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SPENCER'S PHILOSOPHY OF SCIENCE

THE HERBERT SPENCER LECTURE
DELIVERED AT THE MUSEUM
7 NOVEMBER, 1913

BY
C. LLOYD MORGAN, F.R.S.

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SPENCER'S PHILOSOPHY OF SCIENCE

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Towards the close of 1870, while I was still in my teens, my youthful enthusiasm was fired by reading Tyndall's Discourse on *The Scientific Use of the Imagination*. The vision of the conquest of nature by physical science—a vision which had but lately begun to open up to my wondering gaze—was rendered clearer and more extensive. Of the theory of evolution I knew but little; but I none the less felt assured that it had come to stay and to prevail. Was it not accepted by all of *us*—the enlightened and emancipated men of science whose ranks I had joined as a raw recruit? Believing that I was independently breaking free of all authority, to the authority that appealed to my fancy, and to a new loyalty, I was a willing slave. And here in one glowing sentence the inner core of evolution lay revealed.

'Strip it naked and you stand face to face with the notion that not alone the more ignoble forms of animalcular and animal life, not alone the nobler forms of the horse and the lion, not alone the exquisite and wonderful mechanism of the human body, but that the human mind itself—emotion, intellect and all their phenomena—were once latent in a fiery cloud.'^[1]

With sparkling eyes I quoted these brave words to a friend of my father's, whose comments were often as caustic as his sympathy in my interests was kindly. With a grave smile he asked whether the notion was not perhaps stripped too naked to preserve the decencies of modest thought; he inquired whether I had not learnt from *Sartor Resartus* that the philosophy of nature is a Philosophy of Clothes; and he bade me devote a little time to quiet and careful consideration of what Tyndall really meant—meant in terms of the exact science he professed—by the phrase 'latent in a fiery cloud'. I dimly suspected that the old gentleman—old in the sense of being my father's contemporary—was ignorant of those recent developments of modern science with which I had been acquainted for weeks, nay more for months. Perhaps he had never even heard of the nebular hypothesis! But I felt that I had done him an injustice when, next morning, he sent round a volume of the *Westminster Review* with a slip of paper indicating an article on 'Progress: its Law and Cause'.^[4]

Such was my introduction to Herbert Spencer, some of whose works I read with admiration during the next few years.

I have no very distinct recollection of the impression produced on my mind by the germinal essay of 1857, save that it served to quicken that craving, which is, I suppose, characteristic of those who have some natural bent towards philosophy—the imperative craving to seek and, if it may be, to find the one in the many. In any case Tyndall's suggestive sentence was here amplified and the underlying law was disclosed.

'Whether it be in the development of the Earth, in the development of Life upon its surface, in the development of Society, of Government, of Manufacture, of Commerce, of Language, Literature, Science, Art, the same evolution of the simple into the complex, through successive differentiations, holds throughout. From the earliest traceable cosmical changes down to the latest results of civilisation, we shall find that the transformation of the homogeneous into the heterogeneous, is that in which Progress essentially consists.'^[2]

Here was just what I wanted—on the one hand the whole wide universe of existence; and on the other hand a brief formula with which to label its potted essence. How breathlessly one was led on, with only such breaches of continuity as separate paragraphs inevitably impose, right away from the primitive fire-mist to one of Bach's fugues or the critical doctrines of Mr. Ruskin, guided throughout by the magic of differentiation. What if the modes of existence, dealt with in successive sections, were somewhat startlingly diverse! Was not this itself a supreme example of the evolution of that diversity which the formula enables us to interpret? For if there were a passage from the homogeneous to the heterogeneous, the more heterogeneous the products—inorganic, organic, and superorganic, as I learnt to call them—the stronger the evidence for the law. Only by shutting one's eyes to the light that had been shed on the world by evolution could one fail to see how simple and yet how inevitable was the whole business.^[5]

If then differentiation be the cardinal law of evolution—for the correlative concept of integration receives no emphasis in this early essay—does not the universality of the law imply a universal

cause? Just as gravitation was assignable as a *cause* of each of the groups of phenomena which Kepler formulated; so might some equally simple attribute of things be assignable as the cause of each of the groups of phenomena formulated in terms of differentiation. Now the only obvious respect in which all kinds of Progress are alike, is, that they are modes of change; and hence in some characteristic of changes in general, the desired solution must be found. Thus we are led up to the statement of the all-pervading principle which determines the all-pervading process of differentiation. It is this: *Every active force produces more than one change—every cause produces more than one effect.*[3] [6]

