Chapter 3

Science as an Inadequate Mythology

The word "mythology" bespeaks a series of functions — such as ethical guidance — which a society’s system of knowledge should, ideally, perform. This was and is for cultures other than our own. The location of our myths has always puzzled me. We may talk of our having a mythology, of there being a mythos of contemporary Western culture, but what are the stories that constitute our mythology? Scientific knowledge as theories, I believe, constitutes the centre of our modern Western mythology: this is where the most important of our myth stories are to be found. It is this at least in that we define, explain, and seek to control the events of the universe in terms of its stories. But it is inadequate as a mythology, and precisely at its points of inadequacy arise the problems of our society.

In this chapter I shall elaborate the above points, investigating science as our mythology, and, secondly, drawing out the inadequacies of this use of science. I want to look deeper into the insight that science is performing a mythical role for Western culture. To do this I shall compare science with the properties of myth outlined in the preceding chapter: a myth is a story usually of extra-mundane beings, groups or events, and often set in another space and time; myths are usually basic to their societies’ understanding of the origin and operation of the world; they can present models for behaviour, and involve a person’s emotions; they inevitably are authoritative and truth-defining for their societies; and, finally, frequently are associated with rituals. How does science fare on this list?

SCIENCE IS A MYTHOLOGY FOR US

It is easier for trained anthropologists working with some end-of-the-earth tribe high in the jungled mountains of Toogamoola, than it is for us to deal with our having myths. Our problem is trying to see our myths, but anthropologists...
have only to elicit some meaningful pattern from the collections of myths and social behaviour which is staring them in the face. Confusion awaits anthropologists' return to their own modern Western society and their attempts to see our society as they do others! To attempt this we must put behind us all notions of myths as untrue fables; hack off that biased pejorative. Take a functionalist use of the term; then we can be free to ask, "What are our myths?"

We can without too much thought make out a few, perhaps surface myths of ours. They are often discussed in literature on our dreams, fantasies, and longings. Less esoteric and fanciful myths are built from the secular ideals of equality and freedom for all, for instance, or that democracy is the most desirable form of government. The values of freedom and human rights are so widely and deeply held that we would even die for them! And yet on critical examination they have nothing to substantiate them except that they feel right and are widely held. Or that a successful or happy person is one with a large house, lots of boats, lovers, cars, fat wallets, and so forth: these are mythic ideas. We can see these things and isolate them from the general mill of life when we have an idea of what to look for. These mythic ideas have no "real" or objective foundation, except that we feel them to be true, for they present their own authority. Some are stronger than others in their control over us. But some are very powerful and widely held — the ideals of equality and freedom for all, for instance — and I feel like a traitor to myself, my ideals, and the good in society to question these as not being of the truth, among the highest possible goals for which we can strive.

There are many other mythic aspects to our culture when we come to look for them. Langdon Gilkey gives examples: "the liberal view of cosmic and historical progress, well summed up in the great word Evolution, and ... the allied but nonetheless significantly different vision of Marxism, with its belief in an Historical Dialectic that is moving inexorably toward the communist ideal". And under the head of "gnostic myths of autonomy", he writes: "We really believe that if we know or are aware of everything, if we understand all relevant causes and factors, we can control everything." And so we have developed what he calls "the myth of the new scientific man ... the man who embodies gnosis".¹

Don Cupitt writes of our myth, the dominant ethic, "utilitarianism":²

The test of the goodness of a deed lies in its consequences. Pleasure (or happiness or satisfaction or benefit) is the only good, and the equal pleasures of any two persons are equally good. The sole criterion of an action's rightness is its tendency to produce the greatest and most widely-distributed surplus of pleasures over pains. The optimal solution to any practical problem is the one that maximizes benefits and has minimal disadvantages.

Think of the stories we are told as children and the news items we hear as adults which expound this mythic idea. But Cupitt continues by showing in what ways utilitarianism is incomplete as an ethical theory; a move we need to note when thinking later of science as a mythology.

When I studied Latin at high school I came across a myth of ours which I would never have otherwise realized was a myth. I am talking of inclusive and exclusive counting (the difference between one and three is two in exclusive counting and three in inclusive counting). And we feel there is no other way of counting; the difference between two numbers is what we deduce it to be. Exclusive counting has become part of our store of mythic beliefs. It is interesting to note that most Christians ignore the statement (in fact many do not recognize it) that Jesus was in the tomb for three days; is not Friday to Sunday only two days?

Remaining with religion, modern Christian liturgies present quite a difference in emphasis than do the old and traditional liturgies. This reflects the change in society's mythology; we are turning to the communal or family myth for structure and meaning, and turning away from the hierarchical myth stories.

Peter Berger in his Pyramids of Sacrifice writes that people are crushed by the ideologies of capitalism (creating hunger today, especially in third world countries, while promising a questionable affluence tomorrow), and of socialism (creating costly revolutions today while promising a questionable humane order tomorrow). When people are hurting, then the myth — that which validates the power — is wrong.⁴ But then again, we can say that the idea that "crushing and hurting people is wrong" is also a mythic (Christian) idea. It is facing one mythology with another: who is right or who wins is another question.⁵

We do have myths. But can the theories of science be rightfully taken as forming a mythology for us? It is not at all that uncommon to hear and see science referred to as mythical in some way or other. In running through a few of these claims, I want to check especially the use made of the word myth; we still find that the intent is often pejorative, a critical attitude to the worshipping of science and technology and their powers.

An interesting survey of this was conducted by Arthur Peacocke for his 1978 Bampton Lectures: "It comes as something of a shock to the Western scientifically educated inquirer to find that, in the anthropological and, to some extent, the sociological literature too, the scientific perspective on the world is often included among today's 'myths' and 'rituals' — those narratives and actions which societies relate and perform in relation to the natural world in order to meet real existential needs."⁶ He found his scientific self somewhat startled to discover the scientific creation story included in a collection of creation myths from various societies.³ There appears to be a similarity of intention in the
mythical and scientific perspectives, both attempting to take cognisance of and describe as much of the observable world, of the "way things are", as possible.

The chief difference for Peacocke is one isolated by Philip Hefner: myths "focus primarily on describing the cosmos from the point of view of what assumptions are necessary if human beings are to live optimally in the world". The physical sciences, especially, are hardly aware as yet of working upon such value judgements, being more keen on "empirical reference and feedback"; whether value judgements are a "behind the scenes" motivation is another question to be investigated. It may well be that the value of living optimally as defined by secularity and politics is what in part subtly motivates scientific research, even in the physical sciences.

Hefner's drawing of the parallel between myth and science shares much with what Peacocke explores, and with what will be presented later in this chapter. Both attempt to describe cosmology in a unified and comprehensive manner. We judge each of these cosmologies by such criteria as these: whether they take into account as many of the known data concerning the Universe as possible, their simplicity and elegance, their plausibility and consequent persuasiveness.

A number of others from the philosophy of science have associated myth with science. Mary Hesse, for instance, suggests that "all theory construction involves an element of myth-making" since, as shall be more fully explained later in this chapter, new relationships between objects are postulated but which have yet to be accepted as true. For her a myth pertains to the imagination.

Earl MacCormac in his book Metaphor and Myth in Science and Religion draws out the similarities between science and religion as systems of explanation, building on the linguistic category of metaphor to undermine any criticism of religion as factually meaningless. He extends, over extends I would claim, his argument that religion and science be taken hypothetically until they fulfill certain conditions. To do otherwise, to take the metaphors involved as literally true, is to create what MacCormac calls myths. Thus he employs a pejorative sense, that we not make scientific and religious theories into myths. Not only do I think that we do need to take some such theories as literally true (and therefore making them myths in MacCormac's nomenclature), but I also think it is a misuse of the word to attach that stigma to it needlessly.

"There are", writes Michael Mahoney, "many striking parallels between organized religion and organized science." He outlines the way in which both are populated by passionate and often dogmatic adherents who work diligently toward system-specific goals.

Science does involve worship (e.g., of knowledge) and various forms of ritualistic behaviour designed to serve that worship (e.g., publication, research, and convention attendance). It has dogmas and a hierarchy of clergy ranging from prophets (e.g., Nobelists) and gate-keepers of truth (journal editors) to the more mundane occupants of the pulpit (college instructors). It collects its memorabilia and enshrines them in museums as sacred reminders of our fight against ignorance. Moreover, science is a thoroughly persuasive enterprise. Like religions, it makes ambitious claims about both the nature of reality (ontology) and the appropriate methods of gaining access to that reality (epistemology). While its pulpits are a bit more subtle than those of organized religion, its attempts at proselytization are no less energetic. Its temple is often the classroom and its persuasion is often transmitted in the form of textbooks, popular magazines and the mass media (on any morning but Sunday).

Let us look a little at the anthropological literature as it startled Peacocke. The mythical and the scientific modes of thought are a result of the same sort of mental process, according to Claude Lévi-Strauss: "The kind of logic in mythical thought is as rigorous as that of modern science, and ... the difference lies, not in the quality of the intellectual process, but in the nature of the things to which it is applied." John Blacking does not approve of the differentiation of scientific and mythical thinking: "All the anthropological evidence suggests that if such categories are valid at all, they do spring from biological or intellectual variations in man and are not essentially different." Robin Horton draws an even stronger parallel between scientific thinking and the mythical as it appears in traditional African religion. His case is worked out in detail, drawing out what he thinks are the characteristics of scientific thinking and showing how these are to be found in that of the traditional African.

