

experts in a free society*

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Ladies and Gentlemen,

Let me start with a confession.

I think very highly of science, but I think very little of experts, although experts form about 95% or more of science today. It is my belief that science was advanced, and is still being advanced by *dilettants*, and that experts are liable to bring it to a standstill. I may be entirely wrong in this belief of mine, but the only way to find out is to tell you. Therefore, with my apologies, here is my paper.

My attitude towards experts is as follows.

As long as we are as strict with the ascription of rights and responsibilities as we are today when we still refuse the vote to the 18 year olds because of their *alleged* immaturity (1), we must certainly deny the vote to experts because of their *actual* immaturity. We must wait, until they grow up, until they become mature and responsible, that is, until they become *dilettants*. A free society, of course, recognises the value of immaturity. A free society will therefore give the vote to 18 year olds as well as to experts, *but it will most carefully watch the latter* as so much depends on their activity (besides, a free society must keep itself well informed about its hardened ingredients). So, experts will certainly have the vote; they will certainly be listened to as every other citizen will be listened to, but they will receive none of the special powers which they would so dearly love to possess. *Laymen* will look after their affairs and will make the decisions which must be made if we want to apply science to society. Laymen will control science - and no harm will come of it. This is my attitude. Now let me explain it.

An expert is a man, or a woman who has decided to achieve excellence, supreme excellence in a narrow field at the expense of a balanced development. He has decided to subject himself to standards which restrict him in many ways, his style of writing and the patterns of his speech included, and he is prepared to conduct most of his waking life in accordance with these standards. He is not averse to occasionally venturing into different fields, to listen to fashionable music, to adopt fashionable ways of dressing (though the business suit still

seems to be his favourite uniform, in this country, and abroad), or to seduce his students. However, these activities are aberrations of his private life, they have no relation whatever to what he is doing as an expert. A love for Mozart, or for *Hair* will not, and must not make his physics more melodious, or give it a better rhythm. Nor will an affair make his chemistry more colourful.

This separation of domains has very unfortunate consequences. Not only are special subjects voided of ingredients which make a human life beautiful and worth living, but these ingredients are impoverished, too, emotions become crude and thoughtless, just as thoughts become cold and inhumane. Indeed, the "private parts" of one's existence suffer much more than does one's official capacity. Every aspect of professionalism has its watchdogs; the slightest change, or threat of a change is examined, broadcast, warnings are issued, and the whole tremendous machinery moves at once in order to restore the status quo. Who takes care of the quality of our emotions? Who watches those parts of our language which are supposed to bring people together more closely, where one gives comfort, understanding, and perhaps a little *personal* criticism? There are no such agencies. The result is that professionalism takes over even here.

Let me give you some examples.

In 1610 Galileo reported for the first time his invention of the telescope and the observations he made with it. This was a scientific event of the first magnitude, far more important than anything we have achieved in our megalomaniac 20th century. Not only was here a new and very mysterious instrument introduced to the learned world (it was introduced to the *learned* world, for the essay was written in Latin), but this instrument was at once put to a very unusual *use*, it was directed towards the sky, and the results, the astonishing results quite definitely seemed to support the new theory which Copernicus had suggested over 60 years earlier and which was still very far from being generally accepted. How does Galileo introduce his subject? Let us hear.

"About 10 months ago a report reached my ears that a certain Dutchman had constructed a spyglass by means of which visible objects, though very distant from the eye of the observer, were distinctly seen, as if nearby. Of this truly remarkable effect several experiences were related, to which some persons gave credence while others denied them. A few days later the report was confirmed to me in a letter from a noble Frenchman in Paris, Jacques Badovere, which caused me to apply myself wholeheartedly to enquire into the means by which I might arrive at the invention of a similar instrument..." and so on. We start with a personal story, a very charming personal story which slowly leads us to the discoveries, and these are reported in the same clear, concrete, colourful way: "There is another thing" writes Galileo, describing the face of the moon "which I must not omit, for I beheld it not without a certain

wonder; this is that almost in the center of the moon there is a cavity larger than all the rest, and perfectly round in shape. I have observed it near both the first and last quarters, and have tried to represent it as correctly as possible in the second of the above figures..." and so on. Galileo's drawing attracts the attention of Kepler, who was one of the first to read Galileo's essay. He comments: "I cannot help wondering about the meaning of that large circular cavity in what I usually call the left corner of the mouth. Is it a work of nature, or of a trained hand? Suppose that there are living beings on the moon (following the footsteps of Pythagoras and Plutarch I enjoyed toying with this idea, long ago...) It surely stands to reason that the inhabitants express the character of their dwelling place, which has much bigger mountains and valleys than our earth has. Consequently, being endowed with very massive bodies they also construct gigantic projects..." and so on.

"I have observed"; "I have seen"; "I have been surprised"; "I cannot help wondering"; "I was delighted" - this is how one speaks to a friend or, at any rate, to a live human being.

