

## COMMENTARY ON THEOLOGICAL RESOURCES FROM THE PHYSICAL SCIENCES

by *John R. Platt*

The major point I want to make concerns the relation of physics to reality. I applaud what Brown and Northrop have said about the power of physical methods of thinking and about the need for consistent epistemology and careful use of language. But I find myself in considerable disagreement with what I take to be their epistemology, and I think it is worth making a brief outline of a radically different view in which the basis of scientific knowledge connects much more closely with theological problems. There is coming to be a small but important group of physical thinkers, communications theorists, psychologists, and philosophers who take a more personal and existential and manipulative view of epistemology, of what a man can know and how he can know about the world and his relation to it. This personal-operational viewpoint was foreshadowed by Ernst Mach in his *Analysis of Sensations*, and it has been developed by Percy Bridgman in his final book, *The Way Things Are*, by Erwin Schrödinger in his little book *Mind and Matter*, by Michael Polanyi in *Personal Knowledge*, and by David Bohm in the Appendix to his book on *Relativity*.

In this view, which I share, the blazing central reality in which all perception and scientific knowledge are rooted is here-and-now personal, subjective, holistic experience, including all of what we try to separate more or less accurately into immediate sensations, memories, knowledge, predictions, values, decisions, and actions. This is the "eternal present," the "canvas on which the picture is painted," in Schrödinger's phrase, and perhaps close to what some have called Thatness or the Ground of Being. It is a totality which is Nameless, which is No-Thing, which "cannot be pointed to" because it precedes and includes any separation into objects and self, persons who use language, and pointing and naming. It is not an experience but the set of all experiences, an immediate-totality-field or T-field, as a mathematician or physicist might say.

This view is simple but leads to consequences which may be somewhat unexpected. For one thing, every element of this total field of

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immediate awareness and action has what we commonly distinguish as two aspects, a "given" or uncontrollable or surprising or "absurd" aspect and a controllable or manipulable aspect which I change at every moment by acting, by moving head, eyes, grasp, or attention. (I did not expect the cat would be on the table. With my eyes I move her to the center of my field.) The remarkable thing that has been discovered recently is that these two aspects are to some degree inextricably mixed. We have always known that action requires awareness; but we now find that awareness, even of the absurd or surprising, requires action, some familiar motions or familiar invariances of motion to make the surprising comprehensible or even perceivable.

This requirement for motion is not easy to detect subjectively, but the objective evidence for it has been given by the experiments and analyses of several perception psychologists, such as R. W. Ditchburn, Lorrin Riggs, J. J. Gibson, and Richard Held. They have found, for example, that there is a continual tremor action of the eyeballs of which we are unaware but that, if this tremor is canceled out by various physical methods, vision disappears. Likewise, they have found that without self-moving, a kitten can learn nothing about visual distances, and a human subject cannot adapt to distorting glasses. It would appear that active manipulation-observation of the environment is a *sine qua non* for learning or adaptation or for perceiving objects or, as I have emphasized elsewhere, for any veridical organization of space. Held and I have suggested that what happens is that movement provides a referent, so that the "reafferent stimulation" from eye movements or body movements helps the brain to single out regularities or invariances which are independent of retinal or other anatomical variations. It is a kind of unconscious "pointing" which helps us to assemble these regularities reliably into boundaries and objects and to normalize the balancing and directional mechanisms of the body. This active manipulation is, therefore, what makes possible, in Held's great phrase, the "transcendence of individual anatomy" that is necessary in order for us to have *any* public agreement with peers or ignorant babies, or *any* teaching, or *any* public language. Active manipulation-observation is then the subjective machinery by which we choose what we will call the objective world.

The external component, the objective world so-called, is present in every observed part of the personal here-and-now totality; but we see that, with such a mechanism of perception and veridification, the self-mover must also be present in every part of the here-and-now totality.

(There is no Thou that is not That, no That that is not Thou.) This is as true of so-called immediate sensations as it is of memories, for memories interact with sensations in the continuous time-flow of invariance-comparisons. If we try to make the traditional dichotomy between the "world" and the "self," we have to say that awareness has a world and a self component and that action has a self and a world component. They both would have to be located on the "interface" between self and world, with a foot in each. For awareness-and-action form a "feedback loop" (or many of them) from world to self to world to self again. How else describe an animal smelling food, seizing it, and consuming it? The cycle repeats again and again, with each output serving as the input for the next step in the loop and with no sharp beginning or end either in the self or in the world. It is time for us to abandon the old and rather static self-world formulation and to go over to the awareness-and-action terminology, to emphasize the continuous dynamic and transactional and feedback character of existence.

