KARL POPPER

THE MYTH OF THE FRAMEWORK*

> "Those who believe this, and those who do not, have no common ground of discussion, but in view of their opinions they must of necessity scorn each other."
>
> PLATO

I

One of the more disturbing features of intellectual life at the present time is the way in which irrationalism is so widely advocated, and irrationalist doctrines taken for granted. In my view, one of the main components of modern irrationalism is relativism (the doctrine that truth is relative to our intellectual background or framework: that it may change from one framework to another), and, in particular, the doctrine of the impossibility of mutual understanding between different cultures, generations, or historical periods. In this paper I discuss the problem of relativism. It is my claim that behind it lies what I call 'The Myth of the Framework'. I explain and criticize this myth, and comment also on arguments due to Quine, Kuhn, and Whorf which have been used in its defence.

The proponents of relativism put before us standards of mutual understanding which are unrealistically high; and when we fail to meet those standards, they claim that understanding is impossible. Against this, I argue that if common goodwill and a lot of effort are put into it, then very far-reaching understanding is possible. Furthermore, the effort is amply rewarded by what we learn in the process about our own views, as well as about those we are setting out to understand.

This paper sets out to challenge relativism in its widest sense. It is important to present such a challenge. For today, the increasing escalation in the production of weapons has made survival almost identical with understanding.

II

Although I am an admirer of tradition I am, at the same time, an almost

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orthodox adherent of unorthodoxy: I hold that orthodoxy is the death of knowledge, since the growth of knowledge depends entirely on the existence of disagreement. Admittedly, disagreement *may* lead to strife, and even to violence; and this, I think, is very bad indeed, for I abhor violence. Yet disagreement may also lead to discussion, to argument — to mutual criticism — and this, I think, is of paramount importance. I suggest that the greatest step towards a better and more peaceful world was taken when the war of swords began to be supported, and sometimes even to be replaced, by a war of words. This is why my topic is of practical significance.

But let me first explain what my topic is, and what I mean by my title, 'The Myth of the Framework'. I will discuss, and argue against, a myth — a false story that is widely accepted, especially in Germany. From there it invaded America where it became almost all-pervasive. So I fear that the majority of my present readers may believe in it, either consciously or unconsciously. The myth of the framework can be stated in one sentence, as follows:

A rational and fruitful discussion is impossible unless the participants share a common framework of basic assumptions or, at least, unless they have agreed on such a framework for the purpose of the discussion.

This is the myth I am going to criticize.

As I have formulated it, the myth sounds like a sober statement, or like a sensible warning to which we ought to pay attention in order to further rational discussion. Some people even think that it is a logical principle, or based on a logical principle. On the contrary, I think that it is not only a false statement but also a vicious statement which, if widely believed, must undermine the unity of mankind, and must greatly increase the likelihood of violence and of war. This is the main reason why I want to combat it, and to refute it.

Let me say at once that the myth contains a kernel of truth. Although I contend that it is a vast exaggeration to say that a fruitful discussion is *impossible* unless the participants share a common framework, I am very ready to admit that a discussion among participants who do not share a common framework may be *difficult*. A discussion will also be difficult if the frameworks have little in common, and it will be the easier the greater the overlap between the frameworks. Indeed, if the participants agree on all points, it will often turn out to be the easiest and smoothest discussion possible — though it is likely to be a little boring.

But what about fruitfulness? In the formulation I gave of the myth, it is a *fruitful* discussion which is declared impossible. Against this I shall defend the thesis that a discussion between people who share many views is unlikely to be fruitful, even though they may regard it as pleasant and highly satisfactory, while a discussion between vastly different frameworks can be extremely fruitful even though it will usually be difficult and *perhaps* not quite so pleasant (though we may learn to enjoy it).

I think that we may say of a discussion that it was the more fruitful the more its participants learned from it. And this means: the more interesting questions and difficult questions they were asked; the more new answers they were induced to think of; the more they were shaken in their opinions; and the more they could see things differently after the discussion; in short, the more their intellectual horizon was extended.

Fruitfulness in this sense will almost always depend on the original gap between the opinions of the participants in the discussion. The greater the gap, the more fruitful *can* the discussion be — always provided of course that such a discussion is not altogether *impossible*, as the myth of the framework asserts.

III

But is it impossible? Let us take an extreme case. Herodotus tells a very interesting though somewhat gruesome story of the Persian King Darius the First who wanted to teach a lesson to the Greek residents in his country, whose custom it was to burn their dead. He "summoned", we read in Herodotus, "the Greeks living in his land, and asked them for what payment they would consent to eat up their fathers when they died. They answered that nothing on earth would induce them to do so. Then Darius summoned the ... Callatians, who do eat their fathers, and asked them in the presence of the Greeks, who had the help of an interpreter, for what payment they would consent to burn the bodies of their fathers when they died. And they cried out aloud and implored him not to mention such an abomination."[1]

Darius, I suspect, wanted to demonstrate the truth of the myth of the framework. Indeed, we are given to understand that a discussion between the two parties would have been impossible even with the help of the interpreter. It was an extreme case of a '*confrontation*' — to use a word much in vogue with believers in the truth of the myth, and a word

they like to use when they wish to draw our attention to the fact that a confrontation rarely results in a fruitful discussion.

But assuming that this confrontation staged by King Darius did take place, was it really fruitless? I deny it. There can be little doubt that both parties were deeply shaken by the experience. I myself find the idea of cannibalism just as revolting as did the Greeks at the court of King Darius, and I suppose my readers will feel the same. But these feelings should make us all the more perceptive and the more appreciative of the admirable lesson which Herodotus wishes to draw from the story. Alluding to Pindar's distinction between nature and convention,[2] Herodotus suggests that we should look with tolerance and even with respect upon customs or conventional laws that differ from our own conventions. If this particular confrontation ever took place, some of the participants may well have reacted to it in the enlightened way in which Herodotus wishes us to react to his story.

This shows that there is a possibility of a fruitful confrontation, even without a discussion, of people deeply committed to different frameworks. Of course, *we must not expect too much*: we must *not* expect that a confrontation, or even a prolonged discussion, will end with the participants reaching *agreement.*

But is an agreement always desirable? Let us assume that there is a discussion and that the issue at stake is the truth or falsity of some theory or hypothesis. We — that is, the rational witnesses or judges of the discussion — would of course like the discussion to end with all parties agreeing that the theory is true if in fact it is true, or that the theory is false if in fact it is false: we should like the discussion to reach, if possible, a true verdict. But we should dislike the idea that agreement was reached on the truth of the theory if the theory was in fact false; and even if it was true, we prefer that no agreement is reached on its truth if the arguments supporting the theory were far too weak to bear out the conclusion. In such a case we prefer that no agreement is reached. And in such a case we should say that the discussion was fruitful when the clash of opinion led the participants to produce new and interesting arguments, even though these arguments were inconclusive. For conclusive arguments are very rare in all but the most trivial issues, even though arguments against a theory may sometimes be pretty strong.

