Physics and our view of the world

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5 The world of empiricism

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My topics are the relation between science and myth, and the possibility of empiricism as an approach to life as well as to science. But philosophy is a thoroughly historical enterprise, a dialogue that continues in the present but is always almost entirely shaped by our past. So I will devote the first half of this chapter to setting the historical stage.

1 Two philosophical traditions

There are two main traditions in philosophy about science and about our knowledge of nature; I'll refer to them as *realist metaphysics* and *empiricism*. Both of these can be approached more narrowly as concerning how we should understand science. But we can also think of them more broadly as concerned with making sense of the world and, at the same time, of our attempts to make sense of the world.

For the realist, science is a journey of discovery. In fact, realists think of philosophy and science as jointly trying to uncover what is really going on in nature, even 'behind the scenes' so to speak. And at the same time, the realist sees science as aiming at real understanding of how nature works, and why it is the way it is. The two aims, of discovering what the world is like, and understanding or making sense of it, are not automatically the same! But for realism there is no tension between them – they are happy to identify the What and the Why.

All of this presupposes of course that there is a *Why*, that for everything there is a reason. Another way to characterize realist metaphysics, more or less equivalently, is as follows. For realists the question *Why*? has absolute primacy; and they presuppose that it must have an answer always. Science is then conceived of as taking on the task of

answering that question. What sort of answers is it supposed to get? Realist metaphysical systems (which are proposed as extensions of and continuous with science) – or extant science itself (under some realist interpretation) – give the answers, and do so by postulating 'deep' facts about the world. In other words, realists are satisfied with answers-by-postulate.

It is not equally easy to characterize empiricism. Mostly empiricists have distinguished themselves by their negative, critical reactions to various sorts of realism. Happily we possess a dramatization of what it is like to become an empiricist through bone and marrow. I at least have always understood Jean-Paul Sartre's novel *Nausea* as doing exactly that: the protagonist Antoine Roquentin is in the agonizing process of becoming what I'll call a *classic empiricist*. Eventually Roquentin says: 'Now I knew: things are entirely what they appear to be – and behind them . . . there is nothing.' This is an extreme form of empiricism: Roquentin denies the realist assumption that there is something to be known or found 'behind' the phenomena which appear to us. Later I will quote him further to illustrate some of his agony with this way of being in the world. I will also argue that not every way of being an empiricist needs to entail such agony.

Not every empiricist is equally extreme in his or her conclusions. To reject realism it is enough to become agnostic about what the realist says we need to find. But a thoroughgoing agnosticism may not be any more comfortable, for it lacks even the sense of certainty that comes with saying 'There is nothing there!'

The philosophical reactions that I identify as empiricist through the course of history have always in the first instance been rebellions against realism. The empiricist comes across as being 'against theory', calling us back to experience. He or she is thoroughly sceptical of the philosophical stories about why experience must be this way or that. Realists counter that this will lead us into utter, debilitating scepticism, that it will deprive life and the world of all meaning and intelligibility.

It is a sad fact that when empiricists have tried to do something more constructive, they have often just ended up doing metaphysics too. Often they were seduced by the assumption that we can give meaning to life simply by attributing some postulated 'deep structure' either to

the world we live in, or to our experience. Empiricism cannot simply go at right angles to the realist course; if it is to work at all, it must step out of that plane of motion altogether. The realist sees our epistemic enterprise as achieving a world-picture, something that purports to be the 'One True Story of the World'. Outright denial of that view would push us simply into a rival world-picture. I want to raise the possibility of life without a world-view – at least without the sort of world-view that metaphysical realists hold out for us as the aim of science and philosophy.

2 Classical empiricism

The story I shall tell in this part is a drama in three acts. Aristotle insisted that science aims not just to describe the phenomena but to explain them. He then immediately went on to identify explanation with description of something 'deeper'. This led to a view of science as describing necessity in nature (as opposed to the 'merely' actual), or laws of nature (as opposed to 'mere' regularities). The nominalist/empiricist rebellion of the late Middle Ages challenged any such enterprise which requires empirical science to reach for something far beyond empirical ken. In the third act the realists face the empiricists with a tragic dilemma: either you resign yourselves to living in an utterly meaningless world, or you must believe something not because your experience leads you to it, but purely to escape this meaninglessness.

Of course I admit what will already be obvious to you from this little synopsis: I am giving you a rather biased history of philosophy. But you know my bias: I want to be an empiricist, in some way that makes sense for us today.

2.1 Aristotle's view of science: the What and the Why

Let us begin with Aristotle's account of the eclipse. We find him focussing on eclipses of the moon. Looking back from the twentieth century, we think immediately that the reason is not far to seek. A lunar eclipse is visible at the same time over a large part of the earth, while the solar eclipse is visible only in a small part. Therefore quite accurate predictions

were possible for lunar eclipses, but not for eclipses of the sun. But when we then check Aristotle's discussions, we find to our surprise that they are not at all concerned with this difference in predictability!

