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UNDERSTANDING THE WORLD: THE "MIXED QUESTION" TEST

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Part 3 of 3

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For the stated purpose, I am going to take the mixed question that we have been using as an example throughout this chapter—the one which presents us with an apparent conflict between philosophy and nuclear physics.

It is easy to say what cannot be done with regard to this problem. If we persist in holding a realist view of science, we cannot remove the conflict by treating the particles of nuclear physics as theoretical entities which serve as convenient fictions but have no reality. If we persist in regarding common experience as the basis of philosophical knowledge, we cannot remove the conflict by treating our common experience of material objects as illusory. If common ex-

perience is itself illusory, it can hardly be used to test philosophical theories; and if it is not illusory, then it provides some warrant for the truth of the commonsense opinions about the reality of the sensible, material objects of ordinary experience and also for any philosophical theory which employs certain conceptual constructions, such as that of individual physical substances, to defend and explain the truth of that common-sense opinion.

The validation of such conceptual constructions in philosophy is exactly like the validation of the theoretical entities of nuclear physics. Occam's Razor can be justly applied in both cases to excise these reifications if the data of experience—common or special—can be adequately accounted for without their employment; but if, in the case of nuclear physics, the experimental data cannot be satisfactorily accounted for unless certain theoretical entities are posited, and if, in the case of philosophy, the data of common experience cannot be satisfactorily accounted for unless certain conceptual constructions are posited, then the entities or constructs posited—elementary particles, in the one case, and individual physical substances, in the other—are validated in the only way that such things can be validated. Their validation by empirical evidence leads not only to the affirmation of the truth of the theory in each case, but also to the affirmation of the real existence of that which is signified by the theoretical concepts in each case.

So far we have rejected as unsatisfactory two ways of trying to solve the problem by removing the conflict. A third way is equally unsatisfactory. It is the effort made by some writers to show that the two theories are complementary, rather than conflicting, accounts of the same objects. Gilbert Ryle, for example, tries to treat the two theories by analogy with a librarian's and a bursar's account of the same books on the shelves of the college.[21] The analogy fails. The same books do have different properties (namely, their contents and their prices) which are of interest respectively to the librarian and to the bursar; but the real existence of this chair as an individual substance in a certain region of space and the real existence of an organized congeries of atoms or elementary particles in exactly the same region of space can hardly be treated as different properties of the same object, or even of the same region of space. There is no need to reconcile what the librarian records about the contents of the books when he classifies them with what the bursar records about the prices of the books when he enters them into his ledger; but I do not see how anyone can fail to question how the individual physical substance and the organized congeries of elementary particles can *both really exist in identically the same region of space.* Stated thus, in realistic terms, the prob-

lem is genuine, not a pseudo-problem or a merely verbal one. Any satisfactory effort to arrive at a solution must begin by conceding that, in a mixed question of this sort, there is at least an apparent conflict between what science claims to know and what philosophy claims to know.[22]

21 See *Dilemmas, op. cit.,* pp. 75-81.

22 In view of the fact that Ryle tends to take the instrumentalist approach to both science and philosophy, it may be unfair to treat the librarian's and the bursar's account of the books in the college library as analogous to a scientific and a common-sense, or philosophical, account of the same material objects when these are regarded as know-that, not merely know-how. Ryle's analogy may work well enough for science and philosophy as know-how; it does not work when they are both interpreted as know-that.

To concede this is to concede that there is some truth in what each theory asserts—some truth in the assertion that atoms and subatomic particles really exist and some truth in the assertion that the solid material objects of our common experience really exist as solid material objects and, in addition, have the unity of individual physical substances. Can these apparently conflicting truths be reconciled?

The problem would be insoluble if the two assertions to be reconciled stood in relation to each other in the same way that the statement that Jones is sitting in a particular chair at a particular time stands to the statement that Smith, another man, is sitting in the same chair at the same time, and is not sitting on top of Jones or on the arm of the chair, but exactly where Jones is sitting. The statements about Jones and Smith are contradictory; both cannot be true; they cannot be reconciled. The assertion about atoms or nuclear particles as the imperceptible physical constituents of the chair and the assertion about the chair as an individual physical substance having certain sensible properties are not contradictory and can be reconciled by a philosophical theory of matter and energy, of potential, virtual, and actual being, capacious and subtle enough to allow for a wide range of distinctions in the modes of existence among things *all of which really exist to some degree,* more or less.