In the first part of the Essay many and varied facts are adduced to show that every kind of progress is from the simple to the complex. The aim of the second part is to show why this is so: it is 'because each change is followed by many changes'. From the beginning, the decomposition of every expended force into several forces has been perpetually producing a higher complication, and thus Progress is not an accident but a beneficent necessity. In a brief third part we are bidden to remember that

'after all that has been said the ultimate mystery remains just as it was. The explanation of that which is explicable does but bring out into greater clearness the inexplicableness of that which remains behind.... The sincere man of science, content to follow wherever the evidence leads him becomes by each new enquiry more profoundly convinced that the Universe is an insoluble problem.... In all directions his investigations bring him face to face with the unknowable; and he ever more clearly perceives it to be the unknowable'.[4]

There is I think a growing consensus of opinion that the first of these three parts, subsequently expanded and illustrated with astonishing wealth of detail in the volumes of the *Synthetic Philosophy*, contains the germ of all that is best in the teaching of Herbert Spencer; and that it was amid phenomena which admitted of interpretation from the biological, or quasi-biological, point of view that he found his most congenial sphere of work and the one in which his method was most effectively employed. The story of evolution is the story of inter-related changes. In any organic whole there are certain salient features of the historical sequence.[5] The parts get more different from each other, and they also get more effectively connected with each other; the individual whole gets more different from its environment, and it also preserves and extends its connexion with the environment; the several individuals get more different from others, while their connexion with others is retained and new connexions are established. Nowadays these central ideas may seem familiar enough; but that is just because Spencer's thought has been so completely assimilated. And then we must remember that these main principles are supplemented by a great number of ancillary generalizations, many of which have been incorporated in the scientific doctrine which is current to-day. We must bear in mind that of the *Biology* Charles Darwin wrote:[6] 'I am astonished at its prodigality of original thought.' Of the *Psychology* William James says[7] that of the systematic treatises it will rank as the most original. These are the opinions of experts. No discussion of sociology or ethics is complete if it ignores Spencer's contributions to these subjects. The *Ethics*, says James[8] is a most vital and original piece of attitude-taking in the world of ideals. It was his firm and often inflexible 'attitude' which was a source of strength in Spencer, though it was the strength of rigidity rather than that of sinewy suppleness. This was part of a certain 'narrowness of intent and vastness of extent' which characterized his mental vision. He was so obsessed with the paramount importance of biological relationships that in his *Sociology*, his *Ethics*, his *Psychology*, he failed to do justice to, or even to realize the presence of, other and higher relationships—higher, that is, in the evolutionary scale. But it was his signal merit to work biological interpretation for all, and perhaps more than, it was worth. It was on these lines that he was led to find a clue to those social and political developments, the discussion of which, in the *Nonconformist* of 1842, constituted the first step from the life of an engineer to that other kind of life which led to the elaboration of the *Synthetic Philosophy*. [9] In his later years he was saddened to see that many of the social and political doctrines, for the establishment of which he had striven so strenuously, were not accepted by a newer generation of thinkers. Still, to have taken a definite and, for all his detractors may say, an honoured position in the line of those who make history in the philosophy of life and mind—that could never be taken away from him. [8]

It will perhaps be said that this emphasis on the philosophy of life and mind does scant justice to the range and sweep of Spencer's philosophy as a whole; and no doubt others will contend that the emphasis should be laid elsewhere; on the mechanical foundations; on evolution as a universal principle. It will be urged that Spencer widened to men's view the scope of scientific explanation. He proclaimed 'the gradual growth of all things by natural processes out of natural antecedents'. [10] Even in the *Nonconformist* letters 'there is', he himself says, [11] 'definitely expressed a belief in the universality of law—law in the realm of mind as in that of matter—law throughout the life of society as throughout the individual life. So, too, is it with the correlative idea of universal causation.' And if there be law it must at bottom be one law. Thus in *First Principles* Spencer propounded a sweeping and sonorous formula, which every disciple knows by heart, embodying the fundamental traits of that unceasing redistribution of matter and motion which characterizes evolution as contrasted with dissolution. Was it not this that he himself regarded as his main contribution to philosophy? Did he not himself provide a summary, setting forth the sixteen articles of the Spencerian creed; and is not this summary given a prominent position in the Preface he wrote to Howard Collins's *Epitome of the Synthetic Philosophy*? Do not these fundamental articles of his faith deal with ubiquitous causes, with the instability of the [9]