Looking back at Herodotus's story of a confrontation, we can now see that even in this extreme case where no agreement was in sight the confrontation may have been useful and that, given time and patience

— which Herodotus seems to have had at his disposal — it did bear fruit, at least in Herodotus's own mind.

IV

Now I wish to suggest that, in a way, we ourselves and our attitudes are the results of confrontations and of inconclusive discussions of this kind.

What I mean can be summed up by the thesis that our Western civilization is the result of the clash, or the confrontation, of different cultures, and therefore of the confrontation of frameworks.

It is widely admitted that our civilization — which at its best may be described, somewhat eulogistically, as a rationalist civilization — is very largely the result of Greco-Roman civilization. It acquired many of its features, such as the alphabet, and Christianity, not only through the clashes between the Romans and the Greeks, but also through its clashes with the Jewish, the Phoenician, and other Middle Eastern civilizations, and also through clashes due to Germanic and Islamic invasions.

But what of the original Greek miracle — the rise of Greek poetry, art, philosophy, and science; the real origin of Western rationalism? I have for many years asserted that the Greek miracle, *insofar as it can be explained*, was also largely due to culture clash. It seems to me that this is indeed one of the lessons which Herodotus wants to teach us in his *History*.

Let us look for a moment at the origin of Greek philosophy. It all began in the Greek colonies in Asia Minor, in Southern Italy, and in Sicily; places, that is, where, in the East, the Greek colonists were confronted with the great oriental civilizations, and clashed with them, or where, in the West, they met Sicilians, Carthaginians, and Italians such as the Tuscans. The impact of culture clash on Greek philosophy is very obvious from the earliest reports on Thales. It is unmistakable in Heraclitus. But the way in which it leads men to think critically comes out most forcefully in Xenophanes, the wandering bard. Although I have quoted some of his verses on other occasions, I will do so again, because they illustrate my point so beautifully.[3]

The Ethiops say that gods are flat-nosed and black
While the Thracians say that theirs have blue eyes and red hair.

Yet if cattle or horses or lions had hands and could draw
And could sculpture like men, then the horses would draw their gods
Like horses, and cattle like cattle, and each would then shape
Bodies of gods in the likeness, each kind, of its own.

The gods did not reveal, from the beginning,
All things to us; but in the course of time,
Through seeking we may learn, and know things better. . . .

These things are, we conjecture, like the truth.
But as for certain truth, no man has known it,
Nor will he know it; neither of the gods,
Nor yet of all the things of which I speak.
And even if by chance he were to utter
The final truth, he would himself not know it:
For all is but a woven web of guesses.

Although Burnet and others have denied it, I think that Parmenides, perhaps the greatest of these early thinkers, stood under Xenophanes' influence.[4] He takes up Xenophanes' distinction between the one final truth which is not subject to human convention, and the guesses or opinions, and the conventions, of the mortals. There are always many conflicting opinions and conventions concerning any one problem or subject matter (such as the gods), which shows that they are not all true, for if they conflict then, at best, only one of them can be true.[5] Thus it appears that Parmenides (a contemporary of Pindar to whom Plato attributes the distinction between nature and convention) was the first to distinguish clearly between truth or reality on the one hand, and convention or conventional opinion — hearsay, plausible myth — on the other; a lesson which, we may say, he derived from Xenophanes and from culture clash. It led him to one of the boldest theories ever conceived.

The role played by culture clash in the rise of Greek science — mathematics and astronomy — is well known, and one can even specify the way in which the various clashes bore fruit. And our ideas of freedom, of democracy, of toleration, and also the ideas of knowledge, of science, of rationality, can all be traced back to these beginnings.

Of all these ideas the idea of rationality seems to me the most fundamental.

So far as we know from the sources, the invention of rational or critical discussion seems to be contemporaneous with some of these clashes, and discussion became traditional with the rise of the earliest Ionian democracies.

V

In its application to the problem of understanding our world, and thus to the rise of science, rationality has two components which are of about equal importance.

The first is poetic inventiveness, that is, storytelling or mythmaking: the invention of stories which explain the world. These are, to begin with, often or perhaps always polytheistic. Men feel that they are in the hands of unknown powers, and they try to understand and to explain the world, and human life and death, by inventing stories or myths about these powers.

This first component, which may be perhaps as old as human language itself, is all-important and seems universal: all tribes, all peoples, have such explanatory stories, often in the form of fairy tales. It seems that the invention of explanations and explanatory stories is one of the basic functions of the human language.

The second component is of comparatively recent date. It seems to be specifically Greek and to have arisen after the establishment of writing in Greece. It arose, it seems, with Anaximander, the second Ionian philosopher. It is the invention of criticism, of the critical discussion of the various explanatory myths, with the aim of consciously improving upon them.

The main Greek example of explanatory mythmaking on an elaborate scale is, of course, Hesiod's *Theogony*. This is a wild story of the origin, the deeds, and the misdeeds, of the Greek gods. One would hardly feel inclined to look to the *Theogony* to provide a suggestion which can be used in the development of a scientific explanation of the world. Yet I have proposed the historical conjecture that a passage in Hesiod's *Theogony*[6] which was foreshadowed by another in Homer's *Iliad*[7] was so used by Anaximander, the first critical cosmologist.

I will explain my conjecture. According to tradition Thales, the teacher and kinsman of Anaximander, and the founder of the Ionian school of cosmologists, taught that 'the earth is supported by water on which it rides like a ship'. Anaximander, the pupil, kinsman, and

successor of Thales, turned away from this somewhat naive myth (intended by Thales to explain earthquakes). Anaximander's new departure was of a truly revolutionary character, for he taught, we are told, the following: "There is no thing at all that is holding up the earth. Instead, the earth remains stationary owing to the fact that it is equally far away from all other things. Its shape is like that of a drum. We walk on one of its flat surfaces while the other is on the opposite side."

This bold idea made possible the ideas of Aristarchus and Copernicus, and it even contains an anticipation of Newton's forces. How did it arise? I have proposed the conjecture[8] that it arose out of a purely logical criticism of Thales' myth. The criticism is simple: if we solve the problem of explaining the position and stability of the earth in the universe by saying that it is supported by the ocean, like a ship that is supported by water, are we not then bound, the critic asks, to raise a new problem, that of explaining the position and the stability of the ocean? But this would mean finding some support for the ocean, and then some further support for this support. Obviously, this leads to an infinite regress. How can we avoid it?