The awful Newton who more than anyone else is responsible for the plague of professionalism from which we suffer today starts his first paper on colours in a very similar style: "... in the beginning of the year 1666 ... I procured me a triangular glass prisme, to try therewith the celebrated phenomena of colours. And in order thereto having darkened my chamber, and made a small hole in my window shuts, to let in a convenient quantity of the sun's light, I placed my prism at its entrance, that it might be thereby refracted to the opposite wall. It was at first a very pleasing divertisement, to view the vivid and intense colours produced thereby; but after a while applying myself to consider them more circumspectly, I became surprised to see them in an oblonge form ..."

Remember that all these reports are about cold, objective, "inhuman" *inanimate nature*, they are about stars, prisms, lenses, the moon, and yet they are described in a most lively and fascinating manner communicating to the reader an interest and an excitement which the discoverer felt when first venturing into strange new worlds.

Now compare with this the introduction to a recent book, a bestseller even, *Human Sexual Response* by Masters and Johnson. I have chosen the book for two reasons. First, because it is of general interest. It removes prejudices which influence not only the members of some profession, but the everyday behaviour of a good many apparently "normal" people. Secondly, because it deals with a subject which, seen from inside science, is new and without special terminology. Also, it is about men rather than about stones of prisms. So, one would expect a beginning even more lively and interesting than that of Galileo, Kepler, or Newton. What do we read instead? Listen: "In view of the pervicacious gonadal urge in human beings, it

is not a little curious that science develops its sole timidity about the pivotal point of the physiology of sex. Perhaps this avoidance ..." and so on. This is human speech no more. This is the language of the expert.

Note that the subject has disappeared from the scene. Not: "I was very surprised to find" or, as there are two authors, "we were very surprised to find", but "It is surprising to find..." only, not expressed in these simple terms (2). Note also to what extent irrelevant technical terms intrude and fill the sentences with antediluvian barks, grunts, squeaks, belches. A wall is erected between the writer and his readers not because some information is missing, not because one does not know who the reader is but in order to make utterances conform to some curious professional ideal of objectivity. And this ugly and inarticulate idiom turns up everywhere and takes over the function of the most simple and straightforward description.

Thus on page 65 of the book we hear that the female, being capable of multiple orgasm must often masturbate after her partner has withdrawn in order to complete the physiological process that is characteristic for her. And, so the authors want to say, she will stop only when she gets tired. This is what they *want* to say. What they actually say is: "Usually physical exhaustion alone terminates such an active masturbatory session." On the next page the male is advised to *ask* the female what she wants or does not want rather than try to guess it on his own. "He should ask her" - this is what our authors want to convey. What is the sentence that actually lies there in the book? Listen: "The male will be infinitely more effective if he encourages vocalization on her part." "Encourages vocalization" instead of "asks her" - well, one might want to say, the authors want to be *precise*, and they want to address their *fellow professionals* rather than the general public and, naturally, they have to use a special lingo in order to make themselves understood. Now as regards the first point, precision, remember that they also say that the male will be "infinitely more effective" which, considering circumstances, is not a very adequate statement of the facts. And as regards the second point we must say that we are not dealing with the structure of organs, or with special physiological processes which might have a special name in medicine, but with an ordinary affair such as *asking*. Besides, Galileo and Newton *could do* without a special lingo although the physics of their time was already highly specialised and contained many technical terms. They could do without a special lingo because they wanted to start afresh. Masters and Johnson find themselves in the same position, but they cannot think straight any more, their linguistic talents and sensibilities have been distorted to such an extent that one asks oneself whether they will ever be able to speak normal English again.

The answer to this question is contained in a little pamphlet which I have with me and which contains the report of an ad hoc

committee formed for the purpose of examining rumours of police brutality during some rather restless weeks in Berkeley (winter 1968/69). The members of the committee were all people of good will. They were interested not only in the *academic* quality of life on campus, they were even more interested in bringing about an atmosphere of understanding and of compassion. Most of them came from sociology or from related fields that is, they came from fields which deal not with lenses, stones, stars, as did Galileo in his beautiful little book, but with humans. There was a mathematician among them who had devoted a considerable time to setting up and defending student-run courses and who finally gave up in disgust - he could not change the "established academic procedures". How do these nice and decent people write? How do they address those to whose cause they have devoted their spare time and whose lives they want to improve? Are they able to overcome the boundaries of professionalism at least on this occasion? Are *they* able to speak? They are not.

The authors want to say that policemen often make arrests in circumstances when people are bound to get angry. They say: "When arousal of those present is the inevitable consequence". "Arousal"; "inevitable consequence" - this is the lingo of the laboratory, this is the language of people who habitually mistreat rats, mice, dogs, rabbits and carefully notice the effects of their mistreatment, but the language is now applied to humans, too, to humans moreover with whom one sympathises, or says one sympathises, and whose aims one supports. They want to say that policemen and strikers hardly talk to each other. They say: "Communication between strikers and policemen is non-existent." Not the strikers, not the police, not people are in the center of attention, but an abstract process, "communication", about which one has learned a thing or two and with which one feels more at ease than with living human beings.

