The Implications of Science for the Law

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It has become a truism — almost a cliché, indeed — to remark that we are living in an age of science. Nevertheless I am constrained to begin this essay by uttering that truism. For I wish to argue that the law — our profession, our art, our discipline, call it what you will — has grown out of touch with the scientific outlook that dominates our age, and that it must change its attitude so as to harmonise with that outlook if it wants to remain a living and respected force in contemporary society.

At the outset of the Gifford Lectures which he delivered in 1959-60, the eminent physicist Carl-Friedrich von Weizsäcker [1] discussed the interrelationship of science and religion. He pointed out that religious agnosticism is, most probably, the dominant attitude of the western mind in our time. The years which have passed since he spoke have confirmed rather than diminished the force of this observation. Of course we have recently seen the emergence of cults ranging from witchcraft and satanism to the "Jesus freaks", but these are really no more than excrescences. They do little or nothing to satisfy on a large scale the psychological hunger of human beings for something to believe in and to guide their lives by. That hunger, von Weizsäcker thought, was being filled in our time by science, or, as he preferred to put it, by "scientism" — faith in science.

It is interesting that the cults which I have just mentioned are at present showing signs of increased popularity and that at the same time we can discern in the western world signs of a reaction against the dominance of science. This may have occurred because, to quote von Weizsäcker again, "the guiding factor in faith is not belief but trust". The object of faith needs to be trustworthy — to demonstrate that the reliance placed on its powers is not misplaced. It is precisely because organised or institutional religion lost this quality of trustworthiness over a long period of time that it has ceased to be a dominating force; such calamities as the Lisbon earthquake of 1755 dealt it blows from whose effects

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[1] C. F. von Weizsäcker, *The Relevance of Science*, (1964). All references are to chapter 1.

it never really recovered, and the ability of science to make good its promises drove the lesson home.

In recent years science itself appears to have been treading the same path of distrust and rejection. In the late nineteenth and early twentieth centuries it rode the crest of a wave of optimism. The prevailing mood was one of belief that every problem could be solved by science, which was leading us rapidly towards a paradise that we were just on the point of entering. The claims of scientists which provided the underpinning of this mood, though understandable enough if considered in their historical and social context, were too large. It is one thing to have the ability to find solutions to a problem, and quite another to choose the wise solution from among the possibilities. Questions of value enter into the act of choice, and one of the features of nineteenth and early twentieth century science was its affirmation that it was not concerned with choice and evaluation — that its sole task was to provide explanations and techniques and that it was for others to decide how those explanations and techniques should be used.

Here again we are witnessing a change of mood or of heart; scientists today are examining their responsibilities to the society in which they live. Meanwhile, the technologically-based countries are struggling to deal with the problems of pollution, population increase, and so on which the uncritical use of technology has produced, and not surprisingly there is a temporary disenchantment with science. I say a "temporary" disenchantment because scientism, like any other faith, will not disappear until something better appears to displace it. And I can see no reason to suppose that such "faiths" as occultism, satanism, or the "Jesus revolution" will prove adequate replacements. After all, they were in the past weighed in the balance and found wanting (for the purposes I have been discussing). Moreover it is an observable fact that the societies which have not yet reaped the benefits of modern science and technology are most anxious to do so, despite the accompanying perils; it is the technologically-advanced societies that are showing disenchantment, and even then only with the evils that uncontrolled technology brings in its train. Technology is, in truth, something like a remedial drug in the armoury of weapons against the diseases of life as it might be lived by men in the "state of nature" envisaged by Hobbes. We would prefer to have a drug without serious side effects, but we would nevertheless rather have a drug with side effects than no drug at all. Hence the solution to our present problems seems to lie in the hope of improving and controlling technology — not in repudiating and abandoning it.

What follows is written with these beliefs in mind. Despite the temporary reaction in some quarters against the dominance of science, I believe that during any future period with which the readers of this essay are likely to be concerned the methods of science will be a major influence in guiding our course. I further believe that an institution or system of social control that disregards or turns its back on the method of science is likely to wither away. For it is the method of science that provides the basis for our trust in its powers, and we are not likely to continue to endure an institution in which we can no longer place our trust.

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At this point I should discuss a probable objection. "Nonsense", the reader may say. "How can it be claimed that the law is out of touch with the scientific spirit and discoveries of the age? A glance at the various law reviews circulating throughout the common-law world is enough to refute any such thesis. The reviews are packed chock-a-block with articles discussing the application and use of scientific discoveries and techniques for legal purposes."

I readily concede the apparent force of this reply. Indeed, if I were willing to devote a great amount of time to no useful purpose, I could at this point add a footnote which would extend over many pages or tens of pages, giving citations to this material. Except for the occasional, very rare instance, however, I do not regard the extra-legal material discussed in these articles, and sometimes in the court decisions, as dealing with science. It would be more accurate to say that what is invoked and discussed is pseudo-science.

To ascertain the scientific status (or otherwise) of a particular theory we can fruitfully make use of the tests propounded by Sir Karl Popper, the noted philosopher of science. Not only is he a recognised authority in his own field, but his views are accepted by eminent scientists [2] who have concerned themselves with the matter as being an accurate description of how scientists behave.

Popper's criterion of the scientific status of a theory is its falsifiability, or refutability, or testability. In a lecture delivered in 1953,[3] he explained that he had originally formulated this criterion

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[2] Such as Sir John Eccles and Sir Peter Medawar (both Nobel prize-winners for medical research), and Michael Polanyi (a physical chemist).

[3] Originally entitled "Philosophy of Science: a Personal Report", republished as chapter 1 of his *Conjectures and Refutations*, (1963), esp. pp. 36-38. See also: Popper, *The Logic of Scientific Discovery*, (1959).

some 35 years earlier as a summary of considerations which had led him to the following conclusions:

1. It is easy to obtain confirmations, or verifications, for nearly every theory — if we look for confirmations.

2. Confirmations should count only if they are the result of *risky predictions*; that is to say, if, unenlightened by the theory in question, we should have expected an event which was incompatible with the theory — an event which would have refuted the theory.

3. Every "good" scientific theory is a prohibition: it forbids certain things to happen. The more a theory forbids, the better it is.

4. A theory which is not refutable by any conceivable event is non-scientific. Irrefutability is not a virtue of a theory (as people often think) but a vice.

5. Every genuine *test* of a theory is an attempt to falsify it, or to refute it. Testability is falsifiability; but there are degrees of testability: some theories are more testable, more exposed to refutation, than others; they take, as it were, greater risks.

6. Confirming evidence should not count *except when it is the result of a genuine test of the theory*; and this means that it can be presented as a serious but unsuccessful attempt to falsify the theory (Popper now terms confirming evidence which satisfies this criterion "corroborating evidence").

7. Some genuinely testable theories, when found to be false, are still upheld by their admirers — for example by introducing *ad hoc* some auxiliary assumption, or by re-interpreting the theory *ad hoc* in such a way that it escapes refutation. Such a procedure is always possible, but it rescues the theory from refutation only at the price of destroying, or at least lowering, its scientific status. (Popper describes a rescuing operation of this kind as a "conventionalist twist" or a "conventionalist stratagem").

Popper explains that at the time he was engaged in formulating this test he applied it to several theories: specifically, Einstein's theory of gravitation, astrology, the Marxist theory of history, the psycho-analysis of Freud, and the individual psychology of Adler. The latter three theories came under his scrutiny because they were being widely discussed among students at the time; this perhaps explains why the analytic psychology of Jung (which should surely accompany the theories of Freud and Adler) was not included. Of the five theories considered, Einstein's passed the test easily (Eddington's eclipse observations in 1919 had brought important

confirmation of it), but the remaining four failed. The predictions of astrology were so vague that they could scarcely fail, and were thus irrefutable. The Marxist theory of history was testable, and in some respects its predictions had proved false; but by re-interpreting the theory and the evidence (the conventionalist stratagem) the supporters of the theory rescued it from refutation.

The theories of Freud and Adler were of a different kind, for they were, and still are, completely non-testable. It is impossible to conceive of human behaviour that would refute them. They thus cannot lay claim to scientific status. Exactly the same point has been made in the last few years by Sir Peter Medawar, as regards psycho-analysis and the much more recent existentialist school of thought in psychiatry.[4]

To the list of theories just discussed we could add some others which are currently enjoying a great vogue as all-embracing explanations. The behaviourist theory of B. F. Skinner has temporarily superseded psycho-analysis (or so we are sometimes told), and in the field of sociology "alienation" and "urbanisation" are making strong claims to be the root of all evil. Since these theories exhibit exactly the same defects as those listed by Popper — vagueness of concepts, irrefutability, re-interpretation *ad hoc* — we are justified in rejecting their pretensions to be scientific as opposed to mythological.