In looking round for a way out of this frightful impasse which, it appeared, no alternative explanation was able to avoid, Anaximander remembered, I conjecture, a passage in which Hesiod develops an idea from the *Iliad* where we are told that Tartarus is exactly as far beneath the earth as Uranus, or heaven, is above it.

The passage reads: "For nine days and nights will a brazen anvil fall from the heavens, and on the tenth it will reach the earth. And for nine days and nights will a brazen anvil fall from the earth, and on the tenth it will reach Tartarus."[9] This passage may have suggested to Anaximander that we can draw a diagram of the world, with the earth in the middle, and the vault of the heavens like a hemisphere above it. Symmetry then suggests that we interpret Tartarus as being the lower half of the vault. In this way we arrive at Anaximander's construction as it is transmitted to us; a construction that breaks through the deadlock of the infinite regress.

There is I think a need for such a conjectural explanation of the tremendous step that carried Anaximander beyond his teacher Thales. My conjecture, it seems to me, makes the step more understandable and, at the same time, even more impressive; for it is now seen as a rational solution of a very difficult problem — the problem of the support and the stability of the earth.

Yet Anaximander's criticism of Thales and his critical construction

of a new myth would have led to nothing had these not been followed up. How can we explain the fact that they *were* followed up? Why was a new myth offered in each generation after Thales? I have tried to explain this by the further conjecture that Thales and Anaximander together founded a new school tradition — *the critical tradition.*

My attempt to explain the phenomenon of Greek rationalism and of the Greek critical tradition by a school tradition is again, of course, completely conjectural. In fact, it is itself a kind of myth. Yet it does explain a unique phenomenon — the Ionian school. This school, for at least four or five generations, produced in each new generation an ingenious revision of the teachings of the preceding generation. In the end it established what we may call the scientific tradition: a tradition of criticism which survived for at least five hundred years, and which survived some serious onslaughts before it succumbed.

The critical tradition is constituted by the adoption of the method of criticizing a received story or explanation and then proceeding to a new, improved, imaginative story which in turn is submitted to criticism. This method, I assert, is the method of science. It seems to have been invented only once in human history. It died in the West when the schools in Athens were suppressed by a victorious and intolerant Christianity, though it lingered on in the East. It was mourned during the Middle Ages. And it was not so much reinvented as reimported in the Renaissance, together with the rediscovery of Greek philosophy and Greek science.

The uniqueness of this second component — the method of criticial discussion — will be realized if we consider the old-established function of schools, especially of religious and semireligious schools. Their function is, and has always been, the preservation of the purity of the teaching of the founder of the school. Accordingly, changes in doctrine are rare and are often due to mistakes or misunderstandings. When they are consciously made they are as a rule made surreptitiously; for otherwise changes lead to splits, to schisms.

But here, in the Ionian school, we find a school tradition which carefully preserved the teaching of each of its masters while deviating from it afresh in each new generation.

My conjectural explanation of this unique phenomenon is that Thales, the founder, encouraged Anaximander, his kinsman, pupil, and later his successor, to see whether he could produce a better explanation of the support of the earth than he himself had been able to offer.

However this may have been, the invention of the critical method

could hardly have happened without the impact of culture clash. It had the most tremendous consequences. Within four or five generations the Greeks discovered that the earth, the moon, and the sun, were spheres; that the moon moved round the earth, while always 'wistfully' looking at the sun; and that this could be explained by the assumption that she borrowed her light from the sun.[10] A little later they conjectured that the earth rotated, and that the earth moved round the sun. But these later hypotheses, due to the Platonic school and especially to Aristarchus, were soon forgotten.

These cosmological or astronomical findings became the basis of all future science. Human science started from a bold and hopeful attempt to understand critically the world we live in. This ancient dream found fulfillment in Newton. We can say that only since Newton has humanity become fully conscious — conscious of its position in the universe.

All this, it can be shown, is the result of applying the method of critical discussion to mythmaking — to our attempts to understand and to explain our world.

VI

If we look back on this development, then we can understand better why we must not expect any critical discussion of a serious issue, any 'confrontation', to yield quick and final results. Truth is hard to come by. It needs both ingenuity in criticizing old theories, and ingenuity in the imaginative invention of new theories. This is so not only in the sciences, but in all fields.

Serious critical discussions are always difficult. Nonrational human elements always enter. Many participants in a rational, that is, a critical, discussion find it particularly difficult that they have to unlearn what everybody is taught in a debating society, for they have to learn that victory in a debate is nothing, while even the slightest clarification of one's problem, even the smallest contribution made towards a clearer understanding of one's own position or that of one's opponent, is a great success. A discussion which you win but which fails to help you to change or to clarify your mind at least a little should be regarded by you as a sheer loss. For this very reason no change in one's position should be made surreptitiously, but it should always be stressed, and its consequences explored.

Rational discussion in this sense is rare. But it is an important ideal,

and we may learn to enjoy it. It does not aim at conversion, and it is modest in its expectations: it is enough, more than enough, if we feel that we can see things in a new light, or that we have got even a little nearer to the truth.

VII

But let me now return to the myth of the framework. There are many tendencies which may contribute to the fact that this myth is often taken for an almost self-evident truth.

One of these tendencies I have already mentioned. It results from an overoptimistic expectation concerning the outcome of a discussion; the expectation that every fruitful discussion should lead to decisive and deserved intellectual victory of the truth, represented by one part, over falsity, represented by the other. When it is found that this is not what a discussion usually achieves, disappointment turns an over-optimistic expectation into a general pessimism concerning the value of discussions.

A second tendency which deserves careful scrutiny is connected with historical or cultural relativism, a view whose beginnings may perhaps be discerned in Herodotus, the father of history.

Herodotus seems to have been one of those somewhat uncommon people whose mind was broadened by travel. At first he was no doubt shocked by the many strange customs and institutions which he encountered in the East. But he learned to respect them, and to look on some of them critically, on others as the results of historical accidents: he learned to be tolerant, and he even acquired the ability to see the customs and institutions of his own country through the eyes of his barbarian hosts.

This is a healthy state of affairs. But it may lead to relativism, this is, to the view that there is no absolute or objective truth, but rather one truth for the Greeks, and another for the Egyptians, and still another for the Syrians, and so on.

I do not think that Herodotus fell into this trap. But many have done so since — perhaps inspired by an admirable feeling of tolerance which they have combined with very dubious logic.

There is one version of the idea of cultural relativism which is obviously correct. In England, Australia, and New Zealand we drive on the left-hand side of the road, while in America and in most other

countries we drive on the right-hand side. What is needed is *some* such rule of the road, but which of the two — the right or the left — is obviously arbitrary and conventional. There are many similar rules of greater or lesser importance which are purely conventional or customary. Among these are the different rules for pronouncing and spelling the English language in America and in England. Even two quite different vocabularies may be related in a conventional way closely resembling the two different rules of the road, provided the grammatical structures of the two languages are very similar. We may regard such vocabularies, or such rules, as differing in a purely conventional way: there is really nothing to choose between them — nothing of importance.

