

Introduction

*Ordnung ist heutzutage meistens dort,
wo nichts ist.*

Es ist eine Mangelercheinung.

BRECHT

Science is an essentially anarchistic enterprise: theoretical anarchism is more humanitarian and more likely to encourage progress than its law-and-order alternatives.

The following essay is written in the conviction that *anarchism*, while perhaps not the most attractive *political* philosophy, is certainly excellent medicine for *epistemology*, and for the *philosophy of science*.

The reason is not difficult to find.

'History generally, and the history of revolutions in particular, is always richer in content, more varied, more many-sided, more lively and subtle than even' the best historian and the best methodologist can imagine.¹ History is full of 'accidents and conjunctures and curious juxtapositions of events'² and it demonstrates to us the 'complexity of human change and the unpredictable character of the ultimate consequences of any given act or decision of men'.³ Are we really to believe that the naive and simple-minded rules which methodologists take as

1. 'History as a whole, and the history of revolutions in particular, is always richer in content, more varied, more multiform, more lively and ingenious than is imagined by even the best parties, the most conscious vanguards of the most advanced classes' (V. I. Lenin, 'Left-Wing Communism - An Infantile Disorder', *Selected Works*, Vol. 3, London, 1967, p. 401). Lenin is addressing parties and revolutionary vanguards rather than scientists and methodologists; the lesson, however, is the same. cf. footnote 5.

2. Herbert Butterfield, *The Whig Interpretation of History*, New York, 1965, p. 66.

3. *ibid.*, p. 21.

their guide are capable of accounting for such a 'maze of interactions'?⁴ And is it not clear that successful *participation* in a process of this kind is possible only for a ruthless opportunist who is not tied to any particular philosophy and who adopts whatever procedure seems to fit the occasion?

This is indeed the conclusion that has been drawn by intelligent and thoughtful observers. 'Two very important practical conclusions follow from this [character of the historical process],' writes Lenin,⁵ continuing the passage from which I have just quoted. 'First, that in order to fulfil its task, the revolutionary class [i.e. the class of those who want to change either a part of society such as science, or society as a whole] must be able to master *all* forms or aspects of social activity without exception [it must be able to understand, and to apply, not only one particular methodology, but any methodology, and any variation thereof it can imagine] . . . ; second [it] must be ready to pass from one to another in the quickest and most unexpected manner.' 'The external conditions,' writes Einstein,⁶ 'which are set for [the scientist] by the facts of experience do not permit him to let himself be too much restricted, in the construction of his conceptual world, by the adherence to an epistemological system. He therefore, must appear to the systematic epistemologist as a type of unscrupulous opportunist. . . .' A complex medium containing surprising and unforeseen developments demands complex procedures and defies analysis on the basis of rules which have been set up in advance and without regard to the ever-changing conditions of history.

4. *ibid.*, p. 25, cf. Hegel, *Philosophie der Geschichte, Werke*, Vol. 9, ed. Edward Gans, Berlin, 1837, p. 9: 'But what experience and history teach us is this, that nations and governments have never learned anything from history, or acted according to rules that might have derived from it. Every period has such peculiar circumstances, is in such an individual state, that decisions will have to be made, and decisions *can* only be made, in it and out of it.' - 'Very clever'; 'shrewd and very clever'; 'NB' writes Lenin in his marginal notes to this passage. (*Collected Works*, Vol. 38, London, 1961, p. 307.)

5. *ibid.* We see here very clearly how a few substitutions can turn a political lesson into a lesson for *methodology*. This is not at all surprising. Methodology and politics are both means for moving from one historical stage to another. The only difference is that the standard methodologies disregard the fact that history constantly produces new features. We also see how an individual, such as Lenin, who is not intimidated by traditional boundaries and whose thought is not tied to the ideology of a profession, can give useful advice to everyone, philosophers of science included.

6. Albert Einstein, *Albert Einstein: Philosopher Scientist*, ed. P. A. Schilpp, New York, 1951, pp. 683f.

Now it is, of course, possible to simplify the medium in which a scientist works by simplifying its main actors. The history of science, after all, does not just consist of facts and conclusions drawn from facts. It also contains ideas, interpretations of facts, problems created by conflicting interpretations, mistakes, and so on. On closer analysis we even find that science knows no 'bare facts' at all but that the 'facts' that enter our knowledge are already viewed in a certain way and are, therefore, essentially ideational. This being the case, the history of science will be as complex, chaotic, full of mistakes, and entertaining as the ideas it contains, and these ideas in turn will be as complex, chaotic, full of mistakes, and entertaining as are the minds of those who invented them. Conversely, a little brainwashing will go a long way in making the history of science duller, simpler, more uniform, more 'objective' and more easily accessible to treatment by strict and unchangeable rules.

Scientific education as we know it today has precisely this aim. It simplifies 'science' by simplifying its participants: first, a domain of research is defined. The domain is separated from the rest of history (physics, for example, is separated from metaphysics and from theology) and given a 'logic' of its own. A thorough training in such a 'logic' then conditions those working in the domain; it makes *their actions* more uniform and it freezes large parts of the *historical process* as well. Stable 'facts' arise and persevere despite the vicissitudes of history. An essential part of the training that makes such facts appear consists in the attempt to inhibit intuitions that might lead to a blurring of boundaries. A person's religion, for example, or his metaphysics, or his sense of humour (his *natural* sense of humour and not the inbred and always rather nasty kind of jocularly one finds in specialized professions) must not have the slightest connection with his scientific activity. His imagination is restrained, and even his language ceases to be his own.⁷ This is again reflected in the nature of scientific 'facts' which are experienced as being independent of opinion, belief, and cultural background.

It is thus *possible* to create a tradition that is held together by strict rules, and that is also successful to some extent. But is it *desirable* to support such a tradition to the exclusion of everything else? Should we

7. For the deterioration of language that follows any increase of professionalism cf. my essay 'Experts in a Free Society', *The Critic*, November/December 1970.

transfer to it the sole rights for dealing in knowledge, so that any result that has been obtained by other methods is at once ruled out of court? This is the question I intend to ask in the present essay. And to this question my answer will be a firm and resounding NO.

There are two reasons why such an answer seems to be appropriate. The first reason is that the world which we want to explore is a largely unknown entity. We must, therefore, keep our options open and we must not restrict ourselves in advance. Epistemological prescriptions may look splendid when compared with other epistemological prescriptions, or with general principles – but who can guarantee that they are the best way to discover, not just a few isolated ‘facts’, but also some deep-lying secrets of nature? The second reason is that a scientific education as described above (and as practised in our schools) cannot be reconciled with a humanitarian attitude. It is in conflict ‘with the cultivation of individuality which alone produces, or can produce, well-developed human beings’⁸; it ‘maims by compression, like a Chinese lady’s foot, every part of human nature which stands out prominently, and tends to make a person markedly different in outline’⁹ from the ideals of rationality that happen to be fashionable in science, or in the philosophy of science. The attempt to increase liberty, to lead a full and rewarding life, and the corresponding attempt to discover the secrets of nature and of man entails, therefore, the rejection of all universal standards and of all rigid traditions. (Naturally, it also entails the rejection of a large part of contemporary science.)

