional studies began concluding that the IPCC reports were underestimating climate change impacts and that key changes were happening even faster than anticipated: rainfall was becoming more intense in already rainy areas, surface ocean heat uptake and deep ocean warming were higher than expected, sea level rise had far exceeded predictions, melting of the Arctic sea ice was happening far beyond the models' predictions. CO_2 emission levels were also meeting the high-end scenarios developed in 1999 and applied in AR4, showing that scientists' "worst-case scenario" had in fact been realized.

Hansen argues that scientific reticence involves "*a tendency for 'gradualism' as new evidence comes to light*," and a "*pressure on scientists to be conservative*," to submit scientific papers that "*do not push too far and are larded with caveats*" (Hansen, 2007). An additional factor beyond the fear of being wrong is "behavioral discounting". This amounts to the belief that some ways of being wrong are considered worse than others. In particular, scientists' fear of "crying wolf" is more immediate than their fear of "fiddling while Rome burns". They call this "erring on the side of least drama"—or ESLD (Brysse et al., 2013). Other research shows how

and why scientists are vulnerable to climate change denial (Lewandowsky, Risbey, & Oreskes, 2015).

The shift from risk to catastrophe also came from a few economists; who had for the most previously been on the side of gradualism and underestimated the need for strong regulatory action.[2] Nicholas Stern in his seminal "Stern review" (Stern, 2006), showed that the cost-benefit analysis was factoring in the costs of action while completely ignoring the cost of impacts, because of uncertainty. Indeed mainstream economists systematically undervalued potential serious damages. As a starting point this leads to reasoning in terms of rational choice theory and insurance: decision-makers are confronted with a universe of choice where they can, much like in a lottery, ponder the probabilities of gain and loss. Yet economic models—by definition—exclude the possibility of the improbable but catastrophic (Dupuy, 2002). The aversion to uncertainty is profound.

Martin Weitzman argued that the analysis of climate in terms of risk was inadequate to account for the potential of catastrophic extremes (Weitzman, 2011). Scientific knowledge does not allow for the exclusion of these hypotheses. The risk than cities in Bangladesh, San Francisco or New York will be completely submerged is not really "insurable", but it is not impossible.

As Weitzman argued: "*the most striking feature of the economics of climate change is that its extreme downside is not negligible. Deep structural uncertainty about the "unknown unknowns" of what might go very wrong is coupled with essentially unlimited downside liability on possible planetary damages… these numbers do not look to me like evidence supporting "wait and see" policies. The capacity of the oceans to take up atmospheric heat, the saturation of carbon sinks, the loss of albedo, and many, many other relevant mechanisms tell a similar story of long stock-accumulation irreversibilities relative to the time it takes to filter out and act upon meaningful signals of impending disasters*." (Weitzman, 2011).

Yet most economists framed the discussion about action on climate change as a cost-benefit analysis, and climate risk as insurable. To use that framework, they then need to ignore "low probability and very high impact" events, as probabilities cannot be efficiently attributed to these phenomena. The rationale of the academic discipline is then to discard or to ignore them on the basis that "catastrophe is not insurable, so it cannot happen."

The philosophical perspective of enlightened catastrophism developed by Hans Jonas and Jean-Pierre Dupuy advocates for bringing the possibility of a catastrophe into the ethical realm. Because of the radical uncertainty of the climate future, it states that the unique moral position is to act as if it was to happen. In a way it could mirror the famous phrase of Nelson Mandela "it always seems impossible until it's done." It requires to believe in the possibility of the catastrophe to prevent it.

[2]Most economists, up to the publication of the Stern Review in 2006, and even after contributed to delay action or inaction. Imposing cost-benefit reasoning despite the uncertainties about impacts strengthened politicians in their consistent decisions to push back action to a later time.

The German sociologist Ulrich Beck who theorized second modernity as "risk society" (Beck, 1992) in his later published works developed the idea of "emancipatory catastrophism" (Beck, 2015), and questioned us about "how climate change might save the world" (Beck, 2014). In his unfinished book published posthumously, he developed a strong argument that, because of the immense threat of environmental crises, we are living a time of "metamorphosis" (Beck, 2016). The challenge, in his words, is to create a new cosmopolitism and a new "world order" because the ancient one (frequently named as Westphalian) is not able to tackle the issue of the catastrophe.