As long as we consider only conventional rules and customs such as these, there is no chance for the myth of the framework to be taken seriously; for a discussion between an American and an Englishman about the rule of the road is likely to lead to an agreement. Both are likely to regret the fact that their rules do not coincide. Both will agree that in principle there is nothing to choose between the two rules, and that it would be unreasonable to expect the United States to adopt the left-hand rule in order to achieve conformity with Britain; and both are likely to agree that Britain cannot at present make a change which may be desirable but which would be extremely costly. After agreement has thus been reached on all points, both participants are likely to part with the feeling that they have not learned anything from the discussion.

The situation changes when we consider other institutions, laws, or customs — those for example which are connected with the administration of justice. Different laws and customs in this field may make all the difference for those living under them. Some customs can be very cruel, while others provide for mutual help and the relief of suffering. Some countries and their laws respect freedom while others do so less, or not at all.

It is my opinion that a critical discussion of these important matters is not only possible, but most urgently needed. It is often made difficult by propaganda and by a neglect of factual information. But these difficulties are not insuperable. Thus it is possible to combat propaganda by information, and information, if available, is not always ignored; though admittedly it often is ignored.

In spite of all this there are some people who uphold the myth that frameworks of laws and customs cannot be rationally discussed. They

assert that morality is identical with legality or custom or usage, and that it is therefore impossible to judge, or discuss, whether one system of customs is morally better than another, since the existing system of laws and customs is the only possible standard of morality.

This view has been stated by Hegel with the help of the formulae: 'What is real is reasonable' and 'What is reasonable is real'. Here 'what is' or 'what is real' means the world, including its man-made laws and customs. That these are man-made is denied by Hegel who asserts that the World Spirit or Reason made them, and that those who seem to have made them — the great men, the makers of history — are merely the executors of reason, their passions being the most sensitive instrument of reason; they are the detectors of the Spirit of their Time, and ultimately of the Absolute Spirit, that is of God Himself.

This is just one of those many cases in which philosophers use God for their own private purposes; that is, as a prop for some of their tottering arguments.

Hegel was both a relativist and an absolutist: as always, he had it at least both ways, and if two ways were not enough, he had it in three ways. And he was the first of a long chain of post-Kantian, that is, postcritical or postrationalist philosophers — mainly German philosophers — who upheld the myth of the framework.

According to Hegel, truth itself was both relative and absolute. It was relative to each historical and cultural framework: there could thus be no rational discussion between the frameworks since each of them had a different standard of truth. But his doctrine that all truth was relative to the various frameworks was absolutely true, since it was part of Hegel's own relativistic philosophy.

VIII

Hegel's claim to have discovered absolute truth does not now appear to attract many people. But his doctrine of relative truth and his myth of the framework still attracts them. What makes it so attractive is that they confuse relativism with the true insight that all men are fallible. This doctrine of fallibility has played an important role in the history of philosophy from its earliest days on — from Xenophanes and Socrates to Charles Sanders Peirce — and I think that it is of the utmost importance. But I do *not* think that it can be used to support relativism with respect to truth.

Of course, the doctrine of human fallibility can be validly used to argue against that kind of philosophical absolutism which claims to *possess* the absolute truth, or at least a criterion of absolute truth, such as the Cartesian criterion of clarity and distinctness, or some other intuitive criterion. But there exists a very different doctrine of absolute truth, in fact a fallibilist doctrine, which asserts that mistakes we make can be absolute mistakes, in the sense that our theories can be absolutely false, that they can fall short of the truth. Thus the notion of truth, and that of falling short of the truth, can represent absolute standards for the fallibilist. These notions are a great help in critical discussions.

This theory of absolute or objective truth has been revived by Alfred Tarski who also proved that there can be no universal criterion of truth. There is no clash whatever between Tarski's theory of absolute or objective truth and the doctrine of fallibility.[11]

But is not Tarski's notion of truth a relative notion? Is it not relative to the language to which the statement belongs whose truth is being discussed?

The answer to this question is 'no'. Tarski's theory says that a statement of some language, say English, is true if and only if it corresponds to the facts; and Tarski's theory implies that whenever there is another language, say French, in which we can describe the same fact, then the French statement which describes this fact will be true if and only if the corresponding English statement is true. Thus it is impossible, according to Tarski's theory, that of two statements which are translations of each other, one can be true and the other false. Truth, according to Tarski's theory, is therefore *not* dependent on language, or relative to language. Reference to the language is made only because of the unlikely but trivial possibility that the same sounds or symbols may occur in two different languages and may then perhaps describe two totally different facts.

However, it may easily happen that a statement of one language is untranslatable into another, or in other words that a fact, or a state of affairs, which can be described in one language cannot be described in another.

Anybody who can speak more than one language knows, of course, that perfect translations from one language into another are very rare, if they exist at all. But this difficulty, well-known to all translators, should be clearly distinguished from the situation here discussed — that is, the

impossibility of describing in one language a state of affairs which can be described in some other language. The ordinary and well-known difficulty consists of something quite different, namely this. A crisp, simple, and easily understandable statement in French or English may need a highly complex and awkward rendering in, say, German, and a rendering which is even difficult to understand in German. In other words, the ordinary difficulty known to every translator is that an aesthetically adequate translation may be impossible, not that *any* translation of the statement in question is impossible. (I am speaking here of a factual statement, not of a poem or an aphorism or bon mot, or of a statement which is subtly ironical or which expresses a sentiment of the speaker.)

There can be no doubt, however, that a more radical impossibility may arise; for example, we can construct artificial languages which contain only one-termed predicates, so that we can say in these languages 'Paul is tall' and 'Peter is short', but not 'Paul is taller than Peter'.

More interesting than such artifical languages are some living languages. Here we can learn much from Benjamin Lee Whorf.[12] Whorf was perhaps the first to draw attention to the significance of certain tenses of the Hopi language. These tenses are experienced by a Hopi speaker as describing some part of the state of affairs which he tries to describe in his statement. They cannot be adequately rendered into English, for we can explain them only in a roundabout way, by referring to certain expectations of the speaker rather than aspects of the objective states of affairs.

Whorf gives the following example. There are two tenses in Hopi which might inadequately be rendered in English by the two statements

> 'Fred began chopping wood', and
> 'Fred began to chop wood'.

