The Function of Science---With Some Conclusions

WITH regard to Science, let it first of all be said, in order to avoid confusion, that it does not furnish us with an explanation of natural phenomena; that is, not in the accepted sense. It supplies us only with a distinct method, a certain way of looking at, and describing, the processes it sets out to study; and those generalizations of science known as natural laws, so far from being fiats or decrees similar to acts of parliament or the ten commandments, on the contrary, are merely statements in brief of the totality of conditions under which given events occur. Failing these conditions, the phenomena in question do not appear.

But, if science does not explain anything, what, then, is its purpose? What does it do? Well . . . but, before answering that question, let us point out that we have not yet said that science does not explain anything, only that it does not provide us with an explanation in the accepted sense. In another sense, as we may have occasion to show in a short time, the description "how" given by Science may be taken as an adequate substitute for the reason "why" demanded by philosophy.

And now—to come back to the question as to what the purpose of science was, or is—let us say that the business of science is simply to describe the universe. Nothing more. Simply to describe the universe. A design, nevertheless, not without a certain ambitious grandeur. For this describing the universe is a tall order. It means, to begin with, ascertaining the facts. No simple matter, because the facts are rarely what they seem to be on the surface. For instance, the sun, as I write, is going down; but nowadays everyone is perfectly aware that the sun goes down in appearance only; the reality as we all know, is something quite different. So that getting at the facts is not quite such an easy matter as one would think.

Very well, we'll grant the difficulty, and allow, further, that the facts have been amassed—what then?

Well, then, to proceed, the ascertained facts have to be arranged in order, and studied, and the relations between them noted, their sequence recognized, and finally, the full conditions of their existence or occurrence described as concisely, but also as completely, as possible. It is this complete description, summed up in a general formula, that we know as a natural law, as when we say that development from the simple to the complex is the law of progress.

A law is a uniformity. A human law describes the way things should happen; a natural law, how they do happen.

"Thou shalt not steal" is an example of the first; of the second, we have a good example in the law of biogenesis, which is that "every organism in its individual development repeats the life history of the race to which it belongs."

The law of gravitation is that "all objects attract each other with a strength directly proportional to the amount of their mass and inversely proportional to the square of their distance."

It is as though the scientist after his labors should sit back and say to himself: Now, what is the conclusion we are to draw from all that? He summarizes the results of his study and gives to his summary an axiomatic expression; and that expression states the law.

The nature of the study is immaterial. What matters is that it should admit the application of the scientific method. All that is knowable is the province of science, all experience its happy hunting ground. That is to say that everything becomes a scientific study provided only that it can be treated in the scientific manner.

Speaking of art—or, as we would now say, of science—Aristotle says it "begins when, from a great number of experiences, one general conception is formed which will embrace all similar cases." Exactly. And Aristotle's "general conception" answers to the underlying law, or uniformity, of which we have already spoken. Beneath the scientist's group of facts, this uniformity is observable, and it is the aim of the scientist to disclose it.

Science, then, is "the complete and consistent description of the facts of experience in the simplest possible terms."

At first sight this sounds disappointing. Science, of which we have believed so much, and hoped so much, and thought was accomplishing so much—to be reduced to a mere barren description! But not so fast. We are disappointed before there is any need to be. Let us consider the definition well.

First, it must be complete—that is, it must leave nothing out. Next, it must be consistent—that is, consistent with itself, with the rest of the science of which it forms a part, with science as a whole, and, also with experience in general. After that, it must publish its results in the simplest possible terms. The simplest possible terms—that is difficult; difficult to reduce our accumulated and complex knowledge, together with the conclusions drawn from it, to a clear succint statement incapable of being misunderstood—infinitely more difficult than at first sight it would be thought.

But, if that is all, then we have to give up the idea we have been harboring that science offers us a solution of the riddle of the universe, for it leaves matters just as much unexplained as before.

Oh no. That would be jumping to a conclusion too quickly—without thinking. Let us see. Certainly, science does not attempt to refer the facts of experience to any ultimate reality, but what of that? That is the function of philosophy—not of science; and a thankless function it is at best. There remains a sense, however, in which science does explain things, as we shall discover. Science reduces occurrences to simple terms, lays bare the conditions of their existence, or procedure, and discloses their history. When we say that science has accounted for the tides we are saying something that is quite permissible, and mean that we have been given a more intelligible conception of what takes place in the case of that particular phenomenon. Now, this increased intelligibility, depends, in a very great measure indeed, on the discovery and exhibition of causes—only these causes are not causes in the final sense. In the natural sciences the term "cause" refers only to secondary causes—causes which are themselves the result of antecedent, or preceding, causes. The question of ultimate causes is never raised. That, as we said before, is not the business of science—which deals with the knowable only. A scientific cause is an efficient cause, not a final cause. It gives no answer to the question "why;" so that we never get further than the ideal description previously set forth.