Whatever we might think about his solution it is clear that a drastic climate change puts the habitability of Earth at stake and generates chaos effects on societies, their economics and cultural characteristics. If it is an Earth issue then all humankind is involved—that is to say all and each citizen of each country. Climate without instability is in that sense a global public good—and due to its consequences on all aspects of human life on Earth the first and fundamental public good—all others depending on its provision, in a way or another. The late economic Nobel Prize winner Elinor Ostrom, argued as she always has done that neither market nor state are the only way to manage commons, and therefore put the accent on "polycentric approach" (Ostrom, 2009). That is to say that in all parts of the world people can and are contributing to the reduction of emissions and the preservation of the environment, while bearing in mind the multiscale of actions. As Ostrom put it: "*while we cannot solve all aspects of this problem by cumulatively taking action at local levels, we can make a difference, and we should,*"; but at the same time she was stressing the urgent necessity of international coordination (IRIN Global, 2012).

Climate change is a common problem and a problem of the global commons, and for this reason should be tackled by all governments, institutions, enterprises and citizens of the Earth. This brings us to a certain and new universality, defining at the same time part of the "all-mankind" ethics, even though participation in the production of this architectonic public good remains very dissymmetric. However there is also a double responsibility in terms of ethics: first towards the poorest and later industrialized countries (without even mentioning the most vulnerable countries: like Pacific islands and deltas,… or the most vulnerable communities directly dependent on conditions and natural resources radically changed by the climate modification); and secondly towards the future generations. By our action—or inaction—today, we are "producing" the world of tomorrow—the one of our children and grandchildren.

Intergenerational and world-equity responsibilities are not only a new area for international relations[3]; but putting the Earth's habitability at stake for our species redefines the realm of ethics. The very idea that we might have of man- and humankind is transformed by this unquestionable consubstantial relation to our

[3] As a counter example we can cite Henry Kissinger's latest book, a kind of geopolitical testament and manual of international relations that does not have a word on climate change and its implications for how we have think the world system today (Kissinger, 2015).

planet. The ethical sphere can no longer be limited to the individual or the different communities but extended to the universal through our common conditions of living, even if these are still going to be differentiated.

Inaction as a Response to Threat of Catastrophe

One obvious reason for this thwarted debate was, undoubtedly, the growing complexity of the question as these multiscale, multidimensional and international dimensions were brought in negotiations. In that sense if we can say that there is A global cosmopolite Enquiry about climate change, this collective Enquiry is fractioned in an immense set of local, sectorial, national, communitarian (etc.) enquiries. National interests, climate debt (of the old industrialized countries), technology transfers, etc. created an incredibly complex forum for the creation of an integrated and universal climate change regime.

However other elements must also be taken into account to explain the observed reluctance of all type of actors.

A first element is of course the political economy underlying potential action—or rather *inaction*. The active denial of the problem by a number of actors and in particular: the incumbents of the fossil fuel industry; large chunks of industry such as the chemical industry, heavy industries, agribusiness and the automotive sector (…); governments of fossil exporting countries and all the other groups that depend on the use of fossil fuels….

Together these actors constitute a very big share of the global economy, and support for their interests is well organized. They have for instance launched campaigns of doubt about the reality of climate change, its scope and its origin, and therefore also about the potential solutions needed. Naomi Oreskes and Erik Conway's seminal book *Merchants of Doubt* (2010) addresses what can only be described as a strategy that played on the uncertainty inherent to scientific research to deny the need to act. These maneuvers, fueled by "dark money" and the creation of institutions and campaign lobbies, has proved rather effective. These campaigns were based on and have sought to amplify the well-studied area of human psychology and cognitive biases. The catastrophe forecast was used in this campaigns to trigger human reflexes and biases.

Some scholars have named our reaction to catastrophic discourse "apocalypse fatigue" (Stoknes, 2015), confirming that several elements of human psychology are stopping us from taking the necessary action on climate change.