Heisenberg hints at the solution to which we are coming. As we have seen, he refers to the elementary units of matter as "possibilities for being or tendencies for being." He also thinks that an "objective tendency or possibility" for being might be regarded as "a '*potentia'* in the sense of Aristotelian philosophy. In fact," he writes, "I believe that the language actually used by physicists when they speak about atomic events produces in their minds similar notions as the concept 'potentia.' [23] Later he adds the following

concluding observation: "In the experiments about atomic events we have to do with things and facts, with phenomena that are just as real as any phenomena in daily life. But the atoms or the elementary particles are *not as real; they form a world of potentialities or possibilities rather than one of things or facts."*[24]

There are passages in Heisenberg (especially those dealing with the "Copenhagen interpretation of quantum theory") which make it difficult to determine whether he takes a realist or an instrumentalist view of nuclear physics.[25] There are still other passages in which he appears to adopt the extreme Pythagorean doctrine that the ultimate "building blocks" of the universe are mathematical forms, not material particles, quanta of energy, or physical entities of any sort.[26] In consequence, it is difficult to decide whether Heisenberg is of one mind on the question. But this does not affect the significance which I attach to his remarks about the potential being of elementary particles. This means, he says, that they are *not as real* as the things of daily life—the things of common experience. "Not as real" can hardly be read as equivalent to "not real at all." If the nuclear particles are real, *but less real* than the material objects of common experience, there must be diverse modes of real existence which differ in the grade or degree of reality which they respectively possess. Herein lies a clue to the solution of the problem. It involves two points.

23 *Physics and Philosophy, op. cit.,* pp. 180-181.
24 *Ibid.,* p. 186 *(italics* added).
25 See *ibid.,* Chapters II and VIII, *passim.*
26 *Philosophical Problems of Nuclear Physics, op. cit.,* pp. *56-59;* 97 ff. Cf. *Physics and Philosophy, op. cit.,* pp. *71-75.*

(I) The reality of the elementary particles of nuclear physics cannot be reconciled with the reality of the chair as an individual sensible substance if both the particles and the chair are asserted to have the same mode of existence or grade of being. The same thing can also be said about the nuclear particles and the atoms of which they are component parts. The particles are less real than the atoms; that is, they have less actuality. This, I take it, is the meaning of Heisenberg's statement that the particles are in a state of *potentia*—"possibilities for being or tendencies for being."

(2) The mode of being of the material constituents of a physical body cannot be the same when those constituents exist in isolation and when they enter into the constitution of an actual body. Thus, when the chair exists actually as one body, the multitude of atoms and elementary particles which constitute it exist only virtually. Since their existence is only virtual, so is their multiplicity; and

their virtual multiplicity is not incompatible with the actual unity of the chair. Again, the same thing can also be said about a single atom and the nuclear particles which constitute it; or about a single molecule and the various atoms which constitute it. When an atom or a molecule actually exists as a unit of matter, its material constituents have only virtual existence and, consequently, their multiplicity is also only virtual.[27]

27 A basic insight of the theory of atoms or elementary particles, repeatedly stated by Heisenberg, Hanson, and others, is that, in order to explain the physical properties of composite bodies, it is necessary for their material constituents to be *without* the properties to be explained. This insight does not go far enough. It states only one of two prerequisites for the explanatory value of elementary particles or atoms. The other prerequisite, also negative, is the point mentioned in the text above; namely, that the material constituents *cannot* be actually present in the composite body in the same mode of existence which they have when they are not constituents of a composite body, but exist in isolation. In order to explain the physical properties of a composite body, the material constituents must be virtually, rather than actually, present in that body and lack the properties to be explained.

The virtual existence and multiplicity of the material constituents do not abrogate their potentiality for actual existence and actual multiplicity. If the unitary chair—or a single atom—were exploded into its ultimate material constituents, the elementary particles would assume the mode of actual existence which isolated particles have in a cyclotron; their virtual multiplicity would be transformed into an actual multitude.