The first would be used by the Hopi speaker if he expects Fred to *go on* chopping for some time. If the speaker does *not* expect Fred to go on chopping, then he will *not* say, in Hopi, 'Fred began chopping'; he will use that other tense rendered by 'Fred began to chop'. But the real point is that the Hopi speaker does not wish by the use of his tenses merely to express his different expectations. He rather wishes to describe two different states of affairs — two different objective situations, two different states of the objective world. The one tense

may be said to describe the beginning of a continuing *state* or of a somewhat repetitive *process*, while the other describes the beginning of an *event* of short duration. Thus the Hopi speaker may try to translate Hopi into English by saying: 'Fred began sleeping', in contradistinction to 'Fred began to sleep', because sleeping is a process rather than an event.

All this is very much simplified: a full restatement of Whorf's description of the complex linguistic situation could easily take up a whole paper. The main consequence for my topic which seems to emerge from the situations described by Whorf and more recently discussed by Quine is this. Although there cannot be any linguistic relativity concerning the *truth* of any statement, there is the possibility that a statement may be untranslatable into some other language. For the two languages may have built into their very grammar two different views of the stuff the world is made of, or of the world's basic structural characteristics. In the terminology of Quine this may be called the 'ontological relativity' of language.[13]

The possibility that some statements are untranslatable is, I assert, about the most radical consequence we can draw from what Quine calls 'ontological relativity'. Yet in actual fact most human languages seem to be intertranslatable. We may say that they are mostly *badly* intertranslatable, mainly because of ontological relativity, although of course for other reasons too. For example, appeals to our sense of humour, or comparisons with a well-known local or historical event which has become typical may be completely untranslatable.

IX

It is obvious that this situation must make rational discussion very difficult if the participants are brought up in different parts of the world, and speak different languages. But I have found that these difficulties can often be surmounted. I have had students in the London School of Economics from various parts of Africa, the Middle East, India, Southeast Asia, China, and Japan, and I have found that the difficulties could usually be conquered with a little patience on both sides. Whenever there was a major obstacle to overcome, it was as a rule the result of indoctrination with Western ideas. Dogmatic, uncritical teaching in bad Westernized schools and universities, and especially training in Western verbosity and in Western ideologies were, in my

experience, much graver obstacles to rational discussion than any cultural or linguistic gap.

My experiences suggested to me that culture clash may lose some of its value if one of the clashing cultures regards itself as universally superior, and even more so if it is so regarded by the other: this destroys the major value of culture clash, for the greatest value of culture clash lies in the fact that it can evoke a critical attitude. More especially, if one of the parties becomes convinced of his inferiority, then the critical attitude of learning from the other will be replaced by a kind of blind acceptance, a blind leap into a new magic circle, or a conversion, as it is so often described by fideists and existentialists.

I believe that ontological relativity, though an obstacle to easy communication, can prove of immense value in all the more important cases of culture clash if it can be overcome slowly. For it means that the partners in the clash may liberate themselves from prejudices of which they are unconscious — from taking theories unconsciously for granted which, for example, may be embedded in the logical structure of their language. Such a liberation may be the result of *criticism* stimulated by culture clash.

What happens in such cases? We compare and contrast the new language with our own, or with some others we know well. In the comparative study of these languages we use, as a rule, our own language as a metalanguage — that is, as the language in which we speak about, and compare, the other languages which are the objects under investigation, including our own language. The languages under investigation are the object languages. In carrying out the investigation, we are forced to look upon our own language — say English — in a critical way, as a set of rules and usages which may be somewhat narrow since they are unable completely to capture, or to describe, the kinds of entities which the other languages assume to exist. But this description of the limitations of English as an object language is carried out in English as a metalanguage. Thus we are forced, by this comparative study, to transcend precisely those limitations which we are studying. And the interesting point is that we succeed in this. The means of transcending our language is *criticism.*

Whorf himself, and some of his followers, have suggested that we live in a kind of intellectual prison, a prison formed by the structural rules of our language. I am prepared to accept this metaphor, though I have to add to it that it is an odd prison insofar as we are normally

unaware of it. We become aware of it through culture clash. But then, this very awareness allows us to break out of the prison if we wish to: we can transcend our prison by studying the new language and comparing it with our own.

The result will be a new prison. But it will be a much larger and wider prison; and again, we will not suffer from it; or rather, whenever we do, we are free to examine it critically, and thus to break out again, into a still wider prison.

The prisons are the frameworks. And those who do not like prisons will be opposed to the myth of the framework. They will welcome a discussion with a partner who comes from another world, from another framework, for it gives them an opportunity to discover their so far unfelt chains, to break them, and thus to transcend themselves. This breaking out of one's prison is, of course, not a matter of routine:[13a] it can only be the result of a critical effort — of a creative effort.

X

In the remainder of this paper I will try to apply this brief analysis to some problems which have arisen in a field in which I am greatly interested — the philosophy of science.

It is now fifty year since I arrived at a view very similar to the myth of the framework; and I not only arrived at it but at once went beyond it. It was during the great and heated discussions after the First World War that I found out how difficult it was to get anywhere with people living in a closed framework; I mean people like the Marxists, the Freudians, and the Adlerians. None of them could ever be shaken in his adopted view of the world. Every argument against their framework was by them so interpreted as to fit into it; and if this turned out to be difficult, then it was always possible to psychoanalyse or socioanalyse the arguer: criticism of Marxian ideas was due to class prejudice, criticism of Freudian ideas was due to repression, and criticism of Adlerian ideas was due to the urge to prove your superiority, an urge which was due to an attempt to compensate for a feeling of inferiority.

I found the stereotyped pattern of these attitudes depressing and repelling, the more so as I could find nothing of the kind in the debates of the physicists about Einstein's General Theory, although it too was hotly debated at the time.

The lesson I derived from these experiences was this. Theories

are important and indispensable because without them we could not orientate ourselves in the world — we could not live. Even our observations are interpreted with their help. The Marxist literally sees class struggle everywhere; thus he believes that only those who deliberately shut their eyes can fail to see it. The Freudian sees everywhere repression and sublimation; the Adlerian sees how feelings of inferiority express themselves in every action and every utterance, whether it is an utterance of inferiority or superiority.

This shows that our need for theories is immense, and so is the power of theories. Thus it is all the more important to guard against becoming addicted to any particular theory: we must not let ourselves be caught in a mental prison. I did not know of the theory of culture clash at the time, but I certainly made use of my clashes with the addicts of the various frameworks in order to impress upon my mind the ideal of liberating oneself from the intellectual prison of a theory in which one might get stuck unconsciously, at any moment of one's life.

It is only too obvious that this ideal of self-liberation, of breaking out of one's prison of the moment, might in its turn become part of a framework or a prison — or in other words, that we can never be absolutely free. But we can widen our prison, and at least we can leave behind the narrowness of one who is addicted to his fetters.

