

With Compliments
Georgios
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Where science has gone wrong

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The current predicament of British science is but one consequence of a deep and widespread malaise. In response, scientists must reassert the pre-eminence of the concepts of objectivity and truth.

In 1968 Sir Peter Medawar wrote:

Ask a scientist what he conceives the scientific method to be, and he will adopt an expression that is at once solemn and shifty-eyed: solemn because he feels he ought to declare an opinion; shifty-eyed because he is wondering how to conceal the fact that he has no opinion to declare¹.

The witty style of this passage might amuse the reader. But the humorous tone only serves to conceal the gravity of the matter.

Medawar's remarks were made in the, financially speaking, halcyon days of the 1960s. The British science budget was then increasing by over 10 per cent every five years in real terms². The growth continued in the 1970s, though at a lower rate. But a drastic reversal occurred in the 1980s. During the first five years of this decade, public expenditure on science in Britain declined by over 10 per cent in real terms, and all the signs indicate that the cutbacks will continue. But British scientists cannot complain that they had not been warned. In 1971 Shirley Williams, then a Member of Parliament and later (1976-1979) Secretary of State for Education and Science, spelled out an unmistakable warning:

For the scientists, the party is over. . . . Until fairly recently no one has asked any awkward questions. . . . Yet there is a growing suspicion about scientists and their discoveries. . . . It is within this drastically altered climate that the dramatic decline in expenditure on scientific research in Britain is taking place³.

Public spending on science has declined in other countries too. But a combination of reasons peculiar to Britain has made the situation perhaps the worst in any advanced industrial state. It is not our intention to discuss here all these reasons. Rather our objective is to identify and endeavour to combat what we consider to be the most fundamental, and yet the least recognized, cause of the present predicament of science, not only in Britain but throughout the world.

In 1986 British scientists reacted to the cutbacks with the launching of a campaign called Save British Science (SBS). Its stated objectives were:

. . . to communicate to the public, Parliament and Government a proper appreciation of the economic and cultural benefits of scientific and technological research and development, and of the consequent importance to the nation of

adequate funding of research by Government and industry.

These are also the declared aims^{3,4} of the Royal Society (RS). As its President Sir George Porter says, the RS "is effectively the national academy of science of the UK and it must therefore assume some special responsibility for science in this country"⁵.

Interestingly, British philosophers were quick to emulate the scientists in launch-

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ing their own campaign to save British philosophy, for the latter too has had its share of budget cuts⁶. In this article we argue that the British scientific and philosophical communities, and in particular the RS, have to their cost neglected one important factor in implementing their policies, and that therefore the present financial crisis is to a considerable extent self-inflicted.

On 17 and 22 February 1986 BBC television broadcast, in the highly regarded *Horizon* series, a film entitled "Science . . . Fiction?", and in the issue of 20 February 1986 *The Listener* published an article entitled "The Fallacy of Scientific Objectivity"⁷. As is evident from their titles, these were attacks against objectivity, truth and science. After rehashing the usual anti-science chestnuts, both the film and the article came to this conclusion: "The gradual recognition of these arguments may affect the practice, the *funding* and the institutions of science" (our italics). At least in Britain, the repercussions of these mistaken arguments are already happening. Scientists in other countries are duly forewarned.

We shall refer to these erroneous and harmful ideas as the epistemological antitheses — the (un)philosophical positions which are contrary to the traditional and successful theses of natural philosophy. (Epistemology is the study of the nature, generation and validation of knowledge.)

Articles and programmes attacking the scientific theses and championing the antitheses are published and broadcast regularly by the British media. But oddly, the RS, SBS and the other scientific bodies remain silent and do not deploy their powerful corporate muscle to answer such attacks against science (and sometimes against the RS itself). As a result, it appears, the editors of the popular media have come to the conclusion that the RS has no satisfactory answer.

This state of affairs is bad enough. But things are even worse: perversely, many individual scientists and philosophers seem bent on questioning and rejecting the true theses, and supporting the antitheses. For example, most of the participants in the "Science . . . Fiction?" film were academic scientists. What is more, the RS apparently co-operated in the making of this programme: a scene in which the RS was explicitly assailed, was filmed in the RS's own London headquarters.

In order to demonstrate the threats that the antitheses pose not only to science but also to society in general, it is useful to outline briefly the manner in which these ideas emerged gradually in the twentieth century.

