

**GUEST EDITORIAL:
WHAT IS PHILOSOPHY OF SCIENCE?***

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I was an Editor-in-Chief of *Philosophy of Science* during its early years. Now, over a half century later, I have to admit that I was not very clear what the journal was about, except that it tried to reflect on the meaning of science and its relation to other human activities.

At this time I am even less sure of its purposes. The journal seems to spend most of its pages on the puzzles and imperfections of scientific theories, especially those arising in that most confusing of all the disciplines, physics. Whether human beings should study physical nature, whether it is dangerous or ethical to do so, how such studies relate to other human interests and activities; in fact, all the issues complicating the study of physics are never discussed in the journal. Even after almost 50 years since the first explosion of the atomic bomb. The fact that the study of physics had almost led humans to believe that humanity was about to disappear on the face of the nuclear-winter earth was not a topic worth mentioning in a journal called “philosophy” of science.

Did the study of atomic physics cause the atomic bomb? Yes; a detailed account of the theory of the atom, the realization in the late 1930s and early 1940s that atomic energy could be produced in the form of a bomb, the scare that led Einstein to write his famous letter to Roosevelt, and the Manhattan Project and its “success” constitute an historical account of causally connected events leading to the explosion of the atomic bomb in Hiroshima and Nagasaki. These events then became the center of the so-called deterrence era among the super-powers up until recently, and undoubtedly will reappear as threats for centuries to come. So should we not ban the study of physics except under close control of its consequences?

Such a question may appear absurd in the sense that it should not be

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considered. In fact, there seems to be no place in science to consider it. In the peculiar way in which science is organized, “should the study of physics be stopped?” does not belong to any recognized discipline and certainly not physics. Nor would the typical scientist have any idea of how to study the issue. Most scientists, if they paid any attention to the question at all, would say that it is an ethical issue, and hence outside the boundaries of science. I would be inclined to agree that it is ethical, all right, but a more helpful suggestion is that it is a question of the management of science. In this discussion I suggest that there is such an activity as the managing of the scientific enterprise, and that its neglect has led to an unfortunate state of affairs relating to the future of the world, and of the future of science itself.

The word “management” comes from the Latin word for hand, and suggests what hands do so well: move, shape, point, punch, and perform other manipulations of matter directed by a mind, some of them quite exciting, some deadly. Management is the activity of creating and using resources for various purposes. At one point in my philosophical life I left the purity of research in modal logic to learn about the management of human affairs. I did not take a direct route; I first studied statistics, which I thought to be a kind of practical logic of management, but its theory was so philosophically weak, I had to travel further into Operations Research which claimed to be a “scientific” approach to management. It was not.

I found that once you let philosophers loose in the world of management, they are bound to find it ridiculous and simplistic, and, if they are conscientious, full of problems that they should correct. My first exposure occurred during the second world war, in the context of the manufacture of small arms ammunition. If you are a manufacturer of such ammunition, what is your management problem? To this rational mind it appeared to be to make the bullets; test them; if okay, package them correctly; ship them without damage to the correct places where GIs could best use them; make sure that the GIs know how to use them, in guns which work properly; and keep the ammunition in safe places where it does not deteriorate. Is that all? Not quite. The management problem keeps expanding: There is the ethical question whether GIs should fight in the war, and attempt to kill other humans called the enemy whenever they need to. Does this last belong to the manufacturer’s set of management problems? Certainly not? What management decides the membership of a manager’s class of problems?

Scientists like to keep their problems neat and grounded, lest they lose control of rigor. But now you are in a war, and wartime objectives demand a lot more of you than keeping control of rigor. What do you do as a scientist? Where is the textbook on scientific method that tells you

what to do? There is none. So do the best you can until the war is over and you can run back home to the safety of the domain of closed and irrelevant problems? What management makes pure science a safe place to work?

This first experience with the world of managing came as a kind of intellectual wakening. I could see that in the world of symbolic logic there was a QED—a stopping place in a problem—where the problem disappeared. Of course, you could use the proven theorem for other proofs, but the “proving” was terminated. However, in the world of management, nothing is ever “proven”. In fact, it is safe to say that managers never “solve” their problems; some of the problems demand less attention at times, but never really go away. You can see why. If managers take their job seriously, they cannot avoid the expanding universe of concerns. They can say “that’s up to some other manager in the organization”, but once they understand that what the other manager decided affects their own managing, they cannot let the matter rest. I still recall how my positivist friends would respond when I would ask how they would handle fatigue and bias of laboratory technicians in reporting observations: “that’s a matter for psychology”, they would say. And never worry about it. They assumed that science could escape the expanding universe of problems by creating walls without doors between the disciplines, that is, a nonresponsive and nonresponsible science.

