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ANTHROPOMORPHISM IN SCIENCE

ANTHROPOMORPHISM is an inveterate tendency to project human qualities into natural phenomena—consciously or not. The standard and most important variant of anthropomorphism is animism which sees a soul in everything in nature. Before entering into the role of anthropomorphism in the history of science, let us consider a few important and usually neglected logical aspects of the idea.

First, when we draw an analogy from humans to nature, we assume that we know humans; that is to say, we make an analogy from known human qualities to unknown natural qualities. However, it is not what we *know* of human beings, but what we *assume* to be human that we read into nature. For all we know, the analogy may go the other way: like sticks and stones, human beings may not have souls. At the very least, we may leave the question, "Do human souls exist?" open, and still speak of animism as based on an analogy—not so much from known human qualities to unknown natural qualities, but from assumed human qualities to nonhuman qualities.

The second characteristic of anthropomorphism in need of critical attention is one related to the "genetic fallacy." When we make an anthropomorphic assumption, the assumption may be true or false; it is not decisive to show that it is anthropomorphic, just as it is no criticism of any idea to point to its origins. Some anthropomorphic assumptions are known to be false, but not simply because they are anthropomorphic, since other assumptions, e.g., that animals behave like humans in certain respects, may indeed be anthropomorphic and yet true. Nevertheless, it is assumed by and large that when we make an anthropomorphic assumption, it is not likely to be true. This, however, may rest on a more general situation, in which any guess—whether based on analogy or not—is not very likely to be true simply as a guess. If we want our guesses to be more likely than wild fancies, we may suggest a theory concerning the increase of the likelihood of *a priori* guesses. But then, this theory may be false as well. And therefore we have, at least for the time being, to leave open the question "Are any anthropomorphic assumptions true?" Nevertheless, on different grounds we may suggest that practically all anthropomorphic assumptions are likely to be false. The reason is very simple. Looking at the history of culture, we can see that the deeper we go into the past, the more likely we are to find anthropomorphisms; and the nearer we come to our era, the less anthropomorphic our theories become. We also know that the deeper we go into the past, the more likely we are to find erroneous views, or at least, views we consider erroneous today. For this historical reason, we may claim that by and large, anthropomorphism is "out." The question which this approach raises, of course, is "Is there some fundamental defect in anthropomorphism?"

This leads us to the third point. We know certainly that some anthropomorphisms are based on false assumptions (or at least on views which are unacceptable to us)—indeed often one false assumption may generate quite a few analogies. We speak pejoratively of anthropomorphic analogies which present no problems to us because they depend on unacceptable assumptions. The most prominent example is anthropocentrism, namely, the idea that the universe is created for the benefit of man and, therefore, may be judged from

the viewpoint of its utility to man. For instance, the essence of wood, Aristotle suggests in his *Physics,* is that it is floatable and combustible, for the obvious reason that the most important functions that wood played in the ancient world were in its use as material for ship-building and as fuel. One may wonder, were Aristotle living today, whether he would make the essence of wood reside in its capability of becoming printing paper. A similar criticism of Aristotle is actually to be found in the late Renaissance and the seventeenth century; for instance, in the works of Robert Boyle, who suggested the following observation: for many people the essence of ice is that it is meltable into water, and thus, in essence, is water; whereas, for doctors, who use ice for lowering temperatures, the essence of water may be that it is freezable into ice.

The criticism made thus far of anthropocentrism, is, of course, not decisive. It is quite possible to claim that though it is an error to judge wood, and ice, on the basis of their use to mankind at present, we should judge the essence of wood or ice from the viewpoint of mankind throughout the whole of human history. Perhaps it is very difficult to find out the total possible uses of wood or ice to mankind from its beginning to its end; but anthropocentrists might claim that this is what science should be about—that science is more difficult than Aristotle thought, precisely because scientific knowledge grows by attempting to find out the uses of different natural things for mankind through all the ages. It looks as if this generalized anthropocentrism is merely an intellectual exercise, but one may interpret instrumentalism in science as just that. Instrumentalists, however, will object. Somehow, the evidence that anthropocentrism happened to be parochial in the past was taken as evidence that anthropocentrism in any form must be parochial; and parochialism, of course, must be rejected.