This last remark needs a qualification as regards behaviourism. It originated as a methodology in the study of psychology, and there can be no complaint as to its scientific status so long as it remains a methodology. As Medawar neatly puts it:

> Behaviourism... taught psychology with brutal emphasis that 'the dog is whining' and 'the dog is sad' are statements of altogether different empirical standing, and heaven help psychology if it ever again overlooks the distinction.[5]

The advocates of behaviourism have, however, gone far beyond treating it as a methodology; they have erected it into a theory, and in doing so have eradicated the distinction that Medawar makes. Starting from the fact that 'the child is weeping' is a very different type of statement from 'the child is sad', they have moved to arguing that behaviour such as that described by 'the child is weeping' is all that exists, and that states of mind, feelings, purposes,

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[4] Medawar, *Science and Literature*, Encounter (January, 1969), 15, at p. 22. See also: Medawar, *The Art of the Soluble*, (Pelican, 1967), and Medawar, *Induction and Intuition in Scientific Thought*, (Methuen, 1969).

[5] Medawar (1967), *ibid.*, at p. 100.

and so on (as in 'the child is sad') are fictions which mankind no longer needs. Behaviour is all; it can be fully described and explained in terms of stimulus and response, and it is completely determined by the environment, i.e. everything outside the skin of the human being that (I could not, in this context, properly say 'who') is behaving. Thus Skinner was reported recently as saying:

> Consider a woman who has a baby. It cost her a lot of pain and trouble to have it. But she didn't design that baby; it was all settled at the moment of conception what the baby was going to be like. The same thing is true when a man writes a book, invents things, manages a business. He didn't initiate anything. It's all the effect of past history on him. That's the truth, and we have to get used to it.[6]

I quote this passage because it illustrates some of the difficulties that behaviourists find themselves in. The speaker has not managed to eradicate references to allegedly mythical persons, thoughts, and feelings, and it is highly improbable that such a task could be performed. Moreover, it is hard to see what force should be given to the last sentence of the quotation. Skinner's utterances are, on his theory, merely a part of my environment, and as such they have no claim to preference over the contrary utterances of an anti-behaviourist.

There is no need for me to set out the reasons which make behaviourism as a theory not only impracticable but indeed meaningless; the only point I wish to make is that its irrefutability (in so far as it can be said to have any real meaning) robs it of any pretension to scientific status. And I would add, in passing, that if all other objections to it could by any chance be overcome, there would be some formidable scientific problems for it to meet. It is easy enough for a behaviourist to assert that no man initiates anything — that his brain acts simply as a machine for processing stimuli into responses. But there is powerful evidence from neurophysiologists that the brain acts in quite a different way.[7]

In one respect, however, behaviourism may well pose a problem for lawyers — indeed, for society as a whole — that could be more troublesome than any problem posed (up to the present time at any rate) by the other theories I have mentioned. For it has given rise to a dubious practice called "aversion therapy". The nature of this is explained by Professor B. F. Singer, an experimental

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[6] Time Magazine, vol. 98, (September 20, 1971), at pp. 49 *et seq.* See also: Skinner, *Science and Human Behaviour*, (1953) and Skinner, *Beyond Freedom and Dignity*, (1971).

[7] Sir John Eccles, *Facing Reality*, (1970).

psychologist, in an article intended to inform lawyers of recent "advances" and accordingly published recently in a law review.[8] It merits a detailed comment.

For some years, experimental psychologists have been investigating the behaviour of rats, with a view to ascertaining the effectiveness of what they term "punishment". The design of the experiments was pioneered by Skinner. A good deal of information has been accumulated. The rats are isolated in a situation where they have the opportunity of pressing a lever; if they press it they get an electric shock and so they quickly give up pressing it. If time is allowed to elapse between pressing the bar and receiving the shock, the rat takes longer to give up the practice. Again, the severer the shock on pressing the bar, the more quickly the rat gives up. It has even been found that an animal subjected to treatment of this kind which is sufficiently painful will starve to death rather than repeat the behaviour that produces the pain.

These may be important scientific discoveries of the twentieth century. I am inclined to think, however, that they do not provide any information that was not known centuries ago to circus animal trainers. At the present time, the trainers are prevented by laws about cruelty to animals from acquiring further experiences that would complement the experimental observations. The laws probably do not apply in scientific laboratories or protect rats. Nevertheless it may be that the experimenters have slighly uneasy consciences, since they use the term "punishment" to describe the shocking of the rat. It seems a curious use of the word.[9]

There might be some difficulty in applying the information derived in this way to human beings, arising from the fact that the human brain is so vastly different in its structural complexity from that of a rat or other lower animal as to merit the comment that it is different in kind rather than in degree.[10] (I do not think, incidentally, that Professor Singer mentions this fact.) Leaping over this difficulty with gay abandon, some psychologists and psychiatrists have devised the technique known as "aversion therapy", which works in the same way as the rat experiments. Thus if we wish to stop a man from sucking his thumb, we can wire him up to a machine which will give him an electric shock every time he puts his thumb in his mouth. If he co-operates with the therapist in

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[8] B. F. Singer, *Psychological Studies of Punishment*, (1970), 58 Calif. L. Rev. 405 *et seq.*

[9] M. Ginsberg, *On Justice and Society*, (London, 1965), chapter 10.

[10] Eccles, *op. cit.*, n. 7, chapter II.

a series of sessions during which he puts his thumb in his mouth repeatedly and each time gets a shock, he soon learns not to suck his thumb. It is not, at present, known whether he will retain the lesson for the rest of his life, and it may well happen that he takes to sucking his little finger instead. Nevertheless, it can be claimed that he has been cured, at least temporarily, of his thumb-sucking; and if need be we can repeat the process and cure him of his little-finger sucking, his middle-finger sucking, his straw sucking, and so on — if we and he do not get bored.

Professor Singer shows how "aversion therapy" can be applied to "cure" criminal behaviour. He discusses a case in which a habitual woman shoplifter sought help by its use. The initial efforts failed, but:

> The therapist then repeatedly showed the patient a treatment film in which a woman entered a co-operating store while a number of people in the store overtly watched. When the woman then shoplifted several items on a counter, the film showed expressions of horror and disgust on the faces of those watching. At the moment the woman in the film shoplifted the items, the therapist shocked the patient. Hospital personnel (nuns) administrated the treatment. This treatment was successful. The patient finally stopped shoplifting, and she reported uneasy feelings of being watched whenever she entered a store. The therapist planned to repeat the treatment every few months.[11]

I must confess to some difficulty in reconciling the final sentence of this extract with the claim that the treatment was "successful". Perhaps the explanation is that the therapist did not have many patients — which would not be surprising, even though he had the help of nuns to show that what he was doing was ethically acceptable. Another explanation could be deduced from Singer's remark, in the paragraph that follows this extract, that:

> no one really knew how long the treatment would be effective. It might have lasted only a few months or a lifetime. Since stores are such common environmental objects, extinction might soon set in.[12]

["Extinction" here refers to the effect of the treatment on the shop-lifting, not to the patient.]

This seems to suggest that the criterion of "success" is something other than permanent suppression of shop-lifting tendencies on the patient's part. However, in a footnote [13] Singer reports that "Bandura [the author of a book on behaviour modification] is optimistic about the potential durability of such treatments, given

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[11] Singer, *op. cit.*, n. 8, at p. 432.
[12] *Ibid.*, at p. 433.
[13] *Id.*, footnote 106.

the proper procedures." This no doubt rallies the reader's hopes, though Singer almost at once dashes them again by noting the patient's later uneasiness whenever she entered a store. In the next sentence, however, he raises them again by remarking that the uneasiness, though "certainly a personal handicap", was not as great a handicap as the patient's "previous affliction", and that such a result is "part of the price of successful aversion therapy".[14]

At this point I add that it is an inevitable price. It arises in this instance because "shoplifting" has been "treated" by methods which ignore what a lawyer would call the *mens rea* of the shoplifter. Of course, the behaviourist must ignore this, because mental states do not enter into his universe of discourse. But it seems obvious that they must enter into any meaningful description of criminal conduct. One can test this by endeavouring to distingnish between the activities of a woman who, while the shop assistant is elsewhere, picks up an article on the counter and puts it in her shopping basket, intending to carry it to the cashier's desk and pay for it, and those of another woman, who similarly picks up a similar article and puts it in her shopping bag intending to steal it. The distinction must of course be made without reference to the intentions of either woman. I do not believe that this can be done, and I am confident that a criminal code could not be written in terms which eschewed any reference to mental states.

Singer is not, apparently, troubled by these problems, for he follows his description of the shoplifting case by an enthusiastic vision of the future:

> One can treat almost any criminal behaviour in a similar manner. Particularly when working with a prisoner serving a sentence of a year or more, the behavior therapist would have time to discover the most effective treatment, and having found it, he could make the conditioning thorough. The program might require community co-operation. For example, a large banking enterprise could establish a branch office for the aversive conditioning and testing of bank robbers. Correction personnel could administer most of the program. Given the time and the resources, a behavior therapy program could make a bank robber want to vomit every time he saw a bank, could make an armed robber shudder every time he saw a gun. As experimenters have successfully conditioned verbal and imaginal stimuli, such a program could also induce these reactions whenever the convicted thief even thought or talked about guns and banks. The program could include booster treatments after prison whenever needed. Afterwards, the offender should probably do his banking by mail.[15]

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[14] *Id.*
[15] *Id.*

The date when we could hope to implement such a programme is not suggested, but I should imagine it will be some time after 1984. Ond I should warn that there may be some problems in enlisting the aid of the correction personnel (perhaps nuns will once again help out) and of the rest of the community, including the bank officials. After all, they may have to endure a lot of unpleasant sights and smells.