In 1919 Sir Karl Popper by his own account⁸ had taken a strong dislike to the theories of Marx, Freud and Adler, whose supporters maintained that they were scientific. The difficulty was that Popper could not find any obvious way to refute them conclusively. Having noticed that Einstein's theories made (what seemed to him) falsifiable predictions, Popper resolved all his difficulties simply by declaring: "Irrefutability is not a virtue of a theory (as people often think) but a vice. . . . The criterion of the scientific status of a theory is its falsifiability"⁸. (Example: "The Earth is (approximately) a sphere" is not a scientific statement because it is not falsifiable; whereas "The Earth is a flat disk" is indeed scientific.) Popper also thought that observations are theory-laden. He phrased it thus: "Sense-data, untheoretical items of observation, simply do not exist. A scientific theory is an organ we develop outside our skin, while an organ is a theory we develop inside our skin"⁹.

But if observations are theory-laden, this means that observations are simply

theories, and then how can one theory falsify (never mind verify) another theory? Curiously, the full implications of this little complication were not fully grasped by Popper, but by Imre Lakatos: not only are scientific theories not verifiable, they are not falsifiable either — “If a theory is refuted, it is not necessarily false”¹⁰. (Example: both “the Earth is round” and “the Earth is flat” are neither verifiable nor falsifiable.) As David Stove¹¹ remarked, Lakatos has removed the logical stigma of falsity from refuted propositions, just as earlier public benefactors had removed the social stigma of illegitimacy from certain individuals.

So back to square one: if verifiability and falsifiability are not the criteria, then what makes a proposition scientific? It is hard to discern the answer to this question in Lakatos’s writings. But if any answer is discerned at all, it is one that contradicts flagrantly the motto of the RS: “I am not bound to swear as any master dictates”¹². This answer is more obvious in Thomas Kuhn’s¹³ writings: a proposition is scientific if it is sanctioned by the scientific establishment. (Example: if the scientific establishment decrees that “fairies exist”, then this would be scientific indeed.)

According to Kuhn, science is not the steady, cumulative acquisition of knowledge that was portrayed in old-fashioned textbooks. Rather, it is an endless succession of long peaceful periods which are violently interrupted by brief intellectual revolutions. During the peaceful period, which Kuhn calls “normal science”, scientists are guided by a set of theories, standards and methods, which Kuhn collectively designates as a “paradigm”. (Others call it a “world-view”.) During a revolution, the old paradigm is violently overthrown and replaced by a new one.

Vogues

So according to Kuhn, the business of science is not about truth and reality; rather, it is about transient vogues — ephemeral and disposable paradigms. In fact three pages from the end of his book *The Structure of Scientific Revolutions*¹², Kuhn himself drew attention to the fact that up to that point he had not once used the term “truth”. And when he used it, it was to dismiss it: “We may have to relinquish the notion that changes of paradigm carry scientists . . . closer and closer to the truth”. This passage was quoted approvingly by the author of a review in *Science*, whose final assessment of Kuhn’s book was this:

Since Kuhn does not permit truth to be a criterion of scientific theories, he would presumably not claim his own theory to be true. But if causing a revolution is the hallmark of a superior paradigm, *The Structure of Scientific Revolutions* has been a resounding success¹³.

So now that the term “truth” has become a taboo, we know what must take

its place: mass popularity and prevailing fashion.

Kuhn’s view, that a proposition is scientific if it is sanctioned by the scientific establishment, gives rise to the problematic question: what exactly makes an establishment “scientific”? This particular Gordian knot was cut by Paul Feyerabend: *any* proposition is scientific — “There is only one principle that can be defended under all circumstances and in all stages of human development. It is the principle: Anything goes”¹⁴. (Example: “There are one million fairies in Britain” is as scientific as “There are two hydrogen atoms in one water molecule”.)

In 1979 *Science* published a four-page complimentary feature¹⁵ about Feyerabend, the Salvador Dali of academic philosophy, and currently the worst enemy of science. In this article Feyerabend was quoted as stating that “normal science is a fairy tale” and that “equal time should be given to competing avenues of knowledge such as astrology, acupuncture, and witchcraft”. Oddly, religion was omitted. For according to Feyerabend (and the “Science . . . Fiction?” film too), religion — and everything else — is an equally valid avenue of knowledge. In fact on one occasion Feyerabend characteristically put science on a par with “religion, prostitution and so on”¹⁴. This is a queer theme to pursue, but it is really a serious matter. For whereas in Britain the hot issue has been the cutbacks in the science budget, in the United States the most conspicuous impact of the antitheses has been the alarming growth of religious fundamentalism. All this and much else notwithstanding, the *Science* article’s assessment of Feyerabend’s monstrous ideas was: “Compared with the stiff and sober work that is often done in the philosophy of science, Feyerabend’s views are a breath of fresh air”¹⁵.

