11

KNOWLEDGE, RESPONSIBILITY AND ETHICS OF SUSTAINABILITY IN VIEW OF THE GLOBAL CHANGE

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Abstract: This article explores the interrelationship among scientific knowledge, ethical debates and the question of responsibility through sustainability thinking. In a globalising world which appears to be establishing itself, sustainability should form the basis for achieving a new ethics, shared on both a local and global scale. The *sustainability culture* should become an integral part in this process, in which the rights of future generations, of non-human species and global shared resources are taken into account. Sustainable culture is, in fact, an inevitable process that will involve changes in many of the established stances of society, science and ethics.[1]

Keywords: *Knowledge - Responsibility - Ethics - Sustainability - Globalisation*

[1] The figures provided here, along with other worldwide figures cited in the paragraphs below, follow the historical interpretation of McNeill (2000), "Some of them may also be seen", McNeill (2006, 175-184).

SYMPTOMS AND INDICATORS OF GLOBAL CHANGE

We are living in a global world where transnational and planetary connections have transformed our ways of living and thinking. In the early 16th century, in a feat of daring unheard of before then, Ferdinand Magellan and Juan Sebastián Elcano took three years (1519-1522) to circumnavigate the world. Later, a 19th century traveller, using motorways, railways and steamboats, needed 80 days to go around the world. In the late 20th century, jets made these same round-the-world journeys by air in just 24 hours. In the early 21st century, an astronaut circles our planet in his spaceship approximately every hour and a half. To the mind of Peter Sloterdijk, this trajectory traces a pathway taken throughout Modernity, marked by a transcendental philosophical change: the job of sketching the new image of the world has shifted from the metaphysicists to the geographers, sailors and now pilots and astronauts. From the 15th to 16th centuries, the confines of the Earth shifted from the metaphysicists to the sailors, cartographers, conquerors, merchants and missioners in a massive race to draw and depict the image of the world, which ultimately culminated in the space race of the second half of the 20th century, which lies halfway between technology and metaphysics:

> The goal now is to encompass and physically go around this real Earth, like an irregularly stratified, chaotically folded body eroded by storms. For this reason, the new image of the Earth, of the globe, became a guiding icon in the modern world view. From Behaim's globe from Nuremberg dating from 1492 – the oldest of its kind still conserved today – to NASA's latest photograms of the Earth and the shots taken from the Mir space station, the cosmological progress of Modernity is marked by the formal changes and fine-tunings in the image of the Earth made possible by technical means. But never – not even in the age of space travel – could the boldness of visualising the Earth conceal its semi-metaphysical nature. (Sloterdijk, 2007, 39).

The technological, social and cultural changes associated with the evolution of humanity in recent millennia or centuries are still surprising for both their boldness and their risks. When human beings invented agriculture (around 10,000-12,000 years ago), the world population probably hovered at between 2 and 20 million people. At that time, the population of some primates, like baboons, was higher than the human population. But with the introduction of agriculture came the first major

surge in the number of human beings. The population grew much more quickly than before, probably between 10 and 1,000 times more quickly. However, its annual rise was quite slow, equivalent to tiny fractions of percents. In the year AD 1, the planet sustained from 200 to 300 million people (a figure equal to Indonesia or the United States today). In AD 1500, the world population had reached 400 or 500 million. Around one and a half millennia had been needed for the world population to double, and it had risen at a rate far below 0.1 percent per year. From then on, the world population kept rising steadily, reaching 700 million in around 1730. At that point, its growth started to rise sharply, triggering the prolonged expansion that still exists today. In 1820, the human population hovered at around one billion. In 1900 it reached 1.6 billion, and by 2000 it had reached 6 billion.[2]

This process of human expansion has also come, not coincidentally, with a rise in the use of energy. Human beings' efficiency, for example, is around 18 percent. Of every 100 calories a human being consumes as food (a concentrated form of chemical energy), it only turns 18 into mechanical energy. The other calories are lost, almost always as residual heat. The advance of itinerant agriculture starting in the Neolithic probably multiplied the availability of energy to be gotten from hunting and gathering by ten; later on, stable agriculture multiplied it by ten once again.