The reader may think that in the last-quoted extract Singer is being humorous. In my estimate, however, both the immediate context of the extract and the rest of the article give the lie to any such explanation.

Up to this point, Singer has been talking about "aversion therapy" as it has hitherto been practised, that is, as a form of "treatment" carried out at the request and with the co-operation of the patient. Almost at once, however, he mentions that "while a voluntary aversion therapy program would probably be most effective, involuntary treatment could also work. Such therapy could be part of a regular sentence or an alternative to it." [16]

Here the wheel has finally come full circle. There is really nothing new about the use of physical torture as a means of special deterrence. In the past it was far more used than imprisonment, though the favoured methods were the lash, the pillory, the stocks, and the ducking stool. Since it was difficult to exert close quantitative control over the amount of pain inflicted — a point which troubled Bentham [17] — it is understandable that contemporary enthusiasts prefer to use electric shocks and induced nausea, thus allowing us refinements of control unknown to our predecessors. Just as modern technology has produced this benefit, so also modern techniques of jargon permit us to disguise what we are doing by such reassuring words and phrases as "patient", "treatment", "cure", and "involuntary aversion therapy". I prefer the older methods as at least more honest.

After all this, the reader will not be surprised to learn that among the possibilities for improvement of our present unscientific and ineffective methods of dealing with convicted criminals, Singer recommends consideration of the following: requiring the offender to make a public apology to his victim who would then ceremoniously [sic] forgive him; requiring the offender to wear a scarlet letter; and the revival of stocks and dunkings. He consoles

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[16] *Ibid.*, at p. 434.

[17] Bentham, *Principles of Penal Law*, Part II, Book II, chapter I, found in *Works of Jeremy Bentham*, (Bowring ed., 1843), I, at pp. 414-415.

us with the remark that some of these treatments (he does not say which) "are in many respects more humane than prison" and that they might be more effective (the latter point appears to ignore the experience of the past).[18]

I have selected this article by Singer for critical discussion because it exhibits most of the vices that the lawyer should be on his guard against. The trivial and well-known is disguised in the trappings of scientific language and set forth as if it were a new discovery; the basic theory (behaviourism) is quite untestable but advanced as if it were established scientific fact; and every possible problem of jumping from the behaviour of rats in laboratories to that of human beings in society is glossed over with the statement that the "scientific" laws of behaviour can only be thus extrapolated if all other things are equal (though it is surely obvious that when the jump is made other things will not and cannot be equal). Inconsistencies in the available data that would put a genuine scientist on his guard are relegated to footnotes,[19] and above all there is the nauseating disclaimer of moral responsibility by means of frequent reminders that the ethics of what might be done is a matter for "society" and that the scientist is "no more qualified than any other man" [20] to place a value judgment on particular applications of his knowledge (one might conclude from this remark that he is also no less qualified and no less subject to moral duties). I find this last point peculiarly distressing and repulsive. I have no use for torturing people to get evidence, but I would find a mediaeval treatise on the rack more honest and decent than, say, an experimental psychologist's paper on "the elicitation of information by involuntary aversive stimuli", especially if the latter were accompanied by disclaimers of moral responsibility.

Let me, however, make it quite clear that my criticisms are not directed to all forms of experimental psychology. On the contrary, I have no doubt that much experimental work in psychology is of great value, and that psychology could not hope to progress as a science if it were not firmly based on experimental work wherever possible. Our problem, as lawyers, is to distinguish

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[18] Singer, *op. cit.*, n. 8, at p. 435.

[19] Thus Singer, *ibid.*, footnote 112, at p. 434, refers to recent work demonstrating the possibility of "conscious control over brain waves". It does not seem to occur to him that such conscious control is irreconcilable with the view that human behaviour is completely determined and explainable solely in terms of stimulus and response.

[20] Singer, *ibid.*, at p. 410.

between the genuinely scientific work in the field and the remainder, to make use of the former, and to reject the latter.

I should like at this point to make a brief reference to another species of pseudo-science which is showing signs of intruding into the administration of justice. A trial is a form of historical enquiry and thus its outcome is necessarily a matter of uncertainty. We can never recapture the past, and so our results will always leave us with the uncomfortable feeling that we may have been wrong. Accordingly, there have been some recent efforts to lessen this discomfort by the recommendations of techniques, based on mathematics, which will supposedly enable us to place more confidence in our assessments. One well-known move of this kind has been the introduction of "prediction tables" into the process of sentencing convicted offenders.[21] A more recent move is the effort to make use of Bayes's theorem in combining the inferences which can be drawn from various items of evidence.[22]

I believe that many of these recommended mathematical or statistical techniques are basically unsound. I do not wish to cast doubt on the value of statistical tables when properly used. But statistics are collections of data about groups of people or events with common characteristics, and while they can properly be used to make inferences about the future behaviour of similar groups, they tell us nothing about the future behaviour of any individual member of the group. Nevertheless, the belief that they can be used to predict the outcome of individual instances persists, as the wealthy proprietors of gambling casinos can attest.[23]

The Bayes's theorem type of error is of a different order. Once again, I do not wish to cast doubt on the validity of the theorem, which I gather has long been in use by statisticians. It can be said, however, that the mathematical formulae used in calculating probabilities are all based on arithmetic, and involve dealing with items that can be counted. For instance, in dealing with the throws of dice we start with the fact that the six faces of each die can be counted one by one. We can also count the number of instances in a series (albeit long or short) of throws. And so far as I can

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[21] For discussion see papers in E. Glueck and S. Glueck, *Ventures in Criminology*, (Cambridge, Harv. U.P., 1964).

[22] L. H. Tribe, *Trial by Mathematics: Precision and Ritual in the Legal Process*, (1971), 84 Harv. L. Rev. 1329. Professor Tribe advances excellent reasons for rejecting the use of this technique as too dangerous in practice, but I do not understand him to argue (as I do) that it is theoretically unsound.

[23] H. C. Levinson, *Chance, Luck and Statistics*, (Dover ed., 1963) provides a full, simple and non-mathematical discussion of these matters.

judge, the Rev. John Bayes in his theorem pre-supposed that the prior but unknown probabilities which concerned him could be computed (at least in theory) by counting instances.

The legal literature on this topic uses the Bayes theorem in a different way. It combines what are termed "subjective probabilities" with "objective" ones.[24] The latter are ascertained (at least in theory) by counting instances, but the former cannot even in theory be ascertained in this way. They are no more than an assessment, in numerical terms, of the strength at which the believer assesses his belief. Thus, if his belief in an inference is very weak he might assess the likelihood that the inferred event had occurred as being 1: 1000, whereas if it were a much stronger belief he might assess it as 1: 50. But in neither case would the figure be arrived at by counting a series of instances, for in fact the event under consideration would (if it had occurred at all) be an unique instance.

From this it will be seen that the numbers used in assessing subjective probabilities are no more than symbols used to determine a ranking order. It thus seems totally improper to use arithmetical techniques in combining such numbers with numbers (used in assessing objective probabilities) ascertained or ascertainable by counting. The former are assigned quite arbitrarily and are easily replaceable by letters or other symbols; the latter are not.[25]

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[24] Tribe, *op. cit.*, n. 22, at p. 1348 points out that the justification for doing this is that subjective probabilities obey the same rules as objective probabilities, "once a few entirely plausible postulates are accepted". Whether these postulates are entirely plausible or should be accepted is, however, a matter of debate. Among them is a postulate of transitiveness, i.e. that if A believes event X to be more probable than event Y, and event Y to be more probable than event Z, he must therefore believe event X to be more probable than event Z. No doubt A ought to think in this way, but it cannot be assumed that he does. Human beings are often irrational.

[25] Whitehead, in one of his last lectures, made it very clear that there is a vast difference between the behaviour of numbers which are operated arithmetically and the behaviour of what the numbers represent. In *Immortality*, The Interpretation of Science, (1961), he says, at p. 266:

> Let us take the simplest case; for example, the sentence, 'One and one make two'.
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> Obviously this sentence omits a necessary limitation. For one thing and itself make one thing. So we ought to say, 'One thing and another thing make two things'. This must mean that the togetherness of one thing with another thing issues in a group of two things.
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> At this stage all sorts of difficulties arise. There must be the proper sort of things in the proper sort of togetherness.
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> The togetherness of a spark and gunpowder produces an explosion, which is very unlike two things. Thus we should say 'The proper sort of to-

Despite these criticisms, which have been made time and again by others far more eminent and expertly qualified than I am, I expect to see the pages of legal literature continue to contain large amounts of pseudo-science and pseudo-mathematics. It is not hard to see why this should be so. The material that I have been discussing is comforting. It gives an appearance of introducing certainty or near-certainty into realms which have hitherto been full of doubt. In doing so, it meets what seems to be a basic need of human beings.[26]

Moreover, some of this material provides further advantages. The general theories of psycho-analysis, behaviourism, alienation, and so forth have, as Popper has said,[27] all the qualities of a religious revelation. Wherever the convert looks, he can find instances of their applicability and explanatory power. And those of them which reject considerations of morality and responsibility as outworn fictions not only provide ammunition for certain classes of lawyers (such as criminal defenders) but also comfort every one of us when we transgress (as, sooner or later, we all do).