homogeneous and the multiplication of effects, with segregation and equilibration, and with the basal conception of the persistence of force? There is here, it may be said, no special reference to the organic and the superorganic. And why? Just because Spencer's interpretation is all-inclusive; because biology, psychology, sociology, ethics are, broadly considered, concerned only with incidents of the later scenes of the great mechanical drama of evolution. Are we not again and again bidden, now in forecast, now in retrospect, to look below the surface, and constantly to bear in mind that the aim of philosophy, as completely unified knowledge, is 'the interpretation of all phenomena in terms of Matter, Motion, and Force'?[12] It is true that the affairs of the mind give pause and seem to present something of a difficulty. But even here 'specifically stated, the problem is to interpret mental evolution in terms of the redistribution of matter and motion'.[13] An adequate explanation of nervous evolution involves an adequate explanation of the concomitant evolution of mind. It is true that the antithesis of subject and object is never to be transcended 'while consciousness lasts'.[14] But if all existence, distinguishable as subjective, is resolvable into units of consciousness, which in their obverse or objective aspect are oscillations of molecules,[15] what more is required to round off the explanation of every thing, save the Unknowable—save the Ultimate Reality in which subject and object are united? In the end we are baffled by mystery; let us, therefore, make the best of it and rejoice.

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'We can think of Matter only in terms of Mind. We can think of Mind only in terms of Matter. When we have pushed our explorations of the first to its uttermost limit we are referred to the second for a final answer; and when we have got the final answer to the second we are referred back to the first for an interpretation of it.'[14]

And so neither answer is final. Finality is only reached when both are swallowed up, not in victory, but in defeat. Shall we not then glory in defeat and sing its praises often?

I must leave to some future Herbert Spencer lecturer the discussion of his doctrine of the Unknowable and the critical consideration of its place and value in philosophy. I would fain leave it altogether on one side; but that is impossible. Although the *First Principles* is divided into two Parts, dealing respectively with the Unknowable and the Knowable, we have not by any means done with the former when we turn from the First Part to the Second. With Spencer we have never done with the Unknowable, the Unconditioned Reality and the other aliases by which it goes. His persistence of force is the persistence of Unknowable Force. In a leading passage, at any rate, it is avowedly 'the persistence of some Cause which transcends our knowledge and conception. In asserting it we assert an Unconditioned Reality without beginning or end'.[16] There must, he holds, be something at the back of the evolutionary drama which we study—something that is both a principle of activity and a permanent *nexus*. [17] The pity of it is that we know not, and can never know, what on earth (or in heaven!) it is. We only know that it exists, and somehow produces the whole show. Now it would much conduce to clearness of thought and of statement if we could agree to eliminate those terribly ambiguous words 'force' and 'cause' when we are dealing with the fundamental postulate (if such it be) that there must be something at the back of evolution to make it what it is; and the word Source seems ready to our hand and might well be given this special significance. But Spencer uses Agency, Power, Cause, Force, in this connexion. In how many senses he uses the word 'force' I am not prepared to say. It is often a synonym for cause; it stands alike for matter and energy; [18] it is the objective correlate of our subjective sense of effort. [19] There is a 'correlation and equivalence between external forces and the mental forces generated by them under the form of sensations'. [20] And when we pass to human life in society, whatever in any way facilitates or impedes social, political, or economic change, is spoken of in terms of force. [21] With an apparent vagueness and laxity almost unparalleled, force is used in wellnigh every conceivable sense of this ambiguous word—except, perhaps, that which is now sanctioned by definition in mathematical physics. I say apparent vagueness and laxity because, subtly underlying all this varied usage, is the unifying conception of Source as the ultimate basis of all enforcement. From this flows all necessity whether in things or thoughts or any combination of the two. Thus persistence of force is Spencer's favourite expression for uniform determinism at or near its Source.

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Now, as I understand the position, science has nothing whatever to do with the Source or Sources of phenomena. By a wise self-denying ordinance it rules all questions of ultimate origin out of court. It regards them as beyond its special sphere of jurisdiction. It deals with phenomena in terms of connexion within an orderly scheme, and it does not profess to explain *why* the connexions are such as they are found to be. In any discussion of this or that sequence of events which may fall under the wide and rather vague heading of evolution, it is just a consistent story of the events in their total relatedness that science endeavours to tell. The question: But what evolves the evolved? is for science (or should I say for those who accept this delimitation of the province of science?) not so much unanswerable in any terms, as unanswerable in scientific terms. For the terms in which an answer must be given are incommensurable with the concepts with which science has elected to carry on its business as interpreter of nature. To this question therefore the man of science, speaking for his order, simply replies: We do not know. Is this, then, Spencer's answer? Far from it. The man of science here makes, or should make, no positive assertion, save in respect of the limits of his field of inquiry. If you beg him to tell you what that which he knows not is, or does, he regards such a question as meaningless. But Spencer's Unknowable, notwithstanding its negative prefix, is the Ultimate Reality, and does all that is in any way done. We may not know *what* it is; but *that* it is, is the most assured of all assured certainties. And when it comes to doing, what can be more dramatically positive than that which bears a name of negation? Whatever it may not be, it is the Power that drives all the machinery in