Thus our view of the world is at any moment necessarily theory impregnated. But this does not prevent us from progressing to better theories. How do we do it? The essential step is the linguistic formulation of our beliefs. This objectivizes them; and this makes it possible for them to become targets of criticism. Thus our beliefs are replaced by competing theories, by competing conjectures. And through the critical discussion of these theories we can progress.

In this way we must demand of any better theory, that is, of any theory which may be regarded as progressing beyond some less good theory, that is can be compared with the latter. In other words, that the two theories are *not* 'incommensurable', to use a now fashionable term, introduced in this context by Thomas Kuhn.

(Note that two logically incompatible theories will be, in general, 'commensurable'. *Incommensurability* is intended to be much more radical than *incompatibility*: while incompatibility is a logical relation and thus appeals to one logical framework, incommensurability suggests the non-existence of a common logical framework.)

For example, Ptolemy's astronomy is far from incommensurable with

that of Aristarchus and Copernicus. No doubt, the Copernican system allows us to see the world in a totally different way; no doubt there is, psychologically, a *Gestalt* switch, as Kuhn calls it. This is psychologically very important. But we *can* compare the two systems logically. In fact, it was one of Copernicus's main arguments that all astronomical observations which can be fitted into a geocentric system can, by a simple translation method, always be fitted into a heliocentric one. There is no doubt all the difference in the world between these two views of the universe, and the magnitude of the gulf between the two views may well make us tremble. But there is no difficulty in comparing them. For example, we may point out the colossal velocities which the rotating sphere of the fixed stars must give to the stars which are near to its equator, while the rotation of the earth, which in Copernicus's system replaces that of the fixed stars, involves very much smaller velocities. This, together with some practical acquaintance with centrifugal forces, may well have served as an important point of comparison for those who had to choose between the two systems.

I assert that this kind of comparison between systems is always possible. Theories which offer solutions of the same or closely related problems are as a rule comparable, I assert, and discussions between them are always possible and fruitful; and not only are they possible, but they actually take place.

XI

Some people do not think that these assertions are correct, and this results in a view of science and its history very different from mine. Let me briefly outline such a view of science.

The proponents[14] of such a view can observe that scientists are, normally, engaged in close cooperation and discussion; and the proponents argue that this situation is made possible by the fact that scientists normally operate within a common framework to which they have committed themselves. (Frameworks of this kind seem to me to be closely related to what Karl Mannheim used to call 'Total Ideologies'.[15]) The periods during which scientists remain committed to a framework are regarded as typical: they are periods of 'normal science', and scientists who work in this way are regarded as 'normal scientists'.

Science in this sense is then contrasted with science in a period of

crisis or revolution. These are periods in which the theoretical framework begins to crack, and in the end breaks. It is then replaced by a new one. The transition from an old framework to a new one is regarded as a process which must be studied not from a logical point of view (for it is, essentially, not wholly, or even mainly, rational) but from a psychological and sociological point of view. There is, perhaps, something like 'progress' in the transition to a new theoretical framework. But this is not a progress which consists of getting nearer to the truth, and the transition is not guided by a rational discussion of the relative merits of the competing theories. *It cannot be so guided since a genuinely rational discussion is thought to be impossible without an established framework.* Without a framework it is not even thought to be possible to agree what constitutes a point of 'merit' in a theory. (Some protagonists of this view even think that we can speak of truth only relative to a framework.) Rational discussion is thus impossible if it is the framework which is being challenged. And this is why the two frameworks — the old and the new — have sometimes been described as *incommensurable.*

An additional reason why frameworks are sometimes said to be incommensurable seems to be this. A framework can be thought of as consisting not only of a 'dominant theory', but also as being, in part, a psychological and sociological entity. It consists of a dominant theory *together* with what one might call *a way of viewing things in tune with the dominant theory,* including sometimes even a way of viewing the world and a way of life. Accordingly, such a framework constitutes a social bond between its devotees: it binds them together, very much as a church does, or a political or artistic creed, or an ideology.

This is a further explanation of the asserted incommensurability: it is understandable that *two ways of life and two ways of looking at the world* are incommensurable. Yet I want to stress that *two theories* which try to solve the same family of problems, including their offspring (their problem children), need *not* be incommensurable, and that in science, as opposed to religion, it is the *theories* that are paramount. I do not wish to deny that there is such a thing as a 'scientific approach', or a scientific 'way of life': that is, the way of life of those men devoted to science. On the contrary, I assert that the scientific way of life involves a burning interest in objective scientific theories — in the theories in themselves, and in the problem of their truth, or their nearness to truth. And this interest is a *critical* interest, an *argumenta-*

tive interest. Thus it does not, like some other creeds, produce anything like the described 'incommensurability'.

It seems to me that many counterexamples exist to the theory of the history of science that I have just discussed. There are, first, counterexamples that show that the existence of a 'framework', and of work going on within it, does not characterize science. Philosophy during the scholastic period, astrology, and theology, are such counterexamples. Secondly, there are counterexamples that show that there may be several dominant theories struggling for supremacy in a science, and there may even be fruitful discussions between them. My main counterexample under this heading is the theory of the constitution of matter, in which atomism and continuity theories were, fruitfully, at war from the Pythagoreans and Parmenides, Democritus and Plato, to Heisenberg and Schrödinger. I do not think that this war can be described as falling into the prehistory of science, or into the history of prescience. Another counterexample of this second kind is constituted by the theories of heat. Even after Black we have fluidum theories[16] of heat warring with kinetic and phenomenological theories; and the clash between Ernst Mach and Max Planck[17] was neither characteristic of a crisis nor did it occur within one framework, nor, indeed, could it be described as prescientific. Another example is the clash between Cantor and his critics (especially Kronecker) which was later continued in the form of exchanges between Russell and Poincaré, Hilbert and Brouwer. By 1925 there were at least three sharply opposed frameworks involved, divided by chasms far too wide for bridging. But the discussions continued, and they slowly changed their character. By now not only have fruitful discussions occurred but so many syntheses that the animadversions of the past are almost forgotten. Thirdly, there are counterexamples that show that fruitful rational discussions may continue between devotees of a newly established dominant theory and unconvinced sceptics. Such is Galileo's *Two Principal Systems*; such are some of Einstein's 'popular' writings, or the important criticism of Einstein's principle of covariance voiced by E. Kretschmann (1917), or the criticism of Einstein's General Theory recently voiced by Dicke; and such are Einstein's famous discussions with Bohr. It would be quite incorrect to say that the latter were not fruitful, for not only did Bohr claim that they much improved his understanding of quantum mechanics, but they led to the famous paper of Einstein, Podolsky, and

Rosen which has produced a whole literature of considerable significance, and may yet lead to more:[18] no paper which is discussed by recognized experts for thirty-five years can be denied its scientific status and significance, but this paper was, surely, criticizing (from the outside) the whole framework which had been established by the revolution of 1925—26. Opposition to this framework — the Copenhagen framework — is continued by a minority to which for example de Broglie, Bohm, Landé, and Vigier belong — apart from those names mentioned in the preceding footnote.[19]

Thus discussions may go on all the time; and although there are always attempts to transform the society of scientists into a closed society, these attempts have not succeeded. In my opinion they would be fatal for science.