What does he discuss then? He discusses what an eclipse *is*. To him, the aim of science is to reach understanding, to know the reasons why things happen the way they do. Then it turns out that according to him, we understand such a phenomenon as the eclipse when we know what an eclipse is:

> The question 'What is eclipse?' and its answer 'The privation of the moon's light by the interposition of the earth' are identical with the question . . . 'Why does the moon suffer eclipse?' and the reply 'Because of the failure of light through the earth's shutting it out'.
>
> (Aristotle, *Posterior Analytics* II, 2, 90, 7–18)

Persuasive. But he must have something quite special in mind when he emphasizes the 'is' in 'what is'. Eclipses are many things – perhaps, for example, the eclipse is the one lunar phenomenon that has struck terror in the hearts of millions – but they don't all help to tell us why there are eclipses. So Aristotle envisages a sort of hierarchy or priority of properties: some properties are *essential*, others merely *accidental*. The essential ones answer the Why-question as well.

This hierarchy in what the thing is, comes from an asymmetry in explanation. If A explains B, you cannot also say that B explains A. To take a modern example: The light reaching us from distant galaxies exhibits a red shift if those galaxies are receding from us; and vice versa: those galaxies are receding from us if their light has this red shift. Yet it is the receding motion which explains the red shift – and not vice versa. Aristotle himself gave two examples: the planets do not twinkle (unlike the stars) because they are near; the moon waxes and wanes as it does because it is spherical. In each case, we are disinclined to add 'and vice versa'.

To account for these asymmetries, then, Aristotle holds that some properties of a thing are essential to it, and others not essential but accidental. The paradigm of explanation for him, is appeal to what is essential in order to account for the accidental.

But what is essential? We are never told completely. Part of the answer is that *only what is necessary is essential*. Hence, an explanation

of the phenomena through appeal to what is essential, is partly this: to show why the phenomena *had to be* what in fact they were, they *had to happen* in the way they did.

This is how the idea of necessity enters the discussion: the asymmetry of *Why*? engenders an asymmetry in the *What*? which is traced to an asymmetry between contingency and necessity. But this new distinction is no less mysterious than the preceding one.

2.2 Mediaeval realism

Aristotle's account of the world was developed in depth by the mediaeval philosophers, such as Thomas Aquinas and Duns Scotus. Because they were also theologians, they had in principle available a quite simple account of those distinctions which Aristotle had introduced into natural philosophy.

Let me first say something about how they saw the world. Imagine I am holding a piece of chalk. It must fall if I release it. It must break if I apply a mere ten pounds of pressure on the middle. Looking at it, you would see that it is white; but you would know that if I kept it hidden and merely told you that it was pure chalk. The reason – the mediaeval philosophers would say – is that all those things are necessary to chalk, it is the nature of chalk. To this extent the world is determined.

Besides this deterministic aspect of the world they also recognized *chance* and *free will*. In fact, we today can see a rudimentary idea of statistical science in what Aquinas says about this:

> The majority of men follow their passions, which are movements of the sensitive appetite, in which movements heavenly bodies can co-operate, but [a] few are wise enough to resist these passions. Consequently, astrologers are able to foretell the truth in the majority of cases, especially in a general way. But not in particular cases.
>
> Thomas Aquinas *Summa Theologiae* Ia, 115, 4, ad 3

The mediaevals saw much more chance, and much less determination in the world than people do today, even now.

But Aquinas, following Aristotle, would not have classed all that as science. A stone could begin to roll down a hillside 'just by itself', or a person could 'just decide' to give in to some passion. Such accidental

phenomena are classed as not within the realm of scientific knowledge. The aspect of the world covered by scientific explanation was exactly what is determined by the natures of things, that is, what is necessary. Their world is partly indeterministic, but science describes what is necessary, i.e. deterministic about that world (see e.g. Aquinas, *Commentary on the Posterior Analytics*, I, 16, 6–7; *Summa Contra Gentiles* II, 23, 2).

I said that as theologians, they had an explanation available: some things God decreed, and some He left open (so to speak). Actually that just pushes the issue one step farther back. Here is the puzzle. Suppose – to take one of their examples – that wood always burns when heated. What exactly did God decree: that wood will always burn when heated, or that wood must always burn when heated? That certain things will always happen or always be thus or so, or that they *have to be* always that way? Are there some things that happen every time, but are not necessary?

Let me try to convince you that philosophers are not perverse when they draw this distinction. You make that distinction too. Suppose we could equate: X never happens = X is impossible. That would also mean: if something is possible, then it will happen at some time or other. If you believe that, then you never need to use the words 'possible' again, nor its cognates like 'impossible' or 'necessary', because, if you believe that, the things that are possible are exactly the things that are actual at some time or other. In that case you could always use the word 'sometimes' instead of 'possible'.