Again, such explanations as "alienation" or "urbanisation" comfort us, paradoxically, by offering no hope of a practicable solution to certain evils that beset us, such as the burgeoning of drug addiction. There are some practicable steps we could take to lessen, if not to eradicate, many of these evils, but they are, as a rule, unpalatable steps. It is preferable to avoid them and talk, instead, about the "inevitable fruits of urbanisation" or whatever. We can thus do nothing at all and at the same time have an excuse for our inaction. To say this is not to deny the existence of problems arising from alienation or urbanisation. My criticism is directed to the use of these concepts as all-embracing explanations for every form of social evil.

Let us, however, return to the proper use of science in the administration of justice. As I have said, it can and should play a most valuable part. But there are dangers. I shall briefly mention two that have attracted my notice, adding the warning that there are probably several others.

The first and most obvious danger is that genuine scientific material is often unfamiliar and hard to understand. It is therefore

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getherness of one thing and another thing produces the sort of group which we call two things'.

My point is that subjective and objective probabilities do not have the "proper sort of togetherness".

[26] G. Yahoda, *The Psychology of Superstition,* (1969), esp. chapter VIII.

[27] Popper, *op. cit.,* n. 3, at pp. 34-35.

usually, perhaps always, desirable to have it critically scrutinised by experts in the relevant field in order to avoid the possibility of error. The danger of misinterpretation is especially acute where reliance is placed on secondary sources [28] or where the material is of the kind which is familiar and thus regarded as being of common knowledge (examples are interpretations of statistical data and the elementary uses of probability calculus).[29]

The second danger is that scientific material is always provisional and is constantly becoming out-of-date, so that yesterday's truth is today's error. Unfortunately, however, in the law yesterday's belief, when embodied in a binding precedent, becomes authority for

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[28] *Cf.* Evatt, J. (dissenting) in *Chester* v. *Waverley Corporation*, (1939), 62 C.L.R. 1 (High Ct.) at pp. 14 *et seq.* At p. 47 the learned judge argues that fright or nervous shock causes actual physical damage, and quotes in support a note in 11 Can. B. Rev., at pp. 516-517. The writer of that note (and, following him, Evatt, J.) appears to be confusing the two types of shock described in medicine as "primary" and "secondary": see K. Bowden, *Forensic Medicine*, (2nd. ed., 1965), at pp. 250-252.

[29] *Commonwealth* v. *Malone*, (1946), 354 Pa. 180, 47 A. 2d. 445, is the most startling instance known to me. The Supreme Court of Pennsylvania there upheld the conviction of the defendant (aged 17) for the second-degree murder of his friend. The two youths, who had somehow obtained a five-chambered .32 revolver and a cartridge, agreed to play "russian roulette" (described in the report as "russian poker"). The defendant placed the cartridge in the chamber to the right of the firing pin, placed the revolver against his friend's side, and pulled the trigger three times. On the third pull the weapon discharged and caused a fatal wound. The report does not show whether the cylinder was twirled between each pull, but does show that the defendant testified that he had no intention of harming his friend and did not expect the gun to go off.

The Court upheld the conviction with the remark that the fatal pull of the trigger was done intentionally "in reckless and wanton disregard of the consequences which were at least sixty per cent certain from his thrice attempted discharge of the gun". It seems clear that they were greatly impressed by their "sixty per cent certainty". But 60% is an impossible figure; the only possibilities are 20%, 25%, 33⅓%, 50% and 100%. We can discount the last of these on the ground that although it was in fact correct it was clearly not realised to be so by the defendant. Of the remaining four choices, the most likely seem to be either 20% or 33⅓%, though the meagre information in the report does not aid one to decide the matter. The Court seem to have been impressed by the fact that 60% is more than one-half, and it is reasonable to suppose that they would have taken a different view if they had assessed the probabilities correctly.

I may add that I have taught this case to a class of American graduate students, some of whom had studied elementary probability problems in their undergraduate courses. Not one of them noticed the Court's error until it was pointed out.

today.[30] Hence courts may, with the best of intentions, find themselves unwittingly perpetuating what the world of science now regards as error.

These dangers should not lead us to distrust scientific data and evidence — they should warn us merely to exercise caution and to keep up-to-date in our use of scientific material. But while we can and should make use in our work of the help that genuine contemporary science can afford, an even more useful aid for us is that of scientific method. The essential feature of this is that the scientist adopts in his work a critical as opposed to a dogmatic attitude.[31] It is this approach to the universe that accounts for his visible success and gives rise to the trustworthiness of his work. And if we wish to obtain a similar trustworthiness, we should use his method.

I shall now give some examples of how this can be done.

III

There are four major features of our legal system which can be properly described as fundamentally unscientific in spirit. They are:

1. the adversary system of trial
2. the basic postulates of the rules of evidence
3. the portrait of human functioning which underlies many, indeed most, of our substantive rules of law and
4. the rule of *stare decisis*

I shall consider them in that order.

As Professor Sawer points out:

> Court procedures are often classified as either inquisitorial or adversary. In the ideal type of inquisitory tribunal, the judge supervises and even himself carries out much of the process of calling evidence, and examining and cross-examining witnesses; he takes the initiative in establishing what happened. A basic theory of this type is characteristic of most systems which have been influenced by Roman and Canon law. In the adversary system, the main responsibility for calling, adducing, and

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[30] In *Hobson* v. *Hobson*, (1942), 59 W.N. (N.S.W.) 85, Bonney, J. gives an excellent account of blood groups as evidence of paternity. This was cited with approval in *R.* v. *Jenkins, ex parte Morrison*, [1949] V.L.R. 277 (Sup. Ct.) (though there was much expert evidence in the latter case also). Since 1942, much more has been discovered about the matters discussed by Bonney, J., and it would be dangerous for a court today to rely on his account of them.

[31] Popper, *op. cit.*, n. 3, esp. at pp. 49-52.

> testing evidence is with the parties; the judge has no independent power of calling evidence, interferes little with the conduct of the parties or their representatives when handling evidence except by way of excluding inadmissible material, and regards his task as judging on the basis of what he is told, not on a basis of the 'actual' facts. This approach is characteristic of most systems derived from English common law.[32]

This is an accurate general description, the force of which is not lessened by the fact that no trial system is completely "pure"; the common law trial has some inquisitorial features, and those European trial systems which have been influenced by Roman and Canon law some adversarial ones. Nevertheless the basic adversarial approach is distinctive of the common law trial, and is supported by the vast majority of practising lawyers in common law jurisdictions. Even the late Judge Frank, who bitterly condemned some features of our trial system, regarded them as excesses or excrescences on a basically sound approach. In support of his view that the adversary approach is sound, he cites Macaulay's remark that we obtain the fairest decision when two men argue, as unfairly as possible, on opposite sides, for then it is certain that no important consideration will altogether escape notice.[33]

The source of Macaulay's remark is not given, and he may well have been discussing the presentation of argument. In that event, what he was saying would have been true enough. But totally different considerations apply when we are dealing with the adduction of evidence.

Imagine a case of a scientist asked to decide which of two rival theories, each propounded by an eminent scientist, is to be considered correct. If he is presented by the two rivals with all the relevant data, and then given the arguments of each, presented as strongly as possible, he might be able to perform the task. Even if he thought that neither rival was completely in the right, he could construct his own theory by borrowing elements from each of those already put before him. We might liken this case to that of an appellate court deciding between rival advocates.

But no scientist would dream of making a decision such as that which I have just posited, if he knew (a) that neither of the rival theorists was bound to put forward all the data in his possession — indeed, that each would regard it as proper to suppress any "inconvenient" or inconsistent observations of whose existence he knew and (b) that he, the adjudicator, would be precluded

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[32] G. Sawer, *Law in Society*, (Oxford, 1965), at pp. 72-73.

[33] J. Frank, *Courts on Trial*, (Princeton, 1949), chapter 6.

from suggesting or requiring the elicitation of any additional data that might prove critical. Indeed, he would ordinarily expect to perfect his theory or make his decision by pursuing every line of enquiry which *he* thought might throw light on the matter.

It is precisely because the two factors just mentioned operate in the ordinary adversary trial that the latter must be regarded as basically unscientific in approach, and unsound. The judge — the court, that is to say — is supposed to be deciding the case by applying the law to the "true facts". In saying this, I realise as fully as does anyone else that the "true facts" can never be ascertained (since the past cannot be completely recalled), and that the reality of a common law trial is that it is a battle between the parties rather than a search for truth. But we do not advertise our courts as substitutes for boxing rings or jousting fields. We hold them out as being temples of justice engaged in the search for truth, and I do not believe that society would tolerate their continued existence on any other basis. If this is accepted, then we may recognise that they do not at present in fact search for the truth, but we ought at least to try to improve their actual performance so that it more nearly resembles the ideal.