From one particular type of Christian vantage point, Rousas Rushdoony writes of the mythology of science. A myth, for him, "is the illusion of an age or a culture whereby life and its origins are interpreted". Axiomatic truthfulness is obtained by a myth which is then used to judge and assess reality. The word "illusion" is telling. The course of history discloses for humanity, according to Rushdoony, forces beyond us and which stand in judgement over us. "And this man hates." Myths are thus created to counter these lessons, "to overcome history", to make it amenable and subject to us. Science has become the means by which this goal is achieved in modern times; it has become our "magic". With the purposes of scientific knowledge being "prediction, planning, and control", we are attempting to obtain total power over ourselves, "nature, and the supernatural", beyond the ethical struggle of good with evil. The myths of science include "that all things are possible with man, scientific man", an expression of the unquestioned popular humanism of our day founded on the belief in progress and total commitment to nature and freedom.

The pejorative use of the word myth comes out time and time again. The
Nobel Prize winner Hannes Alfvén criticizes physics' theories of relativity as being myths — derived from divine inspiration or unaided human reasoning — in contrast to science whose theories are developed "in observational contact with the real world". He wants the former to be discarded.20

Many have claimed or assumed that science is (part of) our mythology. This would be an impossible claim to prove incontrovertibly, especially because there are those who seek to hold to the truthfulness of science over against the religious or other, and because there are those who seek to establish a rightful place for the religious as against the scientific. It is very difficult to admit we have myths, let alone to recognize what they are.

Gilkey suggests that myths have by and large gone from modernity because they have to do with the transcendent or sacred within the finite and for which our secular ethos has no room.21 I believe this judgement to be incorrect and based on an inadequate comprehension of what constitutes a myth. Gilkey is perhaps more honestly pointing out that we can recognize relatively few myths in our own culture.

Now why is this, why is it hard for us to see our myths? It is not that they are not there.

The reason lies in one of the functional properties of myths outlined in the previous chapter. Our myths are hard to see because they are constitutive of our thinking: they give the foundation, the tools, the (subconscious) concepts by which we think. They portray the meaning of things: more than just a description of the way things are for us, they are a definition and expression of the way things are. It is like not being able to see the trees for the forest. There is no gap for a rational chisel to get in between reality/life and our strongly held myths on reality/life. That is why people may object, "Of course 'myth' is an empty concept; I can't see my myths!" When you look at an engrossing movie you do not see the screen itself. It is even more difficult to describe the mythic elements of our culture when we are held by them and think everything through them. They are like a movie screen for our lives, but even more subtly; the movie does not end. As Gerald Larue puts it: "We are so much part of our modern mythic environment that we usually fail to see it... We and our mythic environment are one."22

Myth concepts, the corner-stones and building blocks for all of understanding and prehension, are given this status (together with the other cognitive states of myths) by some innate structure which allows the possibility of thought in the first place.23 They serve an explanatory function and are unknown by introspection, much the same as the innate structure of the mind Noam Chomsky calls the "universal grammar".24 They are similar to what Jonathan Edwards calls a person's affections or faith, or "his persona, the character, the role, or the discipline to which he submits himself and makes the principle of his self-government". Such an affection is a mood or attunement of the whole mind or self. "It is able to endow the individual's thinking and acting with a unifying tone, because it suffuses the entire mind... qualifying all of his perceiving and thinking", superimposing on all stimuli and responses "a degree of quality and order". Under a faith, "nothing is intrinsically meaningless". And obviously, such a resonance or affection must lie "at such a depth in personal existence that it is inaccessible to volition".25

Having suggested that modern Western culture holds myths, included scientific knowledge under that category, and having noted some of the reasons for our difficulty in recognizing our myths, perhaps I should set about proving that science is a mythology. I shall not, and in fact cannot, do this. We saw in the previous chapter that there is no list of sufficient and necessary properties with which to define myth. If there were we would only have to show it to be satisfied by science; no such facilitation is possible because no such set exists.

I intend, however, to hold that science is part of our mythology as an interesting and informative hypothesis, and to look at science as a mythology: if science is a mythology for us, is it an adequate mythology? The point is that science is being used by a large segment of Western society as a mythology, and that it lacks the necessary to perform this task adequately. I wish to elaborate on these points in this chapter, and then in the next two to look at alternative systems of belief which may or may not give rise to adequate mythologies.

After taking a peek at the nature of science, how its knowledge is accumulated, I shall zero in on those aspects of myth which are satisfied by science — and hence reasons for saying that science is a mythology — and then look at those aspects of myth not satisfied by science, the foundations for people differentiating between the two.26

THE NATURE OF SCIENCE

What is scientific knowledge that I may seek to underscore its mythical nature? Let us spend a little time glancing at developments in philosophy's understanding of the structure and operation of scientific knowledge.

Thomas Kuhn highlighted, with his 1962 book The Structure of Scientific Revolutions, an attack against a strongly empiricist and sometime positivist, popular and scholarly understanding of the doing of science.27 It had been seen as the accumulation of knowledge approaching a perfect mirror of reality itself. Critics saw it, rather, as humanly-constructed with little rational reference to reality, if that indeed existed. From the extreme positions it is now possible to see a point at which the more recently opposing camps seem to converge. What follows is the relevant portion of that apparent convergence as detailed by Ian Barbour in his book Myths, Models and Paradigms.28
A scientific discipline comprises research traditions (often dominated by one such tradition), each of which is embodied in key examples (or exemplars or paradigms) which, by being taught and modelled, initiate a student into the methods of attacking problems acceptable within the tradition, and guide its research programme. A research tradition also assumes metaphysical beliefs, for instance about the kinds of entities there are in the world, and these can be shared by a number of traditions. Newtonian mechanics (once an extremely powerful paradigm) generated one such widely accepted collection of ontological commitments concerning the regularity, causality, and action-at-a-distance properties of the universe.

The doing of (normal) science within a research tradition requires the construction of models and theories. There are three steps involved. A model (a theoretical model in particular) is an imagined mental construct, usually in science a mechanism or process. Then the particular phenomenon being investigated and some mental construct are taken as analogous, and a theory is developed by correlating some of the observable terms of the phenomenon and some of the terms of the model. Let me give a classic example, the "billiard ball" model for the behaviour of a gas, as detailed by Bébour:29

Consider a box full of a gas, such as air, and imagine that the gas is composed of very tiny elastic spheres bouncing around. If one assumes that the mechanical behaviour of the hypothetical spheres is similar to the familiar behaviour of colliding billiard balls, a theory can be developed (the Kinet¡c Theory of Gases). The theory involves equations interrelating the mass (m), velocity (v), energy and momentum of the hypothetical spheres. Of course, none of these theoretical properties can be observed. But the model also intimates that some theoretical terms might be related to observable properties of the gas (for example, the momentum change of the "particles" colliding with the containing wall might be identified with the pressure of the gas).

A familiar and intelligible situation is thus used in an act of creative imagination as the basis by analogy for the theoretical understanding of some other aspect or part of the world. In particular, a comprehensive theory usually develops within a research tradition from its paradigms as the attempt to understand all that is within that tradition's area of study.30

MacCormac describes what he calls the "tension theory of metaphor", which will explain a little more of what is meant by saying that science is analogous. The central characteristic of a metaphor is that "when the two referents of a metaphor are read literally, they produce shock [or tension] in the hearer either because of their oddity in expression or because they generate a contradiction".31 Metaphors suggest new meanings but which must, if they are to be intelligible, express an experience or perception of the hearer. Amongst the other features of metaphors he develops is the distinction bet-

ween two uses of metaphor. He suggests there is a normal use, conveying "suggestive meanings and ideas with more or less analogy to our own experience", and their use as basic assumptions, "root-metaphors", which are "hypothetical suggestions about the nature of the world [and] offer possible ways of interpreting experience".32

Theories are assessed by a variety of criteria, which include simplicity, coherence, and agreement with experimental evidence. Simplicity not only refers to simplicity in the form of the theory and the minimum number of independent assumptions, but includes also an aesthetic element, the "beauty" or "elegance" or "symmetry" of the theory.33 Coherence refers to a comprehensive unification of separate laws, systematic interrelating of theories, and a portraying of the underlying similarities in apparently diverse phenomena. But the leading criterion is that of supporting experimental observations: a theory should accurately account for known observations, and yield precise predictions of future measurements especially leading to the discovery of novel types of phenomena. We must not assume, however, that theories can be verified or falsified by a straightforward reference to a set of public and purely objective observation data.

Kuhn divides science into two types: normal science and revolutionary science. A scientific community occupied in performing normal science shares a paradigm (or paradigms) and a set of models, developing and exploiting a research tradition, filling out the bones of the paradigm, as it were. Occasionally paradigm shifts or scientific revolutions occur, either in a major way (as with the change from Newtonian to Einsteinian physics) or in more minor ways. Within the established tradition a growing list of anomalies and modifications to theories in attempts to accommodate the anomalies accrues, which sometimes leads to a sense of crisis, the examination of assumptions, and the eruption of an alternative paradigm which challenges the tradition. The new paradigm is not necessarily continuous with the old in the sense of building directly on it, adding in a cumulative sense to the old. It is in some ways a radical break and replacement of the old, in ideas, presuppositions, techniques, meanings, theories, and so on.