But I'm sure you are not happy with that idea. For example, you may believe that the human race will never enter a giant suicide pact and do away with itself – but you won't say that it couldn't possibly do so. Even what you and I could do today, what is possible for us, is not exhausted by the few things we will actually do at some time or other.

Why is this important? Well, if those mediaeval realists are right about what science is, then science has to discover not just what always happens, but what is necessary. In other words, the task of science is to divide the things that always happen in a regular way into two classes: the ones that just happen to be that regular ('mere' regularity), and the ones that are that regular because that is how they have to be

('necessities in nature', 'laws'). But the problem for us humans is that we can't tell the difference just by looking at what actually happens – and still, that is all that we ever get to see.

How would it help to bring God into the picture? If the distinction is one He can make, if it comes for example from what He decreed and left open at Creation, we still have to ask: how can we make sense of science as a humanly possible enterprise? Aquinas himself insisted on making room for this enterprise, though with the reason that, to think of every necessity as directly connected to God's will (rather than having been instilled in nature, so to speak) was to denigrate Creation.

2.3 The nominalist/empiricist rebellion

Happily I can refer you to another literary dramatization: Umberto Eco's *The Name of the Rose*. The character William of Baskerville personifies the intellectual rebellion of such philosophers as William of Ockham. The nominalists of the late Middle Ages concluded there are no necessities in nature, no necessary connections (in later terminology: no laws of nature). On the theological side they merely said that of course it was necessary that if God willed something then it happened. But within nature itself, there is no division between necessary and merely actual.[1]

These nominalists of the fourteenth century turned upside down the whole conception of the world and of science. Their movement marks the true birth of empiricism. Of course they also have to show us that they can make sense of the world we live in, and of the scientific enterprise. Typically they begin with a simple point from logic. Consider the assertion that wood must burn when heated. Here is a piece of wood, namely a table. Should we conclude that it will necessarily burn if heated? Is it impossible for it to stay whole if I put it in a furnace? You are probably nodding *yes* to yourself.

But let me give you a parallel example. It is not an accident or coincidence that all bachelors are unmarried. Bachelors are necessarily unmarried. Now let me see if there is one in the audience. You, sir, are a bachelor? All right, then, should I now turn to you all and say: Behold, here we have one, a person who is necessarily unmarried, a

person who could not be married? Actually there is nothing wrong with him, as far as I can see!

Similarly for a piece of wood: if it didn't burn when heated, we would say: It looks like wood in almost every respect, but it is not wood. If I say *this very thing* must burn when heated, that is elliptical – I expect the listener, to supply a tacit clause like 'given that it is made of wood, as we all know'. But in that case, the necessity is merely verbal.[2]

As you can imagine, this raised a storm of protest. To the realist it is crucial that some things are really necessary and really possible, not just verbally. You really cannot jump over a building, though you really can jump over a doorstep – that is not just a matter of words. Just try and you'll see! Don't such examples show that there are real necessities in nature? No, in fact they don't. For perhaps we just say such things – use the words 'really can, really cannot' – to express a very strong conviction that they won't happen. In that case, the use of those words says a lot more about us than about nature.

The realists answered that there were two things that all science aims at, and that are impossible for the nominalist. The first is *reasonable expectation*, and the second *explanation*. If there is no reason 'in' this table that *makes* it burn when heated, then there is no reason to expect that it will. No reason to expect that individual matches will burn, or water quench thirst next time you drink, or that Rosemary's baby will be human. And secondly, if nominalists are so perverse as to keep expecting that babies born from humans are always human, and so forth, then they have no explanation of that fact; the can't explain why the world should be so regular.

Let me quickly illustrate this with one of their actual disputes, which we look back on today as prefiguring Newton's first law of motion. When the thrown stone leaves the hand, what keeps it going? By Aristotelian principles either this stone continues to act on the air, cleaving it, or the air acts on the stone so as to push it forward. Neither sort of account was very successful; yet it was insisted that there must be some such reason. William of Ockham's reaction was characteristically radical: the question of what *keeps* the stone moving, he rejects.

> If you insist that the moving body does not move unless it acquires something which it did not have before, I answer that indeed it has

> something new, . . . namely a different location. And if you further inquire as to what is necessary for the body to be in that place, I reply that nothing else is required but a body and a place and the absence of any intermediary . . .'[3]

We probably shouldn't blame the mediaeval realists too much for resisting this. Even Newton, though he made it his first principle that things retain the same motion unless interfered with, still kept thinking that perhaps he had to appeal to some special sort of force (*vis insitae*, or *vis inertiae*) to make it intelligible. The realist instinct, that there must always be some deeper reason for everything, dies very hard.

2.4. The recent aftermath of this debate/Today

This debate, as I have said, began in the fourteenth century; these debates happened over five hundred years ago – but don't think that they aren't happening now! Writers who discuss today's physics sometimes have little sense of the history, and so they just repeat it, badly. The Einstein–Podolsky–Rosen paradox and violations of Bell's inequalities have furnished many examples of this, both from philosophers and from scientists.