At a common law trial there is no real reason for supposing that the truth will emerge; for the adversary system is designed so as to permit the parties to conceal it from the court. If one or other party is aware of inconvenient evidence which casts doubt on — nay, refutes — the story which he puts forward as a basis for adjudication, he is perfectly entitled to withhold it if he can. He takes the risk that the other party may triumphantly produce it; and if that happens, the court will learn of it. The other party may, however, be unaware of the existence of the evidence, in which case the court will never learn of it. This cannot be answered by asserting confidently, with Macaulay, that it is certain that no important consideration will altogether escape notice. Such an assertion confuses an incentive to obtain contradictory evidence with the capacity or ability to obtain it.

Nor can my criticism be met by saying that the point may be noticed by the court even if the opposing party overlooks it. In such an event the second unscientific hobble placed on the court in our system comes into action; the court cannot call for evidence.[34]

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[34] *Titheradge* v. *R.*, (1917), 24 C.L.R. 107 (High Ct. of Australia), esp. *per* Isaacs and Rich, JJ., at p. 118. Moreover, severe restrictions are placed on the presentation of further evidence (in rebuttal) by a party who has closed his case: *Shaw* v. *R.*, (1952), 85 C.L.R. 365. These decisions, although given in criminal cases, also apply, as the judgments show, to civil cases.

No doubt the court can suggest very strongly to counsel that certain evidence ought to be presented. But if, for tactical or other reasons, counsel declines to present it, the court must go without it.

I need not give examples by way of elaboration, for what I have been saying is within the knowledge of every practising lawyer. I wish, however, to add one point, which is that the deficiencies of our adversary system operate most harshly and dangerously in criminal as opposed to civil trials and wherever reliance is placed on circumstantial evidence.

I need say little about the special problem of criminal trials. It is surely obvious that even the most favourable things that can be said in support of the adversary system require a presupposition that the contending parties are more or less on a par as regards access to sources of evidence. That presupposition is plainly untrue where, as in a criminal case, the individual is pitted against the state. It is not simply a matter of financial resources, though of course many criminal defendants are poor. It is rather that the police have in practice (whatever the theory) quasi-coercive powers of obtaining statements from witnesses, as well as many more investigators.

Circumstantial evidence poses a different problem. Let me say at once that I agree with the view that it is, if of high quality, far more persuasive and far less open to error than testimonial evidence.[35] But just as the latter possesses defects of which our courts take no account (as I shall later argue) so does circumstantial evidence often pose a problem that is overlooked.

The proper use of it can be regarded as a paradigm case of scientific method. The investigator, being confronted by a problem, forms a hypothesis to account for it; in this stage the process is outside logic; Medawar (whose account of scientific method[36] I am following) terms it intuitive. But having formed the hypothesis, the investigator subjects it to rigorous testing and criticism. He makes use of logic by asking what consequences flow from his hypothesis and then takes steps to find out whether what follows logically is indeed the case. At this stage it is not enough to say that the hypothesis accords with the data already in existence, nor is it enough to look for merely confirmatory data (remember Popper's remark that we can always find confirmatory evidence if we look for it). The investigator must endeavour to

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[35] 1 *Wigmore on Evidence,* (Boston, 3rd. ed., 1940), secs. 25, 26.

[36] Medawar, (1969), *op. cit.,* n. 4, esp. sec. III. See also: Medawar, (1967), *Hypothesis and Imagination, op. cit.,* n. 3.

find consequences that would render his hypothesis false, and it is when he fails to do so that he can place confidence in his hypothesis.

A really good police investigation would follow this procedure. In practice, however, what happens is — more often than not, I believe — that the investigator pins his faith to the confirmatory data that he has and looks for more of the same, and disregards or explains away any apparently contradictory facts. Though this is an understandable human failing, the result is that many trials begin with a theory, based on circumstantial evidence, that has not really been tested with a view to falsification.

Let us, however, assume that the trial starts with an apparently sound prosecution hypothesis. At this point difficulties come thick and fast. The investigatory process is at once split up. The theory is presented by the prosecuting counsel, not by the investigator who conceived it. The witnessess give evidence which is intended by the prosecution to confirm the theory. There is, however, no guarantee that the conclusions drawn by the jury from this evidence will be the same as those drawn by the original investigator. Moreover, the defence may now present further evidence which tends to falsify the original hypothesis. At the end of all this the jury draw their conclusion, but all we know from them is the result. We are precluded from seeing what hypothesis they acted on and hence from asking whether it was in any way falsified by the data.

It is possible that in this way the jury may arrive at a true and just conclusion. My point is that we have no reason to assume that they will. To be sure, they will have been instructed that they must acquit if there is in their view a reasonable doubt as to the accused's guilt.[37] But to carry out such an instruction requires not merely a willing and conscientious mind (which we ought to attribute to each juror) but a trained mind. It may easily happen that the jurors will think that pieces of evidence A and B point inexorably to guilt, and that so do pieces C and D, and nevertheless fail to realise that hypothesis X, for which A and B account, is quite inconsistent with hypothesis Y, accounted for by C and D.

The point was tellingly illustrated in the case of Colin Campbell Ross, who was hanged in 1922 for the felony-murder of a young girl. On his appeal to the High Court of Australia against his conviction, Isaacs, J. said, in the course of a long dissent, that:

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[37] 9 Wigmore, *op. cit.*, n. 35, sec. 2497.

> The Crown placed before the jury a mass of evidence, but in that mass there were three principal pieces of testimony: the Matthews confession, the Maddox confession and the Harding confession. On certain crucial points they were absolutely inconsistent. But the Crown left to the jury the choice, *inter alia,* of accepting any of them as having been made *and as being true*; the whole matter now centres around this one vital question: What is the true position, supposing the jury believed that Ross did *make* the Harding confession, and that every word of it was *true*? Now, to my mind, if the Crown arguments are constantly tested by this one question, *"Suppose the Harding confession was accepted as true"*, all difficulties disappear, because, being itself a denial of intention to kill, it at once excludes other evidence relied on to show a contrary state of facts. It is only when that question is lost sight of, and it is conjectured, that the jury did an impossible thing, namely, accepted the Harding confession as the true state of facts, namely, that murder was not intended, and at the same time drew from other evidence an inference entirely inconsistent with it, namely, that murder was intended, that the verdict can be sustained.[38]

This powerful argument was rejected by the rest of the Court. In their views, the trial judge had correctly instructed the jury as to what constituted murder, and the jury were entitled to apply his instruction to so much of the evidence as they chose to accept; they "were at liberty to believe as much of or as little of the [Harding] confession as they choose".[39] This may be technically correct,[40] but it is surely most unsafe to assume that having arrived at their own construction of what the prisoner had in fact done, they were capable of correctly applying to that version of the facts (which had not until then been advanced) a general direction as to the law of murder.

A rather different species of the same generic problem — ensuring that the hypothesis actually acted upon has been adequately tested — is exemplified by such cases as *Russel*[41] and *Bullock.*[42] In these the trial proceeded with the prosecution offering a specific hypothesis as to how the accused had committed the crime charged, which hypothesis the accused flatly denied. In their deliberations the jury apparently concocted a totally different hypothesis and sought further instructions from the judge, in the light of which they in each case convicted the accused. The conviction was upheld

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[38] *Ross* v. *R.*, (1922), 30 C.L.R. 246, at pp. 258-259.

[39] *Ibid.*, at p. 253.

[40] The rule is that the criterion of "no reasonable doubt" applies to the whole of the issue, not to specific aspects of the evidence. See: 9 Wigmore, *op. cit.*, n. 37.

[41] [1933] Vict. L.R. 59.

[42] (1954), 38 Cr. App. R. 151.

on appeal after the further instruction had been adjudged to be good law. Again, this may be technically correct; but it will be observed that in neither of these cases had the jury's hypothesis been subjected to any testing whatsoever against the available data, and still less against any additional data that might have been obtained by recalling some one or more of the witnesses.

The foregoing discussion may be summarised by saying that our adversary system of trial is utterly unscientific in method, and unlikely to help in the ascertainment of the facts which are the foundation of every legal dispute. The inquisitorial system follows the general lines of a scientific investigation and is much to be preferred. There is little to prevent us from changing our present system. Of course, the latter places a premium on tactical advocacy, and change is accordingly likely to be resisted by those who make an excellent living by their skill in using tactics. Also the word "inquisitorial" conjures up, somewhat unjustifiably, dark pictures of the Star Chamber and the Spanish Inquisition; it would be better to use another word, such as "investigatory" or "initiatory". Moreover, the adoption of such a system would involve the disappearance of jury trial in its present form (since the mental operations of the investigator-decider must be open to scrutiny and criticism). It would not, however, necessarily involve the complete disappearance of juries — a step which I would not wish to see taken. Juries could remain as assistants or assessors to the judge in the task of investigating and settling the facts, and they could be given a decisive voice in the eventual disposition of the case on the basis of those facts.

