THE BOOK WAS DRENCHED

UNIVERSITY  OF DURHAM

RIDDELL MEMORIAL LECTURES

Nineteenth Series

SCIENCE AND POLITICS

BY

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GEOFFREY CUMBERLEGE
OXFORD UNIVERSITY PRESS
LONDON
1947

Oxford University Press, Amen House, London E.C.4

EDINBURGH GLASGOW NEW YORK TORONTO MELBOURNE
WELLINGTON BOMBAY CALCUTTA MADRAS CAPE TOWN

Geoffrey Cumberlege, Publisher to the University

PRINTED IN GREAT BRITAIN

I

AT the present day nobody is surprised if science and politics are mentioned together. Their interconnexion is fairly obvious. Once they are linked together in anybody's thoughts, sooner or later he will think of the atomic bomb. I am not going to speak of the atomic bomb directly. It seems to me to be a symptom, not a cause, though as a symptom it is important, showing clearly one of the several ways in which science and politics are now connected. A century ago things were different. If lectures had been advertised under this title in 1847, most people would have said: 'What is the man going to talk about? Science means discovering the truth about nature; politics means maintaining law and order within the State and defending the State from its enemies outside. The two have no connexion.' That would have been a fair statement about conditions up to that time. In 1847 a few of the more knowing might have added as an afterthought: 'Perhaps he is going to talk about that M. Auguste Comte; the man who says there is a science of politics. "Sociology" Comte calls it; a dreadful name no real classical scholar would use.' That is certainly one aspect of what I am going to talk about; Comte was only partially right and where he was right was not saying anything very novel; yet the suggestion was an important one.

There was a more alarming contemporary of M. Comte, a Dr. Karl Marx, who also thought that politics was a kind of science, though in a different way and for different reasons. Indeed, his present-day disciples have arrived at a more surprising conclusion, namely, that science is a part of politics, a conclusion also arrived at by certain American thinkers who would not like to be labelled Marxists, who have taken a different route and are thinking of a different kind of politics. At any rate, I am going to try to deal with two distinct but related questions: (1) whether there is a science of human relations, knowledge of which can provide solutions of political problems; and (2) whether the aims and beliefs of the man of science (and any other man) are socially conditioned, so that his judgements are made because they are or appear to be socially

advantageous or because of some kind of social pressure on him. If this question is answered in the affirmative it may well be claimed that the activities of the man of science should, like all other activities within the State, be directed by those responsible for the social welfare. I shall take the second question first as it can be dealt with easily and clears the ground for the more important first question.

One further preliminary point. I am not setting out to solve political problems. That is the business of the statesman, not of the academic student. Nor am I setting out to predict the future course of history. That is the business of the charlatan. The business of the philosopher, as I see it, is to study the ideas current in his day to discover what they are like, how they have grown out of older ideas, and, above all, how ideas have worn in the process of growth. Incidentally the philosopher in the course of his discussion may produce some new ideas, and there is no harm in that, provided they are treated with caution; for new ideas need not be better than old ones. A distinction is often drawn between speculative and critical philosophy. This is useful so far as it indicates two different aspects of the philosopher's task. The two aspects, however, are not separable though they are distinguishable. The attempts made to pursue a purely critical, non-speculative philosophy have reduced philosophy to wrangling about trifles, as in the recent efforts of the Logical Positivists and their like. The opposite, speculation without criticism, is perhaps worse, but its defects are obvious. To conclude this digression, my main object is critical, but that criticism is necessarily made from a positive standpoint, a speculative basis, which implies the denial of certain other speculative bases. The course of discussion will, I hope, illuminate that basis sufficiently.

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It is often urged that the activities of men of science *ought* to be controlled by public authority, when it is seen that their activities may be extremely dangerous. This demand is perfectly reasonable. It is not outside the bounds of possibility that a very large and uncontrolled release of atomic energy might liberate enough radio-active material to destroy all living

things on the surface of the earth. If any scientific men are inclined to try to do it, they clearly ought to be stopped. But this is all a matter of applying scientific knowledge to large-scale processes which may be either harmful or beneficial—technology, in short; not science itself. The two must be carefully distinguished though very closely related at all stages. I shall return to this later.

The case to be met is not just that scientific activities ought to be controlled for the benefit of the public, but the more far-reaching assertion that in fact and of necessity all scientific activities, namely, the subjects investigated and the results arrived at, are controlled by social forces, either openly and consciously by the Government or less openly by economic forces, or the pressure of interests of a class or group or the whole community. Which of the possible alternative accounts is given depends upon the political views of the exponent of the theory. This perhaps is an indication that the holders of this kind of view are themselves socially conditioned. At any rate, I am concerned to argue that they are wrong whoever they are who hold it, and their error may be called psychological determinism; a more popular belief now than physical determinism.

The traditional view is that a man makes an assertion because he believes it to be true, or, when he wishes to deceive, because he believes it to be false. Further, that only in the second case is any inquiry into motives relevant, and that in any case truth or falsehood is important, not motives. This traditional view has been attacked in three different ways. The first can be dealt with summarily. It is a reversal of the usual view, that it is generally socially advantageous to believe what is true, as a consequence of its truth; and that it is disadvantageous to believe what is false, again as a consequence. Instead of that it is said that what is called truth is true because socially advantageous. The theory can be argued plausibly because in many cases an important part of the evidence in favour of beliefs is the fact of their social utility. We should not, in fact and in reason, have so great a faith in the theories of physical science if they were not so successful in producing motor-cars, aeroplanes, and radio. These are part of the evidence; but not the whole. The theory is logically unsound. Social utility cannot be the sole criterion of truth, because, first of all, we need a criterion of

whether or not it is true that a belief is socially useful. Moreover, the social consequences of a belief cannot be discovered until it has been believed. Nobody actually knows what would be the social consequences of believing that $2 + 2 = 5$, because it has not been tried on a large scale. For all we know they might be better than those of the more orthodox view. Finally, many beliefs have no known social consequences and yet are successfully judged true or false.

The second argument is that social pressure makes us hold the beliefs we hold and judge them true or false. The argument can be made plausible because in matters of morals social pressure is very often effective. Unfortunately for the argument it is occasionally ineffective; and in scientific matters, as the history of science shows, singularly ineffective in the long run, though sometimes effective in the short run. The argument, however, is a special case of the third argument, that from psychological causes. Social pressure is one form of psychological causation, and there may be such a thing as compulsive causation. This is fairly evidently at work in the insane, mentally deficient, and intoxicated. It is argued with some plausibility that it is at work in apparently more normal cases. Clearly there are emotions, impulses, drives, motives at work in all of us which are part causes in producing action; and the assertion of beliefs is a kind of action. Again, when a man deliberately deceives by uttering what he knows to be false, we properly inquire into his motives. When he is self-deceived, saying what we can see to be false though he may think it true, we can inquire into what causes his self-deception. But in all these cases we are inquiring from a higher human level into something that is in one way or another sub-human. In any case the motives, impulses, &c. which operate are various, indeterminate, competitive, often ambivalent; statements about them are highly speculative and doubtful. A man may be induced to say that $2 + 2 = 4$ because he is angry with his wife or is operating on the black market. It is very hard to discover what his motives are. It is quite easy, though, to examine the truth of his assertion, independently of motives; and it is in fact true.

At the level of conduct at which judgements of truth and falsehood operate, motives are not compulsive and are not rele-

vant as criteria of truth and falsehood. It is only in a secondary way as an explanation of why falsehood is asserted that they are relevant at all, and then only after an assertion has been judged false on independent grounds. Once we start on the line of argument, 'His motives are bad therefore what he says is false', there is no stopping short of the Nazi argument that Einstein's theory is false because Einstein is a Jew, or the argument that appears to have been used in Russia that Mendel's theory of heredity is false because he was a Roman Catholic monk.

Finally, the theory of psychological determinism, which takes motives (impulses, drives, or some other psychological factor) as compulsive, is self-refuting. Those who hold it apply it to other people and not to themselves, and therefore fail to see this. It is obviously an intellectual error to apply to the conduct of other people motives and criteria you do not apply to your own conduct; it is equally a moral error, essentially *the* moral error.

Perhaps I am labouring the point unduly, but it should be made clear beyond doubt that a man makes a significant assertion because and only because he considers it to be true (however mistakenly), or else, when he is deliberately lying, because he considers it false. He takes himself as free to choose between truth and falsehood and as not being conditioned or compelled by motive or anything else outside himself and his own judgement. If he were compelled he would be making a noise because he could not help it, like a whistle when you blow it. Similarly he must for the moment attribute the same liberty to his audience or he would not trouble to speak.

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It does not matter how much or in what way the man of science is socially or otherwise externally determined, provided he tests his assertions for their truth. Reluctant as he may be to do this, if he fails, the decision will be taken out of his hands by his scientific colleagues, who will be ready to do it for him and will be severer critics than he. To this extent there certainly is social determination, and a very healthy thing too.