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this workshop of a world; it is the Power which lies at the back of such wit as man has to interpret it, and, in some measure, to utilize its mechanism. [13]

It seems plain enough that Spencer distinguishes, or seeks to distinguish, between those knowable effects which we call natural phenomena and their Unknowable Cause or Source. And this seems to be in line with the distinction which his critic, M. Bergson, draws between 'the evolved which is a result' and 'evolution itself, which is the act by which the result is obtained'. [22] An act implies an agent, and the agency of which the evolved is a manifestation is for M. Bergson Life, while for Spencer it is that very vigorous agency—the Unknowable. Now in criticizing Spencer, M. Bergson says:

'The usual device of the Spencerian method consists in reconstructing evolution with the fragments of the evolved.... It is not however by dividing the evolved that we shall reach the principle of that which evolves. It is not by recomposing the evolved with itself that we shall reproduce the evolution of which it is the term.' [23]

But does Spencer ever suggest that we shall thus reach the principle of that which evolves—by which, if I mistake not, M. Bergson means the Source of evolution? Does he not urge that we can neither reach it in this way, nor in any other way? For M. Bergson, as for Spencer, it is unknowable by the intellect—it can only be known by what M. Bergson calls intuition. For both thinkers, the intellect provides only a world of symbols; and Spencer's transfigured realism may be matched by what Dr. Wildon Carr calls M. Bergson's transformed realism. [24] So long as we are dealing with the evolved—which is that with which alone science attempts to deal—Spencer, M. Bergson, and the rest of us are in like case. We must stumble on intellectually with our symbols as best we may. 'Whether we posit the present structure of mind or the present subdivision of matter in either case we remain in the evolved: we are told nothing of what evolves, nothing of evolution.' [25] *Nothing of what evolves!* Spencer might exclaim with a groan. Have I then written all those pages and pages on the Unknowable for nought? Is it not a fundamental tenet of my philosophy that there must be, and therefore is, a Source of the evolved—of the phenomenal world which is merely an expression in terms of intellectual symbolism, of that ultimate Power which, though its nature may baffle the intellect, is none the less the most real of all realities? [14]

It would take us too far from the line of Spencer's thought to consider M. Bergson's doctrine that it is the intellect that portions the world into lots; [26] that cuts the facts out of the interpenetrating whole of reality, and renders them artificially distinct within the continuity of becoming. It suffices to note that on such a presupposition 'the cardinal error of Spencer is to take experience already allotted as given, whereas the true problem is to know how the allotment was worked'. [27] I am not prepared to give—indeed I have been unable to find—M. Bergson's own solution of the problem. I gather that it was Life itself that somehow allotted concepts and objects in such correspondence as should be practically useful though metaphysically false and illusory. But just how it was done I have still to learn. 'The original activity was', we are told, 'a simple thing which became diversified through the very construction of mechanisms such as those of the brain,' [28] which, as Life's tool, has facilitated the chopping up of a continuous interpenetrating reality into mince-meat for intellectual assimilation. Such a conception was foreign to Spencer's thought. But some of us may find it hard to distinguish M. Bergson's 'original activity' from Spencer's Unknowable, which, so far as one can make out, somehow produced precisely the same results. As a matter of fact, M. Bergson seems to put into Life, as Spencer put into the Unknowable, the potentiality of producing all that actually exists. [15]

For Spencer, as for M. Bergson, we live in a world of change. But neither is content to accept changes as facts to be linked up within a scheme of scientific interpretation. Both must seek their Source. Now to inquire into the Source or Sources of phenomena is characteristic of man as thinker. And if, in common with those whom I follow, I regard this quest as beyond the limits of science, I am well aware that such delimitation of fields of inquiry is by no means universally accepted. M. Bergson, for example, regards metaphysics as the *Science* [29] which claims to dispense with symbols, which turns its back on analysis, which eschews logic, which dispenses with relativity and pierces to the absolute, which, apparently, uses the intellect only to establish its utter incompetence in this department of 'science'. Merely saying that this, whatever else it may be, is not what I, for one, understand by science—and not, by the way, what M. Bergson in other passages seems to mean by science [30]—I pass on to Spencer's treatment of the philosophy of science which, for him, is 'completely unified knowledge', 'the truths of philosophy bearing the same relation to the highest scientific truths that each of these bears to lower scientific truths.'