There are many avenues open to a scientific community enabling it to hold onto a theory for which there is discordant data. It can, for instance, create auxiliary hypotheses to explain the data, or say the data are incorrect, or hope that reasons be found to undermine the rebel data. Thus a comprehensive theory is highly resistant to falsification, while a low-level law stating relationships between observables is more at the mercy of discrepancies. High-level facets are, in fact, not primarily overturned by discordant data, but by alternatives which have "greater promise of explaining known data, resolving anomalies, and predicting novel phenomena".34

Because of the paradigm-dependent nature of science, the language used to
describe the world — what might be called "data" or "facts" — cannot be seen as neutral or meaning the same for all people. No data can be bare and uninterpreted; all data are theory-laden. Aristotelian physicists saw a swinging pendulum as a constrained falling object which eventually reaches its final end; Galileo saw it as an inertial object, repeating its oscillation almost identically. However, it is not that communication between people of rival paradigms is impossible, their meaning different things with the same words. Rival traditions can communicate via an observation language based on common data not in dispute, and via the majority of their concepts, drawn from both everyday discourse and from their science. There can be some understanding of the other viewpoint without acceptance of it, rather similar to translating between different languages. When Kepler and Tycho argued about the movement of the planets, for example, they argued on the same visual or telescopic information about the sun and planets. Thus while to some extent data can be considered public and objective, to a large extent the data themselves are dependent on the theories (and observation processes); there is no clear dividing line between observational and theoretical terms. Let me reiterate one side of the dispute: observation data, together with the criteria other than from observation, do exert some control over theories (despite there being no specifiable rules for their unambiguous application). Shared observation statements and criteria suggest there can be some objectivity in the decision to abandon one research tradition (or comprehensive theory), when still not totally immune to change. This can happen with the coming of new realism, and it is one to which I aspire.

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Metaphysical assumptions are at a higher level than comprehensive theories, further away from direct empirical verification or falsification, but still not totally immune to change. This can happen with the coming of new emphases in research traditions, or the bringing in of different basic concepts with new traditions, or changes in interest in science or other areas of human experience causing a questioning of the wider application of the metaphysical assumptions of some tradition.

The different facets of scientific knowledge (metaphysical assumptions, research traditions based on paradigmatic exemplars, comprehensive theories, theories built from models and laws relating observables), all can change. And the changes in each case are partly rational and public (more as we move down the above list), and partly irrational or a-rational (less as we move down the list). This compromise reflects Barbour's philosophical position, itself a compromise between a naive realism which wishes to see scientific knowledge as a photographic-type replication of reality, and an instrumentalism or, worse, a conceptual relativism which has no objectivity and takes knowledge as completely relative to the knower. Barbour's position he calls a critical realism, and it is one to which I aspire.

The work of Kuhn (and Polanyi, Hanson, Toulmin, Feyerabend, and others) is important in the science and myth question for two reasons. The first is that it shows us something of the structure and nature of scientific knowledge. This will be important when we come to scrutinize science with respect to the properties of myth I have unearthed.

But perhaps more important at this stage is that it allows for the possibility of this sort of task in the very first instance, by removing the utter objectivity which used to be seen as science's. Science is not a matter of pure description of the world, nor is the objectivity of science to be found in its use of public observations of phenomena describable in theory-free language and against which theories can be verified or falsified. Such a view of science puts it in a different dimension from myth which was associated with religion and private imaginative terms, not testable against some independent factual language, and as such was considered highly subjective. The removal of this barrier allows for the "elevation" of myth into a more "objective" class, and the "relegation" of science into a more "subjective" class. But it is not to remove objectivity entirely from science.

It remains to see if myth in its "elevated" state can meet science at its "relegation".

MYTHICAL PROPERTIES OF SCIENCE

The subjectivity of science is recognized in the writing of such people as Kuhn. Now it is time to take a further step: to look at how science might be a mythology, whether the theories science espouses can be included in the same class as the myths of other cultures.

Looking at science as a mythology refers to scientific knowledge; that is, the theories science has about the nature of reality can be considered myths. The present task I have set myself is to examine science with regard to the properties of myth outlined in the previous chapter. To be a mythology, science need not fulfill all the isolated functions or properties of myths; not all mythologies do. In fact, it seems to falter on what might be called the more subjective, or person-oriented facets of myths. This I take as a fault of science if it is to be an over-arching or under-girding mythology for our times, and not that science is not a mythology; science is a particular sort of mythology, with limited functions in our society, but whose basic assumptions and thought forms have deeply penetrated our common thought forms. Barbour writes that although the theoretical models in science parallel myths in the cognitive functions of interpreting experience, there is no parallel in such things as evoking "commitment to ethical norms and policies of action", eliciting "emotional and valutational responses", encouraging "decision and personal involvement", or offering "ways of life and patterns of behaviour".

FROM SCIENCE TO AN ADEQUATE MYTHOLOGY

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In the remainder of this section I propose to go through the five properties of myths outlined in Chapter Two which can be recognized in science. A following section will examine the three others which cannot be so readily identified.

(1) **Science as Stories.** Myths are stories; can scientific knowledge be seen as a collection of stories too? Is a theory a story? A theory is a story about a particular part of experience, of the world or beyond it, involving ideas about its nature, characteristics, life history, the interactions of its constituents, and so on. Be the story about an electron, the species *macropus titus*, a social theory, group topologies, the matching law, the super ego, or whatever, the theory can still be seen as a story. The characters may not be very human-like and the plot of the story not of very human-like situations. But there are characters, and there are plots which tell of the characters’ interactions in different situations, and the resolutions of their predicaments.

As a detailed example of this property of myth, I have extracted from a physics text book a passage on the already referred to Kinetic Theory of Gases. After proposing six assumptions on which the theory is based, the authors continue:

Let us now calculate the pressure of an ideal gas from kinetic theory. To simplify matters, we consider a gas in a cubical vessel whose walls are perfectly elastic. Let each edge be of length \( l \). Call the faces normal to the x-axis \( A_1 \) and \( A_2 \), each of area \( l^2 \). Consider a molecule which has velocity \( v \). We can resolve \( v \) into components \( v_x, v_y, \) and \( v_z \) in the directions of the edges. If this particle collides with \( A_1 \), it will rebound with its x-component of velocity reversed. There will be no effect on \( v_y \) or \( v_z \), so that the change \( \Delta p \) in the particle’s momentum will be

\[
\Delta p = p_x - p_x = -mv_x - (mv_x) = -2mv_x,
\]

normal to \( A_1 \). Hence, the momentum imparted to \( A_1 \) will be \( 2mv_x \) since the total momentum is conserved.

The rate at which the particle transfers momentum to \( A_1 \) is then calculated to be \( \frac{mv_x^2}{l^2} \), and the authors continue:

To obtain the total force on \( A_1 \), that is, the rate at which momentum is imparted to \( A_1 \) by all the gas molecules, we must sum up \( \frac{mv_x^2}{l^2} \) for all the particles. Then, to find the pressure, we divide this force by the area of \( A_1 \), namely \( l^2 \). If \( m \) is the mass of each molecule, we have

\[
p = \frac{m}{l^3} (v_{x1}^2 + v_{x2}^2 + \ldots),
\]

where \( v_{x1} \) is the \( x \)-component of the velocity of particle 1, \( v_{x2} \) is that of particle 2, etc. If \( N \) is the total number of particles in the container...

Perhaps the point is already grasped. This rendition of the Kinetic Theory of Gases is the story of a collection of particles (sometimes represented by one of its members) in a box, and their interactions with the walls of the box.

Alexander Marshack in *The Roots of Civilization* examines the beginnings of human cognition as portrayed in prehistoric art, especially in symbolic, non-representational art. At times he philosophizes, and at one point, following descriptions and analyses of art or notations he sees as indicating the phases of the moon, he talks about stories: “The capacity to understand and communicate a ‘story’ was perhaps the basic, humanizing intellectual and social skill, the primary tool and technique of developing human culture.” Marshack expands on this: “The Upper Paleolithic hunter”, he says, “had a vast stock of skills and knowledge... including the varied uses of story and notation”, not necessarily all of which were verbalized. They could recognize certain natural processes, and with the equation of a story could recognize sequences of events and changes as parts of processes. In terms of a story they could recognize and see a pattern, they could understand, “unify the extraordinarily diverse phenomena and processes of... life”, participate in the processes in storied terms, and foretell events. This, according to Marshack, is the beginning of human understanding, the process of telling stories in order to explain and comprehend. “For us the important thing is to recognize that the innate evolved *Homo sapiens* capacity for storied thinking has probably not changed significantly in the last 40,000 years.”

There seems to be an innate and universal human behaviour which recognizes processes and things in reality, and a capacity for storytelling, used to explain (by the definition of “explain”) the processes observed. Science is such a storytelling process. I do not want to imply that all myths are aetiological and naturalistic (i.e., merely explaining natural phenomena, as some theories on myth have assumed), but that the stories Marshack is discussing are and become the myths of the people. It is apparent also that seeing science as a storytelling enterprise makes it a descendent of this 40,000-year-old process which Marshack discusses.

(2) **The Characters in Science.** Scientific theories are stories. Myths usually involve extra-mundane beings, groups or events; do scientific theories?

It is interesting to look at the ontological status we give the elements of scientific stories. In making our theories we have generalized from the individuals or individual actions, and constructed models for, say, what an electron is like, what a macropus titus is like, and so on. This generalized picture is of an “ideal” individual (or individual’s actions), and is then seen as the nature of all these individuals (or actions). They become sort of super-individuals and as such have an ontological status beyond that of being...
mere individuals. In a similar way their histories, the events, are extra-ordinary. To quote Alexander Gallus:

The scientist, the counterpart of the mythos-teller, orders in an hypothesis... an aspect of the world. He clarifies this aspect in the form of a description of the structure and activity (cf. behaviour) of an agency (e.g., electron, atomic nucleus). An electron appears simply to ‘be’, just as a mythic figure simply ‘is’. It is described in the midst of its scientific myth and seems to be indestructible and everlasting in the same way as Demeter, or Zeus. And no further questions are asked. This analogy has prompted Jung to call science the mythology of the 20th-century. The equation divinities = forces = scientific laws has already been expressed by Bernard.