They want to say that more than 80 people participated in the venture, and that the report contains the common elements of what about 30 of them have written. They say: "This report tries to reflect a consensus from the 30 reports submitted by the 80plus faculty observers who participated."

Need I continue? Or is it not already clear that the effects of professionalism are much deeper and much more vicious than one would expect at first sight? That some professionals have even lost the ability to *speak*, that they have returned to the state of mind more primitive than that of a 15 year old who is still able to adapt his language to the situation in which he finds himself, talking the lingo of physics in his physics class and quite a different language with his friends in the street (or in bed)?

Many friends who agree with my general criticism of science find this emphasis upon language farfetched and exaggerated. Language they say, is an instrument of thought which does not

influence it to the extent I surmise. This is true as long as a person has different languages at his disposal and as long as he has still the ability to switch from one to another as the situation demands. But this is not the case here. Here a single and rather impoverished idiom takes over *all* functions and is used under *all* circumstances. Does one want to insist that the thought that hides behind this ugly and inhuman exterior (emphasis upon abstract processes such as "communication" instead of living people) has remained nimble and humane? Or are we not rather forced to agree with V. Klemperer and others, notable Karl Kraus who have analysed the deterioration of language in fascist societies that "words are like small doses of arsenic: they are swallowed unawares, they do not seem to have any noticeable effect, and yet the poisonous influence will be there after some time. If someone frequently replaces words such as "heroic" and "virtuous" by "fanatical", he will believe in the end that without fanaticism there is no heroism and no virtue." (3). Similarly, if someone frequently uses abstract terms from abstract disciplines ("communication"; "arousal"; and so on) in subjects dealing with humans, he is bound to believe in the end that a human being can be dissolved into a few bland processes and that things such as emotion and understanding are just disturbing elements, or, rather, *misconceptions*, belonging to a more primitive stage of knowledge.

That being an expert is a predicament and not a matter of pride was realised, long ago, by Aristotle. A free man, according to Aristotle, is a man who has a sense of balance. He has a sense of perspective. He is well informed, in politics, in the sciences, in the arts. He gives some weight to all these things, he lets all of them influence his being to some extent. Men thing - but they are also capable of emotion. They have interest in politics - but they also wonder about the stars. They want power - but they also want on occasions to submit to a higher authority. None of these interests, none of these subjects can demand exclusive attention, and each of them must be pursued with restraint. This restraint cannot be achieved *abstractly* by devoting oneself to one subject and *thinking* that there may be a limit to it. Such thinking will soon lose its effectiveness and will become an empty formula unless it is supported by the *concrete experience* of what goes on outside the limit. It is this concrete experience which prevents a man from becoming narrowminded and partial in the sense of being part of a man only, it is this concrete experience which prevents him from becoming a *slave*. In other words: you can be a free man, you can achieve and retain the dignity, the appearance, the speech of a free man only if you are a *dilettante*. "Any occupation, art, science" writes Aristotle (*Politics* 1337b10ff) "which makes the body, or soul, or mind ... less fit for the practice or exercise of virtue, is vulgar; therefore we call those arts vulgar which tend to deform the body, and likewise all paid employments, for they absorb and degrade the mind. There are some liberal arts quite proper for a free man to

acquire" Aristotle continues "*but only to a certain degree, and if he attends to them too closely, in order to attain perfection in them, the same evil effect will follow*" - he will become a slave in mind, and soon in actual position as well: just remember to what extent the academic profession makes slaves of its participants, especially of the untutored ones, and also remember how greedy and intolerant those slaves become once they get a whiff of freedom, or what they *think* is freedom, viz. *tenure*. "The organization of science" writes Robert Merton on precisely this point "operates as a system of institutionalised vigilance, involving competitive cooperation. It affords both commitment and reward for finding where others have erred or have stopped before tracking down the implications of their results or have passed over in their work what is there to be seen by the fresh eye of another. In such a system scientists are at the ready to pick apart and appraise each new claim of knowledge. This unending exchange of critical judgement (which can become quite nasty - vide the *Double Helix*, the reaction to Velikovsky), of praise and punishment is developed in science to a degree that makes the monitoring of children's behaviour by their parents seem little more than child's play." There are of course wandering minstrels (4) who try to bewitch the onlookers by praising the beauties of science, the joys of discovery, the essentially human character of the search for knowledge and the truth - or whatever other titles they choose for their well paid arias. I am afraid they are singing about a time that has long gone by, and their songs are not melodious enough to let us forget the present squalour.

To sum up: experts today are excellent, useful, irreplaceable, but mostly nasty, competitive, ungenerous slaves, slaves both in mentality, speech, and in social position.