The proponents of the view of the myth of the framework distinguish sharply between rational periods of science conducted within a framework (which can be described as periods of closed or authoritarian science) and periods of crisis and revolution, which can be described as the almost irrational leap (comparable to a religious conversion) from one framework to another.

No doubt there are such irrational leaps, such conversions, as described. No doubt there are even scientists who just follow the lead of others, or give way to social pressure, and accept a new theory as a new faith because the experts, the authorities, have accepted it. I admit, regretfully, that there are fashions in science, and that there is also social pressure.

I even admit that the day may come when the social community of scientists will consist mainly or exclusively of scientists who uncritically accept a ruling dogma. They will normally be swayed by fashions; they will accept a theory because it is the latest cry, and because they fear to be regarded as laggards.

I assert, however, that this will be the end of science as we know it — the end of the tradition created by Thales and Anaximander and rediscovered by Galileo. As long as science is the search for truth it will be the rational, critical discussion between competing theories, and the rational critical discussion of the revolutionary theory. This discussion decides whether or not the new theory is to be regarded as better than the old theory: that is, whether or not it is to be regarded as a step towards the truth.

XII

Almost forty years ago I stressed that even observations, and reports of observations, are under the sway of theories or, if you like, under the sway of a framework. Indeed, there is no such thing as an uninterpreted observation, an observation which is not theory-impregnated. In fact, our very eyes and ears are the result of evolutionary adaptations — that is, of the method of trial and error corresponding to the method of conjectures and refutations. Both methods are adjustments to environmental regularities. A simple example will show that ordinary visual experiences have a pre-Parmenidian absolute sense of up and down built into them — a sense which is no doubt genetically based. The example is this. A square standing on one of its sides looks to all of us a different figure from a square standing on one of its corners. There is a real *Gestalt* switch in moving from one figure to the other.

But I assert that the fact that observations are theory-impregnated does not lead to incommensurability between either observations or theories. For the old observations can be consciously reinterpreted: we can learn that the two squares are different positions of the same square. This is made even easier just because of the genetically based interpretations: no doubt we understand each other so well partly because we share so many physiological mechanisms which are built into our genetic system.

Yet I assert that it is possible for us to transcend even our genetically based physiology. This we do by the critical method. We can understand even a bit of the language of the bees. Admittedly, this understanding is conjectural and rudimentary. But almost all understanding is conjectural, and the deciphering of a new language is always rudimentary to start with.

It is the method of science, the method of critical discussion, which makes it possible for us to transcend not only our culturally acquired but even our inborn frameworks. This method has made us transcend not only our senses but also our partly innate tendency to regard the world as a universe of identifiable things and their properties. Ever since Heraclitus there have been revolutionaries who have told us that the world consists of processes, and that things are things only in appearance: in reality they are processes. This shows how critical thought can challenge and transcend a framework even if it is rooted not only in our conventional language but in our genetics — in what

may be called human nature itself. Yet even this revolution does not produce a theory incommensurable with its predecessor: the very task of the revolution was to explain the old category of thing-hood by a theory of greater depth.

XIII

I may perhaps also mention that there is a very special form of the myth of the framework which is particularly widespread. It is the view that, before discussion, we should agree on our vocabulary — perhaps by 'defining our terms'.

I have criticized this view on various occasions and I do not have space to do so again.[20] I only wish to make clear that there are the strongest possible reasons against this view; all definitions, so-called 'operational definitions' included, can only shift the problem of the meaning of the term in question to the defining terms; thus the demand for definitions leads to an infinite regress unless we admit so-called 'primitive' terms, that is, *undefined* terms. But these are as a rule no less problematic than most of the defined terms.

XIV

In the last section of this paper I will briefly discuss the myth of the framework from a logical point of view: I will attempt something like a logical diagnosis of the malaise.[21]

The myth of the framework is clearly the same as the doctrine that one cannot rationally discuss anything that is *fundamental*; or that a rational discussion of *principles* is impossible.

This doctrine is, logically, an outcome of the mistaken view that all rational discussion must start from some *principles* or, as they are often called, *axioms*, which in their turn must be accepted dogmatically if we wish to avoid an infinite regress — a regress due to the alleged fact that when rationally discussing the validity of our principles or axioms we must again appeal to principles or axioms.

Usually those who have seen this situation either insist dogmatically upon the truth of a framework of principles or axioms, or they become relativists: they say that there are different frameworks and that there is no rational discussion possible between them, and thus no rational choice.

But all this is mistaken; for behind it there is the tacit assumption that a rational discussion must have the character of a justification, or of a proof or a demonstration, or of a logical derivation from admitted premises. But the kind of discussion which is going on in the natural sciences might have taught our philosophers that there is also another kind of rational discussion: a critical discussion which does not seek to prove or to justify or to establish a theory, least of all by deriving it from some higher premises, but which tries to test the theory under discussion by finding out whether its *logical consequences* are all acceptable, or whether it has, perhaps, some undesirable consequences.

We thus can logically distinguish between *a mistaken method of criticizing* and *a correct method of criticizing.* The *mistaken method* starts from the question: how can we establish or justify our thesis or our theory? It thereby leads either to dogmatism; or to an infinite regress; or to the relativistic doctrine of rationally incommensurable frameworks. By contrast, the *correct method* of critical discussion starts from the question: what are the *consequences* of our thesis or our theory? Are they all acceptable to us?

Thus it consists in comparing the consequences of different theories (or, if you like, of different frameworks) and tries to find out which of the competing theories or frameworks has consequences that seem preferable to us. It is thus conscious of the fallibility of all our methods, and it tries to replace all our theories by better ones. This is, admittedly, a difficult task, but by no means an impossible one.

To sum up. Frameworks, like languages, may be barriers; but a foreign framework, just like a foreign language, is no absolute barrier. And just as breaking through a language barrier is difficult but very much worth our while, and likely to repay our efforts not only by widening our intellectual horizon but also by offering us much enjoyment, so it is with breaking through the barrier of a framework. A breakthrough of this kind is a discovery for us, and it may be one for science.

Penn, Buckinghamshire KARL POPPER
England
October, 1972

NOTES

* Based on a paper which I first prepared in 1965. I am indebted to Arne Petersen and Jeremy Shearmur for various suggestions and corrections. The motto is from Plato's *Crito*, 49D.