We have, then, super-natural characters, and the stories of extra-ordinary events. They are not so much the stories of every x in all their actual situations (all real events), although it is hoped in the generalization process that this will be the case, but of some super-individual, ideal representative, traced through all its possible life situations, in all its extra-ordinary events. Consider the Kinetic Theory of Gases quoted above. This is the story of a representative body of gas and sometimes of a representative gas particle, and all gases and gas particles are assumed to act this way.

I have been talking especially of such things as electrons, objects, but what of other things such as force, logic, measurements; what are their ontological status? A force is a theoretical assumption to account for certain behaviours of objects. For example, gravity: we do not see it or experience it; we just see objects being attracted to each other and acting under that force. Gravity is a sort of condition we subject everything to; all must satisfy reason in some way.

In this sort of way the characters in the stories which are scientific theories are generalized aspects of reality, and are representative and archetypal. They are extra-mundane entities set in extra-mundane situations.

We understand via science in a sense by ‘anthropomorphizing’ the universe. We give to objects human-like properties which cause them to behave in the ways they do. For instance, the apple and the earth experience a gravitational attraction towards each other, and acting under that force they move towards each other; in effect, the apple falls from the tree to the ground. But is not ‘attraction’ a human sapient experience? And does not acting under an attraction involve something of a will? We project in scientific explanations specifically human experiences and motivations, via model making, onto the world, impuing it with the abilities to act under those motivations. Thus we explain the workings of the world. We have, as scientists, become even quite sophisticated in our projections to the point of objectifying mathematical formulae; these too are peculiarly human (mental) experiences which we project onto the world to say it experiences and acts according to those models.

This is all to say that we are only doing in science what mythmakers have always done: peopled the universe with anthropomorphic beings and personalities so as to understand it. Scientific causality is a veiled purposefulness.

There are other ‘characters’ in scientific theories than objects, relationships, logic, and properties. They are the assumptions of science. At this basal limit of science appear a number of mythic concepts, flowing under it like geological beds. We can see its stratigraphy of teleological and metaphysical ideas by viewing its escarpments or by excavating trenches. Included in the list of (metaphysical) beliefs held in science are:

- that reality is;
- that every event has a cause;
- that reality is knowable by us (that we can ask questions of it and find answers from it), even if that be something we aim for and often realize we have not reached; and
- that the nature of reality is rational (especially that it parallels mathematics), amenable to empirical methods (induction, verification, falsification), and repeats itself (is uniform).

The over-arching assumptions and general-guiding theories of science turn out not to be subject to its proof mechanisms of empiricism. They are usually held unconsciously by scientists, and expressed either directly or more usually by implication in many of the things said in science; through their studies of the theories of the recent past, by the paradigms of their research traditions, budding scientists absorb the fundamental assumptions of science. They are often considered part of the definition of what it is to be doing science; Michael Polanyi suggests that:

the metaphysical presuppositions of science.... are never explicitly defended or even considered by themselves by the inquiring scientist. They arise as aspects of the given activity of enquiry, as its structurally implicit presuppositions, not as consciously held philosophical axioms preceding it. They are transcendental preconditions of methodological thinking, not explicit objects of such thinking; we think with them and not of them.

It is not surprising that we are usually unaware of these presuppositions, for the reasons Polanyi suggests. They are precisely the reasons given before for our difficulties in observing our own myths.
Is it too much of a jump to say these basic metaphysical beliefs are mythic? Some may consider them mythic in that they are in principle unverifiable — that is, non-scientific — not subject to scientific procedures themselves (they define the procedures!). Their mythical nature is not countered by some of them, especially those closer to the surface of factuality, being abandoned as parts of a research programme (with changes of interest, and so forth), or by failure to be verified. They are mythic in that they are universal, authoritative, and truth or reality defining: myth "is that which is taken for granted when thought begins".

They are also mythic because of their origins in myths. Stephen Toulmin notes that Wittgenstein likened the question of induction, the requiring of justification for science, to the Ancients "who felt there must be an Atlas to support the earth on his shoulders". Myths have often been part of scientific explanation. In ancient Greece, the naturalists of Miletus — usually regarded as the originators of science — established an approach to the universe very close to the creation myths of their time. And it is noteworthy that traditional metaphysical problems (in fact problems with a mythical character) such as the nature of the infinite omnipotence of God, were being faced by such precursors of modern science as Nicholas of Cusa, Kepler, Newton and Liebniz. The historical forerunner of the lunar tidal theory developed by Newton was the astrological tenet of terrestrial events being influenced by the planets; Neo-Platonic sun worship as the "central noble light" inspired Copernicus's planetary theory. It is also interesting to muse over the mythical overtones in Darwin's proposed explanation of women's sexual cycles by the tides of the ocean, and Harvey's association of the circulation of the blood with planetary movements.

More specifically, many fundamental concepts and assumptions of science are derived from myths. Much is made of the dispute between religion and science, from the times of Copernicus and Galileo through to Darwin and onwards. But it is seldom noted that science itself arose out of religion. Science emerges from the meeting of two waters: the Greek and the biblical. From the Greeks were inherited the general mental tools of science (mathematics, logic, methods of observation and experimentation), and from the biblical tradition, a general picture of the world which enabled the tools to be more successfully used on the world, and the vocational ethic of puritanism which encouraged an understanding of the creator-God. As R. Hooykaas puts it, "whereas the bodily ingredients of science may have been Greek, its vitamins and hormones were biblical". All three of the sources mentioned above are mythical, but perhaps the most obviously so is the middle one, derived as it is from myths in the book of Genesis. It includes such orthodox assumptions as the belief that there is an order in nature which can be discovered, which is contingent and so only accessible by empirical inquiry, and the assumption, as Kenneth Cautin puts it, "that the proper object of scientific knowledge is the material rather than the formal aspects of things, so that attention can be directed to what can be quantified and expressed with mathematical precision".

Thus we can see myths in science by looking at its contour revealed at the origins of our modern scientific concepts. Of course myth does not just stop at the beginning; it infuses all of science itself. Nor does it cease at other edges of scientific activity, such as in the questions one can pose within it but not answer from within: "why has the world evolved?" (this contour will be looked at further later in this chapter).

We have been looking at the mythic nature of many of science's assumptions. One could claim the assumptions to be mythic in that they are elements of myths, parts of the paradigmatic theories which form the basis of research traditions. Science's paradigms act as myths, and its assumptions in being incorporated into its paradigms are mythic.

The characters in the theories of science are, it would appear, functionally much the same as those in myths.

(3) The Settings of Science. Myths sometimes have different spatio-temporal settings from our own space and time. They can take place in our own time, or in primordial time, or in a time over and above ours, or in the future. The spatial settings can be equally as varied: myths can be set in the sphere of the gods, in worlds beyond our own world, and gradations down to our world. What are the spatio-temporal settings for scientific stories?

Scientific theories often take place in a time-less era. They are stories, not so much about great characters whose pre-time mighty actions are the causes for present states of affairs, as with some myths, but rather they are beyond time in that they can take place at any time, they can repeat themselves at different times. They are the paradigmatic histories of their heroes, which say how they will behave at any time. The stories are thus not set at any specific time, and are not subject to, nor take place in, what we experience as our living, "historical" time.

Take, for example, our ideas on weather systems. We say a high pressure system moves towards a low pressure area with associated fronts, and so on. When does the text-book description take place? The theory is removed from time, a sort of cassette which is inserted into the tape deck of actual nature whenever we have a high pressure system and low pressure system in the necessary proximity. The characters and the processes in the theory take place and live outside normal time, but they can be inserted into experienced time and then seen to take place historically, although at many different times. Or consider the Kinetic Theory of Gases once again. There is no particular time at which this is set, for it could be applicable at any time, or at all times.
The same is true for the spatial settings of many scientific stories. They are stories apposite in general at any time and in any point in space, and as such can be particularized and historicized, but in themselves they are not set at any particular point of space and time. They can be applied at any appropriate point in space and time and when applied give different quantitative answers given different quantitative beginnings.

(4) Science as Basic to our Understanding of the Origin and Operation of this World. Myths are often essential to the understanding of the origin and operation of this world, physical, spiritual, biological, psychological, social, personal, and so on. They perform an explanatory role by describing how the world came to be as it is, and how it works now. Myths achieve this by telling of events whose consequences are felt or known now — the fall of humanity in Adam is a good example when we consider traditional Christianity — or by telling of supernatural beings who act in specific ways on or in our world.

It is obvious that scientific stories are basic to our understanding of the origin and operation of this world. And this is achieved in essentially the same ways as do myths: they tell of events whose consequences are felt or known now — the models of science act as paradigms or patterns of this world — or they tell of specific forces or entities which act in specific ways on or in our world. The Kinetic Theory of Gases, for instance, provides our understanding of what we know are the properties of gases — described in the macroscopic laws of Boyle, and Charles and Gay-Lussac — given our assumption of the molecular origin of this behaviour. It is unusual for us to reflect and consciously see this aspect of science. Rather, the theories science comes up with are automatically taken as the models of science act as paradigms or patterns of this world — or they tell of specific forces or entities which act in specific ways on or in our world. The Kinetic Theory of Gases, for instance, provides our understanding of what we know are the properties of gases — described in the macroscopic laws of Boyle, and Charles and Gay-Lussac — given our assumption of the molecular origin of this behaviour. It is unusual for us to reflect and consciously see this aspect of science. Rather, the theories science comes up with are automatically taken as the models of science act as paradigms or patterns of this world — or they tell of specific forces or entities which act in specific ways on or in our world.