Now, what I have said so far is only one side of the matter and, although quite depressing, it is by far the most innocuous one. It is quite depressing to see with what fervour thousands of young people throw themselves into special subjects where they are trained, and trained, and trained by receiving now punishment, now a pat on the head until they are hardly distinguishable from the computers whom they want to approach in efficiency except that being human they have to add self-righteousness, lack of perspective, puritanism, and atrocious professional jokes to what they are pleased to call the various steps of their reasoning. Now, the peculiar situation in which we find ourselves today is that these inarticulate and slavish minds have convinced almost everyone that they have the knowledge and the insight not only to run their own playpens, *but large parts of society as well*, that they should be allowed to educate children, and that they should be given the power of doing so *without any outside control* and without supervision by interested laymen. One of the most basic elements of the scientific ideology (and of expert ideology in general) is that only a scientist can understand what a

scientist is up to and that only a scientist can decide how a scientist should be employed. For example, only a scientist can know how his subject should be taught and only he knows how important it is when compared with other subjects. It is this demands of the experts which I want to examine in the rest of my paper. Should we allow a bunch of narrowminded and conceited slaves to tell free men how to run their society? What arguments do they have to demand such meekness from us? What arguments do they have to demand not only that their own particular business should be exempt from inspection by non-experts (though, of course, it should be *financed* by them), but also that their religion should become a state religion and that the education of the young should be left in their hands entirely? What arguments do they have to support their impudent demand that evolution should replace genesis as a view of man in all domains and why are there theologians such as Bultmann and Tillich who try to redefine their subject so that no clash with science can ever arise? Has it been *proved* that scientific theories are better than anything that follows from a literary interpretation of the bible? Where are the proofs? Let us see!

One decisive step in the development of science was the so-called scientific revolution of the 16th and 17th centuries. There are still many people who believe that this event was the result of a radical empiricism and who think that it occurred only because one decided to eliminate views not in agreement with observation and reasonable generalizations therefrom. Hardly anyone is prepared to admit that Copernicus might have been in greater trouble than the Aristotelian-Ptolemaic cosmology and that his views might have succeeded because of ad hoc changes in the evidence, specious arguments, and a lot of hot air. And yet it was Galileo's strong faith in Copernicus, his ebullience, his propagandistic ability, his willingness to cheat that played a most decisive role in the battle that was about to begin. It is interesting to see how suspicious Galileo is of *experience* and how often he prefers an interesting and intriguing *hunch* to a clear and straightforward observation. His suspicion has various sources. It is connected with the fact that experience was appealed to in the *magical tradition* which he despised. Agrippa, Trithemius, the legendary Faust - they all point out that reason has its limits and that it must on occasions be supplemented by a mysterious, magical, but still quite trustworthy source, viz.: experience. "Formal forces are called occult forces" writes Agrippa in his *de occulta philosophia* (I, 10), "for their causes are hidden from us; human reason cannot examine them in all directions and this is why philosophers have learned them from experience, not from deep thinking..." Alchemy which deals with occult forces, is firmly empirical. And so is the art of discovering witches. Asked whether his ability to find witches under the most difficult and trying circumstances "proceeded from profound learning, or from much reading of learned authors" Master

Matthew Hopkins, most excellent, most wise, and most terrible Witchfinder General of the Fourties (the *sixteen-fourties*) replies: "From neither of both, *but from experience* which though it is meanly esteemed of, is yet the surest and safest way to judge by" (*The Discoverie of Witches* Answer Three). Here we already approach Bacon whose empiricism has much in common with the magical tradition but who is also influenced by the Lutherans and by their search for a firm foundation of the faith. This is easily seen from passages such as the following: "We have now treated of each kinds of idols and of their qualities, all of which must be abjured and renounced with firm and solemn resolution, and the understanding must be completely freed and cleared of them, so that the access to the kingdom of man, which is founded on the sciences, may resemble that to the kingdom of heaven, where no admission is conceded except to children" (*Novum Organum* 68).

Such magical and enthusiastic types of empiricism which exclude thought from a large area of knowledge are viewed with suspicion and distaste by Galileo, both in his early works on motion, and later on (remember that he rejects the moon-theory of the tides because of its astrological flavour, despite the existing evidence). He even rejects the sober empiricism of Aristotle, the only empirical philosophy, incidentally, that has been developed in a rational way. Aristotle explains *what* experience is, and he gives reasons *why* it should be regarded as a foundation: experience, according to Aristotle, is what we *perceive* under normal circumstances, with our senses in good order, and what we then *describe* in an idiom that is familiar to all. This experience is trustworthy because man and the universe are attuned to each other, because they are in harmony. The harmony is not denied by Galileo, but he doubts that it can help us to discover the *basic* laws of the world we live in. The phenomena which we perceive depend on those laws, but they also depend on the special conditions which make them appear. For example, our perception of the stars depends on the properties of light, on the conditions of the terrestrial atmosphere, as well as on the idiosyncracies of our senses. Similarly, our perception of celestial motion depends on the actual motion of the stars, on the special conditions of our observation platform, the earth, and again on the idiosyncracies of the senses. It is therefore necessary to *analyse* the phenomena, to *subdivide* them, and to *subtract from them* what is due to the special conditions of their origin.