Lately, the expansion in the energy sources handled has been an indispensable requirement in human life on a global scale. In the 19th century, the amount of energy obtained all over the world multiplied by approximately five thanks to the influence of steam and coal. In the 20th century, it multiplied by 16 with oil, natural gas (starting in 1950) and, to a lesser extent, nuclear energy. Since 1900 we have probably used more energy than all of human history before then: in the 20th century, the world consumed ten times more energy than in the thousand years prior to 1900. In the 100 centuries which range from the dawn of agriculture until 1900, humanity had consumed around two-thirds of the energy expended in the 20th century alone. The economic and demographic growth of the past two centuries would have been utterly impossible without this silent revolution in the expansion of somatic

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energy. In the 1990s, one human being used an average of 20 "energy slaves", that is, the equivalent of 20 human beings working for him 24 hours a day 365 days a year. The magnitude of the global changes in the past century is truly surprising (see these figures studied by John R. McNeill in the table below).

20TH CENTURY MAGNITUDES (John R. McNeill 2000)	**Factor of increase: 1890s to 1990s**
World population	4
Proportion of urban population over world population	3
Total urban population in the world	13
World economy	14
Industrial production	40
Energy consumption	16
Coal production	7
Air pollution	~5
Carbon dioxide emissions	17
Sulphur dioxide emissions	13
Lead emissions into the air	~8
Water consumption	9
Sea fishing	35
Livestock population	4
Swine population	9
Horse population	1.1
Blue whale population (only Antarctica)	0.0025
(99.75% drop)	
Common whale population	0.03 (97% drop)
Bird and mammal species	0.99 (1% drop)
Land area watered	5
Wooded area	0.8
Croplands	2

It is obvious that *mondialisation* and globalisation have grown exponentially, while the universalisation of values and rights have meandered along a slower pathway on a planet with symptoms of social and environmental unsustainability (United Nations Environment Programme, 2007): almost 60% of the services of the planet's ecosystems are depleted, and the average temperature on Earth has risen 0.74 ºC since 1906 due to greenhouse gases. Since 1987, when the concept of "sustainable development" was coined, the world population has risen from 5 billion to 6.7 billion people, and trade had tripled by 2007. Meanwhile, 2.6 billion people lack basic facilities (sewage systems and potable water supply), and one child under the age of five dies every five seconds for reasons that are fully preventable (Save the Children, 2008). In view of the scientific and technological knowledge of these symptoms, which signal a systemic change on a global scale, we must wonder about the scope of our responsibility – already formulated by Hans Jonas in *Das Prinzip Verantwortung* (1979) – and above all, we must reflect on the problem and issues for managing a global world where the ethos of the triple economic, social and ecological accounting would be borne in mind for both today's generation and for future generations on a limited planet.

TWO DIFFERENT EARTH ETHICS: THE HEIDEGGER-LÉVINAS CLASH

Having expanded his scope of action to the global scale, the human being is compelled to rethink the ancient ethical formulas. Among the different possibilities, two traditional forms clamour for attention as they posit the role of the human being with regard to his link to the planet Earth. I shall call these two positions or possibilities the *ethics of humus* and the *ethics of space*, respectively. The former is the position hinted at or sketched out by Martin Heidegger, and the latter is the position upheld by Emmanuel Lévinas.

The "ethics of humus" was suggested by Heidegger in several different sections (from 39 to 44) of his book *Being and Time*, in which he focuses on the analysis of care as the ontological-existential category of the *Dasein*. Specifically, in section 42 the German thinker explains one of the cases of care – *Sorge* – through the ancient fable 220 of Hyginus (Heidegger, 2003, 219), which features the mythological figure of Cura – the Latin term usually translated as *care*:

> Cura cum fluvium transiret, videt cretosum lutum
> sustulitque cogitabunda atque coepit fingere.
> dum deliberat quid iam fecisset, Jovis intervenit.
> rogat eum Cura ut det illi spiritum, et facile impetrat.
> cui cum vellet Cura nomen ex sese ipsa imponere,
> Jovis prohibuit suumque nomen ei dandum esse dictitat.
> dum Cura et Jovis disceptant, Tellus surrexit simul
> suumque nomen esse volt cui corpus praebuerit suum.
> sumpserunt Saturnum iudicem, is sic aecus iudicat:
> 'tu Jovis quia spiritum dedisti, in morte spiritum,
> tuque Tellus, quia dedisti corpus, corpus recipito,
> Cura enim quia prima finxit, teneat quamdiu vixerit.
> sed quae nunc de nomine eius vobis controversia est,
> homo vocetur, quia videtur esse factus ex humo'.