I suppose one of the basal truths in his philosophy of science is for Spencer the universality of connexion between cause and effect. Now let us eliminate Source as the Ultimate Cause (so far as that is possible in Spencer); let us restrict our attention to cause and effect in the realm of the knowable. When we try to do this we find his statements concerning them scarcely less puzzling than those that refer to force, with which cause is so often identified. Thus we are told [31] that 'motion set up in any direction is itself a cause of further motion in that direction since it is a manifestation of a surplus force in that direction'; and elsewhere [32] that 'the momentum of a body causes it to move in a straight line and at a uniform velocity'. A distinction is drawn between cause and conditions. But both produce effects, and only on these terms can there be that 'proportionality or equivalence between cause and effect' on which Spencer insists. [33] There is, however, scarcely a hint of what constitutes the difference between cause and conditions, save in so far as he speaks [34] of 'those conspicuous antecedents which we call the causes' and 'those [16]

accompanying antecedents which we call the conditions'. Many of the details of his treatment I find most perplexing; but to recite examples would be wearisome. And then, in the ninth and tenth articles of the Spencerian creed, cause plays a somewhat different part. For, there, the instability of the homogeneous and the multiplication of effects are given as the chief causes which 'necessitate' that redistribution of matter and motion of which evolution is one phase. Similarly, as I have noted above, in 'Progress: its Law and Cause', the fundamental attribute of all modes of change—that every cause produces more than one effect—is itself spoken of as a cause, and likened to 'gravitation as the cause of each of the groups of phenomena which Kepler formulated'. In these cases a generalization is regarded as the cause of the phenomena from which the generalization is drawn. But sometimes it is spoken of as the reason for the phenomena.[35] Here again, however, as throughout his work, reference to Source is close at hand. Hence, in place of the words cause and force, the word agency[36] sometimes stands for that which produces effects; or the word factor may be used. Thus we are told[37] of phenomena continually complicating under the influence of the same original factors'; and we meet with the argument (contra Huxley) that states of consciousness are factors, that is, they 'have the power of working changes in the nervous system and setting up motions'.[38] Always close at hand, constantly underlying Spencer's thought, is the notion of power which works changes. In his treatment of the philosophy of science we are never far from the noumenal Source of phenomena.

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'For that interpretation of things which is alone possible for us this is all we require to know—that the force or energy manifested, now in one way now in another, persists or remains unchanged in amount. But when we ask what this energy is, there is no answer save that it is the noumenal Cause implied by the phenomenal effect.'[39]

Was it partly with Spencer in view that Mr. Bertrand Russell recently urged[40] that the word cause 'is so inextricably bound up with misleading associations as to make its complete extrusion from the philosophical vocabulary desirable'? Professor Mach[41] had previously expressed the hope 'that the science of the future will discard the use of cause and effect as formally obscure'. And as long ago as 1870 W. K. Clifford[42] tried to show in 'what sort of way an exact knowledge of the facts would supersede an enquiry after the causes of them'; and urged that the hypothesis of continuity 'involves such an interdependence of the facts of the universe as forbids us to speak of one fact or set of facts as the cause of another fact or set of facts'. Such views may, perhaps, be regarded as extreme; and the word cause is not likely to be extruded from the vocabulary of current speech, of the less exact branches of science, or of general discussions of world-processes. Still, a philosophy of science must take note of this criticism of the use of a term which is, to say the least of it, ambiguous. We must at any rate try to get rid of ambiguity. Now we live in a world of what, in a very broad and inclusive sense, may be called things; and these things are in varied ways related to each other. (I must beg leave to assume, without discussion, that the relatedness of things is no less constitutive of the world with which a philosophy of science has to deal than the things which are in relation.) And when things stand in certain kinds of relatedness to each other changes take place. The trouble is that the kinds of relatedness are so many and the kinds of change are also so many! Spencer tried to reduce all kinds of relatedness to one quasi-mechanical type; and he signally failed—or shall I say that he succeeded only by ignoring all the specific differences on the one hand, and, on the other hand, by so smudgy an extension of the meaning of mechanical and physical terms as to make them do duty in every conceivable connexion?