A nominalist or empiricist does have to explain how reasonable expectation is possible. What such a philosopher must say is really quite simple: I believe, just as you do, that every time a stone is released it will fall. I believe that there is this regularity in the world. Whatever reasons you have for saying that something is necessary, are for me simply reasons to think that it is so.

The realist then says: OK, perhaps you can have expectations and predictions; however, you cannot explain them. You have no reasons to show why these things *have to happen* the way they do. The nominalist admits that, but does not give such primacy to the *Why*? question. There is an explanation, the nominalist says, but only in the mundane sense that sometimes we are puzzled, and we need the missing pieces for our puzzle – however very ordinary information will do just fine there, and science can serve us by providing this very ordinary sort of information about how things just happen to be.

In every century the battle of empiricism against realism is fought again. I don't expect you to be convinced yet by my side of the story.

Perhaps you too feel a great dismay that empiricism deprives us of so much that might comfort us in a hostile world. And it is true, it does: all it can offer is the agony and the ecstasy of freedom in a world governed by no laws except those we create ourselves:

> We are born by accident into a purely random universe. Our lives are determined by entirely fortuitous combinations of genes. Whatever happens happens by chance. The concepts of cause and effect are fallacies. There are only *seeming* causes leading to *apparent* effects. Since nothing truly follows from anything else, we swim each day through seas of chaos, and nothing is predictable, not even the events of the very next instance.
>
> Do you believe that?
>
> If you do, I pity you, because yours must be a bleak and terrifying and comfortless life.[4]

I quote this from Robert Silverberg's *The Stochastic Man*, a science fiction novel. This *is* the world of empiricism. It is the world of Sartre's hero Antoine Roquentin in *Nausea*, it is a world in which anything is possible, and whatever happens merely happens, and not because something greater is making it happen. Here is the famous passage in which those apparent limits to possibility dissolve before his eyes:

> I went to the window and glanced out . . . I murmured: *Anything* can happen, *anything*.
>
> Frightened, I looked at these unstable beings which, in an hour, in a minute, were perhaps going to crumble; yes, I was there, living in the midst of these books full of knowledge describing the immutable forms of the animal species, explaining that the right quantity of energy is kept integral in the universe; I was there, standing in front of a window whose panes had a definite refraction index. But what feeble barriers! I suppose it is out of laziness that the world is the same day after day. Today it seemed to want to change . . . then, *anything, anything* could happen.[5]

Roquentin also describes the security of others, who live in an illusory sense of ontological security:

> They aren't afraid, they feel at home. All they have ever seen is trained water running from taps, light which fills bulbs when you turn on the switch. . . .

> They have proof, a hundred times a day, that everything happens mechanically, that the world obeys fixed, unchangeable laws. In a vacuum all bodies fall at the same rate . . ., the public park is closed at 4 pm in winter, at 6 pm in summer, lead melts at 335 °C, the last street-car leaves the Hotel de Ville at 11:05 pm. They are peaceful, a little morose . . . Idiots.[6]

This is frightening; to lose our sense of necessity is to lose our sense of security.

But the danger of losing our emotional and intellectual comforts is not an argument. You will be reminded of those nineteenth-century clergy in Ibsen settings, losing their faith and arguing that religion was indispensable, because otherwise life would lose all its meaning, and they would not be able to continue to live. Well, as a philosopher I have to counsel suicide before an invalid argument.

So I conclude. There are no necessary connections in nature, no laws of nature, no real natural bounds on possibility. Those ideas all resulted when philosophers projected familiar models onto the natural world. Really, nothing is necessary, and everything is possible.

I mean this. All of the above is true. Yet I am not simply trying to persuade you that we have a bleak and comfortless life. What I reject is those philosophical ideas about where to turn for comfort. I am referring here to the realists' identification of understanding with knowledge of 'deep' facts about a reality behind the scenes of the phenomena. Science is our paradigm enterprise of empirical inquiry, and I value it very highly – but not as the acquisition of *such* knowledge. Now I had better try to make good on this by showing that there is another way to go.

3 Points of view/science and myth

Is there a constructive side to empiricism? Or does it make the search for meaning and meaningfulness hopeless? Is meaning just a matter of the psychopathology of everyday life?

3.1 What is our relationship with our world-pictures?

There is more to the role of science in our lives than prediction, expectation, and practical opinion. Science has transformed our world-view.

Empiricists have often been tempted by some form of instrumentalism: science is 'merely' an instrument. If science were a mere instrument, like an abacus or a calculator, how could it transform anything? Abacuses do not transform a world-view. Getting the idea of *how the abacus works* might do that, but not its mere use.

In attempting a positive account, I shall take a cue from Nietzsche, and liken science to myth. Myths, after all, do have the power to transform our consciousness of the world.

As soon as I say this, I know you begin to suspect the worst about me. After all, we use the word 'myth' in practice as a synonym for 'falsehood', and now maybe I am going to say that science is nothing but a myth. Well, I had better correct those impressions right away.