Fortunately, the fallacies of the antitheses have been exposed by other academic philosophers, and the best debunking known to us was carried out by David Stove¹¹. Yet, one or other version of them remains popular with many philosophers, scientists, the media and the public.

The epistemological antitheses — scepticism, agnosticism, criticismism¹¹, cynicism, relativism, anarchism, nihilism — are not of course the invention of the twentieth century. Indeed the agnostic, nihilistic and anarchistic views of Gorgias, a fifth century BC Greek sophist, sound refreshingly modern. Aristotle¹⁶ (fourth century BC) reported that Gorgias taught that “nothing exists; and if anything exists, it is unknowable; and if it exists and it is knowable, yet it cannot be indicated to others”. Gorgias also argued that “one can persuade anyone of anything, if one speaks well enough”. The correct answer to this typical sophistry was already known to Aristotle: “One is more likely to

win one’s argument, if what one says is true”. But it is sadly the case that those such as Gorgias and Feyerabend can fool a lot of people a lot of the time with sophistries like “anything goes”. But of course in the long run one thing goes — objective truth.

Falsity

For reasons known only to themselves, the advocates of the antitheses refuse to recognize that their ideas are flagrantly self-refuting — they negate and destroy themselves. And if a statement entails its own falsity, then it must be nonsense: the proposition “there is no truth” contradicts itself, and hence some truths must exist after all. Similarly, the stricture “nothing is certain, everything is doubtful”¹⁷ casts doubt, besides everything else, upon itself, and so some certain and undoubted things must exist. Likewise, if “anything goes”, then “nothing goes” must go too.

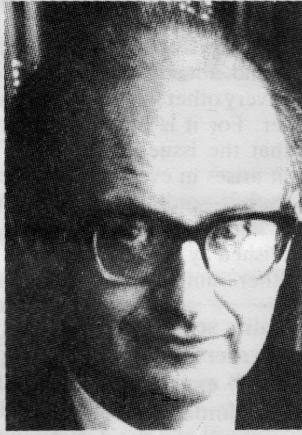
To most people this is sufficient refutation of the antitheses. But instead the sceptics and nihilists persist with doubting anything and everything with a cocksureness that beats any avowed dogmatist — they are dogmatical sceptics, and they would question anything except their own doubts. In the same vein, the epistemological relativists, who uphold the complete equivalence of all “paradigms”, may be aptly termed absolute relativists.

In any event, the spectacle of the supporters of the antitheses appealing to the very standards which they are bent on attacking is reassuring to those who uphold these standards. For example, those who claim to have refuted inductive reasoning have done so by employing inductive reasoning itself, as follows: from the true fact that many examples of inductive inference have indeed been shown to be invalid, these people inferred (inductively!) that all examples of inductive inference will be shown to be invalid.

On the subject of how to teach these weird modern ideas, we turn to the currently popular book *What Is This Thing Called Science?*¹⁷ by Alan Chalmers. It was first published in 1976 as a textbook for introductory university courses in the philosophy of science. Its popularity has been so great that it has been translated into many languages, and a new edition was published in 1982. The heading of the last section of the last chapter of the 1982 edition is “Why Bother?”, and the answer is revealing: “Why bother to carry out investigations of the kind to be found in the foregoing pages? The importance of the question becomes highlighted once it is admitted that philosophy or methodology of science is of no help to scientists”. After 168 pages packed with subtle concepts, sophisticated ideas and complex arguments, and after a gruelling academic session of (apparently futile) study, this must surely come as a rude



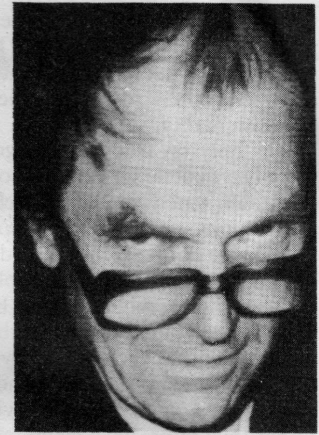
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Betrayers of the truth? Left to right: Karl Popper, Imre Lakatos, Thomas Kuhn and Paul Feyerabend.

shock to the serious student of science. But the student cannot complain. For Chalmers himself with commendable frankness notified the reader of the book from the outset, in the Introduction, what to expect from studying it: "We start off confused and end up confused on a higher level".