The tests of truth are primarily two: (1) logical coherence, (2) conformity with experience. (1) An assertion cannot be accepted unless it is internally self-consistent and also fits in

with the general body of previously accepted assertions. Of course, the structure of accepted assertions is not entirely rigid and sometimes something new is accepted even if it disturbs the old. (2) Conformity with experience means all experience that is publicly ascertainable, though the limits of this cannot be closely defined. Again, the structure of already acknowledged experience is not entirely rigid because all experience is subject to interpretation, with the limitation that experience should be explained by theory, not explained away. There are, in addition, other criteria of a vaguer character which may be important in certain cases: (3) Fruitfulness, (4) Elegance. These tests apply mainly to theory. Some theories which are not all they should be logically and may be difficult to reconcile with some facts find acceptance because they have great suggestiveness or usefulness in opening up new possibilities (3). Some are acceptable on aesthetic grounds, because they have some beauty of form (4). Preference for simplicity in theory is partly utilitarian; the more complicated a theory, the harder to use. Much more important, though, is the fact that what is usually called simplicity has also a certain kind of artistic perfection, balance, symmetry, form; it is coherence of a kind that is not merely logical.

All kinds of external factors, social or other, will help to direct the attention of men of science to certain questions, to the neglect of others. This is a limitation, because no science can develop in directions that are neglected, and science will develop in those directions that are much studied. As a result of this, many people suppose that new scientific knowledge, supposed desirable, can be obtained simply by spending enough money. You have only to build a large laboratory, equip it with the most expensive apparatus, select a large staff with the suitable technical training, pay them more than anybody else can afford, tell them what is wanted, and in a few years the results will be forthcoming. This is true enough of technological advances where the basic scientific knowledge is already there, and it is a matter of exploiting it systematically for a purpose the nature of which can be foreseen, at least in outline. This is in fact the history of the war-time development of the atomic bomb. But the basic scientific knowledge is not so readily obtained by hothouse methods. The goose that lays the

golden eggs does it in her own way, at her own time, and she likes a little quiet and privacy.

Once an investigation is started in any direction, it is the nature of the problem itself that determines what is to be done and what left undone. The problem once set, it points the way; and the investigator has to follow if he is to accomplish anything. In particular, he has to take the parts that are easily soluble first and leave the harder ones for a later day. Far less depends on the initial bias of the investigator or any outside influence than is believed by those who think money can do everything (the characteristic fallacy shared by Capitalists and Marxists).

Science is autonomous.[1] If it is forbidden its independence it will not be deflected from its course; it will die out. It requires a certain climate of thought and morals, a society where persons are respected as persons in their own right provided they grant that respect to others. In no other society can the truth be respected whether or not it appeals to the populace or the ruling class or the desires or ambitions of anybody. In no other society can tradition be valued and be an educative influence without becoming ossified and a hindrance. For the pursuit of knowledge a man must use tradition as far as he can, but be prepared to break with it if his conscience compels him to break with it. He must appeal to his scientific peers and their consciences for their support. His peers will judge whether he is a crank or a reformer; his scientific peers in science, as would his political peers in politics.

After a time for reflection new scientific ventures which begin as controversies turn into something accepted by the scientific community. This judgement is as near to being impartial, objective, and final as anything in human affairs. But it only reaches this standard in so far as the scientific conscience is active and unfettered. This is a matter of morals and reflects the moral standard of the whole community.

Long before there was any direct contact between science and politics of the twentieth-century kind, there was this link between the moral and intellectual atmosphere of the whole community and the growth of science. It was in ancient Greece

[1] For this paragraph cf. M. Polanyi: *Science, Faith, and Society*, Riddell Memorial Lectures for 1946.

that respect for personality and respect for truth, and also science, first developed. That respect was never sufficiently firmly based or widely held or widely applied, and after a brief flowering the scientific spirit died down. It flowered again later in Western Europe in a culture not completely Christian, but still nurtured on Christian teaching. The infinite value of each human soul in the sight of God has always been the explicit doctrine of the Church, however imperfectly many of those in authority have exemplified that doctrine in their conduct. These countries have gone farther than most (though never far enough) in the direction of trying to substitute persuasion for force in human affairs. They have also gone far (though not far enough) in upholding personal integrity in all the affairs of life—the integrity of the man of science is precisely that of the merchant whose word is as good as his bond, and of the craftsman or artist who refuses to turn out work that is slovenly or dishonest. A society which values these standards cannot endure for long under an autocratic government; either it will destroy such a government or be destroyed by it.

To return to the investigator. While investigating he cares for nothing and nobody except his investigation. He has to follow where the subject leads and when he is penetrating into the unknown he cannot tell beforehand where it will take him. Independence and individualism are not complete but modified by the duty and need to consult scientific colleagues who can give encouragement and criticism. I speak in terms of 'he' but that includes 'she' and 'they'. Nothing I have said precludes the collaboration of several workers, or 'schools' of research where juniors work under a senior. Yet many great discoverers have been by nature solitary; though few have gone so far as Cavendish, who seemed content to confide his observations to his notebook, indifferent whether any other human eye ever saw what he had written.

All this applies only to the investigator while investigating; before and after he is a citizen like any other citizen. In a democratic society of the western type every useful man has in principle two functions: one as specialist, engaged on some particular kind of work, the other as plain citizen. In an autocratic régime there are no plain citizens. The Western Democracies have actually made some attempt to produce the

'classless society', a conception which belongs essentially to the Stoic and Christian traditions.

So far I have been considering science in the strict sense, which excludes technology, and must now say something about technology. The distinction between the two is not so much a question of subject-matter, or even method, as of aim. Science is the attempt to understand; Technology, the application of scientific knowledge to the production of things useful for human life—useful commodities or the instruments for producing and handling them. It is convenient to make a third distinction. 'Technics', the practical arts and crafts, existed long before science and some still go on independent of science. Technology is the improving of technics by means of science. While these activities are different they operate together and influence one another. All sciences have originated in some branch of technics, which has provided the subject-matter, the initial methods, and the first problems. You cannot start a new science by sitting down and thinking about it, as Comte supposed, or if you do it will be a sham science. You can only start it by studying systematically some branch of technics with a view to understanding what is being done in the technical process. A great stimulus to scientific discovery has been the failure to do something that was wanted, because no plausible theorizing can conceal a practical failure.

Modern astronomy is almost entirely pure and divorced from technology, but the first main stimulus to its development was the technological problem of determining longitude at sea for the purposes of navigation. Pure mathematics itself originated from the processes of marketing goods and measuring land. But science only begins when the investigator drops utility for the time being and concentrates on understanding. In the long run understanding often pays high dividends in the form of increased utility. The dividends, though, may not come in for centuries and may come in from the least expected quarter.

This brings me to a curious point about technology, which consists in finding the most convenient means for doing things —travelling, telling the time, building houses, lighting and heating them, growing and preserving food, and so on. These all depend upon technique—acquired skill in manipulating objects. Technique is, at least it generally can be, cumulative.

It is learnt by imitation; and the apprentice, if he cares to take thought and trouble, can improve on his master; so that each generation can start a bit ahead of the previous one. But all this cumulative advance in technical skill may be wasted when a new kind of technique is introduced. To take an example used by Polanyi, technical skill in candle-making is wasted when gas-lighting comes in; skill in gas-lighting when electric lighting comes in; skill in making filament lamps when vacuum discharge lamps come in; and so on. If any of the skill is handed on in spite of revolutionary change in technique that is only because it may be a partial revolution, not a complete one. Most factories now drive their machinery by electric motors instead of a steam engine; but the use of electricity has not made the steam engine obsolete because the bulk of the electric power is obtained from steam generators. Nevertheless a new discovery coming from pure science or just from a new invention, or, more probably, from both sources at once, may cause the accumulated skill of past generations to be thrown away and make it necessary to acquire new skill. A change in the relative costs of materials may do it. To put the matter simply in primitive terms, the skill that is acquired at the beginning of a war turning ploughshares into swords is wasted at the end when the swords are reconverted to ploughshares. There is no system or internal coherence about technology: its development is determined by outside causes—by varying social needs, varying economic conditions, the state of scientific knowledge, the idiosyncrasies of inventors who hit on this dodge and not on that.

In contrast, pure science terminates (while taking in other things on the way) in a system of thought; and nothing that was valid at any time ceases to be valid at a later time. The old is incorporated in the new through changes and revolutions of thought, though excrescences may be cut off. Modern physical theory does not invalidate the main structure of Newton's theory; rather it is the expansion or fulfilment of it. Newton's theory applies to all man-size objects, the things we handle, and to other things that are still of moderate size, not bigger than the solar system or smaller than a molecule of hydrogen, and to all motions that are not too fast. Its formulae still provide an approximation close enough for all ordinary purposes and the more complex formulae of the newer theories simplify

down to the Newtonian formulae, except when the very small, the very fast, or the very large are being considered. In fact, if the new formulae did not do that they would be under grave suspicion or even worse, for the experimental methods on which the new theory is based depend upon the assumption that Newtonian theory holds within the man-sized realm of magnitude for which it was intended. The theories of pure science form a systematic whole capable of indefinite expansion. They are subject to minor corrections and reformulation within, since all theories are approximations derived from incomplete knowledge of a limited realm of experience, and closer approximation or better formulation is never out of the question.

Here, arising out of the difference in aim, is a characteristic difference between science and technology; a difference that should not obscure the fact that the two are closely related and may be pursued together in one and the same process. Those who try to make out that science and technology are the same usually do so for the purpose of insinuating the notion that social utility is the sole test of truth.