We come, finally, to the fourth and last point about anthropomorphism. Anthropomorphism may be viewed (rightly or wrongly) as a version of the parochialism that Sir Francis Bacon designated as the Idols of the Tribe and of the Cave. Parochialism is the projection of our present knowledge of our limited environment into the whole universe. Parochialism is also the idea the worm in the apple has, that the whole world is an apple. And, of course, anthropomorphism may be viewed as a version of parochialism in the sense that we are very close to ourselves, and having some notions of our human traits, we generalize and project hem into the universe at large.

So we seem to have arrived at the final condemnation of anthropomorphism. Somehow, we all condemn parochialism and we have the feeling that, viewed historically, science on the whole aims to break down parochial barriers, to give us a better view of the universe, rather than to reinforce the views into which we are born or which are due to space-time accidents of birth, and so forth. And in as much as anthropomorphism is historically parochial, or has its roots historically in parochial philosophy, this fact itself leaves no doubt that anthropomorphism runs against the spirit of science, and that as such, it condemns itself.

On the other hand, there is, no doubt, quite a different aspect or positive value of anthropomorphism in the history of science, which cannot be condemned as parochialism, viz., the human uses of science. To take very simple and obvious examples, scientists have devised many sorts of machines that imitate human operations. This, at least in part, is a technological matter of purely practical significance, interest, or value. We all want to jettison as many of our human burdens as possible with impunity; we try

to dump them on machines. Thus engineers will apply science to the designing of machines to perform as accurately as possible as many human functions as possible. One might say all this technology is devoid of intellectual value. But this is only partly true. There is much to be gained scientifically in the theories of servo-mechanisms and "thinking machines" as they are half-jokingly called we do want to embody part of our views of our functions and of our thought-processes in the observable operations of models, and thus form generalizations in a more scientific and interesting manner. What we learn from these mechanical models may then be used in research—say in biology.

Whether we try to apply our knowledge of machines to humans, or our knowledge of humans to machines, there is in each case an intellectual—even philosophic—interest. We can give examples of both cases, and show thereby that there are certain interactions between the human sciences and nonhuman sciences, as well as between sciences and technologies, which are very stimulating, very suggestive, intellectually very fruitful—and thereby justifiable. Take examples of the applications of scientific knowledge of the inanmate world to the animate world, to humans in particular. Not only have scientists claimed in a succession of hypotheses that the eye is the camera obscura, that the eye is a (lensed) camera, but also that the eye is a television camera of some sort. These are various physiological views of the function of the eyes. We also attempt the opposite when we apply the theories that were first created for explaining human phenomena to the explanation of nonhuman phenomena; there is no reason to discard such hypotheses just because of their anthropomorphic origin. To give a simple example, and a very well-known one indeed, Darwin was influenced by Malthus. Malthus wrote on economic competition and struggle for food in limiting population growth, and Darwin wrote on the origin of species and of biological ecology; nobody ever dreamt of censuring Darwin just because he was indebted to Malthus.

To give another simple example, perhaps more intricate but more important in history, there is nothing more evidently anthropomorphic than the ideas of attraction and repulsion, of love and hate. The introduction of the ideas of love and hate into physics by the Stoics, and in modern times by William Gilbert in his *De magnete* (1600) and by Sir Isaac Newton, is certainly not in itself condemnable. There is even something very interesting in the further development of the theory of love and hate, or attraction and repulsion, in the history of physics. When attraction and repulsion appear together in Newton's *Principia* (1687), they are put together as a theory of force, and the idea of force was considered at that time to be highly animistic. Newton was criticized for his animism and for his occult qualities. He insists in his *Opticks* (1704) that his theories are proper rather than *ad hoc* explanations, and true (because they provide precise predictions), so that one ought not complain about them even if they may need further explanation to fit them into Cartesian philosophy.