First of all, the word 'myth' does not strictly speaking imply falsehood at all. A Christian or Jewish theologian can certainly compare the Judaeo-Christian mythology with such rivals as the Pagan myths or the Hindu–Buddhist mythology. He or she does not say that these are all on a par, but only classifies what the Judaeo-Christian tradition gave us as significantly similar to those rival mythologies.

Second, about the 'nothing but' manoeuvre. This has an absolutely fatal fascination for philosophers. But 'nothing but' is logically not simple. Consider the statement: 'Jesus was nothing but a story-teller.' This presupposes that Jesus was a story-teller and then adds that he did not belong to any significant sub-class of story-tellers. To deny it categorically is to say that Jesus was indeed a story-teller, but of a special sort. After this preamble, I think you will not misunderstand me: I categorically deny that science is nothing but a myth.

3.2 What exactly is a myth?

Some discussions of myth by philosophers, literary critics, psychologists, anthropologists, and theologians, have aimed at a definition of myth. There is so little agreement, that I shall only try to describe salient features.

A myth is a story. This will have to be qualified; but let it stand for now. Myths must be distinguished from such types of stories as legends, parables, allegories, and popular history. Legends and popular history are stories that *purport to be true*. There is no such purport in

the case of parables or allegories. These are distinguished by having a point or significance for morality or the meaning of life.

Sometimes myth is just defined as a combination of these two features: a myth is a story that both purports to be true and has the kind of significance that parables and allegories have.

This cannot be a good definition, for it would even make the story of George Washington and the cherry tree a myth. (Or the story, which is unknown in Holland but familiar to many foreigners, of the boy who saved Holland by putting his finger in the dike, to keep the sea out. In America they even know the name of that boy!)

Under the urging of anthropologists such as Malinowski, myths have now come to be discussed largely in terms of their function. In the nineteenth century there was a school that saw myths purely as embryonic science: the function of myth is to explain natural phenomena (paradigm: the Creation myths). The opposite extreme was espoused by philosophers like Ernst Cassirer and Susanne Langer. According to them, the function of myth was that it furthered a sense of harmony within society and with nature (paradigm: the Myth of the State). Today's anthropologists blend such extreme conceptions, and assign functions of both sorts to myth:

> The myths of the Australian aborigines, which deal with the creation of their Universe and the establishment of their rules of human behavior that all must follow, . . . are the foundations of their social and secular and ceremonial life.
>
> The myths that support these philosophies provide the aborigines with a reasonable explanation of the world in which they live; the stars above them, the natural forces of wind, rain, and thunder and the plants and creatures that provide them with food.[7]

I think there can be no doubt that science can and does serve functions of both those sorts. In his chapter, 'Quantum theory and our view of the world', Professor Feyerabend gives some examples of those social functions of science.

3.3 The rivalry between myth and science

One conclusion seems inescapable. Science presents itself, in each culture, as a rival to the mythical world-picture, and aims to replace it

with a new world-view. To illustrate this, let me quote not a scientist but a theologian. Rudolf Bultmann emphasized this in the strongest terms in recent theological debates:

> The cosmology of the New Testament is essentially mythical in character. The world is viewed as a three-storied structure, with the earth in the centre, the heaven above, and the underworld beneath.
>
> All this is the language of mythology, and the origin of the various themes can be easily traced . . . To this extent *the kerygma is incredible to modern man, for he is convinced that the mythical view of the world is obsolete.*[8]

Bultmann adds, 'It is simply the cosmology of a pre-scientific age' and 'We no longer believe in the three-storied universe which the creeds take for granted.'

But where exactly does the rivalry lie?

There is no obvious rivalry between any little scientific theory and any little myth, such as, say, Archimedes' statics and the Oedipus myth. But the Greek mythology as a whole, like the Judaeo-Christian mythology and the Hindu–Buddhist or Islamic mythology, is a different matter.

So let us distinguish between *little myths*, like the Oedipus myth, and *great myths*, like the Judaeo-Christian, or the Hindu–Buddhist myth. This is the point where I must qualify the idea that a myth is a story. Certainly little myths are stories. Sometimes they are stories of what happened on specific occasions, such as the Fall, or Zeus' advent to hegemony; sometimes accounts of repeating or repeatable events, such as Apollo driving his chariot across the heavens from East to West every day, and the transubstantiation of bread and wine in communion.

Little myths are stories, and they are stories that change. Sometimes they die altogether, sometimes they re-emerge at a later point. A little myth may be born and die, in many versions that differ with time and locale, subject to different interpretations – and all that under the aegis of a single great myth. Little myths change, but the great myth endures.