But come to think of it, once it is accepted, as done in this book, that the business of science is not about the discovery of truth and reality, then its conclusion that the methodology of science is of no help to scientists sounds eminently plausible: epistemological anarchism is a method, and nihilism is an (un)philosophical stance — and they do not require any special learning. Anyhow, Chalmers's answer to the hot question "Why Bother?", is that "as there is no timeless and universal conception of science or scientific method", the most important function of his book

is to combat what might be called the *ideology of science* as it functions in our society. This ideology involves the use of the dubious concept of science and the equally dubious concept of truth that is often associated with it, usually in the defence of conservative positions [italics in original].

While agreeing that genuine science cannot rationally defend any subjective ideological opinion, conservative or not, to dismiss science itself as just another ideology, and to allege that only passionate ideologues (but not dispassionate scientists) may benefit from the philosophy and methodology of science, is to talk nonsense. Yet sadly this is what many students of science, technology and medicine are taught in universities, and as a result these preposterous and dangerous ideas are becoming widespread within the scientific community. It is an objective of this article to refute these ideas, and argue that the correct epistemology is indispensable in any serious and responsible scientific work. For what is really at stake is nothing less than the future progress of our civilization.

One may wonder how many universities

in the world give their science students compulsory formal courses of lectures on the rigours of the scientific method. As for those universities which provide their students with an optional course on the current trends in the philosophy of science, are their governing bodies aware of the fact that many teachers of these courses are bent on sabotaging the scientific method?

Methodology

The hapless student is inevitably left to his or her own devices to pick up casually and randomly, from here and there, unorganized bits of the scientific method, as well as bits of *unscientific* methods. And when the student becomes the professional researcher, lacking proper tuition and training, he or she will grope haphazardly in the dark, follow expensive blind alleys and have recourse to such (unreliable) things as random guess, arbitrary conjecture, subjective hunch, casual intuition, raw instinct, crude imagination, pure chance, lucky accident and unplanned trial — and invariable error. Can this be an adequate methodology by means of which to make new discoveries and beneficial applications? Of course not, yet this is the entire methodology that the exponents of the antitheses actually recommend to professional researchers.

In the light of this evidence, Medawar's statement¹ does not seem surprising at all. In that passage Medawar suggested that the scientist "has no opinion" as to "what he conceives the scientific method to be". This might not be true of every scientist, but it appears to be true of quite a few. What is more, there has never been any attempt to rectify this worrying situation because, oddly and sadly, it was never seen as the anomalous circumstance that it indubitably is, and as the grave problem that it inevitably became.

Even though the endorsement of the antitheses saves one from the painstaking effort of discovering new truths, such conduct has some unfortunate drawbacks: the antitheses pose at least three different kinds of potential threats or actual

dangers not only to science as such, but also to society in general. In summary, these risks are: (i) Intellectual bankruptcy entails financial bankruptcy. (ii) Epistemological anarchism entails social anarchism. (iii) Epistemological relativism, criticismism¹¹ and nihilism entail scientific chaos, confusion and stagnation.

Danger (i). The first harmful repercussion of the antitheses, namely the cutback in the science budget, is already happening. The logical steps leading from the antitheses to the inescapable conclusion that the funding of science should be cut are not usually spelled out in detail. We spell them out now.

In the golden age of science, it was believed that the verified theories of science were true and everlasting. But with the increasing acceptance of the antitheses, these exalted old ambitions of science are seen as bogus. According to epistemological relativism, science should no longer claim superiority for its method and the knowledge that it produces. Moreover, in the capitalist system of economy, a scientific theory is a commodity like any other, and it must obey the laws of this system. Scientific theories are now considered to be temporary and dispensable. Furthermore, by denying truth and reality, the antitheses reduce science to a pointless, if entertaining, game; a meaningless, if exacting, exercise; and a destinationless, if enjoyable, journey. The aim of the game is just to play; the object of the exercise is merely to keep one busy; and the purpose of the journey is but aimless wandering.

Having lost their monopoly in the production of knowledge, scientists have also lost their privileged status in society. Thus the rewards to the creators of science's now ephemeral and disposable theories are currently being reduced to accord with their downgraded and devalued work, and with science's diminished ambitions.

It is the duty of those who want to save science, both intellectually and financially, to refute the antitheses, and to reassure their paymasters and the public

that the genuine theories of science are of permanent value, and that scientific research does have a concrete and positive and useful aim — to discover the truth and establish reality.