Two ideas emerge once the naive philosopher begins to understand the philosophical issues of management. One is that managerial problems are always open-ended and expanding, and that reductionism is impossible. The other is that every purposeful action of every human being is a managerial action. We are all managers in everything we try to do because we have to be concerned with the manipulation of resources to gain goals. Managers are not just the people, usually male, usually clothed in blue or grey suits, usually driving large autos, who sit in large offices and dislike the laboring class. They are managers, often ethically inept, but they are only a small subclass; the class of managers includes almost all humans, and probably a lot of animals and bugs.

And the class of managers certainly includes scientists. But this subclass of the species of managers does very peculiar things. It goes out of its way to bound its problems by setting up disciplines with impenetrable barriers by removing any reflection on the consequences of using its products, which claim to serve customers by providing them with the truths of nature. Manufacturers of sleds would probably like to, but cannot—or should not—ignore children who use sleds on dangerous rocky hills. Likewise, people use the theory of integers to cheat large numbers of gamblers and investors, but pure mathematicians do not worry. Should they? What is the difference between managing sleds and managing num-

bers? This last question reminds me how those two super mathematicians, Russell and Whitehead, fooled us all by proposing that mathematics was free of the problem of management since it was tautological in nature. A con trick if there ever was one. On April 15, you had better manage your income tax return so that $5 + 7 = 12$, whatever you do with numbers in your spare time.

Hence, if one views science from a management point of view, it follows that science is to be seen as a producer, a “manufacturer of truth about nature”, however crass that may sound. It also follows that truth manufacturers have the same set of responsibilities as all other manufacturers: Their problems belong to an ever expanding set.

The philosophy of science is therefore an inquiry into the nature of this expanding set of the managerial problems of truth production to determine how the management of science can best be controlled ethically.

In this discussion, ethics has appeared frequently because there is no way to study management adequately except in the context of ethical judgements. The quality of managing is the most important issue for the students of management. Hence, the notion that pure science is “value free” applies at best to only one aspect of the management of science: the production of truth in a laboratory or a laboratorylike environment where the wishes of the observer are suppressed. In the expanding universe of the scientific managerial problem, the ethical issues appear as central, even if the original problem was the sex behavior of the Sphecidae wasp. The easiest way to see this is to ask the economic question: Is it worthwhile studying the problem, given all the other options, and given that almost all humans have no idea what Sphecidae wasp means, and could not care less. If wasp lovers reply, “We are free to choose our research problem”, they are making a management judgement which is ethical in its meaning, and certainly is not “value free”. So scientific method may be value free in one part of the production-of-the-truth process, but scientific management is value loaded.

What about ethical judgements that lie at the heart of any management process? The subject is almost always by-passed by schools of management, or put into some corner of the curriculum in MBA programs. Part of the reason for this is self-esteem. On most university campuses, business administration or management schools consider themselves to be second or *n*th rate compared to physics and mathematics, and have no idea that they stand “above” these disciplines because of their knowledge of management. I suspect that if I asked my colleagues in the business school at Berkeley what they thought about the way physics is managed, they would mutter something about NSF and say they did not know anything about it, even though they might urge their children to “take” physics.

Can we make “objective” ethical judgements? In the first place, we should realize that “objective”, from a managerial point of view, refers to the design of a group of investigators who are attempting to keep their observations under control in a language context where it is impossible to obtain exact agreement. The designs to date have not worked very well, even in the so-called exact sciences. I. Mitroff’s (1974) study of the moon-rock scientists illustrates this point very well, and along with several other books, demonstrates that objectivity in science is still a confusing issue. So the question whether ethical judgements are objective is still vague, but it is a managerial question. The question is important because ethical judgements are important. Hitler judged that one subspecies of humans was ethically superior to others, and inferred that the ethically inferiors should be killed off. Can we prove him wrong? Who is the “we” that is supposed to design the proof?

Nonetheless, we humans as managers have to make ethical judgements all the time, and we have been able to do so—at least in a primitive way. And if our ethical reasoning is primitive, then so are we, despite our advanced technologies which, after all, are only used by a small percentage of the human species.

I suspect, and many agree, that the guiding ethical principle for a lot of human management is justice. Plato made justice central in his main management book, the *Republic*. So did Bentham in the *Introduction to the Principles of Morals and Legislation*, designed to help managers of the criminal justice system. So did Kant in the *Foundations of the Metaphysics of Morals*, which describes the interactive management of a human kingdom of ends. These books are examples of how a management of science could be discussed based on a principle of justice, that is, on ethical judgements.

Hence, to illustrate what I mean by “philosophy of science”, I would like to suggest a topic for philosophical debate in this journal. I consider two problems which have attracted the attention of the public in recent years, both of which are frequently called “scientific”. One is the problem of adequately feeding all the children of the world; the other is the problem of the origin of the universe.