I now turn to the basic postulates of the law of evidence. The common law trial system is distinctive in the emphasis it gives to the testimony of witnesses actually present in the court. This emphasis reflects the ubiquitous operation of the hearsay rule, and that rule, in its turn, is derived from an insistence that the most reliable evidence obtainable is that of witnesses who will recount what they have seen or heard at some past time, under the twin guarantees of an oath and a liability to be cross-examined.[43] In short, underlying much of our system of evidence are two assumptions — (1) that a person is more likely to tell the truth if he

[43] 5 Wigmore, *op. cit.*, n. 35, sec. 1362. Wigmore regarded the requirement of an oath as of secondary and minor importance, but his reasoning in the section referred to lacks factual support at the critical point. He realises this objection, but brushes it aside with the remark that the factual support is not obtainable.

has sworn an oath to do so, and (2) that whether a person is or is not telling the truth can best be tested by cross-examination.

These assumptions could easily enough be empirically tested. So far as I know, however, no real effort has been made to test either of them. Perhaps one reason for this failure to even attempt to verify our hypotheses springs from a fear that they would be shown to be incorrect, and that we should have to reconsider the very foundations of our system.

It may have been true at some time in the past that the taking of an oath acted as a powerful spur to a witness to tell the truth. But as I noted at the outset, the influence of religious beliefs on the conduct of our daily lives has greatly declined in recent decades, and it is at present reasonable to suppose that most witnesses who take an oath are quite unworried by the possibility of supernatural sanctions. At the same time I do not doubt that the oath has the effect of making some witnesses (for example, those with strong religious beliefs or consciences) hesitant and worried and perhaps less helpful than they otherwise might have been. My point, however, is that on these matters we are content to guess and assume when we could quite easily take some positive steps to find out.

So also with cross-examination. Wigmore describes it as "the greatest legal engine ever invented for the discovery of truth" and says that "the belief that no safeguard for testing the value of human statements is comparable to that furnished by cross-examination ... has found increasing strength in lengthening experience".[44] He quotes numerous examples in support of his thesis, though the value of these is lessened when we once more recall Popper's remark[45] that it is always easy to find confirmations of a hypothesis if you look for them. And revealingly, he adds that "it may be that in more than one sense it [cross-examination] takes the place in our system which torture occupied in the mediaeval system of the civilians".[46]

The last remark suggests that there may have been some confusion in Wigmore's thinking on this matter. And I believe that, in truth, he is confusing two distinct things. There is, first, the scientific method of testing an hypothesis by critical examination. In this respect we may regard cross-examination as scientific in approach, for it allows the evidence of a partisan witness to be

[44] 5 Wigmore, *ibid.*, sec. 1367.
[45] See text, p. 173 reference to point 1.
[46] 5 Wigmore, *op. cit.*, n. 35, sec. 1367.

critically tested. But we may notice that here "cross-examination" is simply a synonym for "critical interrogation", and that it could, as such, be carried out quite as effectively by an active, investigating judge as by a hostile, opposing counsel.

It is this hostile questioning by an opposing counsel bent on destroying the witness' testimony in chief that is the other and more common entity described by the term "cross-examination". And this is far removed from a mere critical questioning of the witness. For the latter is impartial in approach; the tester is seeking the truth, even if it be what the witness has claimed it to be. The cross-examiner, however, is not seeking the truth; he is seeking to win the case for his client by destroying the witness' credibility even if the witness has told the truth. And he is aided in this task by being allowed to badger and bully the witness, to seek to trap him, to try to wear him down by repeated questioning, to sneer at and ridicule him, to deprive him of any opportunity to explain apparent discrepancies in his answers — I need not lengthen the catalogue. Anyone who has seen a "powerful cross-examination" will readily appreciate why Wigmore compared it to torture. We might also recall the howls of protest that are raised when another type of interrogation — for example, the questioning of a suspect by a police officer — is carried out with the same techniques.

While I do not doubt the value of testing a witness' recollections by careful, calm, critical questioning, I am inclined to believe that cross-examination is a quite different process which is likely to produce a quite different effect. I believe that in the majority of cases it is likely to produce confusion and error rather than truth. In a small minority of cases it may help to reveal the truth, and in yet other cases it will have no real effect other than to leave the witness with an abiding dislike of courts and court procedures.

These are no more than my own beliefs. They, like the opposing "official" beliefs of the law, could be tested empirically. It would not be easy to devise a really careful test, but it could be done. Once again, so far as I know, there has been no real effort to carry out any such test.

In the meantime, the belief in the need for an oath and our opportunity to cross-examine continues to dominate our system of evidence and forces us to give pride of place to the witness in court. We rely very largely on what he today tells the court about what happened at some time in the past. So we should be led to ask: is this reliance justified?

As Wigmore points out, the notion of taking a witness' court statement as evidence of a past occurrence impliedly attributes to the witness the three processes of observation, recollection, and communication. The witness must have observed the event in question and in so doing have received some impression of it in his mind; he must now have a recollection of that impression; and he must communicate his recollection of that impression to the court.[47] We need not here concern ourselves with the problem of communication, for it is plain that if communication is to be of use, it must have been preceded by accurate observation and recollection.

"The notion of Observation", says Wigmore, "is that the external event has in some way or other impressed itself on the witness' senses... This impression... should adequately represent or correspond to the fact itself as it really existed or exists... Again, the function of Recollection is to recall or reproduce the original impressions of observation...".[48] This analysis seems accurate; but it should at once lead us to ask whether such observation or recollection can or does ever occur.

On this point there is a wealth of scientific information available to us. Technically speaking, it must be regarded as provisional, in the sense that (like any other scientific material) fresh data at some future time might require an abandonment or modification of what is believed at present. But the material I am referring to has been known for many years, and has withstood repeated and critical testing. If anything, the future seems more likely to bring an extension of what is at present thought rather than a repudiation of it. And consequently the law can (for the time being) safely act upon the present understanding.

I do not wish to give the impression that I am the first to raise these matters. On the contrary, references to some of this scientific material are to be found in the law reviews and in some legal texts.[49] But for the most part it is used to warn lawyers to be on their guard against possibly faulty observation or recollection in specific cases.

This understates the position. In truth, we can rather say that no witness can observe or recollect in the manner suggested by Wigmore. The reason for this lies in the very structure of the

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[47] 2 Wigmore, *op. cit.*, n. 35, sec. 478.

[48] *Id.*

[49] *E.g.* J. Marshall, *Law and Psychology in Conflict*, (Indianapolis, 1966).

human brain, sensory organs, and central nervous system. Our eyes are not cameras which convey accurate pictures of all that exists in front of them to the brain, which then records the result like a videotape to be stored and played back when the appropriate button is pressed. The true situation is almost the reverse of that process. The eye consists of numbers of light-sensitive cells which respond in different ways to external stimuli. The optic nerve conveys the reactions of these cells to the brain which processes, selects, combines, and interprets them so as to produce a "mental picture". In so doing it rejects what is "unimportant" or "uninteresting". In brief, the act of vision is a creative, not a recording, act.[50]

Hence it is correct to say that we do not see and cannot see what is "there" to be seen. We see, rather, so much of what is "there" as may be of importance to us (for example, to enable us to survive), or of interest to us, or in accordance with our expectations of what will be "there". If what is "there" is unimportant, or uninteresting, or not something we are expecting to see, we shall not see it. Again, the detection of an object against a similar background, or of something that would ordinarily be moving when it has "frozen" to avoid observation, is difficult because the brain has, so to speak, to work against the structure of the eye; the eye is built so as to perceive dark against light, to perceive movement against a still background, and so on. We may summarise this by saying that, if by "faulty" observation we mean, with Wigmore, observation that does not correspond to the material that exists to be observed, all observation is faulty. So also with other sense impressions — touch, taste, smell and hearing.

If we pause to think about the matter, the selective and creative nature of our handling of sense impressions from the external world is something we are all familiar with. Who has not engaged in a conversation at a party, conscious of a mere buzz of noise from the other guests in the room, only to find himself suddenly distracted by hearing his name mentioned by a guest in the opposite corner? This phenomenon is often discussed in the literature as the "cocktail party" effect, and it illustrates the way in which we reject and disregard many or most of the sound waves impinging upon our ear drums but select out those of importance or interest to us.

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[50] P. Nathan, *The Nervous System*, (1969).

The selectiveness of perception is, however, only part of the infirmity inherent in placing reliance on the recollected observations of a witness. For when we investigate the phenomenon of memory, we find a similar selectiveness. The act of remembering involves the storage and retrieval of information, but it is far more complicated than that. In a series of elegant experiments carried out in the earlier part of this century, Bartlett showed that:

> ...remembering is not the re-excitation of innumerable fixed, lifeless and fragmentary traces. It is an imaginative reconstruction, or construction, built out of the relation of our attitude towards a whole active mass of organised past reactions or experience, and to a little outstanding detail which commonly appears in image or in language form. It is thus hardly ever really exact, even in the most rudimentary cases of rote recapitulation, and it is not at all important that it should be so.[51]

Bartlett produced a theory to account for the results of his experimental observations. The theory has been subjected to some criticism, and anyway it does not concern us here. The observations that led to it are what is important, and more recent data have confirmed them. Since Bartlett wrote, much work has been done by neuro-physiologists, but it is fair to say that the mechanism of memory is still not fully known. Nevertheless, we find Nathan, a research neurologist, summarising the results of present knowledge in much the same was as Bartlett:

> A remembered scene is not the same as the original scene. It is pale and weak in all respects. The accompanying emotion is far less, much of what was first experienced has dropped out of the remembered scene, much else has become changed or distorted and a great deal has been forgotten... Remembering is similar to imagining a scene; in some respects, remembering is re-imagining. The memory is a reconstruction, based on the original experience.[52]

Later he reminds us that "a conscious effort to look for the past experience is not always the best way of finding it." [53]

The effect of all these teachings is surely clear enough. The picture of the witness as a passive perceiving, recording, and recalling machine — which is how, according to Wigmore, the common law system of trial views him — is totally false. It is not hard to see why this should be so. The common law theory was built up long ago, well before any scientific investigation of perception and memory was attempted. On that theory an enormous

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[51] F. Bartlett, *Remembering* (reprinted ed., 1950), at p. 213.
[52] Nathan, *op. cit.*, n. 50, at p. 338.
[53] *Ibid.*, at p. 348.

superstructure — the whole detailed system of rules of evidence — has been erected. The foundations have disappeared from view, and so we fail to realise that with the passage of time they have crumbled away.