This analysis is carried out by Galileo with great theoretical skill, and its results are presented, and defended with even greater forensic talent. Galileo himself soon takes the Copernican cosmology for granted: one boundary condition of the analysis which he sets himself and which influences his research in dynamics and in optics is that it must lead to the Copernican universe. It is this boundary condition *and not any profound and complicated experimental work* which is responsible for the gradual change of his dynamics from an interesting type of

impetus theory into a wholly new account where motion, and even the motion of a large and sluggish piece of matter like the earth can occur without any moving force whatever. The boundary condition also leads to a redefinition of dynamical terms with the consequence that observation now ceases to conflict with Copernicus. *All these changes are purely ad hoc.* Moreover, they break the very close connexion between observation and theory that was characteristic of the Aristotelian philosophy, observation and theory drift apart, leaving a sizeable chasm between them. The chasm is noticed and filled partly by the promise of further research, partly by spurious experiments, partly by an appeal to what "the reader surely knows but has forgotten" (a phrase that occurs rather frequently in the *Dialogue*), partly by reference to new, surprising phenomena which, though puzzling in themselves and without any theoretical explanation yet seem to fit perfectly into some of the vacant places. And now Galileo *reverses* the whole procedure, he *starts from* facts, plausible conjectures, adds further facts, appeals to the reader's commonsense until the Copernican doctrine arises as an almost inescapable conclusion. This is a fascinating performance to watch, for it shows that science at its best demands *all talents* of man, his critical sense, as well as his literal ability, his prejudices as well as his caution, his arguments as well as his rhetorics, his honesty as well as his will to deceive, his mathematical ability as well as this artistic sense, his modesty as well as his greed, it shows that science at its best demands all these talents *and ennobles them* by making them an essential part of the movement towards a better understanding of our material and intellectual condition. Today we can give some reasons why such an opportunism has always a chance to succeed. A cosmology and the existing evidence may be out of phase in the sense that the evidence depends on ancient views while the cosmology is a step forward. In this case the cosmology will be in trouble, not because it does not represent the truth, but because the customary measure of the truth, because the evidence is contaminated. And as a conservative bias in the evidence can never be excluded, it is quite legitimate to divert attention from it to make propaganda for an apparently refuted view, to reinterpret observations in its light and to transfer the general enthusiasm for experience to the new evidence that arises from the reinterpretation. This is the *heroic time of science* when one can be both a scientist and a man in the full of personal allusions and entertaining asides is not yet regarded as a hindrance to clear thought, when the best scientist is at the same time the best and the most outstanding dilettante. Expert knowledge *does* exist, but it is not produced by people who have devoted themselves to a narrow field for their whole life, to the exclusion of everything else, but by people who have studied a subject for a year or two, who have a sense of perspective, and who can therefore give a well rounded account of special fields also (5).

Now, after all this generosity and splendour - where does the present squalour come from? How can we explain the concern for minutiae that increasingly characterizes the expert? There are many reasons, most of them still unexamined. In what follows I shall discuss only one.

One particular element of the expert ideology that existed at all times and that plays a role in such different traditions as the hermetic tradition and the empiricism of the 19th and the 20th centuries is the belief that success and progress can be achieved with the help of *special methods* only. Simon Magus, Galileo, Newton - they all insinuate that there are special ways of obtaining knowledge, and that they have succeeded by using these special ways. Experience may be emphasized, and it is emphasized by the hermetic tradition (see the quotation from Agrippa above) and by the altogether different tradition of critical rationalism, but it is not a necessary ingredient of the idea with which we are here concerned. It would be extremely interesting to examine this belief in a method further, and to inquire into its origin. Only little research has been done, and the results that have been found have often been distorted in one way or another. However our interest here is not in the *origin* of the belief; what interests us is its *effect* on the development of the sciences. And this effect can be easily ascertained.

Neither Galileo, nor Kepler, nor Newton use specific and well defined methods. They are eclectics, methodological opportunists. Of course, each individual has what one could call a special *style* of research that gives his efforts some kind of unity, but the style changes from one individual to the next, and from one piece of research to another. Galileo on occasions acts like an empiricist while on other occasions he seems to be a toughminded rationalist with no concern for observational results. Newton proceeds differently in his research on celestial mechanics and in his research on optics. Compare Newton with Hooke, and you will see the variety of attitudes and of styles that existed in the Royal Society toward the second Third of the 17th century. So, looking at the actual historical situation we see that science was advanced in many different ways and that scientific problems were attacked by many different methods. *In practice* the only principle that is constantly adhered to seems to be: *anything goes*.