In crossing a river, Cura saw clay and began to mould it, engrossed in thought. As she was thinking about what she had already made, Jove appeared. Cura asked him to grant it *spiritus*, *breath* or *spirit*, and readily grants her request. Cura wanted to give it his name, but Jove refused and asked her to give it her own. While they were arguing, Tellus (Earth) appeared and wanted it to have her name because she had given it her body. They took equitable Saturn as their judge, who determined:

> You, Jove because you gave it your spirit, you should have it in death; and you, Earth, since you gave it your body you should receive the body; and since Cura had been the first to shape it, she would have it in life. And to resolve the debate among you as to its name, it shall be called *homo*, *human being*, because it was made from humus, the earth.

Without delving any further into Heidegger's reinterpretation of this Latin fable, the crux of the matter is the reference to the etymological origin of humans: human beings (*homo*) get their name from humus, the layer of soil or earth that is generated through the decomposition of animal and plant matter and minerals. Thus, the possibility remains open of re-linking humans in their being located in a place (*Dasein*), which is none other than the very Earth that we inhabit and dwell on, to such an extent that the human comes from the humus itself. This kind of pre-modern and pre-technological proposition may contrast with an *ethics of space*, the kind of ethics that corresponds to an age of astronauts and technological journeys through outer space. This is the claim put forth by

Emmanuel Lévinas on space journeys as the shapers of a post-Heidegger image of the world. In his essay *Heidegger, Gagarin and Us* (Lévinas, 2004, 289-292), Lévinas first summarises Heidegger's position on the image of the modern world in the following terms:

> I think about Heidegger and the Heideggerians. The desire was for man to get back the *world*. Men would have lost it and would not have known anything other than the matter that is in front of them, *objected*, in a certain sense, to their freedom. They would not know more than *objects*.
>
> Getting back the world means getting back a childhood mysteriously nestled in Place, opening oneself up to the light of the great landscapes, to the fascination with nature, to the majesty with which the mountains settle; it means following a path that wends its way through the fields; it means feeling the unity of a bridge that connects both banks of the river and the architecture of buildings, feeling the presence of a tree, the chiaroscuro of the forests, the mystery of things, of a quarry, of a peasant's worn out shoes, the glimmer of a pitcher of wine on a white tablecloth. The very *Being* of the real is manifested behind these privileged experiences, giving itself to and trusting itself in the stewardship of man. And man, the guardian of Being, would get his existence and truth from this grace. (Lévinas, 2004, 290).

Given this ethics of humus, of place, of the pathways and clearings of the forest that shapes Heidegger's image of the world and the Earth, Lévinas contrasts the image of the world and the Earth provided to us by astronauts since Yuri Gagarin's first space journey:

> The embeddeness in a landscape, the adhesion to a *Place* without which the universe would be insignificant and would barely exist, is humanity's division into natives and foreigners. And from this perspective, technology is less dangerous than the geniuses of *Place*.
>
> Technology eliminates the privilege of this rootedness and the exile that it refers to. It frees us from this alternative. The goal is not to return to nomadism, which is as incapable of leaving a landscape and a climate as sedentary existence is. Technology breaks us out from Heidegger's world and the superstitions of *Place*. Based on this, a possibility appears: that of perceiving men without taking into account the location where they are, that of letting the human face shine in all its bareness. Socrates preferred the city over the countryside and trees, because that is where he encountered men. Judaism is the brother to

> this Socratic message.
>
> What is admirable about Gagarin's feat is certainly not his magnificent Luna Park performance which impresses the crowds; it is not the sporting achievement of having gone further than the others and broken the world records for height and speed. What counts more is the probable opening up of new forms of knowledge and new technological possibilities, Gagarin's personal courage and virtues, the science that made the feat possible and everything which that in turn assumes in the way of abnegation and sacrifice. But what perhaps counts most of all is that he left the Place. For one hour, man existed beyond any horizon – everything around him was sky or, more exactly, everything geometric space. A man existed in the absolute of geometric space. (Lévinas, 2004, 291)