Whenever a novel truth is first apprehended it must be as a surmise or a conviction in the mind of one man, or at most a very few men engaged in discussion. It is at first an individual and private possession. Others must be persuaded one by one until at last the conviction is spread so widely that it may be called public. Premature judgements about social utility are likely to lead to the condemnation of anything new. Most men object to altering their habits of thought and action; most governments are convinced that novelties are dangerous. When I say 'novelty' I mean a genuine novelty, not the 'latest fashion' which is generally an old error dressed in new clothes. The modern man in the street and the modern politician see how wrong and foolish it was of the Inquisition to condemn the theories of Galileo, but had they been alive at the time they would have been all for the Inquisition and against Galileo. The officers of the Inquisition have no monopoly of obscurantism. Remember how the Athenian populace banished Anaxagoras, the Roman soldier killed Archimedes, the Arab conquerors destroyed the Library at Alexandria, the French Revolutionary tribunal condemned Lavoisier. All these in their different ways are tarred with the same brush; namely, ordinary

political judgements about social utility. I could quote more recent examples, but that would introduce controversial issues.

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I conclude, then, that science should be as far as possible independent of politics; the best the politician can do for the scientific investigator is to leave him alone. There was no difficulty about this in the past. Science was pursued by private people at their own expense; or, if subsidized, it was by universities and scientific societies, themselves autonomous bodies independent of State control. State funds were employed occasionally but only for special purposes, mainly for geographical exploration and for astronomy. Now that science is much more expensive, so many more pursue it, and gentlemen of independent means are fewer and with less means, most of it is paid for by the State. So far, in the democratic countries, there has been no political interference; but our immunity is not too firmly based.

It is strange to find that there are some scientific men who not only confuse scientific truth with social utility but welcome the idea of scientific investigation becoming a matter of state policy. Perhaps they imagine that this would mean political power for men of science. That is certainly an illusion. If it is based upon what has happened in Russia it is still an illusion. The men of science there are a privileged class (like ballet-dancers) as long as they do what they are told. They have no more political power than ballet-dancers. The secrecy restrictions imposed on research in nuclear physics should act as a warning of what may happen even in a democratic country.

The majority of scientific men are ill fitted by temperament to be politicians—by politicians I mean all who exercise legislative, administrative, or legal functions of a public and responsible kind. They are liable to be absorbed in their own thoughts and activities, and oblivious to anything happening round them which does not directly bear on these thoughts and activities; they tend to be 'bad mixers' and are not very apt in the delicate art of handling men; in a word, they are typically 'academic'. Even for those who do not suffer these disabilities there is now the practical hindrance that politics and science are each full-time jobs. Nobody can pursue both together effectively. The

scientist turned politician is only an amateur part-time politician, or else he ceases to be a scientist in anything but name. If scientific investigation became a matter of state policy it would mean the politician telling the scientist what he is to discover; an idea that would be comic if the thing had not actually happened in Nazi Germany.

When I say that scientific investigation should have no connexion with State or Government, I am not denying what I have said already, that it is bound up with the general social and intellectual atmosphere. Public opinion can keep governments in order and check their natural tendency to be oppressive or corrupt or inefficient. It does so openly and legally in countries with constitutional democratic governments; it has some effect even in other countries. The autocrat is apt to be afraid of public opinion, the more so for the difficulty he has in discovering what it is and how far his efforts to manufacture the kind of opinion he wants have been successful.

I have been speaking of science in the strict sense as the attempt to understand the natural world and the relation of the man of science to the society he lives in. The position of the technologist is entirely different. He is making, using, or controlling instruments in a way that should be for the public welfare; and if they are the wrong instruments, used in the wrong way or for the wrong purpose, he does a great deal of harm. The technologist must be considered as a public servant; there is no inherent reason why his activities should not be controlled directly by the Government, or by some other public body in a public way. The most frequent complaint about him is that he does not take his public responsibilities seriously enough, and that there is not enough control. The problem is not entirely new. One of the early triumphs of medieval chemical technology was the preparation of lead acetate and the discovery that a little of it added to new wine made it taste like old—but also made it poisonous. Even the governments of those days were obliged to interfere. Of course, there are technologists whose activities are on a small scale or for some reason very unlikely to be able to do any public harm and who do not require any control. Exceptionally, the blunders of the pure scientist, which usually hurt nobody but himself, may affect others and need to be controlled. But, on the whole, the pure scientist

can be safely left to his own devices, while the technologist cannot. Unfortunately the harm or benefit of any activity is seen most clearly in retrospect, when it is too late, and planning is always done partly in the dark. Still, there are some things that can be foreseen to some extent.

It seems a simple solution of the question of the control of technologists to say that it should be done by the Government. Those who admire the Russian system say this, conveniently forgetting its extreme inefficiency and certain resemblances to the Nazi system. Even if that were in principle always the right solution it is not, in fact, always possible. The matter is more complicated. The politician cannot always direct or effectively control the technologist however much he would like to, and however great his nominal powers. The expert, the man who knows, is apt to have the last word. Negatively, he can have it nearly always by saying 'It can't be done'. Even if the expert gets 'liquidated' for saying so, the thing still remains undone. The cunning politician, if he is also lucky and knows a second technologist who hates the first, can sometimes have his way. He tells Prof. *X* that Dr. *Y* says it can't be done, and so stimulates Prof. *X* to demonstrate that it can be done. But in many cases the technologist wins if he really tries. A group of technologists collectively, if they pulled together, might prove too hard a nut for even a totalitarian government to crack.

This means that in any matter which directly affects public welfare the technologist himself should realize his public responsibility. Trouble arises because in very many cases he does not realize it, but takes a narrow, purely technical view of his functions, thinking solely in terms of the job and its technical efficiency, and not of its after-effects on the public. Efficiency from the technical point of view means the greatest output for the least intake. But output and intake of what? Of what is thought important, leaving out of account what is thought unimportant. A brewer can double his output of beer by doubling the amount of water he puts in. That may count as increased efficiency from his point of view because he pays less for the water than for the other ingredients. It is not, however, the consumer's idea of efficiency, because he also can obtain all the water he needs at small cost. Efficiency, which is sometimes made the technologist's god, is a double-faced deity.

In many cases the technologist excuses himself from taking account of the after-effects of his work by saying they are unknown to him. Sometimes he has no means of knowing, but not always. British motor engineers design cars whose comfortable and economical speed is from 40 to 80 m.p.h., because they know customers like cars of this sort and will pay high prices for them. But they also know that British roads are not adapted to such speeds. Surely they ought to be held responsible for selling lethal weapons to anybody with money to pay for them, as the chemist is held responsible for selling poisons? They could, if they wished, fit automatic governors to cars to keep their speed below a definite maximum. What is more, insurance companies (who employ technologists in the statistical line to study the lethal consequences of reckless driving) could refuse to insure cars not fitted with governors. Of course, speed may not be the lethal factor. Do the technologists try to find out? Or do they prefer to remain ignorant of the public consequences of what they do?

II

THERE is a branch of technology where the problems of public relationship have been solved; at least up to a point. It is medicine. The science of medicine is the understanding of the nature of health and disease. The technology, or the art, as it has been traditionally called, is the process of promoting the first and getting rid of the second. Medical men individually and the medical profession collectively wield great powers over the public, and their activities are of enormous public, indeed political, importance. They could use their power against individuals and the general public interest. Students of crime need no reminder that successful poisoners have generally been medical men or have had some medical training. That the activities of the medical profession have been, on the whole, to the public advantage and that their power over individuals is very seldom abused is not a consequence of technical proficiency or anything of the nature of scientific knowledge, because these can be used equally for good or evil ends. The solution of the problem, so far as it has been solved, can be given in the two words—Hippocratic Oath. In this formula the ancient Greek physician laid down the moral rules which should govern the relation of doctor to patient. They all turn on the principle that the purpose of the physician is to promote the health of his patient and that he should do nothing which is not for this purpose. The medical profession collectively has subscribed to these rules ever since, and the vast majority of practitioners have adhered to them. So far as individual relations go between doctor and patient, the rules are just as good now as twenty-four centuries ago because these relations change very little, if at all; few people are in any doubt about them and simple general rules suffice. If one man has acted unjustly, unkindly, or dishonestly to another man the fact is pretty clear, and whether the thing was done in the twentieth century A.D. or the fifth century B.C. makes little difference.

The new problems of the present day for which the Hippocratic Oath provides no obvious solution are problems of collective relations. These relations have changed, are changing,

and are becoming more and more important. Hippocrates did not need to trouble about the relation of the medical profession collectively to the public collectively; the notion of public health did not then exist. The new problems are seen in the methods of dealing with infectious disease. 'Contacts' and 'carriers' are perfectly innocent persons who have committed no offence and are not themselves ill in any usual sense of the term, but they are expected to submit to restrictions of liberty in the interests of public health, which may amount to a mild form of imprisonment lasting for an indefinite period. Usually they can be persuaded to act as required; but if they are not willing, what then? Sometimes they are subject to legal compulsion. According to the Hippocratic Oath the physician must do nothing that is not for the benefit of the patient and, in particular, for the sake of his health. Nowadays he is prepared to violate the oath in certain cases because the benefit or health of all collectively outweighs the benefit or health of any one individually. True enough. But this is the universal argument of tyrannical authority and can excuse any violation of human rights. The ruler knows what is for the public good and does it; those who oppose, whatever reasons they allege, are plotting the destruction of the State and must be liquidated.