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So long as we can deal with simple types of relatedness, such as that which we call gravitative, in any given system of things regarded as isolated, we can express in formulae not only the rate of change within the system, but also the rate at which the rate of change itself changes. And these formulae are found to be generally applicable where like things are in a like field of relatedness. So that Spencer's persistence of force (at least in one of its many meanings) is replaced in such cases by sameness of differential equations. And in such cases we have no need for the word cause. Of course the value of the constants in any such formula depends upon the nature of the field of relatedness and of the things therein; and only certain systems, in which the relations are simple, or are susceptible of simplification, can be dealt with, at present, in this manner. It is imperative to remember that not only the rate of change but the kind of change differs in different relational fields—a fact of which Spencer took too little cognizance, so bent was he on some sort of unification at all hazards. Revert now to a field of gravitative relatedness, in which the motion of things is the kind of change, while the rate of change is expressible in a formula; may we not say that the co-presence of things in this relationship does imply certain motions and changes of motion within the system to which the term gravitative applies? There seems little room for ambiguity if we call what is thus implied the effect, and if we term those modes of relatedness which carry this kind of implication, effective. It may, however, be said that it sounds somewhat strange to speak of relations as effective. How can mere relatedness as such *do* anything? What is implied by the effect is surely, it will be urged, a cause in the full and rich sense of the word—a cause which produces the effect. For what is here suggested is nothing more than a generalized statement of the truth that the relational constitution of the system being what it is, the changes are what they are! And so we come back to the conception of an agency which in some way produces the observable change—of a power which is active behind the phenomenal scene—of force and cause in the Spencerian sense. But, so far as scientific interpretation is concerned, this reference to Source—for such it really is—is useless. The gravitative system can be dealt with scientifically just as well without it as with it.

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What, then, becomes of the scientific conception of energy? Is not energy that which produces

observable change? Is it not active in the sense required? And can we say that this conception is useless for scientific interpretation? I suppose most of us, in our student days, have passed through the phase of regarding energy as an active demon which plays a notorious part in the physical drama. Spencer loved it dearly. But some of us, under what we consider wiser guidance, hold that what we should understand by kinetic energy is nothing of this sort. It is a constant ratio of variables, conveniently expressed as $1/2mv^2$. That, however, it may be said, is absurd. Energy is not merely a ratio or a formula; it is something much more real; perhaps the most real of all the realities the being of which has been disclosed by physical science. Granted in a sense, and a very true sense. But what is this reality? It is the reality of the changes themselves in those fields of relatedness to which the formula has reference. There is nothing, I conceive, in the modern treatment of energy that affords any scientific justification of the Spencerian view^[43] that energy is an agent through the activity of which the constant ratio of variables is maintained in the physical world.

I feel sure that it will still be said that change must inevitably imply that which produces change, and that, even if energy be only a ratio of variables within a changing field, there is still the implication of Force as the real Cause of which the change itself, however formulated, is the effect. No doubt this is one of the meanings which the ambiguous words force and cause may carry. It is to remove this ambiguity that I have suggested that the word Source should be substituted for cause in this sense. And what about force? In one of its meanings it now generally stands for a measure of change. For those who accept Source as a scientific concept it may well stand for the measure or degree of its activity gauged by the phenomenal effect; for those who do not accept it, the measure or degree of the change itself^[44]—to be dealt with in mechanics in terms of mass and acceleration. This leaves outstanding, however, the use of the word force in the phrase—the forces of nature—gravitative force, cohesive force, electromotive force, and so on. It was, I take it, with this usage in view that Spencer spoke of vital, mental, and social forces. Now the reference in each of these cases is to some specific mode of relatedness among the things concerned. We need to name it in some way; and this is the way that is, rather unfortunately, sanctioned by custom and long usage. When we say that a thing is in a field of electromotive force we mean (do we not?) that the relatedness is of that particular kind named electromotive, and not of another kind. When Spencer spoke of social forces he had in view changes which take place within a field of social relationships. We do not really need the word force in this sense, since the term relatedness would suffice, and has no misleading associations. But there it is: our business should be to understand clearly what it means. It does not, or should not, I think, mean more, in this connexion, than a particular kind of relatedness in virtue of which an observable kind of change occurs.