It is surprising to see how rarely the stultifying effect of ‘the Laws of Reason’ or of scientific practice is examined by professional anarchists. Professional anarchists oppose any kind of restriction and they demand that the individual be permitted to develop freely, unhampered by laws, duties or obligations. And yet they swallow without protest all the severe standards which scientists and logicians impose upon research and upon any kind of knowledge-creating and knowledge-changing activity. Occasionally, the laws of scientific method, or what are thought to be the laws of scientific method by a particular writer, are even integrated into

8. John Stuart Mill, ‘On Liberty’, *The Philosophy of John Stuart Mill*, ed. Marshall Cohen, New York, 1961, p. 258.

9. *ibid.*, p. 265.

anarchism itself. 'Anarchism is a world concept based upon a mechanical explanation of all phenomena,' writes Kropotkin.¹⁰ 'Its method of investigation is that of the exact natural sciences . . . the method of induction and deduction.' 'It is not so clear,' writes a modern 'radical' professor at Columbia,¹¹ 'that scientific research demands an absolute freedom of speech and debate. Rather the evidence suggests that certain kinds of unfreedom place no obstacle in the way of science. . . .'

There are certainly some people to whom this is 'not so clear'. Let us, therefore, start with our outline of an anarchistic methodology and a corresponding anarchistic science.¹² There is no need to fear that the diminished concern for law and order in science and society that characterizes an anarchism of this kind will lead to chaos. The human nervous

10. Peter Alexeivich Kropotkin, 'Modern Science and Anarchism', *Kropotkin's Revolutionary Pamphlets*, ed. R. W. Baldwin, New York, 1970, pp. 150-2. 'It is one of Ibsen's great distinctions that nothing was valid for him but science.' B. Shaw, *Back to Methuselah*, New York, 1921, xcvi. Commenting on these and similar phenomena Strindberg writes (*Antibarbarus*): 'A generation that had the courage to get rid of God, to crush the state and church, and to overthrow society and morality, still bowed before Science. And in Science, where freedom ought to reign, the order of the day was "believe in the authorities or off with your head".'

11. R. P. Wolff, *The Poverty of Liberalism*, Boston, 1968, p. 15. For a more detailed criticism of Wolff see footnote 52 of my essay 'Against Method' in *Minnesota Studies in the Philosophy of Science*, Vol. 4, Minneapolis, 1970.

12. When choosing the term 'anarchism' for my enterprise I simply followed general usage. However anarchism, as it has been practised in the past and as it is being practised today by an ever increasing number of people has features I am not prepared to support. It cares little for human lives and human happiness (except for the lives and the happiness of those who belong to some special group); and it contains precisely the kind of Puritanical dedication and seriousness which I detest. (There are some exquisite exceptions such as Cohn-Bendit, but they are in the minority.) It is for these reasons that I now prefer to use the term *Dadaism*. A Dadaist would not hurt a fly - let alone a human being. A Dadaist is utterly unimpressed by any serious enterprise and he smells a rat whenever people stop smiling and assume that attitude and those facial expressions which indicate that something important is about to be said. A Dadaist is convinced that a worthwhile life will arise only when we start taking things *lightly* and when we remove from our speech the profound but already putrid meanings it has accumulated over the centuries ('search for truth'; 'defence of justice'; 'passionate concern'; etc., etc.) A Dadaist is prepared to initiate joyful experiments even in those domains where change and experimentation seem to be out of the question (example: the basic functions of language). I hope that having read the pamphlet the reader will remember me as a flippant Dadaist and *not* as a serious anarchist. cf. footnote 4 of chapter 2.

system is too well organized for that.¹³ There may, of course, come a time when it will be necessary to give reason a temporary advantage and when it will be wise to defend its rules to the exclusion of everything else. I do not think that we are living in such a time today.

13. Even in undetermined and ambiguous situations, uniformity of action is soon achieved and adhered to tenaciously. See Muzafer Sherif, *The Psychology of Social Norms*, New York, 1964.

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This is shown both by an examination of historical episodes and by an abstract analysis of the relation between idea and action. The only principle that does not inhibit progress is: anything goes.

The idea of a method that contains firm, unchanging, and absolutely binding principles for conducting the business of science meets considerable difficulty when confronted with the results of historical research. We find then, that there is not a single rule, however plausible, and however firmly grounded in epistemology, that is not violated at some time or other. It becomes evident that such violations are not accidental events, they are not results of insufficient knowledge or of inattention which might have been avoided. On the contrary, we see that they are necessary for progress. Indeed, one of the most striking features of recent discussions in the history and philosophy of science is the realization that events and developments, such as the invention of atomism in antiquity, the Copernican Revolution, the rise of modern atomism (kinetic theory; dispersion theory; stereochemistry; quantum theory), the gradual emergence of the wave theory of light, occurred only because some thinkers either *decided* not to be bound by certain 'obvious' methodological rules, or because they *unwittingly broke* them.

This liberal practice, I repeat, is not just a *fact* of the history of science. It is both reasonable and *absolutely necessary* for the growth of knowledge. More specifically, one can show the following: given any rule, however 'fundamental' or 'necessary' for science, there are always circumstances when it is advisable not only to ignore the rule, but to adopt its opposite. For example, there are circumstances when it is advisable to introduce, elaborate, and defend *ad hoc* hypotheses, or hypotheses which contradict well-established and generally accepted experimental results, or hypotheses whose content is smaller than the content of the existing and

empirically adequate alternative, or self-inconsistent hypotheses, and so on.¹

There are even circumstances – and they occur rather frequently – when *argument* loses its forward-looking aspect and becomes a hindrance to progress. Nobody would claim that the teaching of *small children* is exclusively a matter of argument (though argument may enter into it, and should enter into it to a larger extent than is customary), and almost everyone now agrees that what looks like a result of reason – the mastery of a language, the existence of a richly articulated perceptual world, logical ability – is due partly to indoctrination and partly to a process of *growth* that proceeds with the force of natural law. And where arguments *do* seem to have an effect, this is more often due to their *physical repetition* than to their *semantic content*.

Having admitted this much, we must also concede the possibility of non-argumentative growth in the *adult* as well as in (the theoretical parts of) *institutions* such as science, religion, prostitution, and so on. We certainly cannot take it for granted that what is possible for a small child – to acquire new modes of behaviour on the slightest provocation, to slide into them without any noticeable effort – is beyond the reach of his elders. One should rather expect that catastrophic changes in the physical environment, wars, the breakdown of encompassing systems of morality, political revolutions, will transform adult reaction patterns as well, including important patterns of argumentation. Such a transformation may again be an entirely natural process and the only function of a rational argument may lie in the fact that it increases the mental tension that precedes *and causes* the behavioural outburst.