In the age of globalisation, from Lévinas' vantage point, the human being is no longer simple humus, because he is transhumant, he changes places and lands all over the planet, as perceived by an astronaut from a technological spaceship. Thus, we have two apparently contrasting theses: first, an ethics located in the here of the earth and forests, in the realm of the peasant provinces and native regions, which mistrusts modern science and technology, and secondly, a globalised ethics nestled in the sidereal realm, beyond all horizons and places, which does not mistrust contemporary science and technology. Both aim to think about human beings' relationship to the Earth, but one seems to drift towards the local-topographical and the other towards the global-spatial. Both point to two necessary directions in view of global change, and both surely signal if not two opposite tendencies, at least two tensions that must exist in contemporary applied ethics between the local and the global, or, if you will, between the global and the local, which both theses posit.

SCIENCE, RESPONSIBILITY AND GLOBAL SUSTAINABILITY

In the clash between the local and the global, the ethos of science has undergone a move towards responsibility, which entails a shift in its historical evolution since modernity. As Janez Potočnik, the European Commissioner for Science and Research between 2004 and 2009, and the current European Commissioner for the Environment, put it in his speech delivered at the *World Science Forum* in Budapest in November 2005 (Potočnik, 2005), the development of modern science has altered

the function of three historical values: truth, progress and responsibility. These three values, which have helped to construct our modern societies in both Europe and other parts of the world, have had diverse influences in three successive waves in the modern history of science:

- The age of truth: from the Renaissance to the Enlightenment, the period from the 16th to 18th centuries.
- The age of progress: the Industrial Revolution, basically the 19th century.
- The age of responsibility: the Knowledge Society (or Knowledge-Based Society), the second half of the 20th century.

From the historical experience of the 16th to 18th centuries, we have inherited the mission to discover the underlying laws of nature. Galileo and Kepler ushered in this new cognitive and methodological age based on observations and experiments. In it, the topmost value was epistemological, the quest for the truth aside from individual or particular beliefs, which should not interfere with science. This value was expressed in the fundamental principles of academic freedom, and it partly ensured the legitimisation of the self-governance of the scientific community. Starting in the 19th century, in addition to the endless quest for the truth, the value of progress came to the fore by observing that scientific discoveries come with technological developments that positively affect our lives, just as positivists of all stripes had dreamt about. These impacts, which were initially positive, opened up new areas for economic activity and for the growth of industry or labour.

In the 20th century, scientific and technological developments retained their cognitive, emancipating promises, but since then the limits of the concepts of truth and progress have also been revealed. First, we have realised that scientific knowledge does not correspond to an absolute truth or a pre-existing reality, rather to efficient ways of representation that enable us to predict phenomena or interact with them. Likewise, the second half of the 20th century spurred new political and social concerns related to the limits of technological progress:

Abuse of technologies with the use of the atom bomb and other forms of mass destruction.

Sustainability problems with the first oil crisis, pollution, biodiversity and climate change.

Ethical questions, chiefly but not exclusively related to biotechnology.

Thus, doubt was cast on the Baconian statement that knowledge is power, understood as control and prediction. These new fronts of political and ethical concern have led science to be acknowledged as an ambivalent activity that cannot be blindly associated with automatic progress, accepting that science is both part of the problem and part of the solution. In this way, the value of responsibility has come to be part of the evaluation of science and technology, compared to the traditional values of truth and progress. Science has become yet another issue on the political agenda, something that would have been unthinkable for our grandparents.