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We may now pass to cause and conditions. When Spencer distinguishes between those conspicuous antecedents which we call the causes and those accompanying antecedents which we call the conditions, he invites the question: What, then, is the essential difference between them? If the accompanying antecedents are distinguished as inconspicuous, we surely need some criterion of the distinction. Furthermore, inconspicuous conditions are, in science, every whit as important as those which are conspicuous. Now we all know that Mill regarded the cause as 'the sum total of the conditions positive and negative taken together.'^[45] But he expressly distinguishes between *events* and *states*.^[46] Discussing, for example, the case of a man who eats of a particular dish and dies in consequence, he says:

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'The various conditions, except the single one of eating the food, were not events but states possessing more or less of permanency, and might therefore have preceded the effect by an indefinite length of duration, for want of that event which was requisite to complete the required concurrence of conditions.'

Again he says:

'When sulphur, charcoal, and nitre are put together in certain proportions and in a certain manner, the effect is, not an explosion, but that the mixture acquires a property by which in given circumstances it will explode. The ingredients of the gunpowder have been brought into a state of preparedness for exploding as soon as the other conditions of an explosion shall have occurred.'

And he tells us that physiological processes 'often have for the chief part of their operation to predispose the constitution to some mode of action'.

This distinction may profitably be carried further and emphasized in our terminology. Take any thing, or any integrated group of things, regarded as that higher order of thing which we call a self-contained system. Process occurs therein, and process involves change. In so far as the system is self-contained its changes and states are inherent in its constitution. We need a term by which to designate that which is thus inherent and constitutional. The term *ground* might be reserved for this purpose. The word ground has its natural home in logic. It is here extended (if it be an extension) to that to which the logic has reference in the existing world. One is here following Spencer, who claims^[47] that 'Logic is a science pertaining to objective existence'. On these terms the constitution of any system is the ground of the properties, states, and happenings in that system regarded as isolated. But the changes or properties will be also in relation to surrounding things or systems. *These* changes, or modifications of change, in relation to external things or events, may properly be said to be conditioned; and we may well restrict the term

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conditions to influences *outside* the constitution as ground. Of course, if we accept this usage, we must not speak, with Mill, of the constitution of any system as the condition of its inherent changes or properties. That is why we need some such word and concept as ground. Now we may fix our attention on any constituent part of some natural system and make that part the centre of our interest. That part may be changing in virtue of its constitution; and the rest of the system, regarded as external to this selected part, must therefore be regarded as conditioning. It is a matter of convenience for purposes of scientific interpretation whether we select a larger or a smaller system-group and discuss its constitutional character. Thus we may think of the constitution of the solar system, or of that of the sun's corona; of the constitution of an organism or of that of one of its cells; of the constitution of a complex molecule or of that of an atom therein. We have here reached, or nearly reached, the limiting case in one direction—that of restricting our field of inquiry. The limiting case in the other direction is, I suppose, the universe. But could we so expand our thought as to embrace, if that were possible, the whole universe, then there are no conditions; for *ex hypothesi* there is nothing for science outside the universe. We have reached the limiting concept. Hence, for science, the constitution of nature is the ultimate ground of all that is or happens.

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Let us now see how we stand. Consider the following statements:

1. The Unknowable is the cause of all the phenomena we observe.
2. The constitution of gunpowder is the cause of its explosiveness.[48]
3. The fall of a spark was the cause of the actual explosion of the powder.[49]

Or these:

1. Life is the cause of all vital manifestations.
2. The inherited nature of a hen's egg is the cause of its producing a chick and not a duckling.
3. The cause of the development of the chick embryo is the warmth supplied by the incubating mother.[50]

In each case the reference under (1) is to a transcendent cause which produces the phenomena under consideration. I suggest that the word Source should here be used instead of cause. In each case the reference under (2) is to the nature or constitution of that within which some process occurs. I suggest that the word ground should here be used instead of cause. In each case the reference under (3) is to some external influence. I suggest that the word condition should here be used instead of cause. We thus eliminate the word cause altogether. But since, in nine cases out of ten, the conditions, or some salient condition, is what is meant by cause in popular speech, and in the less exact sciences, the word cause may perhaps be there retained with this particular meaning. These are of course merely suggestions towards the avoidance of puzzling ambiguity. One could wish that Spencer could have thought out some such distinctions to help his sorely perplexed readers.