1. One of the few thinkers to understand this feature of the development of knowledge was Niels Bohr: ‘... he would never try to outline any finished picture, but would patiently go through all the phases of the development of a problem, starting from some apparent paradox, and gradually leading to its elucidation. In fact, he never regarded achieved results in any other light than as starting points for further exploration. In speculating about the prospects of some line of investigation, he would dismiss the usual consideration of simplicity, elegance or even consistency with the remark that such qualities can only be properly judged *after* [my italics] the event. . . .’ L. Rosenfeld in *Niels Bohr. His Life and Work as seen by his Friends and Colleagues*, ed. S. Rosental, New York, 1967, p. 117. Now science is never a completed process, therefore it is always ‘before’ the event. Hence simplicity, elegance or consistency are *never* necessary conditions of (scientific) practice.

Now, if there are events, not necessarily arguments which *cause* us to adopt new standards, including new and more complex forms of argumentation, is it then not up to the defenders of the *status quo* to provide, not just counter-arguments, but also contrary *causes*? ('Virtue without terror is ineffective,' says Robespierre.) And if the old forms of argumentation turn out to be too weak a cause, must not these defenders either give up or resort to stronger and more 'irrational' means? (It is very difficult, and perhaps entirely impossible, to combat the effects of brainwashing by argument.) Even the most puritanical rationalist will then be forced to stop reasoning and to use *propaganda* and *coercion*, not because some of his *reasons* have ceased to be valid, but because the *psychological conditions* which make them effective, and capable of influencing others, have disappeared. And what is the use of an argument that leaves people unmoved?

Of course, the problem never arises quite in this form. The teaching of standards and their defence never consists merely in putting them before the mind of the student and making them as *clear* as possible. The standards are supposed to have maximal *causal efficacy* as well. This makes it very difficult indeed to distinguish between the *logical force* and the *material effect* of an argument. Just as a well-trained pet will obey his master no matter how great the confusion in which he finds himself, and no matter how urgent the need to adopt new patterns of behaviour, so in the very same way a well-trained rationalist will obey the mental image of *his* master, he will conform to the standards of argumentation he has learned, he will adhere to these standards no matter how great the confusion in which he finds himself, and he will be quite incapable of realizing that what he regards as the 'voice of reason' is but a *causal after-effect* of the training he has received. He will be quite unable to discover that the appeal to reason to which he succumbs so readily is nothing but a *political manoeuvre*.

That interests, forces, propaganda and brainwashing techniques play a much greater role than is commonly believed in the growth of our knowledge and in the growth of science, can also be seen from an analysis of the *relation between idea and action*. It is often taken for granted that a clear and distinct understanding of new ideas precedes, and should precede, their formulation and their institutional expression. (An investigation

starts with a problem, says Popper.) *First*, we have an idea, or a problem, *then* we act, i.e. either speak, or build, or destroy. Yet this is certainly not the way in which small children develop. They use words, they combine them, they play with them, until they grasp a meaning that has so far been beyond their reach. And the initial playful activity is an essential prerequisite of the final act of understanding. There is no reason why this mechanism should cease to function in the adult. We must expect, for example, that the *idea* of liberty could be made clear only by means of the very same actions, which were supposed to *create* liberty. Creation of a *thing*, and creation plus full understanding of a *correct idea* of the thing, *are very often parts of one and the same indivisible process* and cannot be separated without bringing the process to a stop. The process itself is not guided by a well-defined programme, and cannot be guided by such a programme, for it contains the conditions for the realization of all possible programmes. It is guided rather by a vague urge, by a 'passion' (Kierkegaard). The passion gives rise to specific behaviour which in turn creates the circumstances and the ideas necessary for analysing and explaining the process, for making it 'rational'.

The development of the Copernican point of view from Galileo to the 20th century is a perfect example of the situation I want to describe. We start with a strong belief that runs counter to contemporary reason and contemporary experience. The belief spreads and finds support in other beliefs which are equally unreasonable, if not more so (law of inertia; the telescope). Research now gets deflected in new directions, new kinds of instruments are built, 'evidence' is related to theories in new ways until there arises an ideology that is rich enough to provide independent arguments for any particular part of it and mobile enough to find such arguments whenever they seem to be required. We can say today that Galileo was on the right track, for his persistent pursuit of what once seemed to be a silly cosmology has by now created the material needed to defend it against all those who will accept a view only if it is told in a certain way and who will trust it only if it contains certain magical phrases, called 'observational reports'. And this is not an exception – it is the normal case: theories become clear and 'reasonable' only *after* incoherent parts of them have been used for a long time. Such

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unreasonable, nonsensical, unmethodical foreplay thus turns out to be an unavoidable precondition of clarity and of empirical success.

Now, when we attempt to describe and to understand developments of this kind in a general way, we are, of course, obliged to appeal to the existing forms of speech which do not take them into account and which must be distorted, misused, beaten into new patterns in order to fit unforeseen situations (without a constant misuse of language there can not be any discovery, any progress). 'Moreover, since the traditional categories are the gospel of everyday thinking (including ordinary scientific thinking) and of everyday practice, [such an attempt at understanding] in effect presents rules and forms of false thinking and action – false, that is, from the standpoint of (scientific) common sense.'² This is how *dialectical thinking* arises as a form of thought that 'dissolves into nothing the detailed determinations of the understanding',³ formal logic included.

(Incidentally, it should be pointed out that my frequent use of such words as 'progress', 'advance', 'improvement', etc., does not mean that I claim to possess special knowledge about what is good and what is bad in the sciences and that I want to impose this knowledge upon my readers. *Everyone can read the terms in his own way* and in accordance with the tradition to which he belongs. Thus for an empiricist, 'progress' will mean transition to a theory that provides direct empirical tests for most of its basic assumptions. Some people believe the quantum theory to be a theory of this kind. For others, 'progress' may mean unification and harmony, perhaps even at the expense of empirical adequacy. This is how Einstein viewed the general theory of relativity. *And my thesis is that anarchism helps to achieve progress in any one of the senses one cares to choose.* Even a law-and-order science will succeed only if anarchistic moves are occasionally allowed to take place.)

It is clear, then, that the idea of a fixed method, or of a fixed theory of rationality, rests on too naive a view of man and his social surroundings. To those who look at the rich material provided by history, and who are not intent on impoverishing it in order to please their lower instincts, their craving for intellectual security in the form of clarity,

2. Herbert Marcuse, *Reason and Revolution*, London, 1941, p. 130.

3. Hegel, *Wissenschaft der Logik*, Vol. 1, Meiner, Hamburg, 1965, p. 6.

precision, 'objectivity', 'truth', it will become clear that there is only *one* principle that can be defended under *all* circumstances and in *all* stages of human development. It is the principle: *anything goes*.

This abstract principle must now be examined and explained in concrete detail.

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For example, we may use hypotheses that contradict well-confirmed theories and/or well-established experimental results. We may advance science by proceeding counterinductively.