Nor is it difficult to understand why this should be so. A scientist finds himself in a complex historical situation. There are observations, attitudes, instruments, ideologies, prejudices, errors, and he is supposed to improve theories and change minds under the highly individualised circumstances created by the interplay of all these factors. Instruments as well as people must be coaxed into giving the proper response taking into consideration that no two individuals (no two scientists; no two pieces of apparatus; no two situations) are ever exactly alike and that procedures should therefore be

allowed to vary also. In many ways a good scientist has to be like a *politician* who possesses an intuitive grasp of the objective situation and of the mood of his audience and who has to make the best of both if he wants to get his views across. Or he is like a *prizefighter* who tries to discover the idiosyncracies, the weaknesses, the advantages, the special moves of his opponent in order to be able to adapt his style to them. Considering the complexity of the world he lives in this eclecticism of the scientist, this "ruthless opportunism" (Einstein) is not just an expression of human inconstancy and folly. It is the only type of behaviour that has a chance of succeeding.

Now it is interesting to see how great scientists, while intuitively adopting a methodological opportunism, or anarchism of this kind almost always act as if they had followed a specific and well defined method. We have already described the case of Galileo. He changes ideas, bends concepts, reinterprets laws and observations to fit the Copernican view, he used ad hoc hypotheses, but he also tries to create the impression that he has arrived at this view in a systematic manner, relying now on mathematics, now on observation, now on simple and straightforward commonsense. The case of Newton is even clearer, for he spells out the methodology that has allegedly guided him in his research. There are three different levels: phenomena, laws, hypotheses. These levels are distinct, and must be kept distinct. Hypotheses must never interfere with the phenomenal level, nor must they be used to either suggest, or to constitute laws. Laws are *derived from* phenomena, and are *explained* with the help of the hypotheses. All this is familiar stuff, especially for those who have read Nagel's *Structure of Science*. But Newton not only *preaches* methodology, he also *presents his results* in a form that perfectly fits the pattern of research he recommends. He thereby convinces everyone that the way from phenomena to laws to hypotheses is indeed the only way for a scientist to follow. Every scientist now either tries to proceed in this manner, he tries to find laws by collecting phenomena and looking for suitable derivations, or he tries at least to tell the story of his discoveries in this way, no matter how irrational and whimsical the actual sequence of events. There arises then a period of schizophrenia when a scientist does one thing and says, and believes, that he does another (6). Not everyone can live such a double life, and many people just carry out one experiment after another and hope for the best. Some of them make valuable contributions not because they have found the one and only correct method after all, *but because any method including the silly method of multiplying experiments has a chance of producing results*, as we have said. As science progresses and becomes more complex it also becomes more and more difficult to fit it into the simple Newtonian pattern. The pattern gradually dissolves and is replaced by increasingly vague and ritualistic statements. For example, the notion of a phenomenon and the more general notion of experience is widened

so that in the end it can contain almost any law and almost any hypothesis. One realises that the scientific method is more complicated than one had thought, and that it cannot be captured by a simple set of rules. Yet, despite all these difficulties one still believes that there is something like a method, but one now assumes it is *hidden* in the ongoing process of science, and that it can be absorbed by immersing oneself in the process, and by participating in it in a spirit of complete and faithful *conformism*. *It is this myth of a hidden method rather than any sound evaluation of the nature of science that underlies the expert's demand for special powers, and that supports his claim that scientific knowledge has sufficient authority to resist, and to eliminate all extrascientific ideas.*

Now this myth could prevail only as long as science seemed to be perfect and free from error, as long as there were only minor disturbances, minor corrections, but no major breakdowns. For such disturbances could always be ascribed to inattention, or to the use of an improper method, and besides, they were soon forgotten and eliminated from the official histories of the subject. These histories were, and still are *success stories*, reports of an uninterrupted flood of discoveries and additions to a solid bulk of knowledge that is occasionally subjected to minor corrections, but that is essentially sound and invulnerable.

The situation changes drastically with the scientific revolution of the 20th century, with the arrival of the quantum theory and the theory of relativity. For it now turns out that a great and successful scientific world view *can be entirely wrong* and that it might be necessary to replace not just a constant, or a peripherical law, *but fundamental concepts* one had used for describing the most common and the most easily observable events. Turning back to history with this new insight one realises that the official success story was but the result of wishful thinking, that science has always progressed through catastrophes and intellectual upheavals, and that not a single scientific theory is free from serious trouble. *There is no method, and there is no authority.* Of course, there still remains an almost religious *faith* in the excellence of science and in the supremacy of its results. But it is clear that a free society will have to treat this faith like all other beliefs, such as astrology, or black magic, it will guarantee its adherents freedom of expression, but it will not grant them any of the special powers they would so dearly love to possess.

But is it not utterly foolish to adopt such an attitude? Is it not clear that science has produced innumerable valuable results while astrology has produced nothing? Is it not safer in the case of serious illness to trust a physician rather than a witch and should physicians not therefore receive a special position in society? Was it black magic or physics that brought man to the moon and, if the latter, has not physics proved its case and acquired the right for special treatment? These are the questions

which are thrown at the impudent critic who dares to suggest that a scientist is but a citizen and that whatever special rights he obtains must be based on the judgement of *other* citizens, laymen included, and *not* on the collective judgement of the profession to which he belongs. It is not difficult to reply to these questions.