For decades we have known about considerable starvation to death and starvation-related diseases, especially in Africa, India and Indonesia, but spread all over the face of the earth, including the United States. Children are included. One more-or-less accepted figure is that 35,000 children die every day in the world from starvation and starvation-related diseases. Almost incredible considering that during the six years of the second world war about 7,500 military personnel were killed or missing each day, about one-fifth of the rate in our war against children. As a species, we murder a significant number of our young, and keep an even larger number in

disease and pain. That is not the end of the matter, because we also abuse them, by medicine, miseducation, religion, beatings and violent murder or neglect. We could say, if carried away by the imagery, that humanity collectively is a child abuser.

Why?

Let us keep to starvation for awhile. At one point, a lot of us who were aware of the situation thought that the answer to the “why?” was overpopulation, especially in areas of the world where population growth was exponential and the fertility of land was declining. The nutritional sciences were the most active in the research domain. But the research was astonishingly irrelevant. Someone invented the “Harvard standard” which used calorie intake to determine how many humans in a village in India, say, were below a standard of “adequate intake”. Thus a well-fed nutritionist would come to a village, measure height, weight and intake of the villagers, and then depart with the data. Nothing else happened. Science remained rigorous and pure.

But some agriculturists did respond, and the “Green Revolution” occurred, which provided humans with ways of increasing the yield of grain up to tenfold on the same field. But it did not solve the transportation problem. Note that we had moved from nutritional science to agricultural science to transportation science as the problem expanded. Finally, it dawned on us that in certain places in the world, in Indonesia, Ethiopia, the Sudan, and now in Somalia, food was in the location, but children still starved. Why? Politics, Religion and Greed. The PRG of starvation. All are out of bounds for science. It is true that scientists on occasion do investigate politics (after all, a lot of universities have political science departments). But as far as I know, no one investigates why political power is being used to keep food from children, and what can be done to remove the blockages. Should we use force? taking us into military science? Or the spread of compassion? taking us into spiritual science (what a creation that would be!)? Or nothing, because we humans have no way of investigating the ravages of politics, religion and greed? Our science has limits, after all. It cannot figure out how to better the world for future generations because it cannot go very far into the future of the human species. We have no way of knowing what people are going to be like in the year 2092 A.D., or 10092, so how can we plan for them?

What nonsense! It does not take much intuition to guess that future generations are going to want food, decent education (at a better level than ours), recreation, nondeteriorating environment, and so on. Are we preparing a world for our progeny? No way. Can science grow up and begin finding some ways? Why not?

If the preceding paragraphs sound bitter, it is because every time I write on the subject of the abuse of children and future generations I feel moral

outrage. Because I am as guilty as the rest. I call myself a scientist, but what do I do? Write frustrating papers like this.

But another frustration in this journey into the land of management constituted for me one of the most significant lessons in philosophy I have ever learned.

To begin with, the starvation of children and worldwide child abuse are really no news. They have been going on in “advanced” and primitive cultures for centuries, perhaps always in human history. The most noteworthy aspect of the twentieth century is (1) we have a better worldwide information system than at any time before, and (2) in some significant sense, a much broader decision making political (democratic) power than ever before. Hence, one can say that today a great many people know that child abuse is widespread, and know that they may become part of the decision making to reduce it. But there has been no significant change in child abuse in this century. Thousands of television shows, articles, books, and political speeches advertise the existence of the abuse, often urging people to send in money to alleviate poverty. Several United Nations agencies are supposedly dedicated to alleviation, as well as a number of foundations and government agencies of nations, all functioning to reduce poverty, and yet child abuse, a predator that is never prey, continues and perhaps grows.

As a logician and social scientist, I see this situation summarized as follows: It is known that (1) child abuse is an ethical wrong, (2) the means of reducing or eliminating it are also known, and yet (3) it is not eliminated. This is the unemotional, logical scheme of the child abuse situation today. Statements (1) and (2) imply (4) child abuse should be eliminated but not (3) it is eliminated. First-year college students learn modus ponens if p implies q , and p is true, then q is true. What they do not learn is that if p implies a (an ethical imperative to act) and p is true, it does not follow at all that a will occur.

In management theory language, we are talking about “implementation failure”, which occurs when bright ideas, well defended by arguments, are never carried out. I ran into the phenomenon a number of times during the second world war. Despite the fact that I had found a far better way to test ammunition for misfire than the way it had been tested, it took over two years before the army changed. Some of my colleagues found a way to avoid corroding the barrel of a gun by changing the primer in the bullet, but their invention was never adopted (because of a political fight) and the GIs had to fight the war with inadequate ammunition.

The same lesson has been repeated over and over in human history: Theory “proves” that a policy is ethically correct, and the policy is never adopted. In 1972, *Limits of Growth* appeared which said, in effect, that if the world manages its resources in the same way it had been managing

them for the past 75 years, there would be a colossal destruction of the human race, not by arms but by a collapsing world economy. The book sold a lot of copies in a lot of languages, and along with the establishment of the Club of Rome, and the International Institute of Applied Systems Analysis, brought about a lot of research attention, bolstered by the existence of large-scale world models on the new computers. The net score was 1000 to 0:1000 models with the same disaster message, 0 action.