Examining the principle in concrete detail means tracing the consequences of 'counterrules' which oppose some familiar rules of the scientific enterprise. To see how this works, let us consider the rule that it is 'experience', or the 'facts', or 'experimental results' which measure the success of our theories, that agreement between a theory and the 'data' favours the theory (or leaves the situation unchanged) while disagreement endangers it, and perhaps even forces us to eliminate it. This rule is an important part of all theories of confirmation and corroboration. It is the essence of empiricism. The 'counterrule' corresponding to it advises us to introduce and elaborate hypotheses which are inconsistent with well-established theories and/or well-established facts. It advises us to proceed *counterinductively*.

The counterinductive procedure gives rise to the following questions: Is counterinduction more reasonable than induction? Are there circumstances favouring its use? What are the arguments for it? What are the arguments against it? Is perhaps induction always preferable to counterinduction? And so on.

These questions will be answered in two steps. I shall first examine the counterrule that urges us to develop hypotheses inconsistent with accepted and highly confirmed *theories*. Later on I shall examine the counterrule that urges us to develop hypotheses inconsistent with well-established *facts*. The results may be summarized as follows.

In the first case it emerges that the evidence that might refute a theory can often be unearthed only with the help of an incompatible alternative: the advice (which goes back to Newton and which is still very popular today) to use alternatives only when refutations have already discredited

the orthodox theory puts the cart before the horse. Also, some of the most important formal properties of a theory are found by contrast, and not by analysis. A scientist who wishes to maximize the empirical content of the views he holds and who wants to understand them as clearly as he possibly can must therefore introduce other views; that is, he must adopt a *pluralistic methodology*. He must compare ideas with other ideas rather than with 'experience' and he must try to improve rather than discard the views that have failed in the competition. Proceeding in this way he will retain the theories of man and cosmos that are found in Genesis, or in the Pimander, he will elaborate them and use them to measure the success of evolution and other 'modern' views.¹ He may then discover that the theory of evolution is not as good as is generally assumed and that it must be supplemented, or entirely replaced, by an improved version of Genesis. Knowledge so conceived is not a series of self-consistent theories that converges towards an ideal view; it is not a gradual approach to the truth. It is rather an ever increasing *ocean of mutually incompatible (and perhaps even incommensurable) alternatives*, each single theory, each fairy tale, each myth that is part of the collection forcing the others into greater articulation and all of them contributing, via this process of competition, to the development of our consciousness. Nothing is ever settled, no view can ever be omitted from a comprehensive account. Plutarch, or Diogenes Laertius and not Dirac, or von Neumann are the models for presenting a knowledge of this kind in which the *history* of a science becomes an inseparable part of the science itself – it is essential for its further *development* as well as for giving *content* to the theories it contains at any particular moment. Experts and laymen, professionals and dilettanti, truth-freaks and liars – they all are invited to participate in the contest and to make their contribution to the enrichment of our culture. The task of the scientist, however, is no longer 'to search for the truth', or 'to praise god', or 'to systematize observations', or 'to improve predictions'. These are but side effects of an activity to which his attention is now mainly directed and which is 'to make the weaker case the stronger' as the sophists said, *and thereby to sustain the motion of the whole*.

The second 'counterrule' which favours hypotheses inconsistent with

1. For the role of the Pimander in the Copernican Revolution cf. note 12 to Chapter 8.

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observations, facts and experimental results, needs no special defence, for there is not a single interesting theory that agrees with all the known facts in its domain. The question is, therefore, not whether counter-inductive theories should be *admitted* into science; the question is, rather, whether the *existing* discrepancies between theory and fact should be increased, or diminished, or what else should be done with them.

To answer this question it suffices to remember that observational reports, experimental results, 'factual' statements, either *contain* theoretical assumptions or *assert* them by the manner in which they are used. (For this point cf. the discussion of natural interpretations in Chapters 6ff.) Thus our habit of saying 'the table is brown' when we view it under normal circumstances, with our senses in good order, but 'the table seems to be brown' when either the lighting conditions are poor or when we feel unsure in our capacity of observation expresses the belief that there are familiar circumstances when our senses are capable of seeing the world 'as it really is' and other, equally familiar circumstances, when they are deceived. It expresses the belief that some of our sensory impressions are veridical while others are not. We also take it for granted that the material medium between the object and us exerts no distorting influence, and that the physical entity that establishes the contact – light – carries a true picture. All these are abstract, and highly doubtful, assumptions which shape our view of the world without being accessible to a direct criticism. Usually, we are not even aware of them and we recognize their effects only when we encounter an entirely different cosmology: prejudices are found by contrast, not by analysis. The material which the *scientist* has at his disposal, his most sublime theories and his most sophisticated techniques included, is structured in exactly the same way. It again contains principles which are not known and which, if known, would be extremely hard to test. (As a result, a theory may clash with the evidence not because it is not correct, but because the evidence is contaminated.) ✓

Now – how can we possibly examine something we are using all the time? How can we analyse the terms in which we habitually express our most simple and straightforward observations, and reveal their pre-suppositions? How can we discover the kind of world we presuppose when proceeding as we do?

The answer is clear: we cannot discover it from the *inside*. We need an *external* standard of criticism, we need a set of alternative assumptions or, as these assumptions will be quite general, constituting, as it were, an entire alternative world, *we need a dream-world in order to discover the features of the real world we think we inhabit* (and which may actually be just another dream-world). The first step in our criticism of familiar concepts and procedures, the first step in our criticism of 'facts', must therefore be an attempt to break the circle. We must invent a new conceptual system that suspends, or clashes with the most carefully established observational results, confounds the most plausible theoretical principles, and introduces perceptions that cannot form part of the existing perceptual world.² This step is again counterinductive. Counterinduction is therefore, always reasonable and it has always a chance of success.

In the following seven chapters, this conclusion will be developed in greater detail and it will be elucidated with the help of historical examples. One might therefore get the impression that I recommend a new methodology which replaces induction by counterinduction and uses a multiplicity of theories, metaphysical views, fairy-tales instead of the customary pair theory/observation.³ This impression would certainly be mistaken. My intention is not to replace one set of general rules by another such set: my intention is, rather, to convince the reader that *all methodologies, even the most obvious ones, have their limits*. The best way to show this is to demonstrate the limits and even the irrationality of some rules which she, or he, is likely to regard as basic. In the case of induction (including induction by falsification) this means demonstrating how well the counterinductive procedure can be supported by argument. Always remember that the demonstrations and the rhetorics used do not express any 'deep convictions' of mine. They merely show how easy it is to lead people by the nose in a rational way. An anarchist is like

2. 'Clashes' or 'suspends' is meant to be more general than 'contradicts'. I shall say that a set of ideas or actions 'clashes' with a conceptual system if it is either inconsistent with it, or makes the system appear absurd. For details cf. Chapter 17 below.

3. This is how Professor Ernan McMullin interpreted some earlier papers of mine. See 'A Taxonomy of the Relations between History and Philosophy of Science', *Minnesota Studies* 5, Minneapolis, 1971.