The individual patient can be expected to, indeed should, submit himself to the control of an individual physician who is bound to act for his benefit. Why should the patient submit at all if the physician takes the liberty to excuse himself when he thinks fit? The 'when' will turn on technical points of which physician, not patient, is the judge. And the excuse, as I have said, is a special form of the tyrant's argument. In short, under the new dispensation what is to prevent the medical profession, acting as they say in the interests of public health, of which they alone claim to be judges, from dominating the rest of the community and making the nominal rulers their agents in the process?

This question can be asked equally of any other body of experts who are organized and capable of collective action—engineers, experts in industry and finance, lawyers, administrators, and others. As the processes of government become more complicated and ramify farther into the private lives of people they become more and more matter for experts, about which ordinary people are held incompetent to speak. The

safeguard in the past was the general admission that in the last resort each man, however ordinary, knows where his own shoe pinches. That may all be changed. He will then be told he knows nothing about it; only the expert 'hypodematologist' who studies the statistics of 'podalgia' is entitled to an opinion. This tendency is not accidental or something easily corrected; nor has it anything to do with Socialism versus Capitalism. It is inherent in the large scale and the complexity of modern social organization. We could not go back to the small-scale simple communities even if we wanted. Nor is there any salvation in 'private enterprise'. At any rate, the difficulties that arise out of the new collectivity have to be faced, and old rules like the Hippocratic Oath are no guide.

It has been argued, very plausibly, that we require a new kind of morality, a collective morality in place of the old personal and individual morality. This argument is now advanced as the latest contribution to twentieth-century thought. It is not quite as new as that; in fact it is more than 3,000 years old and is to be found in the most ancient piece of writing in the Old Testament—the Song of Deborah. When Jael, the wife of Heber the Kenite, hammered the tent-peg into the head of Sisera, her argument was the same: 'In place of the old personal morality which made the host responsible for the safety of his (or her) guest we need the new collective morality of service to the State.' Jael herself was not saying anything very novel even in her own time. Personal morality, as we know it, has developed out of the oldest morality of all, loyalty to the family or tribe, which still remains in force in small and remote communities, specially if they are nomadic. For this development all that is required is the articulation of the inchoate bulk of the tribe into individual, mutually responsible agents and the widening of the boundaries so that loyalty becomes inclusive not exclusive. Collective morality was really new round about 4,000 B.C. and was produced by the rise of large permanent agricultural communities in Egypt, Mesopotamia, and northern India. These were governed by a divine king or priest king and were to all appearances strictly totalitarian. Everything and everybody was subordinate to the State, and there was a system of law to enforce a pattern of collective behaviour. This state of affairs must have been already pretty old by the time of

Jael (whenever that was) even though tribal morality was older still. This collective morality was perhaps necessary in its day, and that is the best that can be said for it. It has been one of the great efforts of the moralists of the Judaic-Hellenic-Roman-Christian tradition to get rid of that collective morality and substitute for it a genuine personal morality, different from, yet much more akin to, the most ancient morality. Nazism was a regression to the collective morality, and the Russians (whose civilization is Byzantine, and therefore nearer to ancient totalitarianism) seem to be going the same way. This kind of regression is no solution of any problem; it tends to reduce what should be a human community into an animal herd.

The notion that there can be a collective morality is allied to the belief that the collectivity—Society as a whole, the State, the Nation, the Race, or what not—exists as an end in itself, and not just as a means to the ends of the members, so far as these are common and public. This notion, when put into practice, means that governments or rulers claim the right to put their own aims above those of everybody else and to treat everybody else as means. This happens because there is no such thing as collective will or action, but all actions are actions of individuals directed towards other individuals, singly or in groups, and all wills individual wills interacting with each other. There is nothing to check the wills of those in authority unless they know their authority is delegated. That depends upon others being able to express their own point of view however odious it may appear. The fallacy about the collectivity is plausible because all morality springs from the interrelation of human wills in co-operation and conflict, and these interrelations are embodied in institutions which have names of their own and are easily thought of as though having personalities and wills of their own. We say 'Parliament has decided . . .' and may forget it is only a metaphor which abbreviates an otherwise clumsy statement. Traditions have also a sort of existence of their own, but no will. Institutions in their aspect as a kind of machinery have an existence of their own, and a sort of compulsive force, but again no will.

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It will be granted, I think, that where there is contact

between politics and science or technology, the problems that result are problems of morals. It may be said, however, that morality itself is properly a branch of science; that there is a science of society or of social conduct to provide a scientific basis for morals.

Those who say this generally do so because they admire science and perhaps also because they despise morality, or, at any rate, all that old-fashioned talk about morals which is mixed up with religion, notions of absolute standards, obligation, and duty. For many people 'scientific' means 'very fine and grand' and 'unscientific' is just a term of abuse. What is most admired about natural science is not its attempt to understand the natural world but the control over things which scientific knowledge is supposed to confer in view of the startling triumphs of modern technology. In short, to be scientific is to be powerful; to possess the 'mana' or power of the witch doctor so much admired and feared by primitive man. This power is spoken of as the 'conquest of nature'; a most misleading term. Wild nature remains unconquered as always. The scene of the conquest is an artificial world of machines; and those who are really conquered are the men who, in one way or another, are subjected to the power of the machines. The real conquerors should be those who are in control of the machines, but very often it is difficult to discover them, as the machines have a way of controlling themselves. The 'conquest of nature' may be seen in a new light if we remember that in the course of history technology has been used first, last, with greatest vigour, and on the largest scale, in the service of warfare. Those who suspect that in all this process the only true conqueror is the Devil have some ground for their suspicion.

One point should be perfectly clear: knowledge of the physical sciences confers control of quite a definite, limited kind—the capacity to design, make, and operate machines of every sort. A machine is a tool or instrument, which enhances the powers of the human body, doing with the help of metals, glass, and other materials what flesh and blood alone cannot do, and doing more quickly and precisely many of the things flesh and blood can do. We seldom stop to consider, if things are done so skilfully, whether they are worth doing. Those who admire the physical sciences for these reasons often suppose

that the social sciences are similar and admirable for similar reasons. Others who see that unrestricted pursuit of the technology of the physical sciences has had unpleasant consequences look with rather pathetic faith to the social sciences to put things right. We must now turn to these.

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It is convenient to distinguish three groups of sciences, (1) physical, (2) biological, (3) human or social. This is not necessarily a complete, inclusive classification nor are the groups mutually exclusive. Medical science (and its technology) can well claim to belong to all three. The distinctions here used are based on subject-matter, but it is differences of method that are most important. It is characteristic of the physical sciences to use (1) extremely abstract concepts, (2) mathematical theory, (3) the experimental method. (1) and (2) are closely related. Mathematics can be applied because of the abstractness of the concepts, and some of the concepts, in turn, are the invention of the mathematician. The earliest abstract concepts to be used came from the familiar realm of economics and law and were deliberately transferred by Greek thinkers to the then unfamiliar realm of physics (and modified by the process). The idea that some aspect of a thing can be abstracted from the concrete whole and that, in terms of that property or relation, one thing can be reckoned precisely equal to another, comes from the exchange of goods in the market, where they are valued in terms of a medium of exchange, money. From this first step comes the next, the arithmetical reckoning of values. With the extension of the notions of equality and inequality to lengths and angles geometry becomes possible, and with geometry mechanics, and with mechanics the rest of physics.

Experiment depends upon the artificial ordering of material according to a preconceived pattern, when the process of making and using instruments is extended from its original purpose of production to the new purpose of discovery. Experiment is necessary because in the purely physical world processes, as first observed, are not prima facie orderly but can be made orderly by human interference. The exception in the physical world is the astronomical realm where experiment is

impossible (fortunately) and also unnecessary because prima facie there is order to be found there. Experiment operates in a deliberately simplified situation where only known and admitted factors are present and one factor at a time is deliberately altered in order to see the result. Instruments and machines in their elementary forms are the precursors of physical science, in their elaborated and developed forms are its characteristic products. They are that which is controllable, the processes of which are predictable. But you will notice that the physicist's theoretical account of any mechanical system describes its constant relations and leaves out the process of control—how it was made and why, how it is operated and what for. You may say that physics does not profess to say 'why', only 'how'. True; but here there is a deficiency in the matter of 'how'. It does not explain 'how' the blue print is turned into the machine, surely a mechanical process; nor 'how' the machine is kept in working order and repaired after a breakdown, also a mechanical process.

The regularities of physical process, discovered on the man-sized scale at which experiment operates, are sometimes the reflection of an underlying small-scale regularity; thus the visible regular form of a crystal depends upon a corresponding orderly arrangement of its constituent atoms. What is seen and measured is nevertheless a statistical property of the aggregate of atoms and not of the constituent atoms themselves, though some sort of regularity would be found in a small number of them. More often large-scale regularity is a reflection of small-scale disorder; as, for instance, the properties of gases. However chaotic the units, the aggregate will show some determinate and regular character provided only it contains a very large number of units. Such regularities are also statistical, though of a different type from the first. They may be as well defined, precise, and complete as any conceivable regularity whatever, as long as we are interested only in the properties and relations of aggregates containing very large numbers and not in the constituents themselves. The individuality of a single molecule, atom, or electron, if it has an individuality, is beyond the reach of actual or probable observation; for many reasons, but chiefly because there is no method of identifying or labelling single units in the way aggregates can be identified and

labelled in terms of their statistical characters. The track of a single electron can be seen in a cloud chamber, but *that* electron makes only one appearance on the stage; there are no rehearsals and no encores. From these considerations we can see that there is an important theoretical limitation on physical knowledge. We cannot now accept the eighteenth-century belief that the known laws of physics demonstrate that the physical universe is orderly through and through. Laplace supposed it was possible, in principle, to foresee all events because he supposed that all physical particles are identifiable and that an initial state of any system could conceivably be given. But all particles are not identifiable and the initial state of a chaos cannot be given.

