PRINCIPLES OF EVIDENCE IN SCIENCE AND THEIR APPLICATION TO PARAPSYCHOLOGY

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MARGENAU: After Mr. Tart's very interesting and illuminating talk upon the existential and historical situation in psi research, I would like to bring you way down to the epistemological level of discussion, for a confrontation with the questions of what constitutes "normal" scientific evidence. I hope to show that a proper analysis of what now goes on even in the physical sciences leaves room for parapsychological speculations, and that, in fact, the strain exerted by conventional science upon psi researchers has been greatly lessened by the developments in the physical field.

I hope you will bear with me if I develop for you my own conception of the meaning of scientific method, of what the scientist normally does in providing an explanation for a set of subjective phenomena. Science is nothing more than an attempt at rationalizing our immediate experience. There is no science, no matter how highly developed, which does not begin with subjective elements of experience. As a matter of fact one can divide all experiences into two very large classes: those amenable to scientific understanding, which the philosopher often calls cognitive, and those which are not. To this latter class belong esthetics, perhaps ethics, value judgments, etc.; these of course I am excluding from consideration today. The so-called cognitive experiences may again be divided into two classes: every science begins with a kind of awareness which is distinctly and typically personal, immediate—or in your parlance, subjective. Even a physicist begins with the personal awareness of certain phenomena that appear to him: the char-

acteristic of this world of immediate phenomena is to be incoherent, not to supply its own rationale.

Take for example so simple a notion as temperature. Even that has two aspects: the temperature which you feel in your fingertip when you put it in a hot bath of water, and beyond that, the idea, the "construct" temperature which the physicist uses in his equations. They are not the same, but there is a peculiar relation between them: the immediate experience of temperature is private, not necessarily repeatable; it varies from person to person; it has a peculiar instability about it, an instability which you seem to find likewise in the psi field. The physicist achieves objectivity, stability, by leaving the domain of subjective experience and passing into a field of constructs which he himself creates. The construct of temperature is in this instance operationally defined. You use an instrument, a thermometer; you put it into the bath and observe what it registers. By interposing here an operational definition between the protocol experience of temperature and the construct temperature, you have achieved what is often called objectivity, because the measured temperature is the same for everybody. You have achieved stability, you have achieved all those desiderata upon which stable science, conventional science, physical or otherwise, finally depends. The question is whether this kind of stability can be achieved in parapsychology.

Let me comment on the way in which the passage from immediate to constructive experience takes place. The transition from one domain to the other is made by certain rules of correspondence. In the physical sciences these rules of correspondence amount very frequently to operational definitions. You do something in order to translate the immediately felt temperature into a stable construct, temperature. You do something to make it objective, to make it numerical. There is absolutely no qualitative concept, no "observable" in any of the physical sciences which does not have these two aspects: one purely subjective, and one stabilized, constructed and objective. Stability arises because of the scientist's ability to pass from what is originally subjective and unstable to that which is finally objective and stable.

All objective knowledge in the sciences depends on the possibility of converting something that is directly experienced in an individual person's consciousness into something that is objective, constructional and often numerical. The passage from one domain of experience to the other is by way of rules of correspondence, which are to a large extent arbitrary. Notice, please, that subjective data are personal experiences which do not themselves provide the means whereby they can

be made stable. When the physicist finally arrives at a satisfactory notion of temperature, he has done the following things. He has had, first of all, these personal, immediate experiences. He has then, to a certain extent, arbitrarily introduced objectivity by means of an operational definition, but there are many of these. The physicist's choice among them is not dictated or controlled by the immediate, protocol experiences, but is guided by methodological or metaphysical principles too complex to be treated fully on this occasion. Attention is given to them in another work of mine.[1] Suffice it to say here that they are chosen with an eye toward simplicity, elegance and generality of the "laws" which regulate the resulting constructs. In this way the scientist arrives at stable constructs which populate the fields of science and in terms of which scientific understanding is ultimately achieved.

In this domain of constructs, logical movements of a deductive sort in contrast to mere inductive influences are possible. The subjective data themselves never tell you what are the constructs in terms of which they are finally going to be rationalized. Science has no longer the trappings of an inductive discipline. Free invention, scientific creativity play an increasingly important role. Stability, indeed scientific validity, arises in the field of constructs because of two possibilities opened by the manner in which scientific constructs are established.