The first is **distance**; in terms both of time and geography. With regards to time, people tend to think that climate change is something that will happen in the distant future—it feels remote from the everyday, pressing concerns that are on people's minds. Even when its framed in terms of impacts on children, studies show that people with children are still too focused on the day-to-day challenges of raising a family to prioritize what they see as very-distant action. Many people also see climate change as something very global, which might therefore not affect them. It is rarely

presented as a local story, and since people do not think that the impacts of climate change will affect them, they are much less likely to change their own behaviors to mitigate these impacts.

Another critical element to consider, especially as we think about the best way to communicate on climate change, is the conclusion of many studies that the brain tries to avoid dealing with the doom conveyed by discourse on the apocalypse, collapse or catastrophe (Arnold, 2018). When people have the impression that the problem is too big and that there is nothing they can do; when something is too scary; or when they feel helpless and overwhelmed; they block it out. Further if they do not think that changing their behavior by themselves will solve such a big problem, then they do not do it.

This problem of incentivizing behavior change becomes particularly difficult where there is dissonance. What we know—like the fact that using fossil fuels and eating meat contributes to climate change—is often incompatible with what we do—like flying on airplanes and not being vegetarians (Stoknes, 2015). We all know that this dissonance exists, even for those already engaged in climate action. However because this dissonance is uncomfortable, the preferred option is often to avoid guilt through the justification of actions: by using the argument that changing lifestyles would not help—and at the most extreme, or at the most extreme outright denying the facts.

This dissonance is particularly difficult for people to come to terms with when it affects their identity, culture, and values (Kahan, Jenkins-Smith, & Braman, 2011). If people have a lot to lose personally, or the information they are receiving is not in line with what the people around them believe, it becomes even more difficult (Kahan, 2012). This can be seen in some of the places such as the American society, where climate change has become a sharply partisan issue. If Republicans are generally associated with an opposition to climate action, it becomes much more difficult for any individual Republican to take a pro-climate stance.

Nordhaus and Shellenberger explain this as follows: "*having been told that climate science demands that we fundamentally change our way of life, many Americans have, not surprisingly, concluded that the problem is not with their lifestyles but with what they've been told about the science*" (Nordaus & Shellenberger, 2009).

This shows the importance of considering the cultural context when we think about how to communicate with the public or the non-specialist. We cannot take a one-size-fits-all approach, or assume that the science speaks for itself.

Unleashing Action: The Theory of the Paris Agreement[4]

The design of the framework of the Paris Agreement was based on lessons learnt. After many years of failed attempts, constructing a global consensus on climate action required a recognition that the cognitive dissonance among the social actors would have to be addressed; as an obstacle beyond traditional political ones. The Paris Agreement machinery and delivery process were conceived in an attempt to overcome that dissonance and as a learning exercise: a social and political experiment.

Limiting global warming in a significant way supposes many economic, social and technological transformations. The scope and breadth of the change needed could not be directly envisaged without fear and indeed resistance. Governments and all actors were thus invited to progressively discover and explore the possible. As they explored the future, their expectations changed and came together. This was the theory of change behind the Paris Agreement, designed to generate the convergence of these expectations. From the very beginning, the message had to be: "the low-carbon economy is inevitable and desirable".

During the long six years between the conference on climate in Copenhagen in 2009 and the one in Paris in 2015, there was a major shift to bring the global to the local. This is particularly illustrated by the evolution of heads of states' statements at each COP.

In 2009 in Copenhagen, most of the statements were about the process and issues being debated such as common but differentiated responsibility, justice, finance. President Obama, for example, spent most of his speech talking about transparency, financing, and the design of a review mechanism (The White House Office of the Press Secretary, 2009). In 2015 in Paris, he started his speech by sharing what he had seen happen in Alaska: "*where the sea is already swallowing villages and eroding shorelines; where permafrost thaws and the tundra burns; where glaciers are melting at a pace unprecedented in modern times*." (The White House Office of the Press Secretary, 2015). This kind of message was echoed across each head of states' speech, in which they said "we have experienced the impacts of climate change in our own country, it is happening to us here and now."

This happened for a few reasons. One is the simple reality that President Obama remarked upon—that the impacts of climate change started to be felt even more strongly all around the world, and in rich countries too.