To start with, it is not suggested that a hospital should employ qualified physicians side by side with witches, or that the space program should consult experts in levitation as well as physicists and astronomers, and give them the same authority. What *is* denied is that a judgement of this kind should be left in the hands of experts entirely, and that laymen, or experts of a different kind, such as experts in black magic should have no say in the matter. A hospital serves a community and it must be left to the members of this community, *experts and laymen alike*, to come to a decision. It is quite customary to let a patient, or the relatives of a patient make a decision about a complex operation not because they have special knowledge, *but because they are the concerned party* and because the responsibility should be left to them. On a larger scale the situation is exactly the same. Here again the ideas of the experts must be balanced by the views of outside observers. Will these observers be able to understand a complex situation and will they come to a useful conclusion? They will, if they cease looking at science as if it were a new religion, if they realise that it is a human enterprise run by fallible and oft quite narrowminded individuals, and if they do a little hard work. Will "a little hard work" really make them grasp a controversial problem which they have just encountered whereas experts have spent a lifetime dealing with the background of related problems? It most certainly will, for a great deal of the information which experts have at their disposal is irrelevant ballast while other parts are unstable, and change every month. Stripped of the ballast and voided of the changeable parts a problem is soon reduced to essentials which are understood by everyone and can be used to test and, perhaps, to overthrow expert opinion. In some cases all that is needed is to translate technical language into ordinary terms and one will realise that what sounds like a profound statement of tremendous implications is nothing but a trite piece of nonsense (this happens quite frequently in the so-called "social sciences" which thrive not on ideas, but on jargon).

Other cases are more complex, but even here the layman has a quite sizeable chance. Clever lawyers refute experts every day, and all over the world. The rules for the treatment of expert testimony before the courts even *assume* that a jury can be made to grasp the points of a technical debate, and that a lawyer may be able to score a victory in such a debate. Also special subjects look formidable only because of the way in which they are usually *taught*. A great deal of material is put before the student, but more than 80% of this material is irrelevant to his future profession, or may be obtained from books, or from

computers. Disregarding this material drastically reduces the study time, makes the subject more interesting and, most important of all, prepares the student for emergencies, "revolutions" of which he usually learns very little, or nothing at all. This is not an idle dream as is shown by the success of crash courses in medicine and other subjects which the air force and the navy introduced during world war II. Of course, it needed a war to overcome the inbred conservatism of the medical etc. professions, but now that we have learned the lesson, why should we continue believing in the exclusiveness of the traditional approach to "knowledge"? Especially in view of the fact that experts are always a prejudiced party in disputes of the kind we are considering here, they have a reputation to uphold, they want to retain jobs which are respectable and well paid and they love to preserve the mystery that usually surrounds their activities and so quite naturally they will praise themselves and condemn their opponents. In addition they often want to advance abstract knowledge, for example about human beings, rather than giving help in concrete situations. "The desire to alleviate suffering is of small value in research" says Szent-Gyorgi at an international medical congress - "such a person should be advised to work for a charity. Research wants egoists, damn egoists, who seek their own pleasure and satisfaction, but find it in solving the puzzles of nature" (*Lancet* 1961, 1394). I am not going to quarrel with this late successor of Dr. Frankenstein. Egoism is a legitimate attitude as long as it does not interfere with the interests of others. But the trouble is that like Dr. Frankenstein these "damned egoists" cannot work on their own, they need money, they need laboratories and, most of all, they need guinea pigs, lot of nice human guinea pigs and so they descend like hoards of flies on hospitals, promising to look after the patients while their only interest is to add a few research papers to their already lengthy lists. They want to do research even if this means interfering with the patients (without their permission, of course) in a way that is not always beneficial, and in some cases leads to permanent damage, and even death (7). This is one of the reasons why outside supervision is absolutely indispensable and why it would not only be unwise, but a sign of criminal negligence not to keep ones eyes on the scientist. Besides, scientists often disagree on fundamental matters, and periods of agreement may well be due to a large dose of conformism rather than to a shared truth. Of course, we shall never cease *using* experts but let us be very clear about our reasons! There are many things in our lives and in our societies which we cannot consider not, because we are too stupid, not, because we have not been initiated into the mysteries of a special field, *but because we have not got the time*. In this life, in this world, *we are forced to be superficial in many ways*, many things that closely concern us, such as the safety of a bridge we cross every day on our way to work (or play) must be taken for granted. Experts deal with these matters, they think about them - that is their *only* advantage.

They do not deal with them in the best possible way, the results they have arrived at are never beyond reproach, special interests often replace the demands of proper research and so it is quite possible that a layman who is not restricted by the chains of tradition will be able to improve the situation. Using experts, therefore, has not made us less superficial and has not relieved us from our responsibilities.