Biologically, perception and memory enable us as living beings to cope with the present by appropriate behaviour. Their purpose is not to enable us to relive the past. But a trial is concerned with bringing the past to life. To rely on the present testimony of witnesses to achieve that end is to court disaster.

There exist, however, many means of reliving the past in the present. A tape recorder will reproduce in the present a sound from the past; similarly, a photograph or a videotape will reproduce a sight from the past. A contemporary document will reproduce today what its maker recorded at the time, and although the imperfections of faulty observation and recollection will affect its reliability, they will probably be fewer and smaller than those which occur when the maker of the record tries today to recall the event.

I would think, therefore, that a scientific approach to the reconstruction of a past transaction would lead us to prefer the mechanical record to the human, and the contemporary statement to the present recollection of a witness. Such an approach is almost the exact opposite of what occurs in the courts.

In saying this I have not overlooked the obvious objection that tape recordings can be tampered with, contemporary documents altered, and so on. Of course they can; and the possibility that such falsification has occurred should not be overlooked in a given case. But the danger can be guarded against, and it is of minor importance when we realise that reliance on the present testimony of witnesses contains an inbuilt falsification process that cannot be removed.

The foregoing discussion leads naturally to my third point — the incorrect portrait of man which underlies many of our substantive rules of law. Here I am concerned with a different aspect of human functioning. I referred earlier to Popper's view that Freud's basic theory of psycho-analysis could not, because of its lack of susceptibility to being tested, be accorded the status of being scientific. I indicated my agreement with that view, and it is now appropriate for me to indicate my agreement with Popper's further remark that:

> ... this does not mean that Freud and Adler were not seeing certain things correctly: I personally do not doubt that much of what they say is of

considerable importance, and may well play its part one day in a psychological science which is testable.[54]

Whether or not he was the originator of the idea, Freud must surely be credited with having made us aware that the human mind functions at different levels. As Nathan puts it, "when we are conscious, so much of our mental and psychological activity is in fact unconscious. We make use of conscious effort only in small parts of our mental activities." [55]

The reader may well say that there is nothing startlingly new about this observation. What is startling, however, is the realisation that the vast majority of our daily actions result from the unconscious activity of the brain, and that this is a biological necessity. Successful living depends in part on an ability to relegate what begins as conscious action to the domain of the unconscious. The piano student begins by having to direct his conscious mind to getting his fingers to depress the keys correctly, and as he progresses, he relegates much of the activity of "playing the piano" to an unconscious level and frees his conscious mind to concentrate on the more important process of interpreting the music. This is the process of acquiring a technique or skill, and it involves, as a rule, conscious repetitive actions, until the unconscious can "take over". So also with the baby learning to pick up objects and to walk, and with the adolescent learning to drive. The brain processes involved are still in the very early stages of investigation, though it has been repeatedly shown that the activity of the brain is ceaseless. Nor should we overlook the mysterious ability of the skilled performer to bring what would ordinarily be relegated to the unconscious level temporarily into the realm of complete consciousness, so that he can modify what he is doing.

The relevance of this can be simply stated. The rules of law pay no attention to the importance of unconscious activity. They assume that we all function continually at a single level of complete consciousness and fault us when we have failed to do so.

It would take a series of volumes on the various branches of the law to illustrate this thesis, and I do not propose to lengthen this essay by attempting the task.[56] It is enough to remind the reader of the current vogue in criminal law for insisting on purpose, foresight, and the assumed behaviour of the "reasonable man" as

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[54] Popper, op. cit., n. 3, at p. 37.

[55] Nathan, *op. cit.*, n. 50, at p. 338.

[56] Or to add footnote references to each point discussed, since the doctrines mentioned are known to every lawyer.

the measure of liability, with all the distortions that result therefrom; how, for example, can we sensibly demand of a man who is attacked and defends himself that he should use no more force than is reasonably necessary? In doing so are we not in reality asking that he should direct his attention to measuring the precise degree of force being used by the aggressor? And if he attempted to do so, would he not greatly reduce the likely success of his defence?

Again, much of the law of tort ranges around negligence and the concept of foreseeability. To be sure, in certain stereotyped classes of action, such as motor accident litigation, we turn to specific questions such as whether the defendant driver was keeping a proper lookout. But even then, the notion seems to be that he should be constantly considering at a conscious level every possibility of danger, although if every driver were to do this there would first be a large crop of accidents, following which all traffic would grind to a halt. In less stereotyped cases the notion of foreseeability is carried to absurd lengths, and courts demand of litigants that they should have directed their minds to (foreseeable) events which would never occur to the ordinary person's mind.

Then again, there are the many cases in the fields of contract and commercial law in which the courts, faced with an agreement that makes no provision for an event that the parties never considered, decline to go beyond the agreed terms, remarking that since the parties could have made some provision on the matter but failed to do so, the court will not make one for them. In effect, the courts in such cases penalise the parties for making unconscious assumptions about the expected continuity of conditions. Allied to these are the cases in which the courts assume, in making their decisions, that in their everyday dealings people read the conditions endorsed on tickets, dockets, and the like, that they are capable of correctly understanding and interpreting what they supposedly read, and that it would be possible for them to stipulate for and obtain changes in the conditions if they did not like the effect of them.

These are a few examples. The reader will doubtless find others occurring to his mind, once he directs his attention to the point. The assumption that each of us functions as a constantly thinking and foreseeing being, addressing his mind consciously to every aspect of every transaction that he encounters every day, pervades the whole of our law. It is a false assumption. Necessarily, most of our daily activities are carried out automatically by unconscious

mental activity, and even where we think about a given matter we continue to make, without conscious thought, numerous assumptions as to surrounding circumstances. It may be possible, with arduous effort, to bring some of this unconscious activity under conscious control, but few of us have been trained for the task or are capable of being successfully trained for it. It is probably desirable that this should be so, as any large-scale attempt to eradicate unconscious mental activity would rapidly bring normal life to a stop.

Surely, then, our rules of law should be bottomed on the actualities of human mental life instead of on some impossible ideal. The law should deal with and regulate the lives of human beings as they really exist. At present it endeavours to fit humanity into a Procrustean bed of its own devising.

Lastly, I turn briefly to the rule of *stare decisis*. In recent years it has been somewhat relaxed, and in its stricter forms it operates in very few courts (the Court of Appeal in England is one of them [57]). But although the rule of *stare decisis* no longer retains its full force, it still exercises a potent influence on judicial practice. Courts which assert that they have power to overrule their previous decisions add to that assertion conditions to hobble themselves, such as that the power must be exercised with great caution or only in very special circumstances. The emphasis on the sanctity of an earlier decision remains.

The attitude of the courts in our common law system is thus one which is basically dogmatic and authoritarian. As such it is the opposite of a scientific attitude, which, although not repudiating received beliefs merely because they are received, is determined to approach them in a critical spirit, to test their validity, and to reject them if, as a result of the test, they are found to be unsound.[58]

There are, of course, eminent lawyers who would dispute this point. Indeed, very recently, two members of the Court of Appeal in England have asserted (following in this regard earlier legal authorities) that law is a science.[59] The basis of this assertion is that just as such sciences as physics and chemistry are concerned with the measurement and analysis of physical substances, so the law is concerned with the analysis and measurement of reported decisions.

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[57] *Barrington* v. *Lee*, [1971] 3 W.L.R. 962 (C.A.).

[58] Popper, *op. cit.*, n. 3, at pp. 49-52.

[59] *Incorporated Council of Law Reporting* v. *Attorney-General*, [1971] 3 W.L.R. 853 (C.A.), at pp. 865 (Sachs, L.J.), 874 (Buckley, L.J.).