Imagination may help. Imagine you have landed on a devastated planet on your *Enterprise* voyage and you find in every ruined city large libraries of books, many showing exactly how devastation can be avoided. Evidence shows that the planet was run democratically and had a superb educational system. Poverty (let us imagine) did not exist. Health measures were great. But religion, apparently, was a mess because there were two fiercely competing gods, each of whom demanded the death of the followers of the other god. Absurd? You can change the scenario to “there were two competing nations” or “two competing political parties” or “two competing races”.

There you have it; the story of a highly educated species on a planet which has intelligence, a capability of reading and writing history, a tremendous analytic capacity and information gathering, which lacks the ability to implement any argument for its survival.

Gloomy? Why not? But a philosophy can create the turning point, a philosophy that takes management seriously. Have humans always turned to philosophy when the going gets tough? Will they? I do not know of any mathematical or statistical model that proves they will. There is always hope, but no theory of hope that causes us humans to hope.

What about the origin of the universe? It is a very old problem, familiar to many westerners who have read *Genesis* in their childhood. In recent years, the “big bang” theory has gained solid acceptance, along with an urge to be able to explain and describe it better. But why? What gift of the ingenious human intellect is given to humanity if we can explain the evolution of the galaxies as a consequence of an initial explosion? Whatever comes up will hardly be an “explanation” in a purposive sense since we can do nothing with it, unless it suggests how we can now create some new universe. In the scientific literature, many have claimed that a recent finding on the universe’s origin was one of the most significant events in the history of science. Why?

I think that the question itself, the story of the expanding universe, is unimportant for the development of human knowledge because it teaches us practically nothing about how to bring starvation, the rape of the environment, the tragedy of modern education, into control. Because I can see no connection, I take the universe’s origin to be a teleologically empty question. If the question were why the Bang at all, or does the Bang

theory imply a God, or just a couple of enormous characters doing an experiment on volatile materials on a laboratory bench, then maybe it would have some importance, but not much.

From a teleological point of view, or “systems approach”, pure science is a mystery. I once attended a meeting where a group of enthusiastic young computer geniuses had designed some software to prove theories in lattice algebra. A pure mathematician told them that all the proofs were trivial. Apparently they did not know that. Most of the audience did not know it either. But nobody asked the mathematician what “trivial” means. That is hush-hush. If you do not know what it means, you should not ask. It is like asking why the last movement of Beethoven’s last piano sonata is “great” music; it is merely some variations on a very simple theme, after all. If you ask, you obviously do not know music. But if I ask why the world is starving thousands of children every day, am I to be told I would not ask if I understood eating better?

To this teleologist, the awesome (and awful) suspicion emerges that pure science does not know what it is trying to do. Chess knows better. It also makes a distinction between a trivial and a deep problem, but the proof that the distinction matters is in its relevance to winning in a given situation. Of course, chess does have to ask whether winning matters, especially when we find that computers can win better than humans.

Of course, pure science can, and often does, run to applied science, and especially technology, with the claim that the highly useful technologies, like agriculture, transportation and medicine, all arose out of pure science. So did guns, bombs, poisons, floods, pollution, torture, political power, and so on. In fact, the score of the game of technology is still not in, nor is it clear what is contributing to the good side’s score: The current pause in the threat of nuclear holocaust is political, and not science at all.

In my *Encyclopedia Britannica*, the subject of teleology is handled in three paragraphs, whereas mechanics goes on for pages. The inference that humans have no sound idea why we build machines, and especially the lack of an ethical justification of machinery, seems obvious. It seems almost obvious that our “advanced” civilization is in truth childish, but in the most insidious sense of a child with a huge amount of powerful and destructive toys and no parental guidance.

Why has science neglected teleology when the human need for it is urgent? I know that modern biology is deep in determinism, but I cannot help asking whether biologists include themselves in their biological theories. Do reflective biologists ask whether their deterministic theory of life was itself determined by biological forces? If so, how do they justify asking for funding to work on more of it?

That is enough to reveal my confusion about the current state of the

world, and the state of science. And philosophy's nourishment is confusion. I would like to see a journal devoted to the real confusions of modern science.

But I have to confess that this discussion was not written out of the need to satisfy an intellectual curiosity. Rather in my spiritual grief over the murder of so many children, I hope that there will be a generation soon where it stops. But I do not want it stopped by politics, by a totalitarian dictum, nazi, communist, whatever. I want it stopped by the knowledge of free humans, which is science.

My question is how can a free science be managed so as to transform ethically sound arguments into ethical actions?

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