From: *The Abdication of Philosophy: Philosophy and the Public Good.* Essays in Honor of Paul Arthur Schilpp. Edited by Eugene Freeman. La Salle, Illinois: Open Court, 1976, pp. 23—48.

[1] Herodotus, III, 38. I refer to this passage in n. 3 to Chap. 5 of my *Open Society and Its Enemies.* London: George Routledge & Sons, 1945; Princeton: Princeton University Press, 5th rev. ed., 1966. Vol. I.

[2] The distinction between nature and convention is discussed in my *Open Society*, Vol. I, Chap. 5, where I refer to Pindar, Herodotus, Protagoras, Antiphon, Archelaus, and especially to Plato's *Laws* (cp. nn. 3, 7, 10, 11, and 28 to Chap. 5 and text). Although I mention (p. 60) the significance of 'the realization that taboos are different in various tribes', and although I (just) mention Xenophanes (n. 7) and his profession as a 'wandering bard' (n. 9 to Chap. 10), I did not then fully realize the part played by culture clash in the evolution of critical thought, as witnessed by the contribution made by Xenophanes, Heraclitus, and Parmenides (see esp. n. 11 to the *Open Society*, Chap. 5) to the problem of nature or reality or truth versus convention or opinion. See also my *Conjectures and Refutations: The Growth of Scientific Knowledge.* New York: Basic Books, 1963; London: Routledge & Kegan Paul, 4th rev. ed., 1972. Passim.

[3] Cp. my *Conjectures and Refutations*, 4th rev. ed., pp. 152 f. The first two lines of my text are fragment B 16 and the next four fragment B 15. The remaining three fragments are B 18, 35, and 34 (according to Diels-Kranz, *Fragmente der Vorsokratiker.* 5th ed.) The translations are mine. Note, in the last quoted two lines, the contrast between the one final truth and the many guesses, or opinions, or conjectures.

[4] Parmenides used Xenophanes' terminology; see *Conjectures and Refutations.* 4th rev. ed., e.g., pp. 11, 17, 145, 400, 410. See also my *Open Society.* Vol. I. n. 56, section (8). to Chap. 10. p. 312.

[5] See Parmenides' remark (in fragment B 6) on the muddled horde of erring mortals, always in two minds about things, in contrast with the one 'well rounded truth'. Cp. *Conjectures and Refutations*, pp. 11, 164 f.

[6] *Theogony*, 720—25.

[7] *Iliad*, VIII, 13—16; cp. *Aeneid* VI, 577.

[8] See my *Conjectures and Refutations*, 4th rev. ed., pp. 126 ff. 138 f., 150 f., 413.

[9] *Theogony*, 720—25.

[10] The discovery is, it appears, due to Parmenides; see fragments B 14—15:

> Bright'ning the night she glides round the earth with a light that is borrowed;
> Always she wistfully looks round for the rays of the sun.

[11] See Alfred Tarski, *Logic, Semantics, Metamathematics*, trans. by J. H. Woodger. New York: Oxford University Press, 1956. I have expounded it in various places; see, for example, my *Conjectures and Refutations*, pp. 223—25.

[12] See Benjamin Lee Whorf, *Language, Thought, and Reality*, ed. by John B. Carroll. Cambridge, Mass.: MIT Press, 1956.

[13] See W. V. Quine. *Word and Object.* Cambridge, Mass.: MIT Press, 1960; and *Ontological Relativity and Other Essays.* New York: Columbia University Press. 1969.

[13a] Cp. p. 232 of T. S. Kuhn, "Reflections on my Critics", in *Criticism and the Growth of Knowledge*, ed. by Imre Lakatos and Alan Musgrave. London: Cambridge University Press, 1970, pp. 231—78.

[14] When writing this section, I had originally Thomas Kuhn in mind, and his book *The Structure of Scientific Revolutions.* Chicago: Chicago University Press, 1962, 1970. (See also my contribution, "Normal Science and its Dangers", to *Criticism and the Growth of Knowledge*, ed. by Imre Lakatos and Alan Musgrave. London: Cambridge University Press, 1970, pp. 51—58.) However, as Kuhn points out, this interpretation was based on a misunderstanding of his views (see his "Reflections on my Critics", in *Criticism and the Growth of Knowledge*, pp. 231—78; and his "Postscript 1969" to the 2nd ed. of *The Structure of Scientific Revolutions*), and I am very ready to accept his correction. Nevertheless, I regard the view here discussed as influential.

[15] For a Criticism of Karl Mannheim, see Chaps. 23 and 24 of my *Open Society.* Vol. II.

[16] Few people seem to realize that by his equation $E = mc^2$, Einstein resurrected the fluidum theory of heat (caloric) for which the question whether heat has any weight was regarded as crucial. According to Einstein's theory, heat *has* weight — only it weights very little.

[17] Cp. the discussion between Planck and Mach, especially Planck's paper "Zur Machschen Theorie der physikalischen Erkenntnis", *Physikalische Zeitschrift* **11** (1910): 1186—90.

[18] See, for example, J. S. Bell, "On the Einstein Podolsky Rosen Paradox", *Physics* **1** (1964): 195—200; J. S. Bell, "On the Problem of Hidden Variables in Quantum Mechanics", *Reviews of Modern Physics* **38** (1966), 447—52; John F. Clauser, Michael A. Horne, Abner Shimony, and Richard A. Holt, "Proposed Experiment to Test Local Hidden Variable Theories", *Physical Review Letters*, October 13, 1969. An extension or strengthening of the EPR paradox described in my *Logic of Scientific Discovery.* New York: Basic Books, 1959, 1972, pp. 446—48, seems to me to involve a decisive refutation of the Copenhagen interpretation since the two simultaneous measurements together would allow simultaneous 'reductions' of the two wave packets which cannot be carried out within the theory. See also the recent paper by James Park and Henry Margenau, 'Simultaneous Measurability in Quantum Theory', *International Journal of Theoretical Physics* **1** (1968): 211—83.

[19] See my paper "Quantum Mechanics Without 'The Observer'", in *Studies in the Foundations, Methodology and Philosophy of Science*, Vol. 2: *Theory and Reality*, ed. by Mario Bunge. New York: Springer-Verlag, 1967.

[20] See my *Open Society*, Vol. II, Chap. 11, Sec. II; or my paper "Quantum Mechanics without 'The Observer'", esp. pp. 11—15; or my *Conjectures and Refutations*, pp. 19, 28, section (9), and pp. 279, 402.

[21] I am greatly indebted to my friend Alan Musgrave for reminding me to include in this paper the logical diagnosis contained in the present section.