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an undercover agent who plays the game of Reason in order to undercut the authority of Reason (Truth, Honesty, Justice, and so on).⁴

4. 'Dada', says Hans Richter in *Dada: Art and Anti-Art*, 'not only had no programme, it was against all programmes.' This does not exclude the skilful defence of programmes to show the chimerical character of any defence, however 'rational'. Cf. also Chapter 16, text to footnotes, 21, 22, 23. (In the same way an actor or a playwright could produce all the outer manifestations of 'deep love' in order to debunk the idea of 'deep love' itself. Example: Pirandello.) These remarks, I hope, will alleviate Miss Koertge's fear that I intend to start just another movement, the slogans 'proliferate' or 'anything goes' replacing the slogans of falsificationism or inductivism or research-programmism.

Thus science is much closer to myth than a scientific philosophy is prepared to admit. It is one of the many forms of thought that have been developed by man, and not necessarily the best. It is conspicuous, noisy, and impudent, but it is inherently superior only for those who have already decided in favour of a certain ideology, or who have accepted it without ever having examined its advantages and its limits. And as the accepting and rejecting of ideologies should be left to the individual it follows that the separation of state and church must be complemented by the separation of state and science, that most recent, most aggressive, and most dogmatic religious institution. Such a separation may be our only chance to achieve a humanity we are capable of, but have never fully realized.

The idea that science can, and should, be run according to fixed and universal rules, is both unrealistic and pernicious. It is *unrealistic*, for it takes too simple a view of the talents of man and of the circumstances which encourage, or cause, their development. And it is *pernicious*, for the attempt to enforce the rules is bound to increase our professional qualifications at the expense of our humanity. In addition, the idea is *detrimental to science*, for it neglects the complex physical and historical conditions which influence scientific change. It makes our science less adaptable and more dogmatic: every methodological rule is associated with cosmological assumptions, so that using the rule we take it for granted that the assumptions are correct. Naive falsificationism takes it for granted that the laws of nature are manifest and not hidden beneath disturbances of considerable magnitude. Empiricism takes it for granted that sense experience is a better mirror of the world than pure thought. Praise of argument takes it for granted that the artifices of Reason give

better results than the unchecked play of our emotions. Such assumptions may be perfectly plausible *and even true*. Still, one should occasionally put them to a test. Putting them to a test means that we stop using the methodology associated with them, start doing science in a different way and see what happens. Case studies such as those reported in the preceding chapters show that such tests occur all the time, and that they speak *against* the universal validity of any rule. All methodologies have their limitations and the only 'rule' that survives is 'anything goes'.

The change of perspective brought about by these discoveries leads once more to the long-forgotten problem of the excellence of science. It leads to it for the first time in *modern* history, for modern science *overpowered* its opponents, it did not *convince* them. Science took over by *force*, not by argument (this is especially true of the former colonies where science and the religion of brotherly love were introduced as a matter of course, and without consulting, or arguing with, the inhabitants). Today we realize that rationalism, being bound to science, cannot give us any assistance in the issue between science and myth and we also know, from inquiries of an entirely different kind, that myths are vastly better than rationalists have dared to admit.¹ Thus we are now *forced* to raise the question of the excellence of science. An examination then reveals that science and myth overlap in many ways, that the differences we think we perceive are often *local* phenomena which may turn into similarities elsewhere and that fundamental discrepancies are results of different *aims* rather than of different methods trying to reach one and the same 'rational' end (such as, for example, 'progress', or increase of content, or 'growth').

To show the surprising similarities of myth and science, I shall briefly discuss an interesting paper by Robin Horton, entitled 'African Traditional Thought and Western Science'.² Horton examines African

1. Cf. the marvellous case studies by Evans-Pritchard, Griaule, Edith Hamilton, Jeremias, Frankfort, Thorkild Jacobsen and others. For a survey cf. de Santillana-von Dechend, *Hamlet's Mill*, Boston, 1969, as well as my *Einführung in die Naturphilosophie*, Braunschweig, 1974. These are case studies in the sense of Lakatos and they satisfy his most stringent criteria. Why, then, are he and his fellow-rationalists so reluctant to accept their results?

2. Originally published in *Africa*, Vol. 37, 1967, pp. 87-155. I am quoting from the

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mythology and discovers the following features: the quest for theory is a quest for unity underlying apparent complexity. The theory places things in a causal context that is wider than the causal context provided by common sense: both science and myth cap common sense with a theoretical superstructure. There are theories of different degrees of abstraction and they are used in accordance with the different requirements of explanation that arise. Theory construction consists in breaking up objects of common sense and in reuniting the elements in a different way. Theoretical models start from analogy but they gradually move away from the pattern on which the analogy was based. And so on.

These features, which emerge from case studies no less careful and detailed than those of Lakatos, refute the assumption that science and myth obey different principles of formation (Cassirer), that myth proceeds without reflection (Dardel), or speculation (Frankfort, occasionally). Nor can we accept the idea, found in Malinowski but also in classical scholars such as Harrison and Cornford, that myth has an essentially pragmatic function or is based on ritual. Myth is much closer to science than one would expect from a philosophical discussion. It is closer to science than even Horton himself is prepared to admit.

To see this, consider some of the *differences* Horton emphasizes. According to Horton, the central ideas of a myth are regarded as sacred. There is anxiety about threats to them. One 'almost never finds a confession of ignorance'³ and events 'which seriously defy the established lines of classification in the culture where they occur' evoke a 'taboo reaction'.⁴ Basic beliefs are protected by this reaction as well as by the device of 'secondary elaborations'⁵ which, in our terms, are series of *ad hoc* hypotheses. Science, on the other hand, is characterized by an 'essential scepticism'⁶; 'when failures start to come thick and fast, defence of the theory switches inexorably to attack on it'.⁷ This is possible because of the 'openness' of the scientific enterprise, because of the pluralism of ideas it contains and also because 'whatever defies or fails to fit into the established category system is not something horrifying, to

abbreviated reprint in Max Marwick (ed.), *Witchcraft and Sorcery*, Penguin Books, 1970, pp. 342ff.

3. *ibid.*, p. 362.

5. *ibid.*, p. 365.

4. *ibid.*, p. 364.

6. *ibid.*, p. 358.

7. *loc. cit.*

be isolated or expelled. On the contrary, it is an intriguing 'phenomenon' – a starting-point and a challenge for the invention of new classifications and new theories'.⁸ We can see that Horton has read his Popper well.⁹ A field study of science itself shows a very different picture.

Such a study reveals that, while some scientists may proceed as described, the great majority follow a different path. 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.¹⁰ Attacking the basic ideas evokes taboo reactions which are no weaker than are the taboo reactions in so-called primitive societies.¹¹ Basic beliefs are protected by this reaction as well as by secondary elaborations, as we have seen, and whatever fails to fit into the established category system or is said to be incompatible with this system 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. Newton reigned for more than 150 years, Einstein briefly introduced a more liberal point of view only to be succeeded by the Copenhagen Interpretation. The similarities between science and myth are indeed astonishing.