A certain sense of time, for instance, that of measured or clock time (chronos), has been taken by science as basic for comprehending the universe, and is now by far the chief and superior meaning utilized by Western society at large. Paul Tillich speaks of one other sense, that of kairos, meaning the right time in which to do something, an appropriate and good occasion for some action to occur. Both terms are Greek in origin. Alternatively, one could compare our linear appreciation of time (as moving from a starting point in a straight line) with that of Buddhism: time is like waves in which we move up and down like a cork, repeating itself in a cyclic manner, without any horizontal movement.

Many authors are at pains to detach themselves from the 19th Century view of myth as aetiological, being a primitive (and inferior!) form of science in attempting to explain why the world is as it is; for example, by describing the origin of the solar system and the beginnings of life on earth. Richard Comstock writes: "Myth, properly understood, is not an early attempt to do what modern science can now do better, any more than a poem is an early attempt to express what a geometrical theorem and proof can state more clearly and convincingly." It is incorrect to claim that myths do not aim at giving explanations as to the workings of the world. But it is equally incorrect to state, as perhaps was intended in the "aetiological school", that this is the only or even prime function of all myths. In this context Comstock's caution is worth heeding, without it detracting from the point that a myth can be aetiological, the function most obviously fulfilled by our present science.

Another interesting similarity between science and myth arising from this ideational parallel is their success in controlling reality. Technology — our machines and the know-how generated by our science — helps us very successfully to manipulate and control reality. We make reality do what we want it to do; our machines perform the tasks we design for them. Such is the end of the technological arm of modern science. To understand means to control and manipulate; but to understand is also to hold myths.

"Non-scientific" cultures do the same with their myths. They understand reality (they hold myths about reality) and those myths in their own way enable reality (the reality depicted by the myths) to be controlled and manipulated. Within their own value or judgement system, their manipulation of reality is most successful. It is even most successful by our standards. Mircea Eliade underscores the importance of cosmogenic myths in the process of healing: "As the exemplary model for all 'creation', the cosmogenic myth can help the patient to make a 'new beginning' of his life" — it is a matter of re-creating life by bringing into existence once again, in myth-telling and ritual, the creation forces themselves.

There appear to be two ways of changing reality: supplication and manipulation. Do we go in and manipulate reality on the mythical or scientific basis of what we know of it (if we push A, B will pop out), sort of "twist its arm" and make it produce what we want it to, or do we politely ask the powers that be, in a more gentle manner, to do — if that be their wish — what we would like them to do? Do we manipulate or supplicate? What does magic do, and religion, what does it do? Where does science fit in? The usual solution is given by William Lessa and Evon Vogt.

Magic consists of a variety of ritual methods whereby events can be automatically influenced by supernatural means. While magic and religion have many mutual resemblances — both are supernatural, beyond the realm of experience, and dominated by symbolism and ritual — they are basically quite different. Religion is supplicative; by ritual it conciliates...
personal powers in order to request their favours. Magic is manipulative; it acts ritually upon impersonal powers in order automatically to make use of them. Magic is a formula or set of formulae. It is not a force as in mana. Magic is analogous to science in its use, but its premises, its theoretical bases — are supernatural and antithetical to science.

One wonders whether the foundational assumptions of science as mentioned above are not also rather supernatural.

It is interesting to read sociological accounts of the way scientists work and the place we give them in our society; the elevated shaman-like role we assign to them, the tellers of the truths to be known, very much resembles the role given to the myth-tellers and often to the shaman or witchdoctor. Langdon Gilkey speaks (as we have already witnessed) of the modern myth of the "new scientific man", "the modern gnostic myths of autonomy" in which we express utter confidence that the methods and knowledge of science can and will solve all our problems. Such a mythic understanding presents to us the image of the man in the white coat; the man who embodies the gnosis achieved by the new methods of inquiry. This man thus in modest actuality but also . . . in infinite potentiality knows the secrets of things, what their effective structures are, and therefore how they work. Consequently . . . he is the man who can control these forces.

And so on the myth continues.

Science is similar to magic in that it manipulates reality on the basis of formulae automatically to produce desired ends. Push A and you get B. Its premises — its theoretical bases — and its understanding of reality which give the formulae, are mythic. Thus scientific knowledge is like the myths of other cultures in that it can be used in a parallel way to manipulate reality. Religion's supplication is based on myth also in that its "conciliation" of the "personal powers" requires an understanding of them, usually given in myth.

Let us turn for a moment to miracles, the changes, say those recorded in the New Testament, as the result of religious supplications. Our scientific understanding of the nature and operation of reality is only one of many pictures of it. And not only pictures of it, but also only one sort of understanding of what it means for manipulation of reality to be successful, and only one sort of understanding of how to manipulate reality successfully. The miracles of Jesus probably did happen because they had the possibility of happening in that mythology: enough faith (and being God!) means you can do anything, even move mountains. If you really have faith enough in God that he will do something, it will happen. But this unacceptable situation in our mythology is often explained away, either by saying that such things do not ever happen, or by attempting to give some "scientific" reason or mechanism which accounts for them or their having been recorded. However, the world-view in which these miracles took place stands by itself; it can produce changes in reality according to its methods for doing so, and one of those is miracle. It is as equally a valid mythology as is our scientific one in terms of its changing of reality. Our scientific marvels and technological gadgets parallel New Testament miracles in that they too are based on a mythic understanding of reality.

We explain the success of our devices in terms of their interaction with what we see as reality; early Christians too explained the success of miracles in terms of the relationship between the miracles and what they saw as reality, the most important characteristic of which was an omnipotent and loving creator who came to live among them.

It seems that all peoples manipulate reality in some way, at least to feed themselves and supply other basic human needs. Scientific thinking is functionally the same as Mythmaking in the way it enables control of reality, as well as with other things such as the way they are told or learned. Mythmaking is a basic human activity, the modern Western counterpart of which probably includes our science.

5) Science as Authoritative. It is the next property of myths that I find the most intriguing and informative. It says that myths usually portray normative beliefs; myths tell what is true about reality and life in all their facets (including morals, social structure, supernatural beings, and so forth). More than just saying what is known to be true, myths themselves are the basic, essential, true-knowledge givers in saying how and what things are. They are not merely descriptions of what we know to be true, but more they are the definitions of what is true.

The same is true for scientific knowledge. We think things are the way we know them to be. I think this paper I am writing on is here and that I am really writing on it. It is not a figment of my mind; the paper and marks I make have real existence independent of my mind. This is certainly true for the "deeper" sort of scientific paradigm, assumption and method. We know (not merely think) that the physical-historical world is real, and we assume solutions to problems are to be found there using empirical techniques. We would no longer attribute our car breakdowns or emotional dilemmas to a God in heaven or a supernatural being beyond our ken. This physical-historical world is where "it is all at", and we "get at it" using scientific techniques. And even though complex scientific theories are not part of our everyday knowledge, aspects of them do filter down to become commonplace knowledge. They may be the ideas we are taught at school, and which have become part of our general world-view. For instance, the idea of evolution; how many now think that idea tells about the origins of our world, how we got to be here? And medical ideas too; most of us think that what we are told about our reproductive organs and processes by the medical and biological fraternities is precisely what reproduction is about, biologically at least.

Let me give another example. Is there a neutral standpoint which defines "an
He says: 67

I think that there is a neutral way of getting towards the truth, which might be called commonsense or scientific method or the principles of confirmation, which has sometimes been called reason. But this is something which men of all cultures for many thousands of years have been able to apply well enough to at least some of their concerns, however hard it may be for philosophers of science to formulate it precisely or to justify it in the face of scepticism.

Mackie feels his critic, Martin Hollis, is trying (self-contradictingly) to say all frameworks of thought (ideologies) have relative truth values, and so suggests that we can be released from conceptual imprisonment by testing our beliefs and frameworks of thought (ideologies) have relative truth values, and so suggests that we can be released from conceptual imprisonment by testing our beliefs and theories to see “whether or how often their distinctive predictions are fulfilled”. 68 One can then use this proper standard of “commonsense-scientific method-principles of confirmation-reason” for gauging truth.

While I would enjoy debating Mackie’s positivism, I want merely to point out the ideological or mythical status with which the method of science (empiricism) has been conferred. Mackie to a large extent is right; he is reflecting a common belief that the method of science is the only indubitable way for arriving at truthfulness; the scientific method has become the authoritative arbiter.

The axiomatic truthfulness of our myths to us has been embroidered, extended and tied to other fundamental beliefs to produce our (once?) unquestioned faith in human progress through science. All problems can be solved with science and technology. 69 This was a subject of Rousas Rushdoony’s critique of his society, as mentioned earlier in this chapter.

For J. Milton Yinger, science is a religion when “knowledge of the unquestioned value of science is sanctified knowledge”, and he discusses the religious aspects of scientific positivism. 70 Perhaps it does not need to be pointed out that when I use similar descriptive terms for science I am meaning something much broader.