Parenthetically we may note that in artificially constructed "sensory-motor decision-systems," such as an automatic pilot or a gun-director network, there is also no input without an output that modifies the input again. And in such systems every transistor, like every neuron in a brain, stands on some pathway coupling sensory inputs with motor outputs, coupling awareness with action, at its particular point on the total feedback loop.

In any case, these experiments show us that the elements of our own field of totality cannot be regarded as "its" but have a transactional "I-it" quality; they are not understandable or even observable without the essential introduction of the "I." ("We do not see objects, but re-afferent relationships.") And some of the elements that we talk to and love and identify with have an "I-thou" quality as well.

In such a view, the T-field of course cannot be static; it changes from moment to moment as we manipulate it, whether the manipulations are small ones, like thoughts or eyeball tremors, or large ones. From what we have said about vision, it is probable that an unchanging T-field is a contradiction, a non-observable. We act on it, changing it at every moment, with the changes propagating indefinitely into the future, continually reshaping our world as surely as if it were a car we were driving. Active change is the condition of perception and the condition of existence. What else should we expect of an evolutionary organism in the streaming flow of sunlight? All is flux; but we see that it is in large measure our personal active flux, which we create anew in every mo-

ment. And this flux of active change includes the responsive I-thou relations as well as the I-it relations. Is not this living water? "The universe is plastic to the pious hand," as the founder of Brook Farm said, and it is obvious in every moment of existence, to anyone who looks.

But what has all this to do with physics, you may ask? I hold with Bohm that in a coherent epistemology the foundations of perception and the foundations of physics must be identical. I would fit physical science within the present holistic framework by saying it is derived from that branch of active manipulation where we try to remove the personal local element, the "I," as much as possible, so as to scan those invariant relations that are most public and most independent of observer and time. What is the ideal of physics? It is that kind of observer-free world—or half-world—that we call an "isolated system," a system which we can "prepare" and then take away our hand from, so as to see how this "objective" system will behave as it moves "by itself." This ideal is not quite possible, even in principle, because quantum theory says that any observation requires some interaction with the object (it too says "I-it," agreeing with perception theory); but this is the approximation on which physical science is founded.

Why should we want to create such a specialized and simplified type of experience? Just so we can know better how the totality will respond to our actions, so we can manipulate more precisely and predictably with these objects for our human purposes later.

Where in all this is the "objective" physical world of Newton's laws and Dalton's atoms and Rutherford's nuclei? It is evidently in a simplified subsection of *our* subjective totality, subject to *our* decision as to whether we find it useful to believe in these atoms or not.

But are not the atoms, or the other fundamental particles of which the universe is supposed to be made, the realest things there are? Even within the framework of physical science there has always been some doubt. Ostwald and other great experimental chemists of the last century never thought that atoms were real. They said, as Laplace said of God, that "they had no need of that hypothesis." And our atoms today may dissolve at any moment into interferences of waves traveling at the speed of light or into some other bizarre reformulation, just as the Bohr orbits of 1912 dissolved into Schrödinger waves and then into Heisenberg matrices, more for reasons of elegance and unity than for any great improvement in prediction. I think this raises some serious questions for those who believe in physical science as the foundation of the world. What kind of primary reality is this, whose elements depend

so much on time and taste, in successive new approximations to an ultimate description that they never reach?

Oh, atoms are real enough in an operational sense; we make television sets and bombs with their reality. We break our bones against their bonds, as Samuel Johnson showed. But it is the operations that are real; the atoms and the bonds are only a secondary reality that we have derived, or invented—a reality that must take its evidence, its confirmation, and its meaning from the true primary reality of our experiences, our manipulations, and our changing human choices and linguistic formulations.

Schrödinger quotes a fragment from Democritus in which the intellect has an argument with the senses about what is "real." The intellect says, "Ostensibly there is color, ostensibly sweetness, ostensibly bitterness, actually only atoms and the void," to which the senses retort, "Poor intellect, do you hope to defeat us while from us you borrow your evidence? Your victory is your defeat." If we allow the senses to be manipulative, to be not passive awareness but awareness-and-action, this evidently would be the view of the perception psychologists as well as of existentialists today. It is *our* experience that proves that stones are hard and have X-ray patterns, not the explanation that they are made of special atoms or bonds. Find a soft stone, and the physical theory will have to accommodate itself to restate that fact for you! Physics is a useful and magnificent slave, but still a slave; and let us not forget it. It is slave philosophy to tell us that he, Physics, is the primary reality. As I tried to say in my book, *The Excitement of Science*, we must never mistake the approximations for the whole, or the derived for the real, or the tool for the creative hand.

