RHETORIC AND REALISM

Rom HARRÉ[*]

* Philosophy Centre, 10 Merton Street, Oxford OX1 4JJ, United Kingdom.

ABSTRACT: Does the deconstruction of scientific discourse and experimental procedures undercut realism? In this paper I want to argue that the revelation of the rhetorical character of science serves rather to support realism, since it is in the interests of the presentation of scientific writing as factual and of scientific experiments as disclosing or revealing reality that the various rhetorical devices are employed.

Keywords: rhetoric, realism, experiment, *datum, factum*, grammar, discoursive fact, power, disposition, indexicality, modality, special relativity, affordance, existence.

The construction of facticity

By what devices does a scientific writer present the content of a statement as a fact? To answer this question we must first make clear what facts are supposed to be, within the scientific community and lay community alike. There is a distinction that appeals to philosophers between a *datum*, something given, and a *factum*, something made. Both are relate to the third member of this conceptual cluster, state of affairs. A state of affairs, some object with property (to use the ever popular metaphysics borne by the subject-predicate grammar), or some group of objects arranged in some way, can exist independently of any human being. But in so far as a human being becomes aware of that state of affairs it manifests itself to that person in some guise or other. There is a distinction of which philosophers are fond, and for which there is nowadays little support, beween the sensations a person experiences at that moment and their grasp of the state of affairs. A shape, colour and so on are supposedly the data, from which, by some mysterious psychological process, a person constructs or makes the experience of the state of affairs, and thus the *factum* is born. The *datum/factum* distinction also appears in quite another ontological dress in the distinction between experimental or observational results and the conclusions drawn from them, for example that these data are the manifestations of a law. The genesis or making of the law by induction establishes it as fact. Here the data are facts in the sense of the first level *datum/factum* distinction. These are the familiar foundations of the empiricist epistemology we have all inherited from Locke, and towards which so much recent criticism has been directed.

The failings of this scheme both as an epistemology and as sketch of a psychology of perception are now well established. Yet the most cursory glance at the science journals will show that the two stage *datum/factum* distinction is still very much in use. Why? I believe that its persistence in the face of all sorts of criticism is to be explained by its role in the rhetorical presentation of the results of scientific work

both as worthy of belief, and as factual. It is not I think that because we first establish something as a fact we then find it worthy of belief. The construction of facticity and the creation of belief-worthiness are two sides of the same coin. In doing the one we do the other. The two stage *datum/factum* distinction does not represent a deep ontological/epistemological revelation of how human beings are related to the world. Rather it is a device for presenting the results of investigations, both lay and scientific, in a form that carries conviction.

There are then two quite different questions one can ask about facts. How do we present something as a fact? And is it a fact? To the first we shall give answers in terms of discursive conventions and rhetoric. To the latter we shall give answers in terms of the pragmatic criteria of a scientific research programme. It is important to see that posing the first question and finding a suitable answer does not pre-empt the answer to the second. Some philosophers (and indeed many non-philosophers) misunderstood the purport of deconstruction, as if it cast doubt on the viability of the substantial questions of science, as if showing how a certain status for a claim was created cast doubt on the claim itself. Thus it was assumed by some, for example by both Rorty (1979) and Gergen (1991) that deconstruction led inevitably to relativism. This mistake was not made by Barnes (1974) who insisted, rightly, that the sociological and discursive analysis of science was perfectly compatible with an attitude of realism to the content of scientific claims. That a fact is discursively generated does not make it a discursive fact. To assume it does is to commit the process-product fallacy. It is a fallacy to trasnfer a property of the process that brings something about to the thing that is brought about. Bread baking is hot, but bread is not. Prejudiece may bring someone to believe something that is true.

The presentation of matters of fact is characterized by a certain grammar, the subject-predicate grammar of the Aristotelian tradition. We express our facts, when created, in such forms as 'Sodium *is* a monovalent metal'. We test our facts in the conditional form: 'If sodium is a monovalent metal then it should react with water releasing hydrogen'. We pass, in grammar, from an occurrent property ascription to the ascription of a power or disposition.