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Human beings possess in community the ability imaginatively to construct words (their meanings or uses), project them onto reality, and to read them off reality as being actualities. We extend our discourse from the realm of our ordinary language, used for the realm of our ordinary experience, by making its words apply (theoretically and metaphysically) to the beyond (that is, by the process of model-making). But there are certain words, concepts or constructs, which we elevate to have more value, to be closer to the truth, or to be the framework within which we must place all our thinking. All of us have these corner-stone concepts; the process is inescapable.

The normative-authoritative property of myth causes, in extremes, an “in-

ability to see otherwise”: certain key ideas become the centres of the way we feel reality is, the instinctive reality we prefer. These might be called the focal points of our mythology, or focal beliefs, and will be true of reality for us. This is the “elevation” of these key ideas. Not that this is elevation in any conscious way, as the word “elevate” might suggest, but part of the unconscious biological process of knowing.

It is amazing how scientists fight over ideas and theories. Kees Bolle notes this absolutistic bent of many models throughout the history of science: “Once a model has gained acceptance, it is difficult to replace, and in this respect it resembles myth, while at the same time, just as in myth, there may be a great variety of interpretations.” 71 Consider, for example, Australian archaeology. Alexander Gallus, besides having an interest in matters anthropological and religious, is an archaeologist in Australia. D.J. Mulvaney discusses one of Gallus’s sites, that of Keilor, in his book The Prehistory of Australia. 72 Gallus was privileged to propose relatively early dates for human occupation of Australia, but the established archaeological circles did seem to approve of this outsider. Mulvaney writes: 73

While there is no reason to doubt man’s presence in Australia at this time [around 31,400 B.C., from Keilor’s dates], some workers are skeptical about the human origin of these finds, and are unwilling to accept until a detailed evaluation is presented. These stream-laid deposits contain numerous pebbles and many of them are battered and rolled. It poses a nice matter of judgement (or preferably demonstration [Gallus would claim that no demonstration is needed; they are obviously humanly-made artefacts]), whether the rudimentary flaking which is claimed as intentional, was simply naturally pounded, or thermally fractured [i.e., not humanly-made]. Dr Gallus postulates a complex typological sequence which correlates with Old World Palaeolithic, but with such simple flaking, it is difficult to accept its validity; yet systematic demonstration may force skeptics to recant.

The second edition of Mulvaney’s book paints a better picture of Gallus’s work, but this is typical of normal sciences’ reaction to new thoughts which challenge established models and paradigms. 74 The world is the way they see it to be!

It is apparent, though, that not all scientific theories are believed to be true. Many theories on the outer edge of science are played with, questioned and tested; how can these be myths if many scientists radically question them? Or take the Kinetic Theory of Gases to which we have been referring. For some this is a conscious model-making attempt; if we are aware of this, need it be true for us?

This raises an important question: what is meant by saying some theory is true? Do I believe it in a strong sense as I believe in the law of cause and effect as
witnessed in my immediate physical environment, or do I believe it in a rather weaker sense like the belief in the molecular nature of gas which has little use in my life? This is not a matter of degree of confirmation, but the subjective adoption of the theory. A theory is authoritatively true when we assume it without it even becoming conscious; I just automatically know that this is the way things happen (and it does so happen that a certain theory summarizes it). This is a strong sense of true, in that the theory has become reality defining. Scientific paradigms often induce this sort of authoritative response by defining the framework within which scientific work proceeds, and (together with the other models connected with a paradigm) scientists' commitments, conceptual, theoretical, instrumental and methodological. But the strength of their authoritative truth-definition is seen when a paradigm is questioned and faced with another. Kuhn uses terms like "conversion" as necessary when changing from one to another paradigm, like a "gestalt switch"; so much have the commitments scientists made been permeated and defined by the paradigm.

My understanding of science is that it is one large belief system divided into a number of smaller belief systems, or schools of science, each a "constellation of beliefs, values, techniques, and so on, shared by the members of a given [scientific] community", and each of which is supported by a paradigm or standard example of scientific work. Scientific knowledge is like a whole series of fans radiating from a number of paradigms, some overlapping, but all sitting on a shared base line, a common language. A rationality, a number of epistemological and metaphysical assumptions, and a few techniques. (That is, the fans are not wholly relative to themselves.) Onto each paradigm (or from each) more theories and knowledge are added and tested (using model-making procedures and so forth), gradually building up a system, a fan of knowledge. Each theory, being questioned and therefore not authoritatively true, is mythical in that the beliefs basic to it and some of the elements of which it is built are mythic, being derived from the paradigm, the core myth of the fan.

Being subject to questioning and so not held as authoritatively true does not dismiss a theory from being a myth, especially when it performs other functions of myth. In the next section under the "open/closed dichotomy", I will discuss the fact that for some non-Western cultures there is an awareness of alternative conceptualizations leading to some myths not being authoritatively true. This again is a variable characteristic of myths.

**IS MYTH EMPIRICAL?**

To suggest that science is mythical raises many hackles, one of the strongest of which is generated by my daring to suggest the subjectivity involved in and the prescientific application of the sacred core of the scientific method: epiricism. Can it be that myths are tested against the "objective" world by the societies that hold them?

My answer is that the myths of probably most cultures, as with all belief systems, are subject to factual experience, but that science can be distinguished in its most elevated regard for this principle. I wish to spend the following section looking more deeply at this and closely related matters; I believe this factor serves only to distinguish science and other mythologies by a matter of degree and not of kind.

Stephen Toulmin in an oft quoted paper criticizes the use of the scientific notions of evolution and the second law of thermodynamics to answer ethical, philosophical or theological questions. The biological theory of evolution, he suggests, then becomes a myth, the scientific myth called Evolution. This occurs because it refers to a cosmic process entertained for non-scientific motives, with its technical terms performing "part-time" jobs out of their proper context and with non-verifiable extended meanings. He is critical especially of Julian Huxley's vision of reality as evolving towards quantitatively new levels of existence, and from which we can find solutions to difficult non-scientific problems. Evolution in this use is a myth, not a precise biological theory but a story providing an undergirding framework for understanding ourselves, our activities, values and hopes. The same is true for the use of the second law of thermodynamics to show the universe is "running down", with a limited life expectancy, and the various consequences (often pessimistic) of that.

He says you cannot assume a scientific idea is correct in a scientific sense if it is used in a theological context. These are different language games with different criteria. But what are these differences? Langdon Gilkey summarizes them: myths "provide that widest framework of understanding which underlies man's self-understanding, his activities, values, and hopes, and about which therefore he can never be precise or scientific". Amongst his reasons for Evolution no longer being a scientific term when used in a theological context, he states that they answer different questions, Evolution has no scientific precision and meaning, it is not verifiable or even falsifiable, and it is extended to cover different phenomena than in its scientific usage.

This is partly true; such ideas with their origin in science are no longer being used in a scientific way. They have become myths, at least more like what many would feel are myths (irrational and non-empirical). However, the characteristics of myths vary so widely that we cannot so contrast them all with science. Some myths are precise, some do answer scientific questions, some are verifiable and falsifiable, and so on; it is a narrow view of myths which says none are. A scientific myth, writes Ralph Wendell Burhoe, "is systematically
Traditional myths are tested by a slower form of selection by nature in the history of their success or benefit to a population of people. A cultural myth that benefits a societal system is selected by the facts of the history of that culture, as when it prospers, thrives, and attracts and holds a larger population. A myth that harms a culture declines and dies for corresponding reasons. ... Hence myths prior to science and even the myths (imaginative models, theories, paradigms, etc.) of the sciences carry "truth value" which is tested by their viability.

Both types of myth are empirical; the scientific are quick to be tested — that is a conscious and important part of the scientific establishment — whereas the traditional are slower to be tested and then it is unplanned and not engineered.

It may be that science does not provide a "widest framework of understanding", but neither do all myths (some appear to be only etiological). Science does provide a framework of understanding; the degree of "wideness" for the frameworks of understanding which myths provide is, in fact, variable. Evolution may have become a myth in its non-scientific usage; but it is a myth also in its scientific usage.

One could also question Toulmin's understanding of science. Is science verifiable or falsifiable against empirical fact? The analogical and presuppositional view of science discussed before would imply that these hallmarks of science are not as hard and fast as people used to think. Not all of science is verifiable or falsifiable, and neither are myths as counter to this either. The positivist view of science appears to be now refuted in its extreme.

Alasdair MacIntyre draws this basic distinction between science and myth: "You cannot refute a myth because as soon as you treat it as refutable, you do not treat it as a myth but as a hypothesis or history." The subject matter of myth, he claims, is the same as for philosophy or science, but their difference lies in the fact that the former is living or dead, and the latter is either true or false. Ian Barbour discusses this proposal of MacIntyre, dismissing it because it does not give a serious enough account of the apparent fact that for many myth-holders their myths are serious truth-claims. MacIntyre is right in that myths appear to live, to be around in active use, for longer than do scientific theories. This may mean that scientific theories are refutable and disposable, whereas most myths are not subject to this testing.

The difference MacIntyre and Toulmin point to is still only one of degree. Science and myth are the narration of beliefs, of belief systems in fact. One of the variable characteristics of belief systems which James Borhek and Richard Curtis isolate is that of empirical relevance: it may be that science is more empirically relevant than are other mythologies. But, say Borhek and Curtis,
Kees Bolle makes a similar point by saying that replacement of models does occur in science and that there has developed within it an awareness of the limitations of its models. But a myth is not "regarded as replaceable by the community in which it functions, although an outside observer might record changes and even replacements".