First of all, whenever you have a satisfying theory, you are able to go back from any theoretical construct to the world of subjective phenomena and verify or validate the ideas in terms of which you have chosen to explain the phenomena. In other words, you begin within the subjective domain, and go from there by what I called rules of correspondence into the conceptual field, into the field of theory. But then you must always be able to go back from there by way of predicting and finally checking the consequences of your assumptions. This is the inductive process of empirical verification to which every proper science must subject itself. But this process alone is not enough. Many people in the field of parapsychology believe that once you have inductively provided a set of ideas (many even insist on physical ideas), you are through. Or once you are able to predict what is going to happen, you have finished your job. Such is by no means the case. There exists, in addition to these empirical requirements of verification, a set of metaphysical norms, to which every scientific theory must accommodate itself.

Scientists insist that the ideas to which a given set of primary experiences gives rise must stand in some sort of harmony with other ideas. This is not to say that these ideas must be identical with, or even

immediately compatible with ideas in other scientific disciplines. Even within a given science like physics, there are walls between domains of explanation which are not at present surmountable. For instance, we do not yet know how to go from classical to quantum relativity in a wholly satisfactory way. There are many closed domains, but as science progresses we try to abolish the walls between them and often, though not always, we succeed. A new branch of science may be employing concepts and ideas which are not only different from the conventional ones, they may even be quite incompatible with them.

It may be of interest to review briefly a few of the novel features that characterize today's philosophy of science for, in the selection of ideas and theoretical rules, the scientist now relies upon criteria of simplicity, of elegance of formulation, of universality which were rather foreign to the sciences of the last century.

Some of these changes greatly lessen the strain of the physical sciences upon parapsychological researchers. In the last century common sense was regarded as the ultimate arbiter of scientific truth. You could never propose a theory which did not make sense in terms comprehensible to the man in the street; in terms of the experiences which we have every day in ordinary life.

Nowadays many theories have been developed which contradict the maxims of "common sense." You cannot understand modern relativity, you cannot understand quantum mechanics in terms of the simple notions often called common sense. Even today there are people who doubt the veracity of the so-called paradox on the grounds that it contradicts ordinary expectations, expectations justified by an appeal to that ubiquitous but bumbling agency called common sense. Einstein has a very interesting definition of it. He said: "Common sense is merely the residue of prejudices deposited in our early experience by inadequate teaching." I have no better definition of common sense to offer. I do not know what it is. At any rate, it has been disavowed by modern science. What the modern scientist does is to cling to the subjective features of his experience, to try to devise constructs vis-à-vis these subjective features and subject these constructs (a) to the rules of empirical validation, and (b) to the rules of internal consistency or, more elaborately, to the metaphysical principles outlined elsewhere.

So much for the departure from common sense. But another important movement has taken place in the physical and mathematical sciences. It is the repudiation of visual models. Again, in the science of the last century, no explanation of any phenomenon was deemed satisfactory if it did not involve elements of pictorial, visual representation.

In order to understand the atom you had to picture it as an assemblage of a central body, called the nucleus, surrounded by a lot of little billiard balls that moved about it with definite speeds. Everything had to be pictured before the mind's eye. We have now learned that visual models do not always suffice to explain the facts of the atomic microcosm. Furthermore, they often yield erroneous predictions when applied to the world of subjective experience. We have learned that there are things in the physical world which cannot be conceived in terms of particles with sizes and shapes or even waves, but have characteristics such as probabilities (which, incidentally, are perfectly good quantities for the description of phenomena in this world), or even more abstract ones such as mathematical operators, for which there exist no visual counterparts. Why should it be that things which are too small to be seen should have properties that can be pictured before the mind's eye? Let me illustrate. Consider a blue billiard ball of ordinary size. It has a lot of sensory qualities. It has color, it has size, it has shape, it has weight, it has a position in space, and it has a velocity. But if this billiard ball is made to shrink in size until it becomes smaller than a wave length of light, then it has no more color at all. Not only has it become invisible, you simply cannot ascribe color to it as a matter of fundamental fact. Our attempt to visualize it breaks down. The physicist can show that this vanishing of ordinary properties takes place not only with respect to color but with respect to size, shape, position, momentum and many other such attributes. We then have to cling in our description of elementary objects to more abstract things like Hamiltonians, and state functions, things which the man in the street regards as meaningless simply because he has not acquired the facility for understanding them.

