

Paper read at: 6th *European Meeting of Jesuits in Science* on “Science and Culture”, Frankfurt a. M., Germany (8th - 12th September, 1999).

## **Abstraction and the Environment**

*Louis Caruana SJ, Gregorian University, Rome*

Earlier this year, I visited a work site of the Institute of Environment Science for Social Change in the Philippines. One kind of work they are engaged in concerns maps. As we know, a map is a representation of a landscape. Drawing a map involves a process of abstracting from a complex of aspects some that can be recorded on paper in a significant way. Topographical maps are meant to be precise as regards the information on spatial relations. Cartographers are aware however that they are recording some aspects and neglecting others. They record the ones that are important: important? Important to whom? The details recorded in topographical maps are usually of interest to certain categories of people, and may be unfavourable to others.

I spent some time on the southern island of the Philippines, Mindanao. Knowing something of the political and social situation of the country convinced me that topographical maps of the forest regions favour the interests of civil-engineers, politicians, prospective miners, and other similar categories of people who do not live in the regions themselves. During the abstracting process of map-making, the interests of the local forest dwellers are completely ignored.

There is a technique called ‘community-mapping’. It consists of asking the forest-communities themselves to sit down together and draw the maps of their own area. The concerns of the various members of the community are elicited and are in a larger or lesser extent expressed in the way the map is drawn. The interesting discrepancies between the community map and the topological, technical one are very significant. For example, people working with forest-dwellers have found that the community’s sense of scale expresses more a sense of quality of space rather than quantity. The topographical map neglects the interests of the dwellers, while the community map neglects the precision desired by the miners and loggers. Conclusion: the drawing of maps is never neutral. The map depends on the use we want it for.

Let us generalise this example. Think of human inquiry as the attempt to draw a map of the given in the most general sense. The same problems of abstraction will recur. Abstraction is a technical term in philosophy. It refers to the mental process by which a person identifies individuals and organises them into groups by identifying unifying features. This is done by discarding all but a few facets of a thing or an event so as to cognise those facets and not others.

For example Aristotle and Aquinas held that an object has not only sensible aspects (that give rise to sense-data) but also intelligible aspects (that determine the ideas the object may give rise to when an intelligent being looks on). The intelligible aspects, for example the form of a thing, is grasped through, and not in spite of, the sense-data. For example, regarding the environment as the given, human inquirers will be faced with innumerable singulars: this tree, that tree, this horse, that horse. These singulars appear as fluctuating colours, shapes, and so on. Through the act of

abstraction, inquirers will be able to extract the intelligible aspect from these singulars, and arrive at the idea of tree, horse.

In a culture, like our own, dominated by the mentality of natural science, abstraction is better understood in terms of mathematics.<sup>1</sup> It can be seen as the process by which the inquirer identifies the essential geometric and mathematical features of the object or phenomenon under investigation so as to enable prediction of some of the variables involved. For example, a falling stone is seen as a point-mass, air as random motion of point-masses, plants as self-regulating systems needing minerals and light.

Thus, abstraction is fundamental: it is just as present in the drawing of maps as it is in our overall understanding of the world. The hitch is that this mental operation always leaves something out. It neglects the aspects which make the individual unique. In metaphysical terms, we can see that, to grasp the intelligible aspect of the world, the inquirer must slough off, or discard, the principle of individuality, namely matter. Philosophers say: only if one goes beyond, effectively neglects, the individual horse, can one grasp the idea of horse as a universal. For natural science, the same thing happens. The shape of the falling rock is neglected when it is considered a point-mass. The aim of natural science is to arrive at the outline, or at the equation, which represents many individual things or events, and which thus necessarily goes beyond the individuality of each.

For most areas in natural science this neglect has no serious consequences. In fact, some systems seem to be so free of complications that one easily forgets that

abstraction is leaving something behind. For example, explaining the movement of planets in terms of the mutual attraction and the resulting movement of points in space is apparently all there is to it. Other systems, however, are notoriously difficult. The situation becomes chronic when the method of the natural sciences is applied without qualification to the so-called human sciences. These sciences allegedly explain areas directly influenced by human decisions. In these cases, the inevitable neglect of the individual due to abstraction can give rise to gross deformities and even injustice.

What we need our knowledge for determines the way we abstract. It determines the aspects we retain as relevant and the others we discard as irrelevant. Historians identify an interesting shift in attitude in the post-medieval period. From a vague desire to acquire knowledge for its own sake, Francis Bacon shifts to a desire for a kind of knowledge that guarantees a domination of nature so as to ameliorate the condition of humans.<sup>2</sup> The borderline between relevant and irrelevant changes. The result is that a new map of the given is inaugurated, and it is still with us today. This map is drawn according to the presupposition that the given is something of a menace to be conquered, tamed and exploited for the benefit of humans.