Newton's theory of force was abstract—at least as compared to ideas of force we employ when we speak of applying force to break through locked doors, etc.—the force of the muscles, the actions of the muscles, the disposition of the muscles to act. James Clerk Maxwell, in his *Treatise on Electricity and Magnetism* (1873), compared Faraday's tubes of force to muscles. The tubes of force by which Faraday operated, however abstract they were, had two qualities. They tend to shorten and to become wider, in a manner very similar to that of a tube of a muscle. So one can condone the criticism, launched against

Faraday by the Newtonians of the day, that his theory was very distinctly anthropomorphic and less abstract than the Newtonian theory. Indeed, those in the Newtonian camp (who were indulgent towards Faraday), such as John Tyndall and H. L. F. von Helmholtz, stressed the fact that they had no quarrel with Faraday's use of those concrete images because of his "want of mathematical culture": people who were better versed in mathematics than Faraday, it follows, need not use his anthropomorphic analogy. This is why historically Maxwell's work was so important: he translated Faraday's images into a mathematical language; even Tyndall was very impressed.

There is correspondence between Faraday and Tyndall published in the *Philosophical Magazine* (1856), where Tyndall says to Faraday that he cannot imagine how space, empty space, that is, can have all these strange properties he ascribes to it, as it pulsates with tensions and strains. Faraday answers Tyndall by declaring him to be unimaginative, and in need of a more developed intuition.

In the history of science misplaced concreteness may have all sorts of different manifestations. We may fill space with a material "ether" which will accommodate strains and stresses. We may suggest that the world is simple because we prefer simplicity, or economy of thought. We may suggest that science should be mathematical since reality is mathematical (Galileo: "The Book of Nature is written in geometrical characters."). We may suggest as a speculation that the world is composed of fragmentary units of "atomic facts" because we state our information about the world in fragmentary propositions. The picture theory of language is perhaps one of the most significant manifestations of anthropomorphism insofar as it imputes to reality the limitations of our mode of representing it. It was crystallized in the twentieth century in the early work of Ludwig Wittgenstein (*Tractatus-Philosophicus,* 1922), and, for a while, was also held by Bertrand Russell.

Is anthropomorphism still alive? One aspect of anthropomorphism is parochialism, and it is typical of parochialism that its holders don't consider themselves parochial. That is to say, we never know how parochial we are. We only know how parochial our predecessors were in comparison with us. It is quite possible that we still hold various versions of anthropomorphism that may be rejected by our successors if they are to get rid of our errors and parochial limitations.

In spite of this caution, it is possible to explain a few facts about the historical development of science as it moves away from anthropomorphism. Examples have been given of interaction between ideas in the social sciences and those in biology and physics. What is condemnable about anthropomorphism is mainly its parochialism. Now it is very hard to draw a very clear line between parochial and nonparochial anthropomorphisms, because the main feature of anthropomorphism is its use of analogy from human phenomena to nonhuman phenomena and the idea of analogy is often very vague. Let us go back to the theory of space, pulsating with stresses and strains, which is common to Faraday's view and to Einstein's in his theory of relativity. It is very easy to suggest that however abstract the idea of pulsating space is in comparison with the theory of the pulsating ether in space, there still is an analogy between Einstein's space and any piece of elastic material such as plain rubber..In other words, however abstract our scientific ideas are, we can draw analogies between them and more concrete ideas, and so we can claim that our ideas are always lamentably concrete and parochial, that we are still rooted

in our space-time environment, in local contingent conditions, whether physiological, biological, or social.

Although from time to time we may find analogies that are stimulating, exciting, and interesting, the substance of scientific progress cannot be based on analogies to the given, but rather on novel ideas, on ever increasing abstractions. This explains the situation that was alluded to early in this discussion: historically, the more we go into the distant past, the more we see anthropomorphism in more stark-naked versions. The progress of science is a progress from the more immediate, from the more parochial, to the more abstract, to the more general. And this very increase of generality and abstraction moves us away from anthropomorphism.

It is exactly this characteristic that explains why even our views of human nature, whether psychological, anthropological, sociological, economical, or any other, are increasingly less anthropomorphic, increasingly more abstract. There are very well-known, clamorous protests about making the science of men so abstract as to dehumanize it; for example, it is said that economists have defiled economics by the invention of that monster, the economic man. There is, perhaps, some truth in such claims, but there is also a Luddite attitude lurking in them, to destroy what seems to threaten us. Once we realize that anthropomorphism often takes the familiar and the comfortably acceptable to be true, we see that anthropomorphism may be objectionable even in the social sciences. Still, it is hard to speak against anthropomorphism in human sciences; we do better to speak against parochialism.

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