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The methods of the biological sciences are not all the same as those of physics. Biologists use physical methods wherever they can, but their subject-matter cannot be artificially simplified to the same extent and experiment with it is done under difficulties. For experimental physics (including chemistry) the first step is to produce the material and environment needed —special apparatus, purified materials—and then investigate. The biologist has his material ready made—the living forms as they exist in nature in all their variety. First of all he has to describe and classify them, or some of them, as best he can. Physics begins with description and classification, of course, but not in the same way or for the same purpose. The physical purpose is just to single out what can be considered simple or elementary, so that from these simple elements ordered complex entities can be constructed. The biologist cannot construct a living organism (as yet). He is presented with it in nature, growing, living, reproducing, dying; and all independent of his own efforts. He knows it is complex and already ordered according to an order of its own. He pulls it to bits at his own risk, knowing that he cannot put it together again and that he is trying to discern a pre-existing order partly destroyed in the process of discernment. The nearest physical analogy would be that of an engineer asked to draw up a specification for a machine which he found ready made and of a type he had never constructed. Add to this that he always finds the

machine running, and when he stops it, it soon crumbles to dust.

Biologists do use the experimental method, but find it difficult. The physicist knows what variables are present in his experimental set-up because he has put them there. The biologist has to assume that the variable factors he has discovered are the only ones of importance though he knows perfectly well there are plenty of undiscovered variables too; some negligible, but not all. By considering large groups of organisms he can often obtain a statistical result which is very reliable, because uncontrolled variables average out in the group. But then his information is confined to the group or statistical aggregate and he learns nothing about the individuals composing the group. For many purposes that is enough, particularly for the kind of control that is practically useful. The farmer, merchant, and consumer are not interested in the vagaries of individual potatoes, only in the statistical aggregate, potatoes by the ton, hundredweight, or stone. Most biological experiment and the control that follows from it is essentially physical, a process of shifting material objects according to physical rules; in short, the application of physics to biological material. Nevertheless, the potato, unlike the electron, is an identifiable individual and its individuality can be studied by the biologist; there is a kind of regularity there that is not statistical after the physical pattern.

In medicine experiment is possible, similar in character, and still more difficult. Since most people recover from most diseases, since diseases are complex and variable, since different people differ in their resistance, a definite experimental test of the efficacy of any proposed treatment requires the examination of many cases and often quite elaborate statistical methods. To do it properly a large experimental group of patients (fifty is about the minimum) should be taken, as various as possible in all other respects but all unmistakably showing the symptoms of the disease in question. Another group, if possible as large as the first and as similar as may be, should also be taken as a control group, who receive no treatment. Then the death-rate of the two groups is compared and the rate of recovery of those who recover likewise. Strictly, all patients should appear to be treated alike so that nobody is unduly elated by having the

marvellous new remedy or unduly depressed by being in the control group and not having it; for that will seriously affect the chances of recovery and make the treatment appear better than it should. If the disease is a very severe one, few experimenters are prepared to maintain control as rigorously as, for scientific purposes, they should. The medical practitioner is a technologist of the Hippocratic tradition first and a scientific investigator second, if at all. If the disease is a mild one the technical difficulties are greater because the patients either do not die at all (while under observation) or die of something else. Recovery rates are the chief indications of the effect of treatment and may be difficult to establish with certainty. Diseases of the chronic or slowly developing type call for long-continued and careful observation. It is only occasionally, as with the new synthetic drugs and penicillin, that effects are so conspicuous that troublesome and complicated procedure is not needed. Experiment in medicine is possible but, on the whole, difficult, laborious, complicated, slow, and rather uncertain in its conclusions. This is no more than a paraphrase of a famous aphorism of Hippocrates.

Medical (and also by implication surgical) treatment has been considered as though a purely physical process. So in part it is. The physician puts something into the patient's body—drugs, special foods, X-rays, or what not. The surgeon cuts something out. So far it is all on the plane of physics and chemistry. But no self-respecting medical man from the time of Hippocrates to the present admits that this is all. He is not concerned only with the disease or the statistical group, which can both be treated as though they were purely physical. He is concerned with the patient as a person and it is the patient who requires to be cured, not the disease. An elderly G.P. who is fifty years out of date in his knowledge of medical science and his methods of diagnosis, and perhaps too deaf to use his stethoscope effectively, but who understands human nature in general and his patient in particular, may still be able to do more for him than the elaborate apparatus of the best-equipped hospital; apparatus which can do no more than move bits of matter from place to place. The bits of matter of physics are abstractions, but happen to be useful ones when we are content to have no more commerce with them than just shifting them

about. Indeed, we live by shifting bits of matter, as when we eat and drink; but that kind of shifting is the means of life, not life itself. If the patient in hospital is reduced without his consent to a bit of matter to be shifted about, it is not likely to do him much good; it may even reduce him to that actual status, i.e. a corpse.

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In order to receive medical treatment a patient may reasonably consent to be treated for the time being as a material object, e.g. for an operation. But without prior consent freely given a surgical operation would be criminal assault. We control inanimate matter by force in the strict literal sense because there is no other way. We may have to control human beings by that method in the last resort when they are no longer behaving in a human way; e.g. if they are drunk and disorderly. Except with his own consent or his temporary lapse below the human level, it is definitely wrong to treat a human being as though he were an inanimate object. His chief, if not his one single, moral claim is to be treated by the proper human method, by persuasion. True, persuasion is not control at all in the physical sense of the term, because it leaves the person persuaded free to choose. There are forms of persuasion which approximate to force, because they limit freedom. Persuasion by torture, by terror, or by threats is of this type. It does still leave some freedom. Those who are brave enough can resist threats and torture and can die. It is not much of a choice they are left with but it is still just a choice. Persuasion by bribery and by deception are more subtle, because at one end they are not very different from legitimate persuasion and do always leave freedom to choose. They are never quite legitimate though and, at the other end, hardly distinguishable morally from terror. Bribery is peculiarly subtle because it may figure as the offer of legitimate reward and there are forms that involve no crude clinking of coins.

True persuasion is entirely different. It requires, firstly, sympathy and, secondly, intelligence; a common stock of emotions, desires, purposes, which can be passed from one to another; a common stock of ideas which can be handled intellectually and discursively to make purposes articulate and

effective. The first may operate at the level of the herd, as we can see from the behaviour of gregarious animals. The second does not in itself guarantee anything more than intellectualization of the actions of the herd. A third factor is needed to reach the human level, of community as distinct from herd. This means that both parties realize that they are members of the human community where action is judged in terms of standards and is not solely the automatic outcome of desire. It means, to use the phrase of Leibniz and Kant, that they are members of a realm of ends; or, in stoic or Christian terms, sons of God.

If there is to be social science which produces control of human beings, legitimate yet in some way comparable to that control of physical objects which is the fruit of physical science, should it not be a science of persuasion? If there is a science of persuasion it looks as though it had attained its highest development a very long time ago. There is certainly an art or technique of persuasion. The best, indeed the typical, examples of it are to be found in poetic and dramatic literature, and the earliest extant specimens in this kind are as good as the latest. I need do no more than refer you to the most ancient documents familiar in the West, the Homeric poems and the works of the Hebrew prophets of the eighth century B.C. The poetic language of these works and of tragedy is not an accident or an affectation; it is the only possible medium of communication. It should be remembered that these works are in no way primitive but are rather the finer fruits of an old civilization already well versed in the art of persuasion.

There is not, I think, any science of persuasion, because it operates with the concrete, not the abstract. If there are social or human sciences which are not mixed up with physical or quasi-physical methods of control they are perhaps concerned with a special type of understanding, not a special type of control. After all, physical science is really concerned with understanding. This is forgotten by those who are more eager to control than to understand. What is more, understanding appears in its true colours only in the moment of first discovery or realization; afterwards it 'fades into the light of common day' and ends up as truism, mere mental habit, that is hardly noticed; while attention is fixed on practical consequences or

still unsolved problems. Understanding is not quite so illusory as the crock of gold at the rainbow's end because it is actually seen for a moment, though quickly lost again.

In physics and biology far more understanding has come from the exploration of new and hitherto unsuspected realms of fact, in consequence of which greater regularity has been found and formulated in more precise terms. Nothing of this sort is to be looked for in social science, only the more systematic treatment of already familiar realms of fact. The rules already formulated are generally only assertions of what happens for the most part, not of what happens always; they resemble the looser rules of biology, not the stricter ones of physics.

More important still is a difference in method. To find the truth in physics we must be 'objective' and eliminate everything 'subjective', to use common but misleading terms. That is to say, we must stand apart from the things investigated, not putting ourselves in, or our special point of view, letting the object alone display itself. Though we do interfere, and we do see from our own particular angle, all that has to be discounted and removed from the final description. The need for objectivity, neutrality, and elimination of the special point of view of the observer is required equally for pure theory and for technological practice. But why is it needed? Why not give a partial, biased account? Why not put in emotions and personality? The answer is, of course, that if that is done there is a different account for each observer; there is no common basis, therefore no science; nothing even that can be called fact.