Returning to the distinction between a topographical and a community map, one may ask: is one map correct and the other wrong? The landscape they purport to describe is obviously the same. Both maps include some aspects and neglect others. Is therefore the very map-making process a falsifying one since it cannot include all the aspects together? In the most general terms this question would be: since the real is made up of singulars, and since the act of understanding the real means sloughing off

the individuating aspect to arrive at the intelligible universal, is abstraction an inherently falsifying process which forbids the knowledge of things as they are?

No. After abstraction, our knowledge is certainly not complete but that does not mean it is false. We cannot blame abstraction as such. A problem of distortion however arises when the neglected aspects are the important ones and the retained ones are trivial. The basic attitude of exploiting the environment can be understood in these terms. When we abstract with the attitude of dominating Nature, of considering it a menace to be conquered, tamed and taken advantage of for the benefit of humans, we are essentially retaining some aspects which are in line with one particular project, and neglecting others which are not in line. This kind of abstraction can be devastating. The very life of Mindanao forest-dwellers can be rendered completely invisible. In the words of Michael Northcott,

...the modern money economy operates regardless of natural ecological constraints because its measures of wealth and of exchange relations are abstracted from natural ecological systems. The spatial abstraction of modern economics is so extreme that even were all the rainforests to disappear and sea levels to rise two feet, and the climate warms by 4 degrees and large parts of the world become uninhabitable, individuals and companies who had burnt the energy or consumed the forests in industrial production would still be reckoned wealthy in economic parlance.<sup>3</sup>

When, in economics, abstraction is not handled with care, money is considered the only measure of progress. Moreover, wealth in terms of money can obviously be maximised by the destruction of some people's cultures, and even livelihoods. Sadly

to say, this is the mentality that is becoming global as it dominates both the developed and developing countries world-wide.

The various sciences, natural or human, have varying degrees of possible deformation, depending on their object of study. In the mathematical hard sciences, the possible deformation is often a minimum. This is true because the object of study is usually an ideal case with no interfering causes. The possible deformation however in the human sciences can be considerable (see figure).

To avoid this problem as much as possible, one should try to be aware of all the fundamental characteristics of whatever is being explained. To explain the environment, we cannot forget that it is a complex composite or system. Aerosol sprays in one part of the world affect the stratosphere in another. Its parts are related intimately with each other.

The crucial question is: what kind of system is the environment? Systems or composites come in various kinds. For lack of time, I will just say that there is a kind of spectrum of varying degrees of holism. On one end, we have composites like a heap of sand where the relation between part and whole is minimal. On the other end, we have composites like a community of persons. This is a fully holistic system because one cannot have a community without persons, and one cannot have persons without community.<sup>4</sup> The relation between part and whole is constitutive of each. Composites that sit somewhere in the middle between these two extremes are machines. These are systems whose parts are related to the whole in a functional way.

One can conceive of the radiator of a car as existing independently of the car. And yet the radiator is related to the machine because of the function it has.

Is the environment like the heap of sand, or like a machine, or like a community? The so-called Gaia-hypothesis, building on some ideas of Teilhard de Chardin, holds that the system we call the environment, or the earth, exhibits the behaviour of a single organism, even a living creature.<sup>5</sup> This view contrasts with the assumption that the various parts of the environment are grouped together like sand in a heap, or stones in a pile. It contrasts also with the Cartesian assumption that the various parts of the environment are related to one another only in a functional way, like the various components of a machine.

In conclusion, therefore, I list three shoulds:

- (1) One should be conscious that abstraction can lead to distortion.
- (2) One should realise that it is a mistake to think that by abstraction we can easily control the environment as if it were an ideally closed, theoretical system or machine which we can manipulate from a position outside of or superior to that system.
- (3) One should work with the assumption that the environment is a composite with a very high degree of internal dependence between its parts making it more holistic than a machine and perhaps even as holistic as an organism.<sup>6</sup>

---

<sup>1</sup> This essentially means a return from Aristotle back to Plato.

<sup>2</sup> Bacon writes: 'Knowledge and human power come to the same thing', and 'nature cannot be conquered except by obeying her' (*Instauratio Magna*, 1,3). For him, the purpose of science is the extension of the dominion of the human race over nature.

<sup>3</sup> Michael Northcott, *The Environment and Christian Ethics*, Cambridge: Cambridge University Press 1996, pp. 79-80.

---

<sup>4</sup> This is valid when we use the terms in their *regulative* sense. When we say, for example, a ‘community of bees’, we are using ‘community’ in a *derived* sense so as to emphasise that bees are like human persons.

<sup>5</sup> J. Lovelock, *Gaia: A new Look at Life on Earth*, New York: Oxford University Press, 1979.

<sup>6</sup> By implying that a living organism is not a fully holistic system, I am disagreeing with Aristotle and Aquinas. Although they never discuss the point in detail, they seem to hold that an organism is indeed fully holistic. Cf: Laura Landen, ‘A Thomistic Analysis of the Gaia Hypothesis: how new is this new look at Life on Earth?’, *Thomist* 56 (1) 1992, pp. 1-17. My disagreement with them and with Landen is based on relatively recent knowledge gained from the practice of organ transplants.