The critical point here is that the mode of existence in which the particles are discrete units and have actual multiplicity cannot be the same as the mode of existence which they have when they are material constituents of the one chair in actual existence. If we assign the same mode of existence to the particles in a cyclotron and to the particles that enter into the constitution of an actual chair, the conflict between nuclear physics and the philosophical doctrine which affirms the reality of the material objects of common experience ceases to be merely an apparent conflict. It is a real conflict and an irresolvable one because the conflicting theories are irreconcilable. But if they are assigned different modes of existence, the apparent conflict disappears, for the theories that appear to be in conflict can be reconciled.[28]

28 Let no one suppose that the solution of this problem involves the acceptance of atomism or atomistic materialism as a sound philosophical doctrine. That doctrine, as expounded by the ancients or their modern followers, rests on the proposition that nothing exists except atoms and the void; that is, only the ultimate particles of matter have real existence, and all the material things composed of them are *nothing but* organized congeries of particles and involve no additional forms or principles of being. Materialism of this type, as I pointed out

earlier, provides us with a good example of a philosophical doctrine that must be rejected on empirical grounds; if common experience is not illusory, this doctrine must be rejected as false; see Chapter 9, pp. 155-156. As Heisenberg remarks, "the ontology of materialism rested upon the illusion that the kind of existence, the direct 'actuality' of the world around us, can be extrapolated into the atomic range. This extrapolation is impossible, however" *(Physics and Philosophy, op. cit.,* p. 245). Cf. *Philosophical Problems of Nuclear Physics, op. cit.,* pp. 106-108.

Here, then, we have an example of the "mixed question" test in operation. One measure of the soundness of a philosophical theory or doctrine is its ability to solve problems of the sort with which we have been dealing; that is, its ability to reconcile what truth there is in a scientific theory with what truth there is in a common-sense opinion and in the philosophical elucidation of that opinion, when these several truths appear to come into conflict. No line of philosophical thought is sound which tries to avoid such mixed questions, or which tries to dismiss, as pseudo-problems, such apparent conflicts between science and common-sense or between science and philosophy. Among competing philosophical theories, one is sounder than another if it presents a more satisfactory resolution of such conflicts.

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One matter remains: if we take the realist view of both science and philosophy, and treat both as offering us first-order knowledge of that which is and happens in the world, to which should we primarily turn for our understanding of the world? Which, if either, outranks the other in discharging the task of rendering the world intelligible to us? Philosophy, I submit, and for the following reasons.

In the first place, when there is an apparent conflict between science and philosophy, it is to philosophy that we must turn for the resolution. Science cannot provide it. When scientists such as Einstein, Bohr, and Heisenberg become involved with mixed questions, they must philosophize. They cannot discuss these questions merely as scientists; the principles for the statement and for the solution of such problems come from philosophy, not from science.[29]

29 The two books by Heisenberg from which I have quoted a number of times in this chapter impressively illustrate this point. hi both, Heisenberg combines scientific knowledge with philosophical thought in order to state and try to solve the difficult mixed questions raised by nuclear physics. The excellence of both books, as compared with books by other scientists on these subjects, results from Heisenberg's philosophical competence and philosophical knowledge.

In the second place, the two views of science that we have been considering are philosophical views of science, not scientific views of it. In other words, the understanding of science itself is philosophical, not scientific. While psychoanalysts such as Freud and sociologists such as Mannheim may offer us what appear to be scientific accounts of philosophers and philosophizing, these are not comparable to the philosophical account of science that we find in such writers as Popper or Hanson. The relation is not reciprocal; for the psychological or sociological treatment of philosophy *(a la* Freud or Mannheim) is strictly *ad hominem,* whereas the philosophical treatment of science, history, or any other discipline is addressed to the nature of the discipline itself, not the nature, the activities, or the propensities of the human beings who do its work and produce its formulations.

In the third place, the first-order questions that philosophy tries to answer are more profound—both more elementary and more ultimate—than the questions that science tries to answer. It is philosophy, not science, that takes the over-all view.

Our initial concern with the conditions under which philosophy can be as intellectually respectable as science was accompanied by an additional concern with the special role which philosophy should play in liberal education, in the organization of a university, and in a culture. If science were superior to philosophy with respect to the understanding it gives us of reality and of the world of learning, science, not philosophy, should play that special role. It does not and it cannot; and philosophy can. Philosophy is indispensable to our understanding of science and, beyond that, to our understanding of the world that we know through science as well as through common-sense.

Hence, I conclude that when the philosophical enterprise satisfies, as it can, all the conditions laid down and when, in addition, philosophical thinking meets, as it can, all the appropriate tests of soundness or truth, philosophy will not only deserve the same kind of respect that is now generally accorded science; but, in addition, it will deserve a higher measure of respect, because of the two ways in which it is superior to science—in its practical usefulness and in its theoretic insights. 🕮

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