This is the way with physics. The attempt to carry over the physical method into human and social studies produces the opposite result. The roles of subjectivity and objectivity are here reversed. The student of humanity and society who approaches his subject as something separate from himself after the manner of the chemist analysing a compound, or the zoologist observing the growth of tadpoles, will not attain the common, general, true, or objective conclusion but will, in fact, express a certain bias of his own, and if he claims to be scientific his claims are bogus. The first thing the student of humanity must understand is that he himself is part of his subject-matter and entirely inseparable from it. When he is investigating human beings he is investigating himself, as one

among others. It is reported that Baxter, when he saw a condemned criminal going to the scaffold, said: 'There, but for the Grace of God, goes Richard Baxter.' That is the attitude of the true 'sociologist', as opposed to the far commoner sham one of the man who assumes a criminal to be something he himself could never be, moved by irrational impulses from which he himself is free. The Benthamite catch-phrase 'Each to count for one and none for more than one' is crude, but puts the matter effectively, as long as the exponent of social science remembers he is one of the ones. It is enough, at any rate, to save us from the pseudo-science of the tyrant, the slave-owner, or, in its milder form, the 'superior person'. It is worth noticing that this 'superior person' attitude has deeply infected many novelists and playwrights who are well up in the latest psychological theories, or at least the psychological catch-phrases. The result is that they despise the characters in their books and cannot produce a picture of anybody who is even credible, not to say interesting. The older novelists and dramatists at their very worst never sank to this level. Shakespeare did not despise even the 'Second Murderer' or 'Fifth Citizen'.

The kind of understanding that a study of human relations both aims at and requires for its basis, if it is to be scientific in the sense of truthful and useful, is the understanding of sympathy. This is a difficult matter, not only for the straightforward and obvious reason that it is difficult to sympathize with others in any genuine way, especially if they are doing something that is strange to us—talking in a foreign language or wearing peculiar clothes—but also because sympathy is necessarily mixed up with antipathy.

While community of interests and aims always produces some sympathy, a conflict of these produces some antipathy. There are real conflicts of interests and aims among men, not to be settled by smooth words, specious compromise, or by any 'superior person' constituting himself judge and claiming impartiality. It is quite true that there are standards of right and wrong which are intended to be absolute and would be mere verbiage unless so intended. But, in fact, nobody is wise enough or understanding enough to claim to grasp them adequately. They are ideals, not objective facts, in the sense that

physical science knows objective facts. Thus, in the human and social sciences there are no pure facts that are not influenced by evaluation and there are no evaluations that can claim to be final and impartial. They can, however, be dispassionate and fair. We can usually see the difference between the writers who try to see all sides, to exercise sympathy and (very important) humility, and those who do not. The great historians have often achieved this, neither making the false claim to impartiality, nor dodging the issue by merely saying 'A asserts this, but B asserts the contrary'; but trying to push back the limits of human ignorance as far as possible and to avoid setting down anything simply out of malice. In this sense the history of Thucydides is scientific; a great deal that now passes as sociology, anthropology, and social psychology is not scientific at all, but a caricature of physics and biology. The claim of such caricatures to be scientific could be dismissed off-hand but for the fact that there are sub-human aspects of human behaviour for which treatment in sub-human terms, though speculative and incomplete, has some value. It becomes fallacious just because, by borrowing the prestige of genuine science, it claims to be scientific and therefore a statement of the whole truth instead of a part of it.

It may be objected that I am doing now just the thing I have most severely condemned in others, setting myself up as impartial judge or as possessing an objective standard of truth while denying it to others. But I am not making such a claim, only the one which is not denied to anybody, to detect falsehood. This can be done without claiming impartiality or complete objectivity. The most partial witness can properly point out that the statements of other witnesses are self-contradictory, incoherent, or do not state what they profess to state.

To illustrate my points, let me return to the subject of medicine and also the subject of law—ancient and well-developed sciences one can speak about with more confidence than about new-comers, having also well-defined relations with politics.

Medical science has a physical and biological basis; in fact the recent spectacular advances are primarily due to the marvellous tools which physics and biology have put into the hands of the medical man. But medicine is not just physics and biology, because it does not deal solely with facts but has an end or

aim, which makes it human and social. The primary aim is health, with prolongation of life and the alleviation of pain as secondary aims. These aims are given; they are taken for granted and not discussed as part of medicine. For the most part no difficulties arise, because the aims are definite and limited and there is usually no doubt when they are attained. The layman can see the difference between health and disease, life and death, almost as well as the doctor, even though more subtle manifestations of disease may escape his scrutiny and he may not be able to explain in detail how he comes to recognize the difference. On the whole the three distinct aims work together; what ministers to health prolongs life and abolishes pain. Occasionally, though, there is a divergence and then the medical man is faced with a difficult decision. Ought he to risk his patient's life by performing a dangerous operation which can produce a radical cure, or ought he to take the 'safe' course of applying palliatives and letting him live on as a permanent invalid? Ought he to alleviate pain when it is severe, even at the risk of life or health? To arrive at a decision the doctor must use all the technical knowledge at his disposal in order to get the facts right, but the decision is not a technical one; it is a moral one and it turns upon his view of the meaning or end of human life. No science can even make a claim to have a bearing on the decision unless it is the science of theology. A doctor who takes a purely secular view of life may consider pain the only evil and be prepared to relieve pain at any cost—the easy solution. Another who considers that temporal human life is a preparation for eternal life and that there are worse evils than pain may have to decide differently. At any rate, both of them equally are going beyond the realm of medical science, which provides them with means to their ends but has nothing at all to say about those ends themselves. This is often forgotten because the ends are taken for granted, are not discussed; and usually there is no need to discuss them. If they are discussed, it is often on the assumption that because the means are material and secular the ends are so too. Thus, it is commonly said that the first doctor decides on scientific grounds, the second on theological. Both decide on theological grounds, only the theology of the first is a poor sort of thing.

III

THE case of law is very different from that of medicine. Law clearly deals entirely with social relations and derives no assistance from physical and biological science. Yet if prolonged, systematic, and critical study make a subject scientific there can be no doubt that jurisprudence is a science, for no subject has been so persistently studied for so long by so many of the acutest intellects.

Law is concerned with certain limited human ends: the maintenance of peace and civil order, the just settlement of disputes, and the preservation of civil liberties. The ends can be stated clearly enough. It is not always so clear how and to what extent they are fulfilled. As to whether a man is sick or healthy there is very little doubt. There is often very grave doubt as to what conduct is just and what unjust amid the claims and counter-claims put up by disputants. It may be granted that it is just that 'men keep their covenants made'. Yes, but what precisely has been covenanted, under what conditions, and are the claims made within the terms of the covenant? The vast body of civil law is hardly more than a set of variations on this apparently simple theme of keeping covenants. It is vast because human relations are various and new claims come to be made. A simple and quite general rule is inapplicable because it does not specify conditions. Once conditions are specified in detail the body of rules becomes complicated, so that only experts can find their way about them and experts may differ in their interpretations. No rule stated in general terms itself provides a rule for interpreting it to fit the concrete case. That has to be done afresh for each concrete case.

These are difficulties within one of the aims, the just settlement of disputes. There are even greater difficulties because the several aims may conflict. Requirements of peace and order are generally held to come first and sometimes seem to demand the setting aside of the claims of justice and liberty. If that is generally allowed, however, the way is open to tyranny; and then justice and liberty vanish. Yet if justice and liberty are put first, order may be so weakened that government is unable

to exercise authority and the way is open to anarchy. Even the worst government is preferable to anarchy, for that makes justice and liberty impossible.

Law is based on custom, the factor which makes society stable and coherent. Law originates as the defining and systematizing of custom and the process of extruding nonconformists who would disturb the coherence of society. The use of precedents preserves custom and makes it systematic. It also maintains that aspect of justice which is equality—Smith and Jones received a certain kind of treatment, let Brown be treated likewise. Law has to be devoted mainly to maintaining custom and the *status quo* because, as Aristotle said, custom is its main sanction. Men are prepared, on the whole, to go on doing what has been usually done and are not, in the mass, prepared to go much farther and start doing things not previously done just because a few hot-headed idealists tell them they ought to. Law that is not enforced is bad law. Nevertheless, this is not a very satisfactory state of affairs, for, again as Aristotle says, people do desire what is really just and not merely to follow the ways of their ancestors. Ninety-nine times out of a hundred we are content with what is customary, we call it justice and everybody is satisfied, but the hundredth time we find the customary producing a very queer result, we call it unjust, and the trouble begins.

The traditional way of dealing with the difficulty, a tradition going back at least as far as the time of Socrates and Plato, has been to invoke natural or ideal law as a corrective of the deficiencies of positive or existing law. In many cases this has worked well. It has operated to prevent abuses creeping in under cover of precedent and to introduce reforms. But natural law cannot be formulated, for if the formula is made general enough it is inapplicable, if precise enough it is just one rule among several carrying with it the ordinary difficulties of interpretation. The notion of natural law is specifically religious; it is an appeal to a transcendent authority beyond any existing authority. For the Stoics, who developed the notion, it went along with their doctrine of the fatherhood of God and the brotherhood of man; for the medieval jurists, natural law was explicitly identified with God's law. Because the notion is religious the term 'law' is a bit misleading, for law always suggests

code and custom actually existing and not an ideal beyond code and custom. That is perhaps one reason why it has lost popularity in the last two hundred years.

