Science as truth

Peter Atkins

History of the Human Sciences 1995 8: 97

DOI: 10.1177/095269519500800206

HISTORY OF THE HUMAN SCIENCES Vol. 8 No. 2

pp. 97–102

Science as truth

PETER ATKINS

Although some may snipe and others carp, there can be no denying the proposition that science is the best procedure yet discovered for exposing fundamental truths about the world. By its combination of careful experimentation guided by theory, and its elaboration and improvement of theory based on the experiments it has inspired, it has shown itself to be of enormous power for the elucidation and control of nature. There appear to be no bounds to its competence: it can comment on the origin and end of the world, on the emergence, evolution and activities of life, and it can even, presumably, account for the activities and beliefs of sociologists.

This claim of universal competence may seem arrogant, but it appears to be justified. No other mode of discovery has proved to be so effective or to contribute so much towards the achievement of the aspirations of humanity. Foremost among these achievements is the continually renewed reinforcement of the view that the human brain is such a powerful instrument that it can illuminate whatever it selects as its object of study, including itself. A second major achievement is the demonstration that the world is a rational place, and although it may be too complex globally to be subject to much prediction, science continually reaffirms the view that structures and events can be explicated. Third, of course, in this awesome load of achievements is the rich abundance of goods and technologies that science provides for society, including medicine, transport and communication.

Arrogant its claims may be, but science springs from humanity and exercises it in all its endeavours. In a number of respects, its procedures are an idealization of the qualities that we regard as admirable in everyday intercourse. It is honest. Admittedly, there are some practitioners who for one reason or another are dishonest, but they are invariably found out even though they may waste time. Truth invariably prevails in science even though the road to it is not always straight. It is free of irrational prejudice. I grant that it is not free of prejudice, for the whole edifice is based on the expectation of rationality and the view that

observations and theories will form a mutually supportive network. But it is free of *irrational* prejudice in the sense that it has an open mind towards the acceptance of new paradigms, such as those that have been associated with natural selection, relativity and quantum theory. Thirdly, it is transnational, transcultural and transracial. There is not a Japanese science, a Malawian science and a Slavonic science; there is no Christian science worth the name, no Islamic science and no Hindu science; there is no aristocratic science and no working-class science. What respectable science there is knows no frontiers of country, faith, or class. There may of course be particular *interests* in each of these groups; but that is no different from a chemist being interested in one thing and a biologist in another.

There are no opportunities for lasting conspiracy in science. The structure of the scientific enterprise is such as to encourage the demolition of others. Fame in science comes not from the adherence to old attitudes and the exegesis of authoritative writings but from their overthrow. There is a constant urge to discover the revolutionary and to overthrow current paradigms. Natural selection was a revolution and a stepping-stone to fame; so was relativity, and so was quantum theory. The sheer thrill of discovery is the spur to greater effort. All young scientists aspire to revolution. The same spirit of aggressive inquiry is the basis of scientists' careers, and is the underlying reason why false claims are so soon overthrown. A scientist constantly exposes the breast to attack by those who, if they scent a rat, will attack without mercy. Science is the ultimate market economy of knowledge, where only valid observations and plausible theories survive.

An excellent example of the scientific method in progress is the story of cold fusion (Close, 1992). The facts of this story, such as they are, are well known, and I need not rehearse them here. Although the episode is widely regarded as one in which chemists got egg on their face, the outcome is in fact rather more positive for science as a whole. Then as now the world was in urgent need of cheap sources of energy, and there was a desperation to believe that the reported observations were true. Had the claims been within the context of religion or some other similarly relaxed code of inquiry, then shrines would still have dotted Utah. But scientists smelled a rat, and even those who did not still knew that the reported observations had to be tested exhaustively. What appears to be the end of the story is now well known: the experiments were poorly organized and executed, and too hasty publication circumvented the constraints of peer review. Cold fusion, at least in the form reported, is regarded as an illusion. Here is the longing of society for miracles thwarted by the application of science.

Although science encourages originality and fans revolution, it does not do so willy-nilly. Scientific revolutions are conservative, cautious affairs. They are carried out only if observations show them to be strictly necessary, and they are normally erected on the foundations of the already secure. Revolutions in science do not emerge as free-form bubbles floating in a vacuum. Even relativity is firmly

based in the milieu of classical physics and stems from the imposition of a particular transformation law (Graves, 1971). Likewise, quantum theory, that arch-paradigm of the overthrow of the past, grew out of classical physics and when viewed correctly, can be seen to be an edging forward of an idea that consequently turned out to have profound implications (Jammer, 1966). Max Planck proposed the crucial formula that represents a break with the past, and then spent his life seeking to account for it in classical terms. Desperate as he was to preserve classical physics, he was overtaken by Nature. When we finally achieve a union of quantum theory and gravitation, we shall probably discover that it corresponds to the evolution of an idea in the form of a tiny modification of a constant or a symmetry, but it will have profound implications for the structure of spacetime (Weinberg, 1993).