Of course - matters are hardly ever seen in this way. The expert *knows, therefore* we are not superficial any longer and need no longer be concerned. This is the common attitude (and also the attitude of many contemporary "philosophers"). The attitude is vicious, and it is shortsighted. It calms our anxieties where anxiety is still required, it makes us believe that we have *solved* social problems, or problems of individual life when we have merely *forgotten* them, and left them in the hands of inarticulate and powerhungry slaves. It is this attitude that comes out in infantile questions such as "would you permit a layman to carry out openheart surgery on your mistress?" which are impressive only because of some myth about science, not because of the real situation: assume the operation to be a simple one, then an intelligent layman may pick up the necessary skills in a moment, and he may be better than an expert, being more interested in the individual he is operating on. Assume it to be a difficult one, then experts will invariably disagree, unless, of course, they happen to come from the same school. In such a situation, what is the layman to do? Must he not now come to his own conclusion, study books, provided time permits such study and, maybe, take a hand in the procedure himself. What are his chances of success? They are as good as are the chances of "uncivilised" guerillas vis-a-vis a strategy planned by the most powerful intellects (of the Rand Corporation; of MIT; and so on) and carried out by the most powerful nation in the world - that is, *his chances are excellent*. Some of the reasons have already been explained. In addition let us remember that experts have always a special and quite narrow vision of their subject. Physicians deal only with certain aspects of man, and even psychiatrists regard him as a hydraulic system, as it were, of fears, emotions, and other strange fluids. It is more than likely that they lack knowledge that has been assembled by non-professionals, or by professions that are now in disrepute. Paracelsus learned from witches, Galileo from gunners and carpenters, Edison and the Wright brothers succeeded despite the opposition of science, acupuncture is now being regarded quite seriously and nobody can say that this process of learning has come to an end, and that there are no further discoveries to be made *outside* a profession. Also, the need to speak to laymen, to explain to them their particular business and the reasons for the convictions they hold will force the experts to speak more simply, it will force them to relearn a language which they have almost forgotten, having replaced it by an ugly and narrow idiom. It will make their language more humane, it will make them more humane, it will give them a sense of responsibility that is wider and more important than the ridiculous "codes of

ethics" one tries to establish in academic life. All these are desirable developments - but they will occur only if we abandon the great and unreasonable reverence and almost *fear* we have of experts and adopt instead the much more sensible view that experts are humans just as we are, that they have the ability to make great discoveries and the related ability to commit grievous mistakes, and that they have to be watched because of their narrow field of vision, their conceit, and their thirst for power, power over minds, and power over budgets.

★ Address delivered at the Loyola University (Chicago) Centennial on Freedom and the Human Sciences, 9 Jan. 1970.

NOTEN

1. This was written in 1969, before the voter-amendment.
2. This is not an accident. There exist numerous scientific journals which refuse to publish papers written in the first person singular.
3. V. Klemperer, *Die Unbewaeltigte Sprache*, Munich 1969, 23.
4. C.P. Snow, J. Bronowski, K.R. Popper; etc.
5. Such people exist even today, although their number is vanishingly small. Thus describing the origin of the various textbooks of which he was author or co-author Max Born points out "that in order to write a learned volume one need not specialise in the subject but only grasp the essentials and do some hard work" and he continues: "I never liked being a specialist and have always remained a dilettante, even in what were considered my own subjects. I would not fit into the ways of science today (the 19sixties), done by teams of specialists. The philosophical background of science has always interested me more than its special results...".
6. For historical examples cf. the following essays of mine: "Classical Empiricism" in R.E. Butts (ed) *The Methodological Heritage of Newton*, Toronto 1969. "Problems of Empiricism" in R. Colodny (ed.) *Beyond the Edge of Certainty* Prentice Hall 1965. "Problems of Empiricism, Part II" in R. Colodny (ed.) *The Mature of Scientific Theories*, Pittsburgh 1970. "Against Method" in Ratner-Winokur (eds.) *Minnesota Studies for the Philosophy of Science* vol. IV, Minneapolis 1970. These essays deal mainly with Newton and with Galileo. Kuhn and his collaborators have analysed more recent episodes in the history of science and have made some surprising discoveries. Cf. the report on the interviews in pp3ff of Kuhn-Heilbron-Forman-Allen *Sources for History of Quantum Physics* Philadelphia 1967 as well as Paul Forman "The Discovery of the Diffraction of X-Rays by Crystals; A Critique of the Myths" *Archive for History of Exact Sciences* Vol. VI (1969), 38-71 and John L. Heilbron, Thomas S. Kuhn "The Genésis of the Bohr Atom" *Historical Studies in the Physical Sciences* Vol. I Philadelphia 1969. Cf. also Paul Forman "Alfred Landré and the Anomalous Zeeman Effect, 1919-1921" in Vol. II of *Historical Studies in the Physical Sciences*, ed. Mc.Cormmach, Philadelphia, 1970.
7. Cf. M.H. Pappworth, *Human Guinea Pigs*, Boston 1965.