But the fields are even more closely related. The massive dogmatism I have described is not just a *fact*, it has also a most important *function*. *Science would be impossible without it*.¹² 'Primitive' thinkers showed greater insight into the nature of knowledge than their 'enlightened' philosophical rivals. It is, therefore, necessary to re-examine our attitude towards myth, religion, magic, witchcraft and towards all those ideas which rationalists would like to see forever removed from the surface of

8. *ibid.*, p. 365.

9. See his discussion of what he calls the 'Closed and Open Predicament' in Part 2 of his essay.

10. This is a very familiar procedure in African witchcraft. Cf. Evans-Pritchard, *Witchcraft, Oracles and Magic Among the Azande*, Oxford, 1937, pp. 230, 338; also *Social Anthropology*, *op. cit.*, p. 99.

11. Cf. the early reactions against hidden variables in the quantum theory, the attitude towards astrology, telekinesis, telepathy, Voodoo, Ehrenhaft, Velikovsky, and so on. Cf. also Köstler's amusing story *The Midwife Toad*, New York, 1973.

12. This has been emphasized by Kuhn; see 'The Function of Dogma in Scientific Research' in A. C. Crombie (ed.), *Scientific Change*, London, 1963, pp. 69–347, and *The Structure of Scientific Revolutions*, Chicago, 1962.

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There is another reason why such a re-examination is urgently required. The rise of modern science coincides with the suppression of non-Western tribes by Western invaders. The tribes are not only physically suppressed, they also lose their intellectual independence and are forced to adopt the bloodthirsty religion of brotherly love – Christianity. The most intelligent members get an extra bonus: they are introduced into the mysteries of Western Rationalism and its peak – Western Science. Occasionally this leads to an almost unbearable tension with tradition (Haiti). In most cases the tradition disappears without the trace of an argument, one simply becomes a slave both in body and in mind. Today this development is gradually reversed – with great reluctance, to be sure, but it is reversed. Freedom is regained, old traditions are rediscovered, both among the minorities in Western countries and among large populations in non-Western continents. *But science still reigns supreme.* It reigns supreme because its practitioners are *unable to understand, and unwilling to condone,* different ideologies, because they have the *power* to enforce their wishes, and because they *use* this power just as their ancestors used *their* power to force Christianity on the peoples they encountered during their conquests. Thus, while an American can now choose the religion he likes, he is still not permitted to demand that his children learn magic rather than science at school. There is a separation between state and church, there is no separation between state and science.

And yet science has no greater authority than any other form of life. Its aims are certainly not more important than are the aims that guide the lives in a religious community or in a tribe that is united by a myth. At any rate, they have no business restricting the lives, the thoughts, the education of the members of a free society where everyone should have a chance to make up his own mind and to live in accordance with the social beliefs he finds most acceptable. The separation between state and church must therefore be complemented by the separation between state and science.

We need not fear that such a separation will lead to a breakdown of technology. There will always be people who prefer being scientists to

being the masters of their fate and who gladly submit to the meanest kind of (intellectual and institutional) slavery provided they are paid well and provided also there are some people around who examine their work and sing their praise. Greece developed and progressed because it could rely on the services of unwilling slaves. We shall develop and progress with the help of the numerous *willing* slaves in universities and laboratories who provide us with pills, gas, electricity, atom bombs, frozen dinners and, occasionally, with a few interesting fairy-tales. We shall treat these slaves well, we shall even listen to them, for they have occasionally some interesting stories to tell, but we shall *not* permit them to impose their ideology on our children in the guise of 'progressive' theories of education.¹³ We shall not permit them to teach the fancies of science as if they were the only factual statements in existence. This separation of science and state may be our only chance to overcome the hectic barbarism of our scientific-technical age and to achieve a humanity we are capable of, but have never fully realized.¹⁴ Let us, therefore, in conclusion review the arguments that can be adduced for such a procedure.

The image of 20th-century science in the minds of scientists and laymen is determined by technological miracles such as colour television, the moon shots, the infra-red oven, as well as by a somewhat vague but still quite influential rumour, or fairy-tale, concerning the manner in which these miracles are produced.

According to the fairy-tale the success of science is the result of a subtle, but carefully balanced combination of inventiveness and control. Scientists have *ideas*. And they have special *methods* for improving ideas. The theories of science have passed the test of method. They give a better account of the world than ideas which have not passed the test.

The fairy-tale explains why modern society treats science in a special way and why it grants it privileges not enjoyed by other institutions.

Ideally, the modern state is ideologically neutral. Religion, myth, prejudices *do* have an influence, but only in a roundabout way, through the medium of politically influential *parties*. Ideological principles *may*

13. Cf. Appendix 3, p. 215.

14. For the humanitarian deficiencies of science cf. 'Experts in a Free Society', *The Critic*, November/December 1971, or the improved German version of this essay and of 'Towards a Humanitarian Science' in Part II of Vol. I of my *Ausgewählte Aufsätze*. Vieweg, 1974.

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enter the governmental structure, but only via a majority vote, and after a lengthy discussion of possible consequences. In our schools the main religions are taught as *historical phenomena*. They are taught as parts of the truth only if the parents insist on a more direct mode of instruction. It is up to them to decide about the religious education of their children. The financial support of ideologies does not exceed the financial support granted to parties and to private groups. State and ideology, state and church, state and myth, are carefully separated.

State and science, however, work closely together. Immense sums are spent on the improvement of scientific ideas. Bastard subjects such as the philosophy of science which have not a single discovery to their credit profit from the boom of the sciences. Even human relations are dealt with in a scientific manner, as is shown by education programmes, proposals for prison reform, army training, and so on. Almost all scientific subjects are compulsory subjects in our schools. While the parents of a six-year-old child can decide to have him instructed in the rudiments of Protestantism, or in the rudiments of the Jewish faith, or to omit religious instruction altogether, they do not have a similar freedom in the case of the sciences. Physics, astronomy, history *must* be learned. They cannot be replaced by magic, astrology, or by a study of legends.

Nor is one content with a merely *historical* presentation of physical (astronomical, historical, etc.) facts and principles. One does not say: *some people believe* that the earth moves round the sun while others regard the earth as a hollow sphere that contains the sun, the planets, the fixed stars. One says: the earth *moves* round the sun – everything else is sheer idiocy.

Finally, the manner in which we accept or reject scientific ideas is radically different from democratic decision procedures. We accept scientific laws and scientific facts, we teach them in our schools, we make them the basis of important political decisions, but without ever having subjected them to a vote. *Scientists* do not subject them to a vote – or at least this is what they say – and *laymen* certainly do not subject them to a vote. Concrete proposals are occasionally discussed, and a vote is suggested. But the procedure is not extended to general theories and scientific facts. Modern society is 'Copernican' not because Copernicanism has been put on a ballot, subjected to a democratic debate and then

voted in with a simple majority; it is 'Copernican' because the *scientists* are Copernicans and because one accepts their cosmology as uncritically as one once accepted the cosmology of bishops and cardinals.