Another factor is the role that scientists progressively played in their own countries.

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[4]This part of our contribution is based on the experience of Laurence Tubiana as France's Climate Change Ambassador and Special Representative for COP21. She explains: "I have spent all of my career going back and forth between academia and government, and when I entered the government again to take on one of my greatest challenges—COP21—my goal in designing Paris was to draw on all of these theories and lessons. Both the lessons of past failures like Copenhagen, but also what we know about human behavior, and particularly what we know about the role expectation plays." Sir ***David MacKay*** Memorial ***Lecture***—Wednesday, 17 October 2018 Met Office, Exeter, England.

The IPCC is a global institution. Even if each country participates and negotiates the Summary for Policymakers, it operates on the basis of global consensus, and for the collective global understanding.

In the 2000s, national academies of science started taking climate change more and more seriously and generated their own specific reports: a process through which they took ownership of climate science and re-localized global knowledge. In the United States, President Bush asked the National Academy of Scientists in 2001 to review the IPCC findings, wanting to hear that climate change was not happening. However, the National Academy provided a report supporting the analysis of IPCC and describing the consequences of a warmer climate for United States. A similar process took place in China where several reports were published by national scientific academies (Gao, 2016). For the first time, Chinese voices were telling the government that China was going to be seriously impacted by climate change. Both of these examples show what bringing the global to the local means: having the voices of the people from your own country, your own region, your own city, sounds as a more convincing truth.

This approach proved successful in formal political processes too. Whereas the official declaration that came out of COP15 in Copenhagen clearly separated the political and scientific declarations, things changed with the production of national assessments. Many of the researchers were already participating in IPCC processes; but because they were saying the same thing in a nationally-owned publication, governments more readily relied on their findings.

Another challenge in incentivizing action on climate change has been the way in which people sometimes think of climate change as something that will happen in the distant future. This has however also been changing, notably due to the very visible and tangible increase in frequency and severity of extreme weather events. Hurricanes, typhoons, floods and heat waves have resulted in people dying and cities being destroyed in the present, rather than in some distant dystopia.

The discourse on climate change and its impacts has also progressively become closer in time. The first time climate change was seriously talked about was in the 1980s. Then, 2050 or 2100 were practically meaningless for a lot of people. Now as the IPCC indicates in its latest report, the next 12 years form the decisive period of action to avoid catastrophic climate change: the horizon has been brought closer to ordinary and daily management of desires, projects and plans. Most people on Earth will be alive in 12 years, and in fact in 2050. Many more people than before can imagine themselves living in 2050. The fast-growing engagement of the youth is the testimony of this change in time horizons.

It is with this purpose in mind, to bring the future to the present that a global stock-take and a revision mechanism—each on a 5-year basis—were embedded in the Paris Agreement. The thinking was that a progressive process of reassessment can reduce anxiety about new territories of actions. Asking countries to present by 2020 their 2050 de-carbonization plans consistent with the global goal of keeping global average temperatures to well below 2 °C and pursuing action to stay below 1.5 was another way to bring this future to their present. It allows them to imagine what the decarbonized economy would look like, to bring it to the present and make it more familiar.

Demonstrating that solutions exist, that they are known, that the tools are available to implement them and that the funds available to pay for them are important steps to avoid the blocking out of information, and denial.

Politicians and policymakers for instance need to offer solutions to be successful and to legitimate their position of power. They tend to deal with topics which they have some understanding and knowledge of, and which they feel most comfortable speaking about.

The way politicians deal with global macroeconomics illustrates this point well. Governments have very little control over global macroeconomics in reality. However, they seem to be in control because they understand it more or less, and because they have tools they know they can use (currency rate, debt, tax system…).

On the topic of climate change, people (politicians, policymakers and other actors) might accept that climate change is looming, but still consider it to be someone else's responsibility. A big challenge we faced ahead of COP21 when designing the policy toolkit to reduce emissions was to encourage governments to make their own commitments, when climate change as an issue seemed so aggregated and global. The many discussions before Paris and between 2009 and 2015 sought to figure out what the carbon budget of each country could be. Even if a distribution of the carbon budget could not be agreed, the idea was that countries still needed to figure out their carbon impact, and how they could change it. This was based on the understanding that countries cannot do everything they need to do immediately, but that they still need to think long-term. And in order to do that, countries need to understand the pathways to follow to get to the very deep emissions reductions that are necessary.