The great myth too changes and develops. But its developments are not mainly changes in its narrative. The Judaeo-Christian myth had short periods of drastic change or rapid development around the times

of Moses, St Paul, and Aquinas, to name but three. These were developments where we can truly speak of *conceptual revolutions*. At those points, there is not merely a change in little myths. For a long time, for example, God was an agent within history and within time. But at least as of the Middle Ages, God is trans-temporal and trans-phenomenal, trans-historical (in Jewish as well as Christian and Muslim theology).

Little scientific theories, like little myths, come and go: phlogiston emission gives way to oxidation, light particles to light waves to photons. Some little theories persist, but their details and the way they are understood changes from epoch to epoch: this is the way in which Archimedean statics and Huygens' theory of collision persist to this very day. Meanwhile, science endures: we are engaged in the same enterprise as Archimedes was.

But though it has endured, science has gone through several short periods of intense development amounting to genuine conceptual change, such as the Galileo–Newton and Planck–Heisenberg periods.

It is exactly here, in what we may call Great Science and Great Myth, where the main rivalry occurs, that we also see the most striking parallelism.

Myth is cosmological, presenting a picture which embraces the whole world and all of history. The drama it presents is an on-going one. *Science is cosmological*, global in compass, embracing the whole world and total world history.

Myth is narrative, in that it presents a drama unfolding in time, and a description of certain kinds of processes. But there is a point which, as far as I know, each great myth reached, at which the *dramatis personae* come to be seen as *transcendent*.

This is the *point of paradox*, where myth breaches the categories derived from common sense, and history is seen as a reflection of something not itself set in time and space. *Science too is narrative*, writing for us even a brief history of time – and of the cosmos evolving in time. But with relativity and quantum theory, it also reached the point of paradox. The categories of time and space are subsumed, '*aufgehoben*', in space–time; particles no longer have definite spatial trajectories; even duration and dates become subject to indeterminacy. The *dramatis personae* have become extramundane.

Myth is explanatory; it explains both the natural order and the development of the social order. *So does science*. Myth has a strong grip on the human imagination; it supplies the classification and the categories, the pigeon-holes and concepts, the *categorial framework* within which every subject is placed and understood. *So does science*.

3.4 Parallel debates concerning language

I just want to describe very briefly one more parallel. This concerns the irreducibility of the language of science and of myth, the impossibility of translating them into more 'hygienic' language.

Let me begin with the debate in recent theology, from which I have already quoted above, about demythologizing the gospel. Bultmann began by describing the mythical world-view that underlies the New Testament and contrasting it with our present world-view which is largely determined by science. He maintained that the gospel has not lost its significance, but that it needs to be represented in terms compatible with our present world-view.

After a great deal of demolishing, using both the scientific outlook and the results of historical scholarship, Bultmann also sketches a contemporary presentation of the gospel; and he does so in Existentialist terms.

But as Karl Jaspers pointed out, this is not demythologizing so much as translation into another, modern, mythical framework.[9] Perhaps the content of a myth cannot be rendered except in mythical terms. If so, myth is untranslatable, in a certain sense. We must distinguish this immediately from the sense in which poetry is said to be untranslatable. When a myth is translated into another language, even very badly as by a Sunday school teacher, it is still immediately felt as myth. This is also true of science, *mutatis mutandis*; poetry is almost totally lost in such a case. The point is rather that if Jaspers is right, myths are not interpretable into non-myth; 'Myths interpret each other.'

Bultmann lost that debate in practice. Those on Bultmann's side freely grant that as pastors, they continue to talk the New Testament language of Resurrection and a Second Coming: the mythical element is not eliminated but re-interpreted. The myth of bondage to and conviction of sin becomes the Existentialist myth of the stranger and

nausea; the myth of redemption and second birth becomes the myth of freedom, encounter, and authenticity.

Parallel to this *de facto* consensus about the language of myth we find a rare philosophical consensus, between today's realists and empiricists, about the language of science. Early in this century there was indeed the idea that science can be 'demythologized' in some strict empiricist way. But that idea already had to be abandoned more than 50 years ago. The language of science cannot be reduced through 'operational definitions' or translation into a hygienic, pure observation language.

Philosophers are often slow to adapt to their own discoveries and advances, however. As a result, the sense of transition to a truly non-reductionist view of science did not become prevalent until the 1960s.[10] In the aftermath, the stamp of orthodoxy placed on this realization was somewhat confusingly associated with scientific realism, and equally with Feyerabend and Kuhn, who are also readable as critics of scientific realism. No distinction can be drawn between the theoretical and the non-theoretical, and there is not even in principle, however attenuated, any way to isolate a non-theoretical foundation for our conceptual framework. *Theoretical discourse is irreducible*. Theories can at most be interpreted in other, later theories; as Newton's mechanics was re-interpreted (as of restricted, approximate validity) by Einstein. Briefly: demythologizing the language of science is impossible.

This additional parallel between philosophical and theological debates throws a corollary light on a phenomenon we see both in science and in the varieties of religious experience: that of conceptual immersion. If the language to be used is not translatable without loss into something conceptually poorer, then to speak it we must allow ourselves to be guided by the entire picture presented. There is no disengaged alternative.