Now, all knowledge is based upon the information we obtain through our senses. Other means of learning anything there is none. This brings us to a most important question—the question is this: How can we be sure that the information gleaned through the medium of our senses is authentic, not false? How can we know that our senses supply us with representations of the objects they perceive which are correct, reliable, true? Is it not possible for these perceptions easily to be in error? To which we must answer that, of course, it is quite possible to make mistakes, and they are frequently made. It is the recognition of this propensity to error that leads many a thinker to declare that when he speaks of objects, or the qualities of which he can not know anything for certain, but what he means is the impression, or impressions, such objects have produced on his senses; that and only that. The objects themselves can not be known.

Against this line of argument we have nothing to say. It is plausible, but it has no reality. In an old and very homely saying, the proof of the pudding is in the eating. Our lives, and all our actions, are based irrevocably on our sense perceptions—on the very information, that is, which is now called in question. And the doubts of philosophers notwithstanding, it remains a fact that the race for countless centuries has trusted its existence to just these perceptions; so far without serious hurt. Not only that, but when we begin to turn to our own use the objects around us, using them according to the attributes we perceive in them, we put the accuracy or inaccuracy of our perceptions of them, at that very moment to an unfailing test. This test is infallible because, if our perceptions are wrong, then our estimate of the uses to which the objects we are dealing with can be put must be wrong also, and our efforts to use them will ignominiously fail. Whereas, on the other hand, if we succeed in our purpose, and do actually turn these objects to the uses our perception of their qualities led us to imagine possible, then the objects themselves necessarily agree with out ideas of them, which is sufficient proof that the impressions gained through the senses tally with the reality outside of ourselves.

But even suppose that we fail in our aim, and the qualities we supposed an object to have turn out to be something other than we thought so that our intentions in connection with that particular object fail to materialize—what then? What are we to conclude? That our impressions are unreliable? No. We conclude that the perceptions upon which we acted in this case were either incomplete or superficial, or else were combined with the results of other perceptions in a way not warranted by them—and we are generally not very long in making out the cause of our failure. We correct the fault into which we had fallen—which, after all, was but a matter of defective reasoning—and try again; this time with success. Or, if we do not succeed at once, we still achieve success ultimately, and our perceptions are once more fully justified.

So long as we take care to train and use our senses properly, and to keep our actions within the limits prescribed by our perceptions, so long shall we find that the result of our actions proves the conformity of our perceptions with the objective nature of the things perceived. "Not in one single instance so far," wrote a great scientist, "have we been led to the conclusion that our sense perceptions, scientifically controlled, induce in our minds ideas respecting the outer world that are at variance with reality, or that there is an inherent incompatibility between the outer world and our sense perception of it."

Having established so much, some latter-day philosopher is bound to pop up, and exclaim: All right, all right—we'll grant all that; but it does not overcome the difficulty at all. It may be quite true that we can perceive the qualities of a thing correctly, yet we can not by any sensible or mental process grasp the thing in itself. This thing in itself is unknowable—beyond our ken.

To which Hegel, long since, has replied: If you know all the qualities of a thing, you know the thing in itself already. Nothing remains but the fact that the said thing exists without us, and when your senses have taught you that fact you have grasped the last remnant of the thing in itself, Kant's celebrated unknowable "ding an sich."

But then, in Kant's time, our knowledge of natural objects was, indeed, so fragmentary, that Kant might well be pardoned for thinking that behind the little we knew of things there must still be a strange, mysterious, forever-unknowable personality—the thing in itself. But the world has advanced, and one after another of these ungraspable things have been grasped, have been analysed—and, what is more—reproduced; by such gigantic strides has science victoriously advanced—and what we can produce and reproduce we certainly can not be said not to know.

To the chemistry of the early nineteenth century organic substances were still mysterious objects, behind which might be hidden some secret, unknowable, self. But now, we can build them up—these organic substances—one after the other—from their chemical elements, without the aid of organic processes whatever; and modern chemists claim that as

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