



TELMO PIEVANI

Life on the Earth is a long story of extinction, adaptation and evolution, in which the concept of change is a leitmotif. Does climate change present peculiar characteristics? How are we to interpret it in terms of biodiversity and survival of the species?

I wish to express thanks for the invitation to take part in this discussion. Time for the session has nearly run out, therefore I will be brief, because evolution teaches us that selective competition between philosophy and hunger has a foregone conclusion: hunger wins every time. In just a few minutes, I will give you my take on the subject, and I am particularly grateful for being invited here today because it has been decided – not without significance - to interpret the crucial issue of this morning also from an evolutionary angle. The debate this morning - and yet to take place this afternoon - is of significant interest for a philosopher of science. It is instructive to see scientists discussing and debating issues. I fear that it has not been easy to remain coldly objective, and it will be even less easy this afternoon, but the question is of real interest to an epistemologist because this is a field, as we've seen, where very different methodologies abound: not only the raw empirical data, but also the interpretations we place on it, the models, the simulations and the projections into the future.

The difficulties of method here are objective, not only linked to the various alignments, because in this area of research it is not always easy to know what is a cause, a consequence, an effect, where the data lead us ; or to know where, on the other hand, other things become significant - matters such as interpretation, relations with ethics and politics and, even more so, the time and space of analysis, as well as the delicate issue of when a scientist should advance forecasts i.e. reasoned and supported predictions, which are always risky by definition. But Karl Popper reminds us that precisely because it is a risky – and therefore falsifiable - venture, prediction constitutes an indispensable instrument of knowledge for science. Prediction is that activity by which any single scientist can independently seek to verify and if necessary refute, revise or supplement the theory's conclusions.

However I don't wish to dwell on this issue in the short time that remains. I am in agreement with what was said at the beginning about the concept of the session, namely that the extreme polarisations on the climate issue – between the negationists and sceptics on the one hand and the catastrophists on the other – are redundant. These polarisations, apart from some exceptions politicised within the scientific field, relate above all to the dramatic translation of these debates in newspapers and other mass media, which especially in this country suffer the effects of a huge cultural time-lag in relation to familiarity with science and with the rules of scientific research. We must understand - and more effectively communicate - the nature of scientific consensus, and we must understand how a different scientific conclusion can be reached which, however authoritative and competent, is isolated from the serious and well thought-out conclusions reached by an entire network of scientific institutions. It should be clear which of the two sources we ought to lend our trust to. If the scientific consensus holds that it is highly probable that human activities are the cause of global climate warming, the political classes must face this consensus with resolve and without exaggeration or alarmism, rather than exploiting the occasional negationist seeking to promote him or herself. Mass media polarisation is sterile because it is based more on blame than on rationality, as we saw, and I would add that it is based on an exaggerated way of conceiving nature, so that there are some who would absolve the human race of all responsibility and others who would constantly air the tired Promethean formula of man upsetting the atavistic balance of a provident, all-wise nature. Or there are others who express a certain fatalism, holding that because it is natural, there is not much we can do about it. If we think about how these arguments are presented when brought to these extremes, we will see that they are based on implicit concepts: for example the temptation to associate nature with the idea of equilibrium. Whether it is understood as a very fragile equilibrium which we are disturbing or as a stable equilibrium which is simply there and which we can do little about: the basic concept is that nature is a reliable and harmonious environment. Still, it is not difficult to question this implicit concept: nature – at least in light of our careful examination of how non-linear systems function – is an environment in which there is permanent disequilibrium, incessant change and transformation.

Another problematic concept from the evolutionary point of view is that of sustainability: what does it mean to have sustainable practices in relation to nature? We know that ethically and politically this represents a fundamental appeal, if we wish to survive on this planet of ours, but from the perspective of deep time, the natural history of *Homo sapiens* has never been very “sustainable”, difficult as it may be to admit it. Nor was it very sustainable prior to the agricultural revolution, before the Neolithic period, when we learnt to produce resources in surplus to natural resources, thereby forcing existing ecosystems. If you look at the evolutionary models of the human colonisation of the Americas, for instance, you will see that when the sapiens hunter-gatherers arrived, a mass extinction occurred from north to south of all the large-size mammal megafauna inhabiting those areas. It is likely that it was us who wiped them out thousands of years before the Agricultural Revolution, and this is also the case in Australia and the Pacific. The very important message, which merits reflection, is this: the human race has always been a species that ‘upsets’, one that migrates, adapts and moves, altering the surrounding environments and overcoming external obstacles thanks to culture and technology. As such, the human species from the very beginning has had a strong impact on ecosystem networks. Thus we must try to understand what we mean by sustainability: the meaning we give it should at least be a dynamic one and not merely reflect the idea of conserving what exists, because if we limit ourselves to the latter meaning we again risk embracing one of those illusory implicit concepts.