If you want a crude cliché in terms of which to remember this new development, I would say that at the present time it looks as if the elementary particles of physics were no longer little billiard balls flying around in space, but, rather, have come to be something like a set of mathematical functions, singularities haunting space. This is a fairly accurate description of what goes on at the forefront of physics today.

Now I have another point. Last summer I had the opportunity of attending in Versailles a conference which brought together theoretical physicists and biologists in a common quest for understanding the puzzling facts encountered in the study of living organisms. The phenomena which were to be explained on that occasion were certainly as abstruse, as incomprehensible, as aloof and as withdrawn from ordinary modes of explanation as those which form the starting points of our

meetings here. Yet, among all the people that participated in the deliberations in Versailles, there was not a soul that doubted the applicability of science to the curious things that had been observed. They were divided into two camps: the thoroughly indoctrinated quantum mechanicians who felt that science even now provides the facilities for understanding all these things, and the others, who felt that new principles of understanding were required in order to accommodate the "subjective" phenomena. I happen to belong to this latter camp.

Notice, however, that neither of these groups entertained the view that matters to be explained are supernatural, beyond the reach of science; none was willing to forego the attempt to bring them under scientific scrutiny and ultimately perhaps even control. I do not know whether everyone in this audience shares this attitude; from my reading of the parapsychological literature I conclude that such persons exist. I regret their attitude and bespeak for the student of parapsychology the same openmindedness that characterizes the workers in the equally miraculous field of "parabiology," with which parts of the Versailles conference dealt.

On the other hand, I do not recommend the attitude of the first group I mentioned, the members of which believe that we now possess all the means for understanding the phenomena of life or, in your case, the phenomena of psi. Such people need a jolt, and I believe that there is nothing in the world that can break down the façade of complacency, of smugness and arrogance which physical science has built up in the minds of many, as can these weird phenomena of parapsychology and of modern biology. Many physicists have to be knocked out of their apathy, their preconceptions which lead them to think that they know all that really matters. Science is a dynamic, evolving structure forever incomplete, and this leads me to my last point.

It has to do with a new "faith" in science. Notice the word, faith. I believe that science requires faith, as distinct from belief. Belief is not faith. Belief is something that attaches to matters of fact which can be proved right or wrong on further evidence. Every science, however, begins with a personal commitment which is intrinsically beyond prior evidence. In the last century people believed that every science started with axioms which could never be doubted because they could be "proved." This we now know to be an erroneous conception regarding the bases of sciences. The most fundamental tenets of science cannot be proved. Many principles of physics, the axioms of mathematics (geometry, for instance) cannot be proved to be true or false in an a priori sense. Only their consequences can be tested, and the inference

from the correctness of the consequences to the correctness of the premises is never certain, as every logician knows. Because given protocol facts may be compatible with several theories about them (our earlier constructs), a shift from one theory to the other, made necessary when further facts arise, is indeed logically feasible. This means that the foundations of science with all its postulates and theorems are in a process of slow development. Let me illustrate by means of an example from mathematics.

Until about a hundred years ago, there was no one who believed that the axioms of Euclid could possibly be false. Then bold young men like Bolyai and Lobatchevski showed that a replacement of one of the axioms provided a new geometry which was not false. It was wholly consistent internally, and yet its theorems differed from those of Euclid. Thus new geometries were born, and you know how fruitful they have been in general relativity and in many other parts of modern science.

In essence, what we have in science is a set of basic theoretical commitments, articles of faith, if I may use that term, which we accept tentatively because of their plausibility, their internal consistency, their conceptual beauty. From these basic commitments we deduce consequences in accordance with the laws of logic and mathematics. So long as the consequences of this original faith are in accord with the subjective facts which we are trying to explain, we maintain them. As soon as they contradict one of these subjective experiences, the commitments are changed, and often even relinquished.

I have deliberately sketched the method of "normal" science in terms that suggest compatibility with psi research, leaning at times perhaps too strongly toward an emphasis upon its flexibility. This is legitimate, I think, when science is to be applied to an area of experience which is largely uncharted and which may require maximum departures from convention or orthodoxy.

In concluding, let me say in my role of physicist and philosopher, that if there seems to be no uniform set of *conventional* constructs in terms of which psi phenomena can be finally developed and stabilized, do not be disheartened, because that has happened in the beginning of all the sciences.

REFERENCES

1. Margenau, H.: *The Nature of Physical Reality* (McGraw-Hill, New York, 1950).