So when we were told earlier in this present discussion that something like "the Primary Reality" is to be found in *physics*, I felt myself reacting with shock to this objective inversion of the blazing sense of things. I know that the idea of one's world and oneself as being built up of objects (rather than being the "givens" from which "objects" are derived) has been the standard way of teaching in our atomizing and technological society, and that students, and professors and philosophers too, may grow up without ever being called to question it; in all our mechanisms it works so well! And perhaps this has indeed been the simplest way of teaching children quickly about structural relations and how to make and manipulate things. But by the time a student is in high school he should be taught a juster picture of his personal relation to the world. Such a restructuring could be of the greatest importance to us. For this almost universal objectivist

## ZYGON

view of ours is not only an inversion of the perceptual basis of things, as we have seen, but it is also, I think, a major source of the widespread feelings of dehumanization and meaninglessness and resentment in our national and world society. Any error in our ideas of being will always lead to psychological and social pathology and dehumanization—whether it is a persecution complex, or the belief that all is predestined, or that all is subconscious, or that man lives for the state. The personal meaninglessness produced by the objectivist inversion of things is no exception. The healthiest change we could make today, scientifically and socially as well as theologically, would be to put back into the center the immediate and personal nature of awareness, responsibility, choice, and action; to see that all our magnificent physics and technology are derived from man and for man, not man from physics.

For me, therefore, the primary reality is this immediate present totality of experience, including the sight of all of you and the thoughts I am thinking as I construct my next sentence. And for you, I would hope that your immediate primary reality is not anything so speculative and so difficultly verifiable as the fundamental particles and motions of physics but, rather, the sensations you are now experiencing and your thoughts about what I am saying or what you wish I were saying or where you wish you were right now. Think that the primary reality is anything else or anywhere else, whether in physics or in heaven or in an afterlife, and you damage the accuracy and quality and humanity of your perceptions. The objective world of the physical sciences is only half a world. It contains nothing that is really and humanly important to us as feeling and thinking physiological beings, no love and no vomiting, no thrills, no memories, no plans, no ideas, no human interaction and creation, and no death.

And if we interpret the word "primary" to mean the original processes by which a human baby learns about the world, it is clear that the primary reality for us even at that stage surely cannot be physics or the atoms. It is the mother's arms, the mother's nipple, that gives the baby his first external contact with that human-interacting ever loving world that generates us, feeds us, shares its life with us, and makes us all a part of evolution and the human continuity. And what I mean by the mother's nipple is of course the whole system of family and social care. I mean by it in particular what might be thought of as the "intellectual nipple" of mankind—the mother's voice speaking the mother language which teaches us and transfers to us the first collective human symbols for our skilful Northrops and Whiteheads

to analyze and manipulate. Without the mother's voice, without that ostensive definition that is the mother's finger pointing to the light, to the red ball, to the toy, to the baby sister, where would these symbols be that we manipulate with our semantic-linguistic philosophy? The reality on which all later discourse about reality depends is this reality of a language which so incredibly *can* be ostensively agreed upon between adult and baby, can be shared and can be taught to us by other human beings, and which therefore transcends our personal individuality and makes it possible for us to discuss these more abstract problems of physics or philosophy. The ultimate philosophical basis of physics cannot be understood without first understanding those perception-theory aspects of the totality that make such a remarkable phenomenon possible.

So even in the cradle we see that there already must be the beginnings of many of the components we find in our personal primary reality as adults: I-it awareness and I-thou human nourishment, sharing-teaching, and language.

I want to conclude my remarks about the physical outlook with some thoughts about "operationalism." Physics has often been spoken of and idealized as "operational," meaning that the only realities we know in physics are the operational, testable realities. "What will happen if I do this?"—for example, if I drop this pencil—*that* is the subject matter of physics. A reminder of this viewpoint has been the healthy corrective of many windy theories. But in this technological society, as one might imagine, it is only the objective side of operationalism that has been singled out for emphasis. The very term "operationalism," which originally emphasized action, manipulation, choice, has often come to be identified simply with phenomenology or the raw collection of facts. A fuller operationalism, with fuller attention to motives and choice, might lead us to a more analytical consideration of hypotheses and inferences as well as to more consideration of the other, subjective, aspects of the operation—of whether I *want* to drop the pencil or *should* drop it or whether I am convinced afterward that I understand the experiment or that the theory fits it adequately.