Paul Feyerabend reacts strongly against Horton's suggestion that science is essentially sceptical, an open system of thought, pluralistic, as one which does not become horrified when faced with evidence counter to its established tenets. This is not how scientists proceed, he insists. In science scepticism is at a minimum; it is directed against the view of the opposition and against minor ramifications of one's own basic ideas, never against the basic ideas themselves. Attacking the basic ideas evokes taboo reactions which are no weaker than the taboo reactions in so-called primitive societies.

He gives us examples of this, the "early reactions against hidden variables in the quantum theory, the attitude towards astrology, telekinesis, telepathy, voodoo, Ehrenhalf, Velikovski, and so on". Any such irregularity "is either viewed as something quite horrifying or, more frequently, it is simply declared to be non-existent. Nor is science prepared to make a theoretical pluralism the foundation of research." And what is more, suggests Feyerabend, science is not possible without its dogmatism.

Barry Barnes is similarly critical of Horton and holds that features likely to promote the awareness of alternatives are not typically part of the environment in which scientists work. Borhek and Curtis suggest something similar too:

Much of the material scientists have produced for mass consumption consists of polemics against competing belief systems such as astrology, unidentified flying objects, folk medicine, and theological definitions of the nature of man and the creation of the world. [Science] is not tolerant of its competitors.

And John Beattie in his article "On Understanding Ritual" points out that in many African societies there is an awareness of alternatives, and he concludes that the duo "open/closed" cannot be the key difference between the two sorts of systems, "for both of them are found (though in different proportions and at different levels of development) in both kinds of societies". He considers that "religion and magic" thinking is "characteristic of small-scale, pre-literate, technologically simple societies", and that modern science is a product of more "open" societies, but this only tells us in which sort of society you are more likely to find the scientific or mythical approaches, and nothing about the differences between them. Ernest Gellner also gives examples which counter Horton's claims and concludes by saying: "Not all conceptually plural situations are ipso facto modern or scientific ones." Gellner criticizes Horton further for attributing the awareness of alternatives to individuals, and considers it better to attribute it to systems of thought.

It seems that the "open/closed" duo is not an adequate description of a supposed dichotomy between scientific and mythical thought. Yet these terms do describe something of a difference between science and many myths, a difference which is not, however, a radical one. Can we understand the apparent somewhat "openness" and somewhat "closedness" of these sorts of thinking without resorting to disjunctive criteria?

Joseph Fontenrose considers that when institutions change, myths and beliefs change, thereby providing the new justifications or rationale needed for the new institutions and customs. Interesting for us are his examples of change in myths. He refers to John Middleton's *Lugbara Religion* which discusses the relation of Lugbara mythology to socio-political changes, a number of changes in ancient Greek mythology, and a comment by Wolfram Eberhard that the Chinese communists are renovating traditional Chinese tales into suitable propaganda.

Perhaps our key is here: myths change and emerge in conjunction with changes in institutions and customs. A culture relatively unchanged in this regard has little or no mythical changes. For us to say, therefore, that a difference between science and myth is that science is constantly changing and mythologies are static, for one thing an overstatement, and secondly, merely a restatement of the sociological fact that our society is undergoing constant institutional and customary changes whereas other societies tend not to be. It is also untrue, as some mythologies do change.

So in reference to the basic categories of "open" and "closed", science is not entirely open, and mythical thought is not entirely closed; in fact they are both open and closed. On the open/closed continuum science and myth may fall at different points (or at least various examples of each may fall at different points). But this is not a classification that can allow us to say that the two phenomena are of a radically different nature. I referred before to Alasdair MacIntyre's upholding of the open/closed distinction. In another article he says that mythical thought often contains rival accounts comfortably, which rather contradicts his saying this is a closed phenomena. Think of the biblical book of Genesis and the two accounts of creation; as our myths until not so long ago (and for some even now) we held these two stories together without noticing their discrepancies, even though now they appear contradictory.

It is not possible to separate myth and science in a black-and-white manner. This means (or partly derives from the fact that) some myths are to some extent empirical. In our haste either to exile the sacred from the mundane or to protect it from the mundane, myth and religion have been divorced from the rapidly engulfing tide of scientific discourse; myth supposedly deals with the (disputed) experience of the inner person, or the autonomous realm of revelation and faith,
or with moral experience, emotional experience, etc. Part of the case being made here is that mythical and religious discourse both have to do with the objective world and are in part subject to our experience of it as well.

INADEQUACIES OF SCIENCE AS A MYTHOLOGY

We have looked at five properties of myth satisfied by science — that is if my analysis is a fair one. But there are now to be investigated three further properties of myth not satisfactorily fulfilled by science. From this what can one conclude? That science is not a mythology because those functions are not performed? Or that science is a mythology, albeit inadequate?

It would be silly to say there are absolutely no differences between what we might normally call science and what we might normally call myths, especially religious myths. There are differences, not only in content but in the areas in which they function. The properties of myths which I outlined in the previous chapter do not occur in all myths, but rather appear in varying degrees in each myth. They are, therefore, variable characteristics of myths. If we are to take science as a mythology, it will fit within these variable characteristics, because the differences between what we might normally call myths and science can on the whole be understood as differences in the degree to which the variable characteristics are attained. The properties of myth which are more obviously present in science are its story nature, and those concerned with its characters, settings, authority, and as a base for understanding reality. Problems arise with the more person-oriented aspects of myth as providing models for behaviour, involving the whole person, and as associated with ritual, but even these are minimally present in science. As not all properties of myth are apparent in all examples of myths, so we should not be surprised that they are not all obvious in science either.

(1) **Science as Providing Models for Behaviour.** Myths are often much more than tools for explaining the "why?"s" and "where from?"s" of reality, or bases for changing reality. They often direct human behaviour by presenting models, prototypes and paradigms for people to emulate, or by decrying certain behaviours so as to discourage them.

Our scientific stories do not excel at this, in fact they are pretty bad at this aspect of myth. But there is some behavioural input from them to us. We as a culture are tending more and more to approach problems in a scientific way. "Scientific techniques are the only techniques recognised throughout society", writes Peter Wills. He complains that the "objective method" of science is being adopted by society at large as the only truth-obtaining method, because it is felt to be the one which deals with the "real world". This deprives us from our full personhood for it banishes our "subjective" side from society at large and drives it into "a private world of meaningless thoughts and frustrated intentions". The propriety of the scientific approach, writes Frederick Ferré, "is deeply felt to touch on the ultimately worthy which is valued for its own sake, regardless of whether good is gained or lost thereby".

Many of our secular values have their roots in science, continues Ferré. The ideal of objectivity "is the ground of powerful moral commitment"; in each and every domain "obey no final authority but critical reason". Arising from the objective consciousness are impartiality, self-control, personal accountability, democratic anti-authoritarianism; respect for independence, originality and freedom of expression, tolerance and mutual respect. One could add also a belief in inevitable progress through science, and the authority of nature.

While forming a morality in some ways comprehensive, these values often conflict and fall short in their ability to produce whole and happy individuals and a harmonious society.

A tragic angle to this inadequacy is, as mentioned in Chapter One, our inability to control science. As a voracious monster it devours resources, its transnational and military limbs grabbing wildly at all that is around. The end products of research number the potential horrors of humanity: nuclear arsenals, genetic engineering, etc., etc. What are the right uses of our new technological marvels? And if this could be decided, what impels us to carry out those guidelines? Answers to such questions do not come from science itself.

Angry indictments pierce from the third world: science is a wolf out to devour the poor and their land. Those people who constitute science have little reason to be proud of their patron at least in this light.

(2) **Science as Involving the Whole Person.** Myths often incite an intense emotional involvement in their holders. They involve not only people's minds and direct their behaviour, but they involve the whole being of the person. Does science do this for the holders of scientific knowledge? Perhaps it does for some scientists who find their whole persons centred on their research. But this is not so for most people in our science-holding society.

Gallus feels that it is a "moral catastrophe" that it is more and more difficult for us emotionally to respond "to the environment", for it is that which "balances out existential anxieties (sin, guilt, repentance, expiation, cleansing, forgiveness, life after death)", and which has been mediated up until recent times by the mythology of Christianity. And science as our new mythology is of no help here. The universe cannot be faced "through the delegated expertise of a privileged class of scientists. Contact must be direct, and must permit the individual himself to influence his own destiny." It must be more than with minds. (But this is a matter of degree: some science (for instance, evolution and astronomy) has wide impact and involves more than minds; some myths have small impact and involve mostly minds.)
There appear to be limits to what can be scientifically explained, beyond which more of the whole person is involved. Stephen Toulmin discusses questions at the edge of a field of thought which require answers in different fields; he calls such questions "limiting questions,"

questions expressed in a form borrowed from a familiar mode of reasoning, but not doing the job they normally do within that mode of reasoning. . . . It is . . . characteristic of them that the way of answering suggested by the form of words employed will never completely satisfy the questioner, so that he continues to ask the question even after the resources of the apparent mode of reasoning have been exhausted.

He cites the question, "What holds the earth up?" in the everyday sense, as a limiting question.

We can ask a number of limiting questions from within science: Why does reality operate according to laws? What causes this? We can ask questions of source and goal of all things? Or, are consciousness and mind more than the workings of a biological brain? Or, can life in beings be clearly demarked from non-life? What is life? And so on. Evidently the answers to such questions are not in the domain of science, but rather in theology, metaphysics or philosophy. But the answers to such questions can also be mythic (the myths of Genesis are often seen as answering such questions) in that we might invoke religious myths to give us answers. Pierre Teilhard de Chardin, in surveying the emergence of matter, life and consciousness, posited a final end-point, the "Omega Point", drawing all towards itself as the supreme act of matter-life-consciousness, God. This is a theological answer to the limiting question, "Why has the evolutionary process created from uniform and elemental matter conscious humanity...and to what might this process lead?"