Moreover, when scientific revolutions occur, although they may send an earthquake through the foundations, they cause a barely detectable ripple in more distant parts of science. The unification of the forces will leave taxonomy untouched, and molecular biology will be essentially unruffled. Chemistry will be slightly stirred by a whisper of the unification, but all its reactions and concepts will be unaffected. It is only in deepest spacetime, in cosmology, cosmogenesis and elementary particle physics, that the earthquake will shatter and a new and grander vision will emerge to absorb the old.

True scientific revolutions are utterly distinct from the revolutions proposed by those who hanker for the paranormal. Real scientists have no time for the reports of such phenomena. Indeed, they scorn the reports and regard all practitioners as contemptible charlatans. Although such scornful attitudes are seen by some as politically incorrect, and at worse a conspiracy of the scientific establishment to trample underfoot the green shoots of unorthodoxy, there is good reason to believe that all claims of authentic paranormal observations are hogwash. First, there are no authenticated, reliable observations of phenomena that cannot be explained by the principles of conventional science. Second, whereas true scientific observations are like a canvas stretched over a frame of theory, purported paranormal phenomena are isolated pimples of whimsical speculation that are not grounded in a coherent corpus of knowledge. Third, were purported paranormal phenomena ever to be authenticated, they would devastate the whole structure of science, for most of them strike at two of its great foundations, the conservation of energy and causality. It is simply silly to assert in opposition to this remark that because there is a conspiracy among scientists to preserve these two pillars of rationality, intellectual police are sent to exterminate the first sign of the paranormal. If either foundation were overthrown by careful experiments on elementary particles, then there would be a Nobel prize for the overthrower; but to suppose that these two principles are best tested in the equivalent of the gambling halls of Las Vegas is frankly absurd.

One aspect of the paranormal versus real science should not go unremarked. As in other forms of obscurantist pursuit, such as religion, it is so easy to make

time-wasting speculations. The paranormal is effectively unconstrained whimsicality. Original suggestions in real science emerge only after detailed study and the lengthy and often subtle process of testing whether current concepts are adequate. Only if all this hard work fails is a scientist justified in edging forward human understanding with a novel and possibly revolutionary idea. Real science is desperately hard work; the paranormal is almost entirely the fruit of armchair fantasizing. Real science is a regal application of the full power of human intellect; the paranormal is a prostitution of the brain. Worst of all, it wastes time and distorts the public's vision of the scientific endeavour.

Those who point at real scientists' rejection of the paranormal and claim that it is a sign of science's intolerance and of an inward-looking, self-propagating conspiracy are only one part of the iceberg of opposition to this the greatest of humanity's intellectual achievements. There are those who, fearful of the seemingly unstemmable tide of scientific progress, are anxious to undermine its acceptance by the general public. This is not the place for me to address the particular fear of the religious, who see the legs of their beliefs one by one being sawn away, and hence are desperate to find relief by claiming that science is incompetent to elucidate those parts of the human psyche that yearn for immortality and purpose. Religious beliefs are so patently absurd that they are included in my remarks on the paranormal. Instead, I shall touch on a more insidious attack on science.

There are three related questions. First, to what extent is the practice of science conditioned by its social milieu? Second, is there any validity in the charge that scientific truths are relative and not absolute? Third, do social scientists have any helpful role to play in the elucidation of nature, and if not of nature then of the nature of the scientific endeavour? In this last connection it is important to disentangle the trivial from the profound. It is undeniable, I consider, that social scientists have an interesting role to play in the analysis and elucidation of the deportment of scientists, their interaction with one another, their interaction with the public, and so on. Just as the brain can study itself, so it is appropriate that society should study itself. Such studies are of considerable importance for the understanding of society and the emergence of ideas, but at the same time they constitute a relatively trivial pursuit. The real question that is raised by social scientists (but not of course by natural scientists) is whether they have a special insight into nature itself, and whether they can see that what natural scientists are doing is an absolute quest for absolute truth, or that it is an illusion.

I consider it to be a defensible proposition that no philosopher has helped to elucidate nature; philosophy is but the refinement of hindrance. However, I shall confine my argument to a narrower domain, and argue that no *commentators* on the practice of science have contributed to the elucidation of nature. I include as a subset of commentators, the measurers, investigators and thinkers who comprise the social scientists.