This is where the personal enters into mathematics and science, as L. J. Savage has emphasized. The existential fact is that it is we who choose the problems and it is we who must be convinced by the proof. The bases of these choices and convictions often hide in the scientific unconscious, perhaps because we do not want to feel that there is a choice; it might be healthier if we brought the choices into the open. For it is at these crucial points of initiation and conclusion that in-

telligence, values, and purposes make their very personal entry into science and serve, or fail to serve, our larger human needs. I believe that a fuller operationalism viewed, as Bridgman viewed it, within the personal-perceptual framework I have described, would make the personal nature of our scientific choices clearer and might straighten out many subconscious and pathological knots in our teaching and research practices and our service to society.

My last point concerns some of the indeterminacies that turn up in examining the limits of our knowledge and prediction as biological decision-making systems. (Some related questions of biological individuality are discussed by George Wald in his essay in the book *New Views of the Nature of Man*.)<sup>1</sup> We have seen that in operationalism man is the operator, you are the operator, I am the operator. But we should realize in addition that our every act branches out to our own new operations which are themselves unpredictable. We shape the world anew at every moment. The reason these operations are unpredictable is that they are not a part of objective science. Our precursor states and causal chains are not accessible to us in the form of data. "By quantum mechanics it is impossible for an observer to determine his own wavefunction; observations on your own mind are not data," said Leo Szilard. Such observations do not constitute material for any causal or deterministic prediction, because the "observer" interacts too strongly with the thing observed or predicted and can falsify any prediction by choosing to do exactly the opposite. The result is that the future shaped by human beings is not the determinate Minkowski space of relativity physics, a "frozen passage," with frozen time but, as the philosopher Milič Čapek has emphasized, a future in process of becoming, freely restructured by the thinking mind at every moment.

But there is another kind of unpredictability as well. It probably can also be shown objectively that one person's detailed operations or acts are unpredictable in principle by any other person. The reason is the complexity of the human brain, which prevents complete observation of its "initial state." A human being has only about  $10^9$  sensory cells, but he has about  $10^{11}$  neurons in his brain. And  $10^9$  cells are not enough to tell anyone what  $10^{11}$  cells are doing, either his own or anyone else's. The result is that the total behavior of your neuron cells is inaccessible to me, and mine to you, at least in the finite time available to either of us for such a study.

In the past, physics has concerned itself with "small" systems having



only a few variables, such as the motions of the centers of the planets or the motion of pencils or electrons—not with complexities of the order of  $10^{11}$ . Even there, it has discovered certain statistical and quantum indeterminacies. But I think we come here to a new kind of indeterminism, a “complexity-indeterminism” which makes your thoughts and choices and behavior hidden from me, and my thoughts and choices and behavior hidden from you, even though every corner of our networks might be shown to be working deterministically in the physicists’ sense. I think that this, and the other indeterminism associated with self-prediction, have no counterpart in the world of physics but are characteristically biological phenomena that come to light in these big sensory-motor decision-networks that we call brains.

In summary, we see that there are many fundamental questions being raised in current science that may be of the keenest interest to theologians. We see that there might be a possible restructuring of our philosophical attitude in science with the emphasis changing from methodology or linguistic and semantic analysis to the personal, to questions of curiosity and choice and conclusion. We are beginning to see a new view of the nature of man, supported by the fact that a number of features of the subjective human situation are strikingly like the properties of a decision-network viewed from within; and this may lead to an objective rediscovery of personal indeterminacy and freedom.

But the most important restructuring may be the correction of the common objectivist inversion that plagues and dehumanizes our whole technological society today. Many of us feel that the primary reality of human existence cannot lie in any of our objective scientific results, in the atoms or explanations that we accept or reject, but must lie rather in the immediate realization of the here-and-now totality of awareness-and-action and human interaction, wherein scientific knowledge represents only a small and specialized subsection. As perception theory now suggests, each of us stands at the creative, choosing focus of a moving web of past antecedents and future consequences that branch out from our present choices and actions, propagating and amplifying themselves indefinitely. We interpenetrate the universe; it responds to our every breath. The proof is everywhere. We love each other, and the glance of our eyes begets new children. We teach, we learn; we organize and we respond; we plan and we achieve; we make the earth the creative center of the solar system. Great men and

## ZYGON

prophets have always known that they had this future-shaping seminal power. It is a creative fact that stands outside of physics; but we see that science may yet be reconciled.

When you get rid of the objectivist delusion, do you not feel the unitive focus, the creative power to act freely and differently in yourself, here, now? It is like a release from an obsession. It puts the focus back within. It gives us, as William James suggested, an immediacy, a sense of personal value and personal power, of awareness and action, that could reshape the world.

### NOTE

1. Ed. John R. Platt (Chicago: University of Chicago Press, 1966).