The analogy is on its face a poor one; there is a world of difference between analysing and measuring physical substances and analysing and measuring words. But of much greater importance than the poverty of the analogy is the total misunderstanding of the nature of scientific activity which the judges display. Scientists are *not* engaged in collecting "facts" for analysis, in the hope that some "law" will turn up in the process. They are engaged in formulating hypotheses to explain problems that interest them, and in the rigorous criticism and testing of those hypotheses. As Medawar puts it, "scientists are building explanatory structures, *telling stories* which are scrupulously tested to see if they are stories about real life." [60]

A case recently decided by the High Court of Australia [61] illustrates just how different is the procedure of a court. A succeeded against B at the trial of an action, and B appealed to the Court of Appeal in New South Wales. He was ordered on 10th February by that Court to file and serve appeal books on or before 31st March. Owing to delays by the law stationers, only four copies of the appeal book were ready by 31st March, and these were filed on that day. Copies to serve on A's solicitors were not ready until 6th April, when they were served. The order of 10th February had been made in a form which stated that if the filing and service of the appeal books did not take place on or before 31st March the appeal was "to stand dismissed for want of prosecution". Nevertheless, in September the Court of Appeal ordered that the filing and service which had taken place was a sufficient compliance with its order of 10th February, thus allowing the appeal to proceed.

From this latter order A appealed to the High Court. That Court held (Gibbs, J. dissenting) that the appeal stood effectively dismissed on 31st March and that neither the Court of Appeal, nor for that matter any other court, had an inherent jurisdiction to revive a dismissed appeal.

The Court reached this conclusion partly on the basis of authority. Most of the latter was technically of persuasive status only, but there was also a binding precedent in the form of an earlier unreported decision of the High Court. As Gibbs, J. pointed out, the persuasive authority was susceptible of differing interpretations,

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[60] Medawar (1967), *Hypothesis and Imagination, op. cit.*, n. 4. See also: Medawar (1967), *Two Conceptions of Science, op. cit.*, n. 4 and Medawar (1969), *Induction and Intuition in Scientific Thought*, for repudiations of the view that the essence of scientific activity lies in measurement, analysis, etc.

[61] *Bailey* v. *Marinoff*, (1971), 45 A.L.J.R. 598.

and the earlier High Court decision was not only technically distinguishable, but had also been given without adequate argument by one of the parties (who appeared in person) and without calling on counsel for the other party for any argument at all on the point. Nevertheless the judges of the majority saw no sufficient reason (note the mode of approach) for reconsidering the earlier decision of the Court.

These judges were of course not content to rest there. They made it plain that they thought the reason for both the earlier and the instant decision a sound one — namely, that a court which allowed the reinstatement of a proceeding which it had finally disposed of would not be promoting the due administration of the law or of justice. This proposition, if I may use Medawar's telling phrase,[62] was made not by reasoning but by asseveration. Yet it is a proposition which in some respects is capable of being tested. The courts of the United States, I believe, allow the exercise of powers such as that denied by the High Court, and do so without undue harm to the administration of justice. Moreover, if it be said that there are some undesirable features which accompany the exercise of such a power in the United States, one could go on to enquire whether those features are inevitable accompaniments of the power's exercise or are capable of being avoided. As for the promotion of justice, one perhaps cannot test the matter in the same way (for justice appears in different garbs to different eyes); but I leave it to the reader to decide whether decisions such as this promote either justice or respect for the courts.

The case illustrates the two main respects in which our judicial method, in respect of the use of precedent, is the antithesis of scientific method. Firstly, there is the dogmatic reliance on past authority as virtually unquestionable. This contrasts with the scientific attitude of continuing critical evaluation and modification of received notions. The courts' attitude can in part be explained by a decent respect on their part for their legislatures as proper instigators of major changes. But it is well known that in many respects the legislatures do not expect to be called on to intervene — they leave the courts to get on with their own business of promoting the orderly development of the law and its adaptation to contemporary conditions. The courts' own attitudes, however, prevent them from satisfactorily discharging the latter task.

Secondly, the rule enunciated in the case is grounded upon its supposed effects, or upon the effects which a different rule would

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[62] Medawar (1969), *op. cit.*, n. 4, at p. 6.

supposedly have. But when courts have once reasoned in this way, they continue to reiterate the reason without attempting to investigate whether the desired results in fact occur. For example, more than 20 years have elapsed since a number of United States courts [63] adopted a rule (given constitutional force 10 years ago [64]) prohibiting the use in criminal prosecutions of evidence obtained by means of an unlawful search or seizure. The avowed purpose of the rule was to deter the police from resorting to unlawful practices. The number of cases still reaching the courts in which the rule is applied suggests that the police are not in fact being deterred. But there is virtually no sign of any attempt by the courts to reconsider the rule in the light of its actual effectiveness.[65]

In short, the courts totally ignore the possibility of making use of feedback — neatly defined by Medawar as "the control of perfomance by the consequences of the act performed" and described, also by him, as a "general stratagem that underlies almost all regulative process or processes of continuous control".[66] Feedback is an essential feature of scientific method. The scientist devises a hypothesis, draws inferences (logically) as to its consequences and carries out tests to ascertain whether the consequences of the hypothesis in fact occur. If they do not, he modifies the hypothesis to take account of his new data and starts the cycle anew. In contrast, the courts frame a hypothesis by reference to its supposed consequences, and convert the hypothesis into a "law" with disdainful disregard of the question whether the consequences ever could or do occur. Yet there is ample room for the incorporation of feedback into a legal system. It is the spirit of scientific enquiry that is lacking.

Indeed, the whole system of *stare decisis* rests on assertion rather than critical investigation. Courts assert that the system is essential to produce certainty, like treatment of like cases, and other desirable features of a system of legal control. Yet books have been written which amply demonstrate that the system pro-

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[63] In 1949 only a minority of jurisdictions had adopted the rule discussed in the text. See: *Wolf* v. *Colorado*, 338 U.S. 25; 93 L. Ed. 1782 for a summary of the position. In 1955 the Supreme Court of California reversed its earlier decisions and adopted the exclusionary rule: *People* v. *Cahan*, 44 Cal. 2d. 434; 282 P. 2d. 905. In so doing it gave a lead which was rapidly followed in other jurisdictions.

[64] *Mapp* v. *Ohio*, (1961), 367 U.S. 643; 6 L. Ed. 2d. 1181.

[65] Burger, C.J. criticised the rule on the ground of its alleged ineffectiveness in *Bivens* v. *Six Unknown Federal Narcotics Agents*, (1971), 29 L. Ed. 2d. 619.

[66] Medawar (1969), *op. cit.*, n. 4, at p. 54.

duces none of these effects. They are ignored. So, too, is the experience of the European systems of law that operate without a rule of *stare decisis.*

In summary, then, the rule of *stare decisis* — the very heart of our legal system — is irreconcileable with the scientific approach. So long as we retain it, albeit in a weakened form, the claim that law is a science must be treated with derision.

IV

In his elegant monograph *Elizabeth and Essex,*[67] written during the earlier part of this century, Lytton Strachey contrasted the procedure which led to the execution of Dr. Ruy Lopez for treason with the improved methods current in his own time. He said that:

> The true principles of criminal jurisprudence have only come to be recognized, with gradually increasing completeness, during the last two centuries; the comprehension of them has grown with the growth of science — with the understanding of the nature of evidence, and the slow triumph in men's mental habits, of ordered experience and reason. No human creature can ever hope to be truly just; but there are degrees in mortal fallibility, and for countless ages the justice of mankind was the sport of fear, folly, and superstition.[68]

The implication that we have eradicated fear, folly, and superstition was unfortunately premature. So too was Strachey's belief that scientific methods have taken their proper place in our system. It is probably an exaggeration — but one nearer, I believe, to the truth than Strachey's view — that all we have done is to dress our fear, folly, and superstition in respectable garb.

Indeed, in some respects our present state is worse than our earlier one. Fear, folly, and superstition were in the past tempered to some extent by considerations of ethics, justice, and humanity. The incorrect notion that science consists of measurement and analysis has led us to downgrade those considerations because they cannot be measured or precisely analysed. And in so doing we have lost much. The detailed provisions of the American Law Institute's Model Penal Code may be more capable of precise application to cases of homicide, but they lack the intuitive understanding of human nature displayed by Sir Michael Foster in his celebrated Discourse on the topic.

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[67] L. Strachey, *Elizabeth and Essex,* (1928).
[68] *Ibid.,* chapter 6.

We are not behaving scientifically when we eschew considerations of ethics and humanity because they cannot be measured, or because we have no special expert advice about them to guide us. We are concerned in the law with the regulation of human behaviour, and such considerations are an integral and essential part of the situations that we deal with. To leave them out of account is to adopt an unscientific approach, for it involves the conscious disregard of essential data.

I return, then, to my starting point. Science is the dominant feature of our age, and its methods account for its success and consequent pride of place. If we wish our legal system to achieve similar success and public respect, we should adopt its methods and established teachings wherever we can. Specifically, this would involve, at the least, a re-organisation of our methods of ascertaining the facts at issue, a reconsideration of our rules of evidence and of substantive law to ensure that they are based on a correct understanding of human nature and human behaviour, a re-evaluation of the role which decisions of the past should be allowed to play in the formulation of decisions for the present and the future, and the incorporation into the law of a continuing feedback system. These steps would doubtless require us first to undertake an agonising re-appraisal of everything that we are at present doing; and it is to be expected that the implementation of changes would require much time, thought, and informed debate.

But surely we ought at least to make a start.