4 The scientific spirit

4.1 The demarcation of science and myth

After all this, you may think that at this point you know very well what my conclusion is going to be. You may very well think that now I am going to say:

(1) Meaningfulness always came from immersion/enchantment in a Great Myth – such as the Christian Myth in the Middle Ages in Europe;
(2) Science too is a Great Myth, providing us with a world-view able to replace the lost myths of the past;
(3) Meaning will be regained if we immerse ourselves now in this new Great Myth:
Let the Scientific Middle Ages begin!

Nothing is further from my mind. I do think that there is a great difference between science and the older myths – not an essential black-and-white difference, but still a difference in fact and of degree which is of enormous importance. And I think that scientific realists miss or obscure this difference exactly because they focus on *content* rather than *function*.

What is so crucially different about science? Let me quote again from Bultmann, who had some stake in this:

> The science of today is no longer the same as it was in the nineteenth century . . . The main point, however, is not the concrete results of scientific research and the contents of a world view, but the *method of thinking* from which world views follow.
>
> The contrast between the ancient world view of the Bible and the modern world view is the contrast between two ways of thinking, the mythological and the scientific. The method of scientific thinking [. . . is] the same in modern scientific research [but the theories] are changing over and over again, since the change itself results from the permanent principles [of this method].[11]

Karl Jaspers has already objected that there is a good deal of old and dated philosophy of science in Bultmann's writings. The caricature we can read into it is this: (1) in myth, content is what is important, and the commitment is to a world-picture; but in science, the method of inquiry is what matters and commitment is to a method; (2) within myth, questioning beyond a certain point is a sin; within science everything is subjected rigorously to proof and experimental test. This appealingly simple picture is almost entirely a mess of half-truths and propaganda. But I must emphasize the 'almost'. Let us count the ways in which all this is false.

(1) When we contrast science to myth and superstition, we are contrasting content, not method.

(2) No theory is *established* by proof, experimental or otherwise. (To accept a theory is *ipso facto* to go beyond the facts.)
(3) Scientists follow that scientific ethic in practice only to a limited extent (as Paul Feyerabend emphasizes in chapter 6). (Perhaps progress in science would also be impossible if the ethic of systematic doubt were not held in check in practice. How many geniuses can a science afford, in one century?)
(4) The attitude prescribed by the scientific ethic is also possible – perhaps to the same limited extent as in science – within myth in general. (Indeed, the major and radical changes to which the great myths too are subject argue that there is an underlying commitment which transcends, and is not indissolubly linked to, belief in particular content.)

However all this may be, I think Bultmann put his finger on the crucial aspect of science, in which in practice and in ethic it sets itself apart from all its actual rivals. *We should not exaggerate its extent, but we cannot exaggerate its importance.*

For this is the creed and regulative ideal of science: that our first and overriding commitment shall be *to the method*, uncompromisingly rigorous, which sweeps before it like chaff the inadequate structures of earlier hypotheses. The holy war in which the religious devotee systematically destroys the 'old man' (to use St Paul's term), uprooting one by one the binding desires and illusions in the soul, is transposed by science to its own growth. The primary commitment is to this method with its ideal of constant revaluation and self-critique; all commitment to content is secondary. This is the peculiarity of science among myths.

The hierarchy of responsibility is inverted; in the old myths, to avoid doubt may be piety, in the new it is treason.

4.2 Realism's mistaken moral

Scientific attitude as transvaluation of all values? Yes, that is what I mean.

If this conclusion about the primacy of method *vis à vis* content in science is correct, then realism has throughout mis-focussed the debate. For if realist metaphysicians reify content, then they do for science what the superstitious do for religion: *they avert attention from its significance to the vehicle of that significance.*

What this means is that acceptance of science, and appreciation of its worth, does not require us to believe that it is true. On the contrary, the important point about scientific activity is not that it provides theories which every generation in turn can take as truth, but rather that it accustoms us to giving up our beliefs, changing and altering them, valueing them without being in bondage to them.

Can we feel secure and at home in a world without the certainty that we know what it is really like?

This sounds like a psychological question; and in that form a philosopher has no business or interest in answering it. But actually I think that in a psychological sense the question does not arise at all: we have never had any objective certainty in our interpretation of what is 'really going on', and never will. We have seen the content of the scientific world-picture change radically, and we fully expect there to be more scientific revolutions in our future. So if a psychologist came along and told us we could not cope unless we have full belief in some specific world-picture, he'd just be advising refuge in self-deception.

The scientific attitude, which the empiricist celebrates, does not lead to despair and futility or disorientation. There is a loss when you first lose your certainties, and a temptation to seek refuge in some artificial certainty. When the refuge sought is in some part of science adopted as dogma, we call that *scientism*. That is, a sort of science on a metaphysical pedestal, with the current content of science erected into a final measure of all truth and value. Believe me, that is not science – it is superstition, no matter how scientific it is made to sound. To the extent that scientific realism shades into scientism, it has the same pitfall: to require the sacrifice of the intellect, the desperation of '*Credo ut intelligam*'.