Let us look in a little more detail at the rhetorical moves by which a certain propositional content is presented in *factum* form. I shall be arguing that these rhetorical moves parallel the moves by which an experimental procedure is developed in such a way as make a particular state of affairs available as a matter of fact. These observations go some way back to the points made by Lat our and Woolgar (1959). A candidate fact is marked by three discursive features; indexicality (that is it is credited to a particular person at a particular time and place), modality (that it is presented as a possibility), and epistemic quality (that is it is presented as something for which the evidence is not yet overwhelming). Of these three features Latour and Woolgar highlighted only the first. In moving towards factual status a propositional content is presented with more and more of the indexical markers deleted. We should also be able to trace a similar sequence of modal statuses, from the problematic through the assertoric to the apodeictic, from possibility to necessity.

Examples of the rhetorical trasnformations I have been discussing are to be found in every issue of any scientific journal. Here is one taken at random off my shelves. In an article by Steinsmeier-Pelster, Martini and Reisenzein (1995) the local and

particular character of the subjects of the experiment and the venue is clearly announced (p. 23) as follows: 'Fifty two male and female students from the University of Bielefeld participated on a voluntary basis. Most of them were students of law or management'. By p. 29 the rhetorical trasnformation of the *data* to *facta* has been accomplished and the upshot of the experiment is described as follows: 'In sum the data support our hypothesis that surprise is not a consequence of luck attributions, as maintained in the attributional model, but an affective reaction to to unexpectedness that precedes the attributional process or more precisely, stimulates causal thinking.' Not only is the place at which the experiment performed deleted from the discourse, but also the particular character of the participants in the experiment. Furthermore there has also been a rhetorical transformation of the phenomenon studied. It is first presented (p. 13) as an everyday task, namely recalling an exam result, which is procedure characterised by intentionality (the task had an aim that was specified in the question) and normativity (remembering is a task the outcome of which is correct or incorrect to some degree). But in the conclusion it is presented in a rhetoric of causality, by the use of terms like 'consequence', 'reaction' and 'stimulation'. Unsurprisingly these rthetorical transformations are neither flagged nor justified. They are the 'grammar' of the writing of research reports. They are, of course, problematic!

Is it a grammar or is it a theory?

It has become increasingly clear, under the influence of the deconstructionist outlook, that the simple realist question 'Is this theory true, and to what extent can it be relied on as an accurate depiction of reality?' is not always capable of being answered even in principle. This is not because the theory in question is somehow recondite or obscure in what it says, or because the matters of which it treats are remote from observation, but because it is functionally a grammar, in the generalized sense given to that notion by Wittgenstein (1953). The propositions of a 'theory' which is functionally a grammar are being used by the scientific community which accepts them as rules for the use of terms, and for expressing the limits of application of concepts. Such theories delineate the boundaries of what makes sense. They set up the frame within which we can construct pictures of reality. In both the *Tractatus* (1922) and *On Certainty* (1972) Wittgenstein gave a procedure for identifying framework or grammatical propositions. While we would assent to their assertion as true we would dissent from their negation, not as false, but as meaningless. To take a famous and banal example the statement 'Nothing can be red and green all over at once' is not a general statement about coloured surfaces, supported by observation, but expresses one of the rules for the use of the words 'red' and 'green'. They are determinates under the same determinable. We can grasp this by considering whether it would make sense to say that this or that surface was both red and green. We cannot understand what could be meant by it. Perhaps Newton's three Laws are grammatical in this sense, fixing the use of certain terms. If so we need not worry that they seem to describe idealised physical processes. They do not describe physical processes at all. I believe a strong case can be made out for interpreting the Special Theory of Relativity along these lines, as a set of rules for a grammar of historical discourse under the constraint on communication that comes from the peculiar properties of the transmission of light signals.