Without the notion of natural law or some notion of a transcendent standard there is nothing to prevent law becoming, what the Marxists say it is, the instrument by which a ruling class oppresses the others. There is always a strong tendency in this direction which requires to be checked. The principal check has been the doctrine of civil liberties, the special product of the Western tradition and the one most closely associated with natural law. Custom and law in the restrictive sense can be justified as providing a framework of constant and therefore predictable behaviour within which there is greater scope for free human action and valuable human relations than there could be without it. If you know what people are going to do you can adjust your behaviour accordingly; if you do not know there can be no adjustment and therefore no freedom or very much less. The objections to custom and restrictive law are that the framework may stifle instead of promoting human freedom, that it never fits the exceptional case, which is not always also the negligible case, and that when conditions change it may not fit any case properly. At its very best the customary, even though willingly followed, tends to be a bit below the true human level and tends to be a sort of mechanical relationship. The best and highest human acts are never customary and often consist of breaking through the crust of custom to start something new.

The old doctrine of civil liberties and the notion of natural law worked well enough under more stable conditions, in a simpler form of society where relations were mainly personal and where moral insight seemed adequate to the situation. In most cases custom was at least a useful guide. In this respect the situation of law is very like that of medicine. Natural law, like the Hippocratic Oath, could cope with the old simple personal relations but hardly at all with the modern complex, changing situation of collective impersonal relations. If we wish to understand the nature of justice we can hardly do better in the twentieth century than consult Plato and Aristotle; if of natural law, Cicero. But they cannot tell us what we ought to do now.

In fact, the main trouble about the practice (or technology) of law at the present day is that we have created an immense machinery of statutes and of administrative processes which have the sanction neither of custom nor natural law but work in an arbitrary way. The machine as it gets bigger gets slower and less able to keep pace with a changing situation. Yet the remedy applied is always to make it still bigger, therefore still slower and more cumbrous.

I emphasize this pessimistic conclusion because it is often announced with confidence that there is a quick and easy solution of all political problems—to treat them scientifically. Law is as scientific as any social study is likely to be, yet it may find some problems intractable.

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There is one genuine improvement to be recorded of the last 150 years that can definitely count as scientific: i.e. the collection and use of social statistics. There is now a growing body of information from which it is possible to discover something about the social effects of all acts of government, legislative, administrative, and judicial. This helps to make political thought more factual and political action more efficient. While it undoubtedly increases the powers of governments (a doubtful blessing) it also tends to make those in control of policy in all branches more responsible (an undoubted gain), as long as the information is honestly obtained and used. There is nothing to prevent irresponsible governments issuing statistical reports of what they want people to believe is happening, instead of what actually happens.

This improved knowledge of social conditions is, however, limited from the nature of the case to knowledge of the statistical aggregate. It is not knowledge about individuals but of certain aspects of the group, aspects which are quasi-physical rather than strictly human.

The physicist is quite content with statistical knowledge about atoms because he handles them by the million (or million million); he cannot become acquainted with the individual atom, nor does he want to. The biologist is far less content, because he finds that organisms vary and the variations themselves are interesting and significant. He can and does study

the individual to some extent. Information based solely on the average may be definitely misleading. The usual or average behaviour of fresh-water fish is to face upstream. But if that was the only way they behaved the upper reaches of streams would be crammed with fish and the lower ones empty. Occasionally fish turn downstream. That form of behaviour, though statistically almost negligible, is just as significant as the average. This kind of argument applies *a fortiori* to human behaviour. In the twentieth century the 'average man' can read and write; in the sixteenth and seventeenth he could not. Yet these illiterate centuries produced great literature with which the present cannot compete. The statistical net never catches a Shakespeare or a Newton. Strangely enough it does not even catch you and me. It deals entirely with abstractions, useful abstractions when handled rightly, obstacles to understanding when handled wrongly. Politics, however, deal mainly with men in the mass, with the collectivity, and very little with individuals as such. But there are different kinds of collectivity and different ways of dealing with it. An illustration perhaps will explain this.

Traffic in the streets of a town can be of three different kinds. (1) A procession going down a cleared street is the result of all participants conforming to a prearranged plan. They may participate out of free choice but for the time being have subordinated their wills to that of the organizer and their acts are as if they were purely mechanical. The police, in order to control the procession, have to deal only with an organizer (or organizers), exactly as they would deal with a man in charge of a machine. He has to be persuaded or threatened or compelled, but it can be assumed that the machine will do whatever he wants.

(2) If large numbers of people are going to a football-ground on a Saturday afternoon, they can generally be controlled as to their route by putting up notices saying 'This way to the Match', because they all have a common aim through which the appeal can be made. They all wish to take the easiest and least congested route, and that is exactly what the police also want them to do. Control is by persuasion addressed to individuals, for each reads the notice for himself. It is also addressed to a large number of them and produces a collective

result. Moreover, by this method the main stream of traffic towards the football-ground is directed without interfering with other people going elsewhere with different aims. Any other more compulsive, quasi-physical method, by keeping traffic out of certain streets and directing it down others, would interfere with those who were not going to the match. It would not be more effective than the milder method as long as some eighty or ninety per cent. of those going to the match follow the instructions on the notices.

(3) On ordinary days the streets are filled with people going different ways with different purposes; but these average out so that there is a fairly definite regular flow, a certain density in certain streets at certain times, and for the most part as many going in one direction as in the other. The police cannot control this kind of traffic by any method of persuasion of the ordinary kind, since different people have different aims and they cannot be dealt with singly. The traffic is a steam or flow and has to be dealt with more or less after the manner of water flowing down a channel. It can be kept out of certain streets by barriers and left to trickle round by other routes. It can be controlled by traffic-lights, a method that is not so purely physical as erecting a barrier but is quasi-physical as it does not really allow for individual choice.

In both (2) and (3) successful control depends upon prediction of the amount and direction of traffic, and it is, of course, prediction of the statistical aggregate, not of individual behaviour. But there is a big difference in the method of prediction in the two cases. In (2) it depends upon the police knowing the purpose of the crowd; knowing which match draws a big crowd and where the crowd comes from. It is the purpose of the police to facilitate the purpose of the people in the crowd. Thus the relation of crowd and police is not a purely mechanical one. In (3) purposes all cancel out into a flow of traffic that is purposeless. There is no common purpose at all beyond the very vague one that neither the police nor the people in the crowd want a traffic jam. In fact, the only method is the mechanical one, without taking purposes into account.

Of the three alternative cases, (1) resembles the Nazi and the military method, (2) the kind of political control that the Western democracies aim at, (3) the usual method of control of

economic processes by central authorities. It perhaps represents how the authorities of the U.S.S.R. would like to manage things, but they have also deviated in the direction of (1) and even of (2). In the freest kind of democracy there may be an element of (1). However, if (1) was the principal method there would be no government or politics of the ordinary sort at all, only the personal wills of leaders. If they agree, government is unnecessary; if they disagree, impossible. We may dismiss (1) from consideration as something exceptional. For the purposes of war an army has to be organized as a machine. To be part of a machine is to be a slave. It does not in fact demoralize a man if he becomes a part willingly and wills also the general purpose for which the machine is designed. It is, however, something only to be allowed as a last resort when other methods are impossible.

Method (3) requires more consideration. Where government is concerned with a general flow of commodities; where there is the necessary statistical information, experts to interpret it, and knowledge of what is to be aimed at and how it can be attained; then the task is easy and this kind of method a proper one. The required conditions, however, are not always fulfilled even in the economic sphere. It is not always clear what is the desirable state of affairs to be aimed at. In time of war it is clear enough. In peace-time, when there are obvious scarcities of commodities everybody needs, it is clear enough and plans can be made for a year or two ahead. But if by luck or by past planning there is no obvious scarcity of anything, what then? I do not think this question has yet been answered, except in terms that really belong to method (1)—'We know what everybody else needs, and they are going to have it whether they like it or not.' This is what 'planning' is liable to mean, only the 'planners' do not always know it. It is also liable to end in the 'liquidation' of anybody who does not like being planned. The outmoded advocates of *laissez-faire* in economics were perfectly clear-sighted in supposing that if people are left alone to buy and sell in a free market there will then be the maximum possible satisfaction of all economic needs. They were wrong on a point of fact; for no existing market is free in the manner required. They failed to see also that no market can keep itself free automatically, because the bargaining powers of different

groups are never equal and combinations of buyers or sellers can always restrict freedom. Unless there is some control by a responsible authority, there will be something worse: irresponsible control favouring some and injuring others. The whole trouble with economic relations is that they are necessarily competitive. If *A* enjoys a particular commodity, then *B* and *C* do not. But, except for the negative principle of avoiding scarcity, the principles of control of the market to produce a 'just' distribution appear to be unknown to-day, as in medieval times the principles for determining the 'just price' were unknown. In practice, judgements of what is 'just' in economic relations tend to be judgements of what is customary.