Even bold and revolutionary thinkers bow to the judgement of science. Kropotkin wants to break up all existing institutions – but he does not touch science. Ibsen goes very far in unmasking the conditions of contemporary humanity – but he still retains science as a measure of the truth. Evans-Pritchard, Lévi-Strauss and others have recognized that 'Western Thought', far from being a lonely peak of human development, is troubled by problems not found in other ideologies – but they exclude science from their relativization of all forms of thought. Even for them science is a *neutral structure* containing *positive knowledge* that is independent of culture, ideology, prejudice.

The reason for this special treatment of science is, of course, our little fairy-tale: if science has found a method that turns ideologically contaminated ideas into true and useful theories, then it is indeed not mere ideology, but an objective measure of all ideologies. It is then not subjected to the demand for a separation between state and ideology.

But the fairy-tale is false, as we have seen. There is no special method that guarantees success or makes it probable. Scientists do not solve problems because they possess a magic wand – methodology, or a theory of rationality – but because they have studied a problem for a long time, because they know the situation fairly well, because they are not too dumb (though that is rather doubtful nowadays when almost anyone can become a scientist), and because the excesses of one scientific school are almost always balanced by the excesses of some other school. (Besides, scientists only rarely solve their problems, they make lots of mistakes, and many of their solutions are quite useless.) Basically there is hardly any difference between the process that leads to the announcement of a new scientific law and the process preceding passage of a new law in society: one informs either all citizens or those immediately concerned, one collects 'facts' and prejudices, one discusses the matter, and one finally votes. But while a democracy makes some effort to *explain* the process so that everyone can understand it, scientists either *conceal* it, or *bend* it, to make it fit their sectarian interests.

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logic, and methodology alone decide – this is what the fairy-tale tells us. But how do facts decide? What is their function in the advancement of knowledge? We cannot *derive* our theories from them. We cannot give a *negative* criterion by saying, for example, that good theories are theories which can be refuted, but which are not yet contradicted by any fact. A principle of falsification that removes theories because they do not fit the facts would have to remove the whole of science (or it would have to admit that large parts of science are irrefutable). The hint that a good theory *explains more* than its rivals is not very realistic either. True: new theories often predict new things – but almost always at the expense of things already known. Turning to logic we realize that even the simplest demands *are not* satisfied in scientific practice, and *could not be* satisfied, because of the complexity of the material. The ideas which scientists use to present the known and to advance into the unknown are only rarely in agreement with the strict injunctions of logic or pure mathematics and the attempt to make them conform would rob science of the elasticity without which progress cannot be achieved. We see: facts alone are not strong enough for making us accept, or reject, scientific theories, the range they leave to thought is *too wide*; logic and methodology eliminate too much, they are *too narrow*. In between these two extremes lies the ever-changing domain of human ideas and wishes. And a more detailed analysis of successful moves in the game of science ('successful' from the point of view of the scientists themselves) shows indeed that there is a wide range of freedom that *demand*s a multiplicity of ideas and *permits* the application of democratic procedures (ballot-discussion-vote) but that is actually closed by power politics and propaganda. *This is where the fairy-tale of a special method assumes its decisive function.* It conceals the freedom of decision which creative scientists and the general public have even inside the most rigid and the most advanced parts of science by a recitation of 'objective' criteria and it thus protects the big-shots (Nobel Prize winners; heads of laboratories, of organizations such as the AMA, of special schools; 'educators'; etc.) from the masses (laymen; experts in non-scientific fields; experts in other fields of science): only those citizens count who were subjected to the pressures of scientific institutions (they have undergone a long process of education), who succumbed to these pressures (they have passed

their examinations), and who are now firmly convinced of the truth of the fairy-tale. This is how scientists have deceived themselves and everyone else about their business, but without any real disadvantage: they have more money, more authority, more sex appeal than they deserve, and the most stupid procedures and the most laughable results in their domain are surrounded with an aura of excellence. It is time to cut them down in size, and to give them a more modest position in society.

This advice, which only few of our well-conditioned contemporaries are prepared to accept, seems to clash with certain simple and widely-known facts.

Is it not a fact that a learned physician is better equipped to diagnose and to cure an illness than a layman or the medicine-man of a primitive society? Is it not a fact that epidemics and dangerous individual diseases have disappeared only with the beginning of modern medicine? Must we not admit that technology has made tremendous advances since the rise of modern science? And are not the moon-shots a most impressive and undeniable proof of its excellence? These are some of the questions which are thrown at the impudent wretch who dares to criticize the special position of the sciences.

The questions reach their polemical aim only if one assumes that the results of science *which no one will deny* have arisen without any help from non-scientific elements, and that they cannot be improved by an admixture of such elements either. 'Unscientific' procedures such as the herbal lore of witches and cunning men, the astronomy of mystics, the treatment of the ill in primitive societies are totally without merit. *Science alone* gives us a useful astronomy, an effective medicine, a trustworthy technology. One must also assume that science owes its success to the correct method and not merely to a lucky accident. It was not a fortunate cosmological guess that led to progress, but the correct *and cosmologically neutral* handling of data. These are the assumptions we must make to give the questions the polemical force they are supposed to have. Not a single one of them stands up to closer examination.

Modern astronomy started with the attempt of Copernicus to adapt the old ideas of Philolaos to the needs of astronomical predictions. Philolaos was not a precise scientist, he was a muddleheaded Pythagorean, as we have seen (Chapter 5, footnote 25), and the consequences of his

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doctrine were called 'incredibly ridiculous' by a professional astronomer such as Ptolemy (Chapter 4, footnote 4). Even Galileo, who had the much improved Copernican version of Philolaos before him, says: 'There is no limit to my astonishment when I reflect that Aristarchus and Copernicus were able to make reason to conquer sense that, in defiance of the latter, the former became mistress of their belief' (*Dialogue*, 328). 'Sense' here refers to the experiences which Aristotle and others had used to show that the earth must be at rest. The 'reason' which Copernicus opposes to their arguments is the very mystical reason of Philolaos combined with an equally mystical faith ('mystical' from the point of view of today's rationalists) in the fundamental character of circular motion. I have shown that modern astronomy and modern dynamics could not have advanced without this unscientific use of antediluvian ideas.

While astronomy profited from Pythagoreanism and from the Platonic love for circles, medicine profited from herbalism, from the psychology, the metaphysics, the physiology of witches, midwives, cunning men, wandering druggists. It is well known that 16th- and 17th-century medicine while theoretically hypertrophic was quite helpless in the face of disease (and stayed that way for a long time after the 'scientific revolution'). Innovators such as Paracelsus fell back on the earlier ideas and improved medicine. Everywhere science is enriched by unscientific methods and unscientific results, while procedures which have often been regarded as essential parts of science are quietly suspended or circumvented.