With the relationship between science and society transformed, part of the new ethos of responsible science entails wondering about this globalisation of the planet Earth, and more specifically about the limits of some of the fundamental indicators. First, before getting ahead of myself, it is worth recalling that if we distilled the history of the Earth into a three-hour film, our species would appear in the last second, and our history would only appear in the last hundredth of a second in that film. If an astronaut who had read Lévinas watched this film from space and blinked at this last instant, all the information on humanity would be lost. So having said this, in the last part of this last hundredth of a second, human beings have managed to travel to the Moon, but also to alter some of the thresholds and patterns in the dynamic of the Earth's system. In a recent study in the magazine Nature, Johan Rockström of the Resilience Centre at the University of Stockholm and 28 other scientists from universities and institutes from Europe, North America and Australia set forth the critical limits and thresholds of the planet that humans must respect in order to avoid destabilising the Earth's essential systems, as these violations might trigger abrupt, non-linear changes (Rockström, 2009, 472-475). Based on their analysis, Rockström and his extensive team have detected nine key processes in the planetary dynamic:

1. Climate change
2. Loss of biodiversity (land and sea)
3. Interference in global nitrogen and phosphorous cycles
4. Destruction of the stratospheric ozone layer
5. Acidification of the ocean
6. Global consumption of fresh water
7. Changes in land use
8. Chemical pollution
9. Concentration of aerosols in the air

Three of these nine limits have already been violated beyond reasonable limits: global warming, species extinction and the nitrogen cycle. Four other processes are on the verge of being violated as well: the use or consumption of fresh water, the conversion of forests into croplands, the acidification of the oceans and the alteration of the phosphorous cycle. The changes to the limits of the planet due to anthropogenic activities since the late 18th century – the dawning of the Industrial Revolution – are so great that some scientists (Clark, Crutzen & Schellnhuber, 2005) even claim that we have altered the geological chronology of the Quaternary Period and the Holocene has shifted to a new age, the Anthropocene, an age in which humanity emerges as a global geological force capable of modifying the planet's surface and atmosphere. The major challenge facing science and technology today is to investigate and act to prevent the transformations in all these critical thresholds from becoming collapses or catastrophes (Costanza, Graumlich & Steffen, 2007), both globally and locally.

MONDIALISATION, GLOBALISATION AND UNIVERSALISATION

The evidence that we are experiencing a global change also merits other considerations. Thus, in a global world like today's we can claim that we are living in the "network-society of information and global risk" – coupling the theses of Manuel Castells (Castells, 2006) and Ulrich Beck (Beck, 2002). This social form is experiencing an unprecedented techno-economic expansion in which three superimposed but not equivalent phenomena converge: mondialisation, globalisation and universalisation.[3]

1. Mondialisation: French analysts tend to talk about mondialisation. This is the planetarisation of communications, of certain cultural connections and of the first massive migratory movements thanks to the revolution in transport and communications driven by electrical energy. In the late 19th and first half of the 20th century, railway, telegraph, the press, the telephone, the radio, television, aviation, modern marine transport, cars, lorries, film, video and records spread far and wide. The ontology of this phenomenon: physical space and time are cut through the acceleration of speed. Its scope: the entire planet, the world.

[3] This classification and these ideas are elaborated in more detail in Ayestarán (2007, 22-29). See also Ayestarán (2008, 157-168).

2. Globalisation: English experts talk about globalisation, the creation of a spatial-temporal globality beyond mondialisation, although it supports and is based on the latter: without the mondialisation of electrical energy and transports, globalisation would not be as effective as it is. The key to this globalisation lies in technology: satellite, electronic money, computers, the Internet, remote networks, faxes, digital technologies, artificial intelligence, virtual reality, bio-computing, MP4, CD-ROMs, DVDs. Part of the ontology of globalisation is physical (the entire underlying foundation of mondialisation), but another large part is virtual: a new space and time in the convergence of cyberspace and cybertime. Cyberspace is no longer physical space: I can chat with a person from Argentina and another from Australia at the same time. And when we chat we are in neither Argentina nor Australia, nor even at the desk where I'm hooked up. Rather, we are in a new space, tantamount to a cyber-omnipresence. Cybertime also verges on cyber-simultaneity or instantaneousness: I can send a message via email to 300 recipients in mere tenths of a second. Stock markets and financial markets, too, can earn money or crash in the space of a few minutes. This ontology is unheard of; it does not come from the physical world.

3. Universalisation of values and rights: Rights are proclaimed to be universal: the rights of human beings, of children, of women, of the elderly; the right to a home, to work, to freedom of expression. They are timeless and transcultural because any human being deserves them. However, even though they are atemporal, universal rights have been claimed and established throughout history. They received a huge impetus in the late 18th century (the United States' Declaration of Independence and the Declaration of the Rights of Man and of the Citizen in the French Revolution, which opposes the remnants of feudalism and monarchical authoritarianism), although they were definitively consolidated in the second half of the 19th century (to offset savage industrial capitalism), and especially throughout the 20th century and in what has elapsed so far of the 21st century (to combat colonialism, totalitarianism, racism, militarism, misogyny, economic and ecological exploitation, homophobia...).