Granted these limitations, there is a sphere of government where quasi-physical control is possible and useful, where some prediction of events is possible, and there is to that extent a science of government. Those who suppose that economic factors are the sole or predominant factors in human life also suppose that this is the whole story. Aristotle, or indeed any intelligent Greek of his day, could have put them right in virtue of living in a simpler society where social processes are more clearly seen. Exchange of commodities, and even use of commodities, are means to an end; and exchange, as Aristotle said, is an 'unnatural use'. In order to facilitate the acquisition of material means of life a sort of mechanization has been introduced: exchange, money, and then all the financial apparatus of modern times. The machinery which was meant to be the servant has become the master. It is then supposed that tinkering with the machine (which is all that even Marxists propose) will solve the problem created by giving it the wrong status. The error is the miser's error and can only be corrected by insisting that the end is life, which can only be individual life; it is not the means of life, however massive and impressive. Thus method (3) alone is not enough for decent government.

Therefore, method (2) is needed, where there is a common purpose, the purpose of each individual separately but also of them all combined, and where government is a matter of facilitating it but in certain cases also instructing and guiding it. Public opinion may be something quite definite but it may also be inchoate and unformed. That is the point at which leadership is needed; when a declaration by a statesman can

crystallize public opinion and produce a definite policy which is willingly followed. Of course, common purpose may be entirely lacking. There may be conflict of purposes between different groups, over real interests which really divide or imaginary interests which cause just as great antagonism. Or worse still, about half the people may be dissatisfied but between them have half a dozen different views about the changes needed. The other half may be just frightened of change and hope to keep things unchanged. There are all these difficulties, of course. The only comfort, if it is comfort, is that there is nothing new about them.

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Something more must be said about prediction in human affairs, because it has been asserted that the course of human history can be predicted, and, therefore, there is a science of politics. It is perfectly true that some prediction is possible: in the economic sphere as to trends of abundance or scarcity of commodities and price levels, and in other spheres when statistical data can be used—in public health, for instance. The kind of prediction possible is not at all like that of the more exact branches of physics based on experiment. It is far more like prediction in meteorology. By studying trends in the weather over a large area for the previous two or three days, the meteorologist can predict the weather in a given region during the next twelve hours with considerable success, on the assumption that changes observed to be in progress will continue as before and no new factor will enter. The farther he extends his prediction into the future the more uncertain it becomes. About the next forty-eight hours he can say something, provided nothing new comes into operation; about the next week practically nothing. The lack of knowledge of future events in meteorology is rather concealed by the fact that weather goes in spells, so that on most days it is fairly safe to say to-morrow will be the same as to-day. The only disadvantage of this method is that on the minority of days when a change is impending it fails disastrously. A good deal of illusion persists, too, as to the possibility of long-range forecasts, because if prediction is confined to vague opposites like wet or dry, hot or cold, they will be

correct in fifty per cent. of the cases, whatever their basis; and a somewhat liberal interpretation of the data when they appear can increase that chance to well over fifty per cent.

Moreover, prediction is only of the general state over a wide area. Thunderstorms over the North of England may be predicted correctly for a particular day. This may either mean a fairly uniform moderate rainfall over the whole area, or disastrous floods in some places with a mere sprinkle elsewhere. Where the rain will fall heavily nobody can say.

If we apply this analogy we can safely admit that some prediction of some things in human affairs is possible without being committed to the absurdity that human history is in general predictable and that the study of history is scientific in that sense. Exact prediction is only possible where there is exact repetition. Therefore, most predictions of future history are based on illusion in the same way and for the same reasons as prediction of the winner of the next Derby. Any number of people predicted correctly in the autumn of 1938 that there would be war before long. But it is safe to say that no one in the wildest flights of his imagination guessed what kind of war, how it would develop year by year, or how it would end. Taking all the then-known factors into account, the safest prediction would have been that Hitler would soon go to war and that he would conquer as much as he chose to conquer and that nobody would be able to oust him from his conquests. That was certainly his calculation and that of the German General Staff. A very reasonable one it was, too, in 1938, 1939, and 1940; yet not correct in the end.

The military conqueror could be very 'scientific'. He has a definite aim, the means to which are calculable. He deals with human beings in that special way which makes for the maximum predictability in human affairs. There is only one thing which stands in his way. That is something which most people now ignore even when it stares them in the face; perhaps because it has nothing to do with science of any sort, and is a theme of ancient myth and tragedy. The obstacle is that success brings pride and pride brings retribution. This was the fate of Hitler; a fate that was not tragic, but only sordid, since he was not of the stature of tragedy.

Of course, Hitler was unlucky to die in the moment of defeat.

But to die in the moment of defeat does not cloud the reputation of a man of sufficient moral stature. Montcalm died in the hour of defeat but he stands as high as the victorious Wolfe. Hitler had no moral stature at all and that was the cause of his ruin—not that he was stupid or ill-informed or mad. It is necessary to remember that up to the summer of 1940 everything he did was a resounding success. It is now pretty clear that he was not a puppet in the hands of others, but did at many crucial junctures take the initiative. If he was ever mad it was the madness that follows from success and absolute power. Hitler's defects were moral and the greatest of them was that he despised his fellow men. His power over his fellow Germans was at the herd level; he impersonated frustrated greed and ambition for a whole people. While he believed that the rest of the world was only fit to be a prey for the conquering Germans, he also believed that they were only fit to be his instruments. According to the reports, at the very end when disaster overtook him he complained that he had been betrayed and that the Germans were not fit for such a leader.

It is interesting to compare Adolf Hitler, the bogus statesman, with Franklin Roosevelt, the real statesman. By a strange coincidence they came to power within a few weeks and died within a few weeks. Of course, Roosevelt was lucky just where Hitler was unlucky. He died on the eve of final victory and escaped the inevitable anti-climax to follow. The difference between them is not that between success and failure. Hitler had a great deal of success and only his own bad faith and pride stood between him and complete success in what he set out to do. Roosevelt's success was very incomplete, apart from the defeat of the Nazis and the Japanese. The difference is truly and solely a moral difference. Roosevelt respected his fellow men and understood them; he used the methods of persuasion, rather than force. That is what makes him a true statesman. It also accounts for his relatively incomplete success. People in the mass can be persuaded for a short time and while they have an urgent common purpose. But, for the long run, it is much harder to persuade successfully, and a common purpose does not outlast the special emergency that calls it forth. He rescued his countrymen from depression and despair (Hitler did the same by his own methods), but his home policy, represented by

the New Deal, practically died with him. His support of Britain during the darkest hour was a decisive factor in the defeat of Hitler and definitely his own personal initiative. His insight into what is possible and what is impossible in politics was unrivalled, and he knew when the statesman has to wait on events, when he has to listen to popular opinion, when he has to give his own lead. It is too much to expect that he could have unravelled the tangle of post-war politics, but it is not too much to say that part of the trouble now is that there is no one to take his place.

I conclude that there is no science of statesmanship or politics or persuasion, if by science we mean the results of a systematic inquiry comparable to that of the physical sciences. Intuition of the ends of human life is extra-scientific, though, given the notion of the end, there may be an appropriate science determining the means to the end. No kind of scientific knowledge tells us that life is better than death, but, granted that intuition, there are sciences that subserve the means of life; sciences that can equally well subserve the means of death, if death is preferred.

There are special social sciences developed round the conception of special ends. As they are social, they suffer a certain limitation from which the natural sciences are free. The investigator is himself part of the subject he is investigating, so that there is no such thing as a completely impartial and objective judgement. Attempts to introduce into the social sciences the kind of objectivity that is valid for the natural sciences lead only to confusion and the attitude of the 'superior person' finding excuses for despising everybody else.

These negative points have to be emphasized because the political quack has discovered that he can use the prestige of science to advertise his nostrums, just as the medical quack does. Science has attained its prestige because, in the past, men of science have been sincere and humble-minded. That prestige may very easily be destroyed.

Lastly, there is a very definite cause for the appearance of a new kind of quackery of politics. Sham remedies are not usually forthcoming unless there is a real disease. The real disease consists of unsolved problems raised by the new kind of collectivity. They can be dealt with by the totalitarian methods

of Hitler, which can claim in a very plausible manner to be scientific. But that road leads only to disaster.

Aristotle pointed out that if automatic machines were available there would be no need for slaves; but the chief use of machines has been to make men their servants. This is true of the machines in the literal physical sense that Aristotle was thinking about. It is even truer of those collective relationships of human beings in modern society, which operate in a machine-like way and of which Aristotle never dreamt in his worst nightmare. The direct personal relationships of men out of which our ideas of right and wrong have developed were never always good. In fact, it was because they were often evil that we ever made that distinction. But the distinction could be seen. It was clear enough to anybody who wanted to see it. The whole trouble with our new, mechanized, large-scale relationship is that we have no immediate moral intuition about it and those who think in terms of it lose their capacity to distinguish; or, rather, the machine becomes their god, and they suppose that whatever serves the machine is good.

The principles underlying Western Democracy, which belong to the Jewish-Greek-Roman-Christian tradition, have never been completely realized and many blunders have been committed in the attempt to realize them. Still, they do contain something of infinite value: that which can turn the association of the herd into a true human community. The new problems of collective organization are a challenge to this tradition, because unless it can solve them it will perish, and the process of human evolution will mean no more than that men were once a small and simple herd and now they are a large and mechanized herd.

PRINTED IN
GREAT BRITAIN
AT THE
UNIVERSITY PRESS
OXFORD
BY
CHARLES BATEY
PRINTER
TO THE
UNIVERSITY