Special Relativity as a Grammar

I shall try to show that it makes very good sense to take Special Relativity as a revised 'grammar' for the basic concepts of mechanics, spatial distance s, temporal interval t, and mass m. To reach this insight we need to follow the historical development that led to the theory. Galileo realised that the laws of mechanics would be the same whatever the linear velocity of the material system in which they were put to the test. He imagined a physicist doing some experiments in a closed cabin on a moving ship. There would be no differences in the way things behaved that would enable the physicist to tell whether the ship was moving with respect to the shore or lying becalmed. Put another way we could say that the laws of mechanics are covariant, that is remain the same in their form, under a set of rules which transform measures of some process obtained in one frame of reference into the measures we would obtain for the same process in another frame of reference moving relatively to the first. These rules are called the Galilean transformation. In the course of the development of physics it became clear that not all the laws of nature were covariant under the Galilean transformation, in particular Maxwell's Laws of Electromagnetism were not. They were covariant under the Lorentz transformation, a much more complex set of rules, in which the velocity of the frame of reference with respect to the velocity of light had to be taken into account and in which spatial and temporal measures did not transform independently of one another as they did under the Galilean transformation.

This was the dilemma faced by Einstein. Should one revamp the laws of electromagnetism to make them covariant under the Galilean transformation, or revise the Newtonian laws of mechanics to make them covariant under the Lorentz transformation? Why bother? Einstein was animated by a strong sense that symmetry and simplicity should be aimed at everywhere in physics. By revising the concepts of mass, length and time, he was able to rewrite the laws of mechanics so that they fitted into one single scheme with the laws of electromagnetism. Physicists now take it for granted that all putative laws of nature must be covariant under the Lorentz transformation.

What does that mean? It means that the rules of the Lorentz transformation are a kind of grammar by which data about some process obtained by measurements relative to one reference frame are transformed into new data, the data that would be obtained by making measurements of the very same process in a frame of reference moving with uniform relative velocity with respect to the first frame. These data are histories. So what the Lorentz transformation does, just like the Galilean transformation, is to enable a historian in one frame of reference to work out what a historian in another moving frame of reference would say about the very same process whose history had been written by the first historian.

If the Special Theory is a grammar, then it should be judged in the light of its role in the creation of scientific histories of the motions of particles with respect to one another. How would we judge alternative grammars? Clearly Einstein's own criteria, which are essentially aesthetic, seem to fit this task rather well. The simpler and 'tidier' the grammar the better.

Experiments as 'bringings to light'

Gooding (1990) has made a careful study of the way that descriptions of one of Faraday's most important experiments, the demonstration of the mechanical effects of electromagnetism, progressively deleted the particular circumstances of its first discovery and the particular skills of Faraday himself. In the end the effect was presented as something anyone could bring forth for him or herself. Furthermore what was 'brought forth' was now presented as a *natural* phenomenon, that is its form and existence did not depend on the activity or the apparatus of the experimenter. One could regard an experiment, in the final rewritten form, as a rhetorical device. 'If you don't believe me, see for yourself!' Datum becomes factum, in very overt way in the transformations of descriptions of 'what to do' that Gooding has charted. But the rhetorical character of the procedure is aimed at presenting the effect which is made or produced as a natural phenomenon, in short as a datum.

The realisation that different experimental set-ups revealed different and seemingly incompatible aspects of *a* process, forced on the physics community by the seemingly anomalous behaviour of subatomic particles, has led to a fundamental modification of the conception of experiment, sketched above, in which factum is presented as datum. For more than half a century philosophers of physics have tried to fit the description of quantum mechanical effects into a Faradayian rhetoric. This has produced such tantalising and seemingly insoluble difficulties as the 'measurement problem'. The question 'Given the incompatiblity between the results obtained by different species of apparatus what is the real state of the world that they jointly measure?' seemed to make sense and so to call for an answer. Long ago, buried in the misty Scandinavian discourses of Niels Bohr, an answer was presented. In brief the answer was simple: there is no measurement problem because there is no corresponding real state of the world that is being measured. To support this drastic opinion Bohr had a subtle analysis of the experimental process itself, quite different from the seeming positivism to which many assigned his first efforts to make his position clear.