Having said that, what has evolution itself to teach us? At least three things, and I will be brief. The first is simply the perspective of deep time which is frequently hidden in these discussions. Thanks in particular to the contribution of Professor Orombelli, however, we have seen how one’s perspective can change in light of our planet’s great geological timespan: the tables he displayed showed that if we use a timescale of millions of years, we register very radical variations in global temperature. The American paleontologist Stephen Jay Gould always taught that the Earth has gone through the mill: literally, it has been much colder as well as much hotter than it is today. This declaration, however, is not an alibi for doing nothing now: it simply offers a way of understanding exactly what happened in the distant past and why today, on the other hand, a plateau appears, as the tables tell us i.e. a reduction in instability, which is a very interesting fact worthy of analysis in relation to the most recent climatic changes caused by the onset of industrial development.

But deep time tells so many other things which have only been mentioned in passing this morning. One aspect deserves emphasis again: in this evolution of the dynamic equilibrium of ecosystems, life - the biological aspect - has played a fundamental role. A number of interesting papers have come out recently on the subject. For thousands of years, living organisms have contributed to transforming the planet’s auto-regulation mechanisms: we think of the quantity of oxygen in the atmosphere, of the role of photosynthesis in the history of the planet. Life, therefore, is a fundamental component of the “geophysiology” of the Earth. The theory of evolution teaches us that there have been huge global crises in the planet’s history, not simply great variations in temperature. If we observe the course of our planet’s biodiversity across time, mass extinction has occurred on a global scale at least five times; it had natural causes which we are investigating and are well-known today, but which remind us how many times the Earth has gone through extremely radical crises. Then – like forest fires which remove everything in their way – they free up ecological space and allow the machine of diversity to be set in motion once more: life beginning its multiplication of forms each time.

Deep time also leaves us with a different kind of evidence, somewhat brutal in nature. If we carry out a theoretical exercise and apply the parameters of species destruction and extinction which occurred during these five mass extinctions of the past - the last of which (sixty-five million years ago) led to the extinction of almost all dinosaurs and indirectly of many other living species, opening up the opportunity to kick-start the evolutionary process once again and to become diversified as mammals – if we apply those parameters of destruction to the last twelve thousand years of the planet’s history, we discover very similar quantitative indices, but this time produced by human activity alone. The great entomologist and biodiversity expert from Harvard, Edward O. Wilson, spoke of a “sixth mass extinction” i.e. literally a new process of global extinction of biodiversity similar to the one which occurred in the past - where the cause of this destruction is not comets, asteroids, glaciations, continental drift, eruptions or other paroxysmal phenomena - but the activity of the human species.

I could produce a further unpleasant datum suggested to us by evolution, which philosophically and even ethically we should take account of: if, tomorrow morning, we all decided as a race to behave in the most destructive way possible for the environment and for ourselves – for example releasing the whole arsenal of weapons of mass destruction still available to the stronger nations - evolution teaches us that life will continue in any case, that there will be a new history, a new diversification. It has already happened at different times, but it would certainly be the first time for this to happen as a result of the decision, irrational and abominable as it would be, of one species alone. A final important aspect which merits attention – to which Edward O. Wilson as well as

many other biodiversity researchers have again recalled us – is that yes, life will go on in any case, but this does not take from the fact that we, today, are actually engaged in concrete actions, and we are a completely novel species. Wilson noted that the problem is that we are all engaged in them together: we are fragmenting habitats; we have spread invasive species throughout the planet, transporting species into the wrong place at the wrong time; injurious and disruptive human populations are on the increase, which even still some would deny, imagining that life will persist without end on an infinite planet; chemical substances have been introduced which evolution certainly never intended for the adaptation of many species, and for a long time now there has occurred the super-exploitation of many biological resources through hunting and fishing. Wilson reminds us that these factors taken one by one would not be dramatic: the problem is that we have for some time ensured that all of them are converging. Effects which multiply can be highly dangerous.