It is only on true knowledge that the socially beneficial and economically profitable medical and technological applications can be firmly grounded — knowledge normally discovered by means of the valid and judicious application of the scientific method. Now the hard fact is that most governments, being the political institutions that they are, provide public funds for research on the condition that the findings of this research will, sooner rather than later, have economic returns. For example, the British government told Parliament in 1986¹⁸ that it (the government) is

more likely to be persuaded of the value of increasing public investment in science, if the scientific community, and the users of its products, can point to increasing economic and social benefits, and in particular to prospects for increased national wealth.

Actually the ultimate reason cited by Shirley Williams in 1971 for the “dramatic decline in expenditure on scientific research in Britain”, was that the “expected outcome” of the previously lavish spending, namely “an increase in gross national product”, in fact “never happened”².

In the wake of the rejection of scientific truth by so many researchers, and their candid admission that they do not really know what the scientific method is, the unpalatable fact pointed out by Williams is hardly surprising. If anything is surprising, it is the curious fact that some of the manufacturers of deficient, perishable and basically useless products — the short-lived, disposable and basically untrue theories — should complain that the selling price of their inferior product is dwindling.

It is therefore clear that the usual plea that greater funding of science results in proportionally greater wealth is woefully inadequate. Apart from increased funding, another requirement is increased care in the correct and sagacious application of the scientific method. Thus before laying all the blame at the doors of government and industry, the scientific community should put its own house in order.

It is not enough for scientists to assert vaguely that basic research will (just possibly) lead to new discoveries and profitable applications. Those scientists who want to uphold the intellectual integrity of their profession, and who are interested in selling their skills in the marketplace, owe it to their paymasters to explain adequately how they propose to make new and fruitful discoveries, instead of trying to conceal the embarrassing fact that they do not really know what the scientific method is.

Danger (ii). A second danger could have

an impact both broader and more disastrous than the first. This lies in the fact that epistemological cynicism and anarchism entail social, political and every other kind of anarchism and disorder. For it is not only in formal science that the issue of objective truth arises — it arises in every department of life. Both truths — ordinary and scientific — are of the same character in that they are both established by, either natural or artificial, either simple or

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sophisticated, *observations*. In fact the only meaningful definition of truth is by way of the objectivity of theory-free and context-transcendent observation. If one kind of truth is denied, the other will have to go too. Now if the notion of objective truth established by observational evidence is disregarded, one is left in a chaos of arbitrary and conflicting opinions, opinions which are equally well- or ill-founded. For from the false premise that all observation is theory-dependent, all routes lead inexorably to “anything goes”. **Danger (iii).** A third danger springs from the fact that the antitheses are by nature obscurantist and they inevitably stifle progress. In the jungle of epistemological anarchism and criticism¹¹, every single bit of painstakingly proven knowledge is frivolously questioned and cynically scoffed at. In the consequent intellectual chaos there results a thick fog of confusion which completely obscures every possible route to further discoveries, and in this way the quest to enlarge knowledge is effectively paralysed.

Moreover, if one believes that there exists no objective truth, or even if one has doubts as to its existence, one then has no motivation, nor even inclination, to try to discover it. It is therefore highly unlikely that such a person would make any new discoveries (funding agencies take note). Furthermore, scepticism and nihilism were not threats only in the remote past; nor do they now constitute a risk of only academic interest. There seems to be evidence^{19,20} indicating that they may be impairing scientific progress at this moment.

Natural philosophy has had enemies throughout its 2,600 or so years of recorded history. But the present era is unique in that it is the first civilized society in which an effective anti-science movement flourishes contemporaneously with the unprecedentedly magnificent technological and medical applications of modern science. This is a curious paradox which cries out for clarification. The explanation of this sad situation is, of course, the large number of errors regard-

ing the nature, scope, method, powers and limitations of science.

It is not the objective of this article to correct all the errors which plague science and philosophy today, or to present the detailed solutions to all of the vexed problems of epistemology. For this is a colossal task, a task however that scientists are obliged to undertake themselves. The purpose of this article is merely to show that an acute problem exists, and to indicate broadly how it can be solved. The problem is that although the epistemological antitheses are demonstrably untenable, inherently obscurantist and positively dangerous, they have become alarmingly popular with the public, and even worse, with the communities of professional philosophers and scientists.

In barest outline, the solution of the problem is that science and philosophy will be saved — in both the intellectual and the financial sense — when the practitioners of these disciplines stop running down their own professions and start pleading the cause of science and philosophy correctly. This should be best done, first by thoroughly refuting the erroneous and harmful antitheses; secondly by putting forth adequate definitions of such fundamental concepts as objectivity, truth, rationality and the scientific method; and thirdly by putting the latter judiciously into fruitful practice. Only then will the expounding of the positive virtues of science and philosophy carry conviction. □

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