This is why it is crucial to make clear that the tools and solutions to address climate change exist, that they are well-known and familiar: the timeline, the carbon budget, the technology, the costs—it is all known. Policymakers, politicians and professionals can use all of these tools to make real choices that drive progress.

Citizens also need to be presented with solutions. It is important to let citizens know that there are solutions for their governments, that there are tools which their representatives can use, and to support citizens in holding their governments accountable for using these tools. It is also essential to ensure that the climate threat is communicated in a way that resonates with individuals, also showcasing the responses and solutions which they can themselves implement at different levels.

One way to expand the breadth of people reached is to use different messengers who have resonance with different local communities and appeal to people with varied sets of values and ideas. A recent success was the UK campaign through which sports figures talked about how climate change will affect sports. This was an efficient way to communicate, through figures that people feel connected to, that climate change is not an abstract, distant scientific phenomenon but that it threatens some of the things that are close to people's heart and daily lives.

Having a better diversity of messengers will also mean that the language used is better adapted. The phrase "climate change" for example does not affect everyone in the same way; in fact, many people reject it. However many of the same people respond enthusiastically to topics such as nature or biodiversity conservation, clean energy and energy independence. Climate change is the most complex challenge

of our time, and we need to develop a complexity of language that is equal to the challenge.

It is everyone's responsibility to take action consistent with Paris. Because of the complexity and the scope of climate action needed, it cannot be the sole responsibility of national government officials. The Paris Agreement sought to have a common and shared objective among a whole set of actors: national governments, but also sub-national governments, economic actors, investors and international institutions that have their own governance structures and their own decision-making processes, as well of course as individuals and civil society organizations. What was most important was for them to support the shared Paris goal, to design how their activity would evolve consistently with this goal. Envisaging the implementation of the Agreement as an across-the-board activity is a powerful way of making expectations converge, which in itself is a formidable tool of implementation and enforcement. It offers a resilience to the Agreement itself because of the checks and balances it relies on, which was intentional integrated. Political headwinds were expected to come, which is why a lot of actors were brought together. Their mobilization also enabled the result reached: the acceptance and support of the Paris Agreement goal being adopted far beyond the governments that signed it.

As a Conclusion: Reenacting Dewey's Enquiry Approach?

We have used the terms "experiment" and "learning process" when describing the Paris Agreement. As part of this conclusion we can expand this idea by reactivating certain aspects of John Dewey's thinking and his original interpretation of pragmatism (Dewey, Rogers, 2012). The entry into the era of the Anthropocene—even if it must still be confirmed by geological science—is a new situation with various consequences. It requires action based on knowledge: first the carrying out a diagnosis of change, then putting solutions into place, in response to the economic, political, ethical and scientific implications stemming from this change. There are therefore important epistemological implications, and Dewey's notion of "experimentalism" is useful in framing the question.

We have seen for example that the shift from risk to threat and catastrophe is not a purely "scientific" question but rather linked to the conditions of action and inaction; the question was therefore not to know from an essentialist point of view whether it is "true" that what we are confronted to with climate change, is either an anticipated risk, or an announced catastrophe.

We are in a situation in which action and knowledge are fundamentally linked, as was adamantly affirmed by the philosopher. Inquiry, action and knowledge production are consubstantially linked (Dewey, 1938). The question is not about universals, invariants and scientific knowledge that would be separated from the domain of action through their own rules of production and rationality (which furthermore exist). This knowledge is interpreted, used and understood, *but also produced* by an intention for action and by action itself. The global enquiry around the threat of

global warming can be precisely described as a way to construct the possibility of action, building the acceptance of the magnitude of the threat, processing knowledge to anticipate the potential catastrophe while constituting progressively a collective, a public in Deweyan sense. Recognizing the threat, coming to terms with it, has been and hopefully will be the condition of action.

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