Often, when this kind of discourse about deep time occurs, many people accuse the evolutionists of being somewhat cynical and anti-anthropocentric: in reality these reflections, which place the presence of the human race into perspective by silhouetting that human race against a history of four billion years, are of significant human value and represent an important basis for ethical reflection for mankind, resting on three grounds for humility. The first emerged this morning: the strict interdependence of issues, an interdependence, we were reminded, not only of the factors which operate and which create these situations and which ensure that predictive models are difficult to come by, but an interdependence also in relation to what we wish to do regarding the dimensions of human activities, the possible solutions for the environmental crisis. One single example should suffice: the issue was not touched on this morning, but from an ethical and philosophical point of view, I cannot find a single rational argument of sufficient validity to enable me to tell a fellow *Homo sapiens* living in a different part of this planet that, at the very moment when I am making efforts to understand sustainable development, he should try to avoid pursuing the same process of development which I have pursued to date. I can find no ethical or political argument to enable me to explain to him that he should interrupt or slow down the developmental process he is engaged in, so as not to create further environmental damage. This is a big problem of rational argumentation, a significant political problem which, I think, indicates that the environmental question is a scientific one at a time when it is also a great political challenge associated with the redistribution of wealth. Second idea: Italy is a country which has inherited a difficult history from this point of view, a story of splits and misunderstandings between “two cultures” which hardly communicated with one another. Now, however, the culture of environmentalism - or of those who have a strong ethical sense that these themes need to be worked on in order to locate innovative political solutions - and, on the other side, the language and culture of scientific research are finally beginning to enter into more meaningful dialogue, even if it's not yet enough. Many are beginning to address a theme which I believe is important: what are the fundamentals of a future scientific environmentalism, namely a mode of reasoning on these issues which manages to avoid both an environmentalism tinged by an anti-technological and anti-scientific bias – unfortunately an ancient tradition here in Italy – and an overly cynical scientific approach. Today, however, we can get around this stark opposition: in the middle are the scientists who are conducting serious work with environmental spin-offs and promising applications, there are the new-generation philosophers who are seeking to establish the fundamentals of this scientific environmentalism, and there are environmentalists who no longer regard the scientific and technological enterprise with misconceived perplexity or fear. A final idea. I spoke before about nature and the way we relate to it, imagining that it is the bestower of harmony, providence and equilibrium or - on the other hand - the nemesis that is ready to punish us as soon as we take up arrogant positions against it: two opposed and equally misconceived caricatures. Why? Because at the end of the analysis I believe they are an alibi: we often use nature as an alibi. You only have to think how in public debate we resort to appeals to nature, to the laws of nature, to natural behaviour. Even behaviour regarded as being “against nature” has again entered the debate. Nature is a good alibi because it appears to us to be stable, reliable, trustworthy like granite: when we are uncertain about something or do not wish to take on too much responsibility, we trust nature. So I will conclude with a provocative question: think of recent catastrophes which have affected our species - the tsunami in the Indian Ocean, hurricane Katrina which destroyed New Orleans. You will have observed that those days the most-used phrase to describe what happened was “natural disaster”. But in what precise sense is a tsunami a natural catastrophe? In what sense is the hurricane which destroys a city a natural catastrophe? Submarine earthquakes have always existed on Earth, tsunamis have existed since these kinds of dynamics first occurred, hurricanes are an absolutely normal phenomenon, only their effects on cities are not. If we build a city in a zone where there are hurricanes, earthquakes or landslides and we fail to protect it adequately, then this is not a “natural” disaster it is a cultural, politically and typically human disaster. Therefore let's not use nature as an alibi to remove our responsibility for the choices we must make and those we have already made. Deep time teaches us to understand that instability

is the rule and that it does not occur as a result of hostile fate, but for reasons we can understand. If global warming is a negative trend for us and human activities are responsible for it, the problem is not the planet in itself but the race of so-called Homo "sapiens", which fails to notice that it is cutting away at the fragile evolutionary branch on which it has evolved.
Thank you.