The crucial point seems to be that it is absurd to confuse the mechanism of

discovering with the nature of the discovery. It is certainly the case that there is a global matrix of expectation and plausibility in which the eggs of new ideas must be laid. But that does not mean that those ideas are not an ever-improving approximation to an underlying truth. As an illustration, consider the current effort in particle physics to explore the fundamental structure of the universe and in particular to investigate the regimes of energy at which unification of the forces can be expected. The effort involved, both financially and intellectually, is enormous, and there has been no more complex experiment ever organized. Yet the outcome, when it is achieved, will be the exposure of an underlying simplicity of nature (Atkins, 1992). So often people who do not fully grasp the character of scientific endeavour identify the complexity of the effort of discovery with the fundamental complexity of nature. That is quite false. Nature is fundamentally simple, but it takes complex effort to identify that underlying simplicity, and just as much effort to trace the ramifications of that simplicity out into the world of macroscopic phenomena.

So it is with the insistence of certain groups that the pursuit of science as a social activity implies that the knowledge disinterred is a reflection of the inquisitive society rather than being an absolute contribution to knowledge. There is certainly a considerable social element in the pursuit of knowledge, and in particular in the control of spurious claims, but that does not logically imply that the knowledge so obtained is socially engineered any more than that the outcome of a complex experiment is necessarily a complex aspect of nature.

I also think it relevant that the most powerful penetration of fundamental nature takes place by the application of a technique that has been squeezed dry of social content. Mathematics, the supreme achievement of detached reflection, has proved to be, for whatever reason, the most reliable language for driving concepts forward and equipping them with enough spine to enable them to stand up to experimental investigation. To explore the innermost secrets of nature, to understand the structure of fundamental particles, to understand the nature of spacetime, to understand the origin and to predict the end of the cosmos, and to unravel the implications of molecular biology, we scientists resort to mathematics. How is it that this most etiolated articulation can be the most reliable and fecund procedure for pressing nature to expose its secrets? (Atkins, 1994) Surely it would be an unresolvable paradox if science were a social construct yet needed this most socially expurgated of languages to carry out its investigations and to describe its results?

Beyond all this verbiage, of course, lies the natural scientists' ultimate justification for the procedures of science: it works, and it is consistent. That it works can be seen all around us. It works in condensed matter physics, the basis of information technology. It works in fluid mechanics, the basis of transport. It works in molecular biology, the basis of medicine and agriculture. Not only does it work, it works regardless of the cultural setting. British Airways does not fly its aircraft on British aerodynamic principles and El Al on Jewish aerodynamic

principles. Successful medicine is fundamentally the same in Japan as in Canada. A conference of scientists will be a global meeting of minds and so long as politics does not corrupt the proceedings, the participants will speak a common language of concepts and aspirations. Where external influences do seek to impose attitudes on science, where there are pressures to control the free flow of information and activity, then science soon fails. We saw this with Lysenko in the Soviet Union, where actual social pressure, the attempt of society to impose itself on science, led to the decay of biology there.

I said that as well as working, science is consistent. Ideas flow into science from all parts of the world, from all its cultures and backgrounds, and from different disciplines. Where they merge, they mix, and are seen to be mutually compatible. Ideas emerging from biology, despite the many different pressures at work, are not in conflict with those emerging from particle physics. Ideas in chemistry merge seamlessly with those of geology, botany, physics and astronomy. That is the considerable strength of science, for it springs from many sources, and those sources mingle constructively where they meet. No more compelling example of this marriage of rivers is to be found than in modern cosmology, where an explanation of the large-scale structure of the universe is found to require concepts, information and facts from particle physics. Here the immensely small meets the awesomely large: yet they match and mutually augment. It is frankly absurd to suppose that this matching is a conspiracy and a distortion of vision by an aberrant social lens. It is equally absurd to suggest that the global understanding we are acquiring of nature is an intellectual fantasy. Science, the consummation of the Renaissance and the apotheosis of the human intellect, is on the track of ultimate truth, and no attempt to discredit it will deflect it from this noble task.

Lincoln College, University of Oxford

BIBLIOGRAPHY

Atkins, P. W. (1992) *Creation Revisited*. London: Penguin.

Atkins, P. W. (1994) *The Second Law*. New York: W. H. Freeman.

Close, F. (1992) *Too Hot to Handle: The Story of Cold Fusion*. London: Penguin.

Graves, J. C. (1971) *The Conceptual Foundations of Contemporary Relativity Theory*. Cambridge, MA: MIT Press.

Jammer, M. (1966) *The Conceptual Development of Quantum Mechanics*. New York: McGraw-Hill.

Weinberg, S. (1993) *Dreams of a Final Theory*. London: Hutchinson Radius.