Science in this sort of way shows its inability to communicate with the whole of the person; we are not satisfied from within it, seeking avenues from beyond its borders. Toulmin and June Goodfield quote from Lawrence Durrell's *Prospero's Cell:*"All this is metaphysics," says Zarian a trifle unhappy.

"All speculation that goes at all deep," replies the Count, "becomes metaphysics by its very nature; we knock up against the invisible wall which bounds the prison of our knowledge. It is only when a man has been round that wall on his hands and knees, when he is certain that there is no way out, that he is driven upon himself for a solution."

Science is a cell out of which human nature must try to escape if it is to be true to itself.

Another significant indicator of the inability of science to relate to the whole person is the firm division many wish to make between the subjective and the objective, placing science in the latter and myth in the former. It is the oft mentioned assumption that while science has to do with the objective world of things, myth has primarily to do with our inner subjective selves, our feelings, hopes, fears, and so on, and that these are not present in science. Such descriptions would be the case for some existential (Bultmann, Ricoeur) and psychological (Jung, Freud) approaches to myth; myths express human "feelings, hopes and fears, or experiences of guilt, reconciliation and liberation from anxiety...the projection of inner psychic dramas", being the products of the collective unconscious, and so on. Raphael Patai thinks that the basic difference between the scientific and mythical approaches to phenomena lies in this:

The scientist wants to understand them; for him every unknown is a challenge. But, once having found the answer to a question, he is not concerned with the effect his solution will have on man. Myth, on the other hand, always keeps man in the focus of its interest. The explanations it supplies...invariably contain an element of encouragement. . . . Where science merely explains, myth always reassures; where science reports, myth comforts.

Mircea Eliade in his book *The Sacred and the Profane: The Nature of Religion* opposes the sacred to the profane: the sacred manifests itself to us and is of a "wholly different order [from the profane], a reality which does not belong to our world, in objects that are an integral part of our natural 'profane' world". There is no continuity between the two worlds; a great abyss divides them. We as moder be the first to experience a completely profane world, only one half of the two possible worlds. It is the function of myth to relate "a sacred history, that is a primordial event that took place at the beginning of time" and whose characters are gods or culture heroes; "the profane was not ontologically established by myth". Eliade's solution to there being the sacred and the profane emphases and activities in life is to assume a marked distinction between the two, and only one of which, the profane, we as moder experience.

The "profane" is the objective, the secular, the scientific; any desire for an Eliadean "sacred" for us moder is to imply the inadequacy of the "profane" for us to be truly whole human beings.

Or one could point to the Wittgensteinian separation of myth and science into perhaps exclusive language games each with its own rules and criteria for truthfulness. The function of science is to predict and control, and the function of myth is to provide total life orientations and frameworks for understanding ourselves, our values and hopes, what we do, and so on. They are different language games, and their languages can be seen as complementary and
non-intersecting. This approach appears to be underlying Toulmin’s previously-mentioned criticism of the use of Evolution — in origin a scientific concept — as a more general idea, a myth.

The point of the above examples is to show the inadequacy of science as relating to the whole person, a function often associated with myth. But in the efforts to display these inadequacies too much is often made of the differences: too deep a ditch is excavated between the objective and the subjective, too wide an ocean charted between the profane and the sacred, and too complete a cleavage prised between language games.

Let me again run through my reasons for rejecting such radical distinctions.

In relation to the language-game mode for partitioning off science and myth, two things can be ignored: the question of the truth and falsity of myth statements, and the empirical content of many myths for their holders (as mentioned in the previous section). For many their myths are the way the world is for them. Language and truth are not relative to any “form of life” for there are shared criteria and meanings. The talk of different language games does help us understand that different spheres of discourse function in different ways — if not usually in radically different ways — and that differences in content can be understood as differences in function.

Neither can I accept Eliade’s distinction, partly because mythical evidence does not bear his thesis out, and partly because I do not feel we need to define two sorts of experience — the profane which we experience and the sacred which other cultures experience (especially in their religious lives) — in order to explain the differences between our experience of reality and theirs. For us the religious and the secular are separated (much to the detriment of our lives and society — the key topic for Chapter One), but this can be explained other than by totally separating the religious and secular (sacred and profane) for all peoples, or even for us (our secular, for instance, may contain a truer sacred than we might want to recognize). Neither is there justification for projecting our social differentiations (church and secular) onto other cultures.

In regard to the subjective/objective distinction between myth and science, there are examples of myths which are not about our inner psyches, despite the fact that holders of existential or psychological frameworks will see their analyzed symbols in every myth. Many myths are, for instance, about the cosmic order, including nature and history, myths which tend to be neglected by the “inner life schools” even in their definitions of myth. To relegate these to the collection of “inner life symbols” does little justice to them; they are primarily about the outside world. Moreover, the objective category for science does not fit watertight, either. There are subjective factors in science, as has been the contention of the philosophers of science from the tradition in which Kuhn is found. The concern shown by some scientists in the effects their and their colleagues’ work might have on humanity and our environment perhaps challenges Patai’s image of science not being interested in human beings.

Over-reactions are perfectly understandable given the positivistic scientism ruling earlier this century and which made science the measure and answer for all. Apparently it is not.

Floyd Matson is concerned with the human self-image as reflected in and generated by the sciences. From the biological, social and behavioural sciences we receive a “fractured” self-image: our specific humanness is bypassed in their partial presentation of what is essentially human. They have adopted as their model for knowledge the method of classical, mechanistic Newtonian physics. Will an integrative image of humankind as subject be recovered in a countermovement to the mechanistic image, inspired by this century’s revolution in physics?

(3) Science as Associated with Ritual. The final property of myths to be considered is also rather absent from science. Myths are sometimes closely connected with rituals, and science obviously is not over-represented this way. This is Ninian Smart’s reason for separating the two forms of activity. It is also taken up by Eliade. For him the greatest difference between “archaic and modern man” is our “irreversibility of events”, whereas for him events can occur again by being re-enacted in ritual. He considers the sort of knowledge myths imparts: “This is not an ‘external’, ‘abstract’ knowledge but a knowledge one ‘experiences’ ritually, either by ceremonially recounting the myth or by performing the ritual for which it is the justification; ... in one way or another one ‘lives’ the myth, in the sense that one is seized by the sacred, exalting power of the events recollected or re-enacted.” By enacting the stories of mythology in various media, rituals enable people to participate directly in the total universe of meaning and power.

The ritual of objective consciousness and method is, as mentioned above, sacred and widely participated in. It is a suspension of judgement in the absence of sufficient evidence, methodological doubt, and a discounting of forms of belief other than the objective. The passive-voice approach to the writing of scientific reports (“eight grams of the powder in a beaker”) is a widely practised ritual which points to, as well as participates in, the sacred value of objective scientific consciousness. Further, Earl MacCormac suggests that “future archaeologists may look back upon much present scientific activity as empty ritual, research that had little purpose or direction other than to consume energy and funds.”

But the doing of science is left to “the man in the white coat”, and is far removed from the ordinary person. We are very much involved in the ritual of our technology, our measures of achievement, and other cultural fetishes —
football, alcohol, sex and cars — but there is very little communal ritual involvement in the stories of science, except for minor instances; when we watch TV advertisements for "in-line beam guns" for our colour TVs, or become involved from the teaching of science in schools, for instance.

SECTAR-SCIENTIFIC MYTHOLOGY

From this discussion I hope it is apparent that there is a great similarity between the functioning of our science — not just the mystique of science, or scientism, but the theories of science, scientific knowledge itself — and the functioning of the mythologies of other cultures. They have similar properties in some aspects of content as well. Even by inductive implication, since we consider the understandings of reality of all societies to be myths, so must our understandings of reality be myths, even if we do not recognize them as such.

As attributed to W. V. O. Quine, "the myths of Homer's Gods and the myth of physical objects differ in degree, not in kind". There is no clear line of demarcation between what are usually called myths and science.

Our secular mythology is at root scientific, and is inadequate as a mythology for our lives; our scientific stories, for instance, do not perform well in directing our behaviour, they stimulate little emotional involvement and they are not the centre of our rituals. Even though science may be adequate on the cognitive and rational levels, it is not adequate on the emotional, individual-involvement, ethical, and at the individual's reality-manipulation levels.

Science could also be considered a religion for our society. Compare it with Clifford Geertz's definition of religion: "A religion is: (1) a system of symbols which acts to (2) establish powerful, pervasive and long lasting moods and motivations in men by (3) formulating conceptions of a general order of existence and (4) clothing these conceptions with such an aura of actuality that (5) the moods and motivations seem uniquely realistic." Even though science is a symbol system which formulates "conceptions" and establishes "powerful and long lasting moods and motivations", it does not establish "pervasive" moods and motivations. Science does not act on all our lives, it does not "spread through, permeate or saturate" our lives. It has infiltrated every sphere of our culture, but it has not saturated it. Robin Horton thinks that "outside the various academic disciplines in which it has been institutionalized, its hold is pitifully less than those who describe Western culture as 'science-oriented' often like to think". Even though some of the models of science become to some extent "the intellectual furnishings of a very large sector of the population", they are mainly accepted because of the social status of their propounders, and anyway, he suggests, the rules by which scientists accept or reject models do not filter down to the rest of us.