To understand Bohr's conception of the experiment it is necessary grasp a concept, which is not explicit in his analysis. This is the concept of an 'affordance'. The material world affords certain activities to human beings. The term was originally introduced in this sense by the psychologist, J.J. Gibson (1979). He pointed out that people perceived surfaces as affording walking, and other categories of material things as capable of being perceived as affording a variety of human activities. Using this concept we can interpret Bohr's insight as the idea that different apparatus, hooked up to instances of the same process, embody different human affordances. This one will afford the production of electrons-as-particles and this one will afford the production of electrons-as-waves. Of what are these affordances properties? Not of the world behind the apparatus. The word does not have these affordances. It is the indissoluble apparatus-world complex that has them. So experiments in physics do not bring forth aspects of the world for all to appreciate, but rather they display the affordances of apparatus-world complexes. Neither the apparatus nor the world can be detached from the package. In discursive terms we could say that the *datum/factum* distinction has no place in the explication of the role of experiments, according to Bohr's insight. The

distinction is essential to interpreting experiments in the classical mould, since their role just is to move in rhetorical presentation from *datum* to *factum* back to *datum* again, but seriously misleading if generalised to the presentation of subatomic experimental physics.

When do existence questions make sense?

In Wittgenstein's vivid image grammatical propositions form the frame and descriptive propositions delineate the picture. This is not, of course, the familiar and often criticised distinction between analytic and synthetic propositions. The negation of an analytic proposition makes sense, as indeed it must if we are to realise that it is never true. This sort of modality easily slips over into the 'possible worlds' model. The affirmation of an analytic proposition is true in all possible worlds, and its negation true in none, that is false in all. In essence this is an extensional account of modal concepts, attractive to those who find any other notion of meaning than the denotative hard to accept. For us of a less delicate stomach the distinction between cases in which seeming propositions have no application because the form of words makes no sense and cases in which a proposition has no application because it is false in all contexts is a vital and deep one. The idea that analytic propositions are disguised rules for the use of words is a bad device for trying to elide these two very different ways that application of words in a context may fail.

This distinction bears heavily on the question of when existential hypotheses are justified. A proposition that is always false may be so because, though each of its semantically potent components denotes something, there is nothing that corresponds to the particular combination of expressions that appears in the proposition. This is how Wittgenstein's picture theory accounted for falsehood. Extensional versions of modality cannot distinguish this case from cases in which the formation of the proposition involves some violation of rules of use for some or all of the words in the sentence purporting to express a proposition. Clearly framework propositions which seem to denote entities existing independently of language do not secrete existential claims in any ordinary sense. When we make an existential claim it is surely such that it may turn out false. Leading us astray here is once again the extensional interpretation of modality. We feel that there is something queer here, as if whatever seems to be denoted by the terms of a framework proposition must exist. But this feeling comes from the lingering sense that framework propositions are true in all possible worlds, including this one. A confusion between framework propositions and analytical truths is evident in Kripke's (1980) conception of the rigid designator term, one which denotes the same thing in all possible worlds, a necessary existent.

In the discourses of science the distinction we want is Wittgenstein's, between propositions which express our determination to use words in a certain way, and those in which those word are used in substantive empirical and theoretical discourses in just those ways. For example one may suppose from a superficial inspection of the Special Theory of Relativity that it is *about* space and time, that there are locations and moments at which things and events exist. One can readily mistake the Minkowski Space-Time *diagram* for another manifold that exists 'behind' the manifolds of things and events. Indeed Minkowski himself so advertised his great innovation. But the

propositions of the Special Theory are grammatical propositions, expressing a determination to use spatial and temporal expressions in a certain way. But if that is the case are we not committted to holding that as framework propositions their negations are nonsense? Yet it seems to make sense to say that mass is independent of the ratio of the velocity of a moving body to the velocity of light. *But that is to start the construction of another frame.* It is to create another vocabulary. The proposition 'Mass$_r$ is independent of the ratio of the velocity of the body to the velocity of light' makes no sense, if 'mass$_r$' has been given a use according to a grammar that is expressed in the Special Theory. It is this point that can make sense of the notoriously puzzling idea of 'incommensurability of paradigms'. If we try to make sense of that idea as if it were an epistemological concept about what we can and cannot know, or perhaps a psychological one about what we can and cannot understand, we find ourselves quite confused. Of course we can know some Newtonian things and we can understand Aristotle's cosmology tolerably well. If however we take it as a remark about what we can and cannot say, in the same breath, so to say, it makes perfectly good sense. Grammar does not decide what does or does not exist. But it does bound what we can and cannot say exists.

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