The process is not restricted to the early history of modern science. It is not merely a consequence of the primitive state of the sciences of the 16th and 17th centuries. Even today science can and does profit from an admixture of unscientific ingredients. An example which was discussed above, in Chapter 4, is the revival of traditional medicine in Communist China. When the Communists in the fifties forced hospitals and medical schools to teach the ideas and the methods contained in the *Yellow Emperor's Textbook of Internal Medicine* and to use them in the treatment of patients, many Western experts (among them Eccles, one of the 'Popperian Knights') were aghast and predicted the downfall of Chinese medicine. What happened was the exact opposite. Acupuncture, moxibustion, pulse diagnosis have led to new insights, new methods of treatment, new problems both for the Western and for the Chinese physician.

And those who do not like to see the state meddling in scientific matters should remember the sizeable chauvinism of science: for most scientists the slogan 'freedom for science' means the freedom to indoctrinate not only those who have joined them, but the rest of society as well. Of course – not every mixture of scientific and non-scientific elements is successful (example: Lysenko). But science is not always successful either. If mixtures are to be avoided because they occasionally misfire, then pure science (if there is such a thing) must be avoided as well. (It is not the *interference* of the state that is objectionable in the Lysenko case, but the *totalitarian* interference that kills the opponent instead of letting him go his own way.)

Combining this observation with the insight that science has no special method, we arrive at the result that the separation of science and non-science is not only artificial but also detrimental to the advancement of knowledge. If we want to understand nature, if we want to master our physical surroundings, then we must use *all* ideas, *all* methods, and not just a small selection of them. The assertion, however, that there is no knowledge outside science – *extra scientiam nulla salus* – is nothing but another and most convenient fairy-tale. Primitive tribes have more detailed classifications of animals and plants than contemporary scientific zoology and botany, they know remedies whose effectiveness astounds physicians (while the pharmaceutical industry already smells here a new source of income), they have means of influencing their fellow men which science for a long time regarded as non-existent (Voodoo), they solve difficult problems in ways which are still not quite understood (building of the pyramids; Polynesian travels), there existed a highly developed and internationally known astronomy in the old Stone Age, this astronomy was factually adequate *as well as* emotionally satisfying, *it solved both physical and social problems* (one cannot say the same about modern astronomy) and it was tested in very simple and ingenious ways (stone observatories in England and in the South Pacific; astronomical schools in Polynesia – for a more detailed treatment and references concerning all these assertions cf. my *Einführung in die Naturphilosophie*). There was the domestication of animals, the invention of rotating agriculture, new types of plants were bred and kept pure by careful avoidance of cross fertilization, we have chemical inventions, we have a most amazing

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art that can compare with the best achievements of the present. True, there were no collective excursions to the moon, but single individuals, disregarding great dangers to their soul and their sanity, rose from sphere to sphere until they finally faced God himself in all His splendour while others changed into animals and back into humans again (cf. Chapter 16, footnotes 20 and 21). At all times man approached his surroundings with wide open senses and a fertile intelligence, at all times he made incredible discoveries, at all times we can learn from his ideas.

Modern science, on the other hand, is not at all as difficult and as perfect as scientific propaganda wants us to believe. A subject such as medicine, or physics, or biology appears difficult only because it is taught badly, because the standard instructions are full of redundant material, and because they start too late in life. During the war, when the American Army needed physicians within a very short time, it was suddenly possible to reduce medical instruction to half a year (the corresponding instruction manuals have disappeared long ago, however. Science may be simplified during the war. In peacetime the prestige of science demands greater complication.) And how often does it not happen that the proud and conceited judgement of an expert is put in its proper place by a layman! Numerous inventors built 'impossible' machines. Lawyers show again and again that an expert does not know what he is talking about. Scientists, especially physicians, frequently come to different results so that it is up to the relatives of the sick person (or the inhabitants of a certain area) to decide *by vote* about the procedure to be adopted. How often is science improved, and turned into new directions by non-scientific influences! It is up to us, it is up to the citizens of a free society to either accept the chauvinism of science without contradiction or to overcome it by the counterforce of public action. Public action was used against science by the Communists in China in the fifties, and it was again used, under very different circumstances, by some opponents of evolution in California in the seventies. Let us follow their example and let us free our society from the strangling hold of an ideologically petrified science just as our ancestors freed *us* from the strangling hold of the One True Religion!

The way towards this aim is clear. A science that insists on possessing the only correct method and the only acceptable results is ideology and

must be separated from the state, and especially from the process of education. One may teach it, but only to those who have decided to make this particular superstition their own. On the other hand, a science that has dropped such totalitarian pretensions is no longer independent and self-contained, and it can be taught in many different combinations (myth and modern cosmology might be one such combination). Of course, every business has the right to demand that its practitioners be prepared in a special way, and it may even demand acceptance of a certain ideology (I for one am against the thinning out of subjects so that they become more and more similar to each other; whoever does not like present-day Catholicism should leave it and become a Protestant, or an Atheist, instead of ruining it by such inane changes as mass in the vernacular). That is true of physics, just as it is true of religion, or of prostitution. But such special ideologies, such special skills have no room in the process of *general education* that prepares a citizen for his role in society. A mature citizen is not a man who has been *instructed* in a special ideology, such as Puritanism, or critical rationalism, and who now carries this ideology with him like a mental tumour, a mature citizen is a person who has learned how to make up his mind and who has then *decided* in favour of what he thinks suits him best. He is a person who has a certain mental toughness (he does not fall for the first ideological street singer he happens to meet) and who is therefore able *consciously to choose* the business that seems to be most attractive to him rather than being swallowed by it. To prepare himself for his choice he will study the major ideologies as *historical phenomena*, he will study science as a historical phenomenon and not as the one and only sensible way of approaching a problem. He will study it together with other fairy-tales such as the myths of 'primitive' societies so that he has the information needed for arriving at a free decision. An essential part of a general education of this kind is acquaintance with the most outstanding propagandists in all fields, so that the pupil can build up his resistance against all propaganda, including the propaganda called 'argument'. It is only *after* such a hardening procedure that he will be called upon to make up his mind on the issue rationalism-irrationalism, science-myth, science-religion, and so on. His decision in favour of science - assuming he chooses science - will then be much more 'rational' than any decision in favour of science is today. At any rate -

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science and the schools will be just as carefully separated as religion and the schools are separated today. Scientists will of course participate in governmental decisions, for everyone participates in such decisions. But they will not be given overriding authority. It is the *vote of everyone concerned* that decides fundamental issues such as the teaching methods used, or the truth of basic beliefs such as the theory of evolution, or the quantum theory, and not the authority of big-shots hiding behind a non-existing methodology. There is no need to fear that such a way of arranging society will lead to undesirable results. Science itself uses the method of ballot, discussion, vote, though without a clear grasp of its mechanism, and in a heavily biased way. But the rationality of our beliefs will certainly be considerably increased.