It remains to be seen whether the old processes of mondialisation (electricity, transports and massive migratory movements), the current processes of globalisation (mainly remote technologies) and the well-founded desire for universalisation (first, second and third generation

human rights) converge in the 21st century into a responsible, sustainable planetary management, or whether to the contrary, they lead to a situation of maximal risk, enmeshed in a financial, ecological and social crisis.

THE PRINCIPLE OF RESPONSIBILITY AND THE CULTURE OF SUSTAINABILITY

To conclude, we must point out that all these global changes require us to reconsider some longstanding ethical formulations. Thus, for example, the Kantian categorical imperative, formulated in the context of the 18th century, needs to be revamped and updated to fit the needs of the 21st century. From its anthropocentrism, the Kantian imperative does not outline the ethical relationship with non-humans, with the terrestrial environment, with the other species on the planet, with the future we will bequeath to the forthcoming generations on the planet Earth. For this reason, Hans Jonas (Jonas, 1979) suggests revamping the human ethics of the present that Kant proposed with a planetary ethics of the future which anticipates the principle of precaution and sustainable development based on responsibility. Its ecological imperative would be: "Act in such a way that the effects of your actions are compatible with the survival of authentic human life on Earth". Or, to express it negatively: "Act in such a way that the effects of your action are not destructive for the future possibility of this life". Or more simply: "Do not endanger the conditions of indefinite survival of humanity on the Earth". Or worded more positively: "Include in your present choice the future integrity of mankind as another factor in your desire".

More recently, Leonardo Boff (Boff, 2002) distilled Jonas' imperative into the following ethical-ecological precept: "Act in such a way that your acts do not contribute to destroying the Shared Home, the Earth, and everything that lives and coexists on it with us". Or alternatively: "Use and consume responsibly what you need so that things can still exist and meet our needs, the needs of the future generations and the needs of all other living beings, who along with us also have the right to consume and live". Or: "Solicitously care for everything because care means that everything lasts much longer, protects and provides security".

In any event, regardless of the formula adopted, what is expressed in the pathway embarked upon by both Hans Jonas and Leonardo Boff is a new relationship between human beings and the rest of the planet,

including the forthcoming generations. The extension of responsibility towards other communities, both present and future, both human and non-human, both local and global, once again poses the challenge of devising a philosophy of balance between the *ethics of humus* and that *ethics of space*. This can only be accomplished if we realise that our culture has changed, and along with it our capacity for ethical and political agency has, too. This is what David Tàbara (Tàbara, 2002, 63-85) has precisely called the *culture of sustainability*. In this new culture of sustainability, our spatial, temporal and natural dimension has grown. In the past, our agency or capacity for action had a specific spatial boundary (usually a city, a region or, more recently, a country), a limited time span (only the current generation) and a way of dealing with problems that was directly related to human beings. Today, whether we like it or not, we have extended the systemic boundaries of our moral agency. We have expanded the spatial dimension, as it no longer encompasses a city or a country but also communal or global, cross-border goods. Likewise, we have expanded the time dimension, which includes both today's generation and future generations. Last but not least, we have also raised the number of legal, ethical and political considerations, which no longer solely include human beings but also the rights of non-human species and even some biotic communities.

To summarise and conclude, we can state the following points: 1) The boundaries of knowledge, science and technology have expanded, and we can detect the early symptoms of a global change on a planetary scale; 2) The kind of science that is only concerned about the epistemological value of the truth – a necessary but not sufficient condition – is no longer enough. Its axiology must extend to the realm of responsibility, given the latent split between Homo sapiens and Homo faber (this is the root of the ethics of the technological civilisation posited by Hans Jonas); and 3) The ethical debates – such as the example of the debate between the *ethics of humus* (Heidegger) and the *ethics of space* (Lévinas) – must increasingly accept a culture of sustainability extended into its spatial, temporal and natural dimension, encompassing both the local and the global.

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