What is the alternative to reifying the content of science? The alternative is to accept the challenge of intellectual maturity: to let your faith be not a dogma but a search, not an answer but a question and a quest, and to immerse yourself in a new world-picture without allowing yourself to be swallowed up.

Science allows perfectly well the sceptical discipline that accepts the appearances alone as real, and all the rest as a unifying myth to light our path.

Notes

1. See e.g. Ockham, *Ord. Prol.* q. 9 and *Summa Totius Logicae* III. 2, 5; cf. M. H. Carré, *Realists and Nominalists* (Oxford University Press, 1946).
2. See Ockham, *Ord. Prol.* q. 6, J; *Summa Totius Logicae* III, II, 5, 64v, discussed by E. A. Moody, *The Logic of William of Ockham* (London, Russell & Russell, 1935, 2nd edn 1965). See further E. A. Moody, *Studies in Medieval Philosophy, Science, and Logic* (Berkeley, University of California Press, 1975).
3. Ockham, *Summulae in Libros Physicorum* III, 7. See also *Reportatio* II, q. xxvi N ff. which is printed together with an English translation in P. Boehner, *Ockham: Philosophical Writings* (London, Thomas Nelson, 1957), pp. 139–41, and discussions of Ockham's natural philosophy in Moody, *Studies* and E. J. Dijksterhuis, *The Mechanization of the World Picture* (Oxford, Clarendon, 1961).
4. Robert Silverberg, *The Stochastic Man* (London, Victor Gollancz, 1976).
5. Jean-Paul Sartre, *Nausea* (New York, *New Directions*, 1964), p. 106.
6. Ibid. pp. 211, 212.
7. See Ainslie Roberts and Ch. P. Mountford, *The First Sunrise: Australian aboriginal myths in paintings by Ainslie Roberts, with text by Ch. P. Mountford* (Adelaide, Rigby, 1971), pp. 9, 11. The omitted part between these quotations includes:
   'These myths also describe how, before creation times, the uncreated and eternal earth had always existed as a large flat disc floating in space . . . It was a dead, silent world. Yet, slumbering beneath that monotonous surface, were indeterminate forms of life that would eventually transform the forbidding landscape into the world as the aborigines know it today. As the ages passed, these mythical beings began to emerge from beneath the plain and to wander haphazardly over its surface.'
8. Rudolf Bultmann, 'The Testament and mythology' in H. W. Bartsch, *Kerygma and Myth* (London, SPCK, 2nd edn, in two vols, 1964), vol. 1 pp. 1–44 esp. 1,3.
9. Karl Jaspers, 'Truth and misfortune in Bultmann's mythologisation' in H. W. Bartsch, *Kerygma and Myth*, vol. 2, p. 144.
10. See for example the papers by Rudolf Carnap and Grover Maxwell in the first and third volumes of *Minnesota Studies in the Philosophy of Science*. Among the earlier papers leading up to this are Wilfrid Sellars, 'Concepts as involving laws and inconceivable without them' in *Philsophy of Science* 50 (1948), 287–315 and Paul Feyerabend, 'An attempt at a realistic interpretation of experience' in *Proceedings of the Aristotelian Society* NS 58 (1958), 143ff.
11. Rudolf Bultmann, *Jesus Christ and Mythology* (New York, Scribners, 1958), pp. 37, 38 (my italics).

6 Has the scientific view of the world a special status compared with other views?

Paul Feyerabend

Dennis Dieks, in Chapter 3, sketches a framework which, he says, has guided the work of many physicists. He implies that the remaining conflicts are a purely philosophical phenomenon. Being fond of quarrels philosophers have split into schools. There are now empiricists, positivists, rationalists, anarchists, realists, apriorists, pragmatists and they all have different views about the nature of science. Scientists, on the other hand, collaborate. Collaboration creates uniformity and, with it, a single way of looking at things: it *does* make sense to ask about the status of *the* scientific world-view.

In contrast I want to argue that scientists are as contentious as philosophers. But while philosophers merely talk, scientists act on their convictions; scientists from different areas use different procedures and construct their theories in different ways. Moreover, they often succeed: the world-views we find in the sciences have empirical substance. *This is a fact, not a philosophical position.* I shall explain it by considering the following four questions:

(1) What is *the* scientific view of the world and is there a single such view?
(2) Assuming there is a single scientific world-view – *for whom* is it supposed to be special?
(3) What kind of *status* are we talking about? Popularity? Practical advantages? Truth?
(4) What 'other views' are being considered?

My answer to the *first question* is that the wide divergence of individuals, schools, historical periods and entire sciences makes it difficult to identify comprehensive principles either of method, or of fact.

In the domain of *method* we have scientists like Luria who want to tie research to events permitting 'strong inferences', 'predictions that