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One could wish, too, that he had devoted his great powers of thought to a searching discussion of the different types of relatedness which are found in nature, and to a fuller consideration of a synthetic scheme of their inter-relatedness. It is imperative that our thought of relations should have a concrete backing. 'Every act of knowing', says Spencer, 'is the formation of a relation in consciousness answering to a relation in the environment.' But the knowledge-relations are of so very special a type; and the relations in the environment are so many and varied. Much more analysis of natural relations is required than Spencer provides. I do not mean, of course, that there is any lack of analysis—and of very penetrating analysis—in the *Psychology*, the *Biology*, the *Sociology*, and the *Ethics*. I mean that in *First Principles*, which must be regarded as his general survey of the philosophy of science, there is no searching analysis of the salient types of relationship which enter into the texture of this very complex world. Such omnibus elastics as differentiation, integration, segregation, do duty in various connexions with convenient elasticity of meaning to suit the occasion. But apart from qualifying adjectives,[51] such as astronomic, geologic, and so on up to artistic and literary, there is too little attempt at either a distinguishing of the types of relatedness or at a relationing of the relations so distinguished. One just jumps from one to another after a break in the text, and finds oneself in a wholly new field of inquiry. Little but the omnibus terminology remains the same. Nor does the *Essay on the Classification of the Sciences*, with all its tabulation, furnish what is really required. What one seeks to know is how those specific kinds of relatedness which characterize the successive phases of evolutionary progress, inorganic, organic, and superorganic, differ from one another and how they are connected. This one does not find. The impression one gets, here and elsewhere, is that all forms of relatedness must somehow, by the omission of all other specific characters, be reduced to the mechanical type. This, no doubt, is unification of a sort. But is it the sort of unification with which a philosophy of science should rest content?

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It may be said that unification can only be reached by digging down to some ubiquitous type of relation which is common to all processes throughout the universe at any stage of evolution. But what, on these terms, becomes of evolution itself as a problem to be solved? Surely any solution of that problem must render an account of just those specific modes of relatedness which have been ignored in digging down to the foundations. Surely there must be unification of the superstructure as well as of the substructure. Here and now is our world, within the texture of which things stand to each other in such varied relations, though they may be reducible to a few main types. There, in the faraway part, was the primitive fire-mist, dear to Spencer's imagination,

in which the modes of relationship were so few and so simple, and all seemingly of one main type. How do we get in scientific interpretation from the one to the other? Will it suffice to breathe over the scene the magic words differentiation and integration? Spencer appears to think so. Of course he did exceptionally fine work in elucidating the modes of differentiation and integration within certain relational fields—though he sometimes uses the latter word for mere shrinkage in size.[52] But what one asks, and asks of him in vain, is just how, within a connected scheme, the several relational fields in the domain of nature are themselves related, and how they were themselves differentiated. How, for instance, did the specific relationships exhibited in the fabric of crystals arise out of the primitive fire-mist relations? At some stage of evolution this specific form of relatedness came into being, whereas before that stage was reached it was not in being. No doubt we may say that the properties of the pre-existing molecules were such that these molecules could in due course become thus related, and enter into the latticed architecture of the crystal. They already possessed the potentiality of so doing. And if we have resort to potentialities, all subsequently developed types and modes of relatedness were potentially in existence *ab initio*—they were, as Tyndall said, 'once latent in a fiery cloud.' But it is difficult to see how the specific modes of relatedness which obtain within the crystal, can be said to exist prior to the existence of the crystal within which they so obtain. [27]

Preserving the spirit of Spencer's teaching we must regard all modes of relatedness which are disclosed by scientific research as part and parcel of the constitution of nature, from whatever Source, knowable or unknowable, that constitution be derived. Of these modes there are many; indeed, if we deal with all concrete cases, their number is legion. For purposes of illustration, however, we may reduce them, rather drastically, to three main types. There are relations of the physico-chemical type,[53] which we may provisionally follow Spencer in regarding as ubiquitous; there are those of the vital type, which are restricted to living organisms; there are those of the cognitive type, which seem to be much more narrowly restricted. How we deal with these is of crucial importance. Denoting them by the letters A, B, C we find that there are progressively ascending modes of relatedness within any given type. There is evolution within each type. Within the physico-chemical type A, for example, atoms, molecules, and synthetic groups of molecules follow in logical order of evolution. Now the successive products, in which this physico-chemical type of relatedness obtains, have certain *new and distinctive properties* which are not merely the algebraic sum of the properties of the component things prior to synthesis. We may speak of them as constitutive of the products in a higher stage of relatedness, thus distinguishing constitutive from additive properties.[54] Similarly when B, the vital relations, are evolved, the living products, in which these specific relations obtain, have new constitutive properties, on the importance of which vitalists are right in insisting, though I emphatically dissent from some of the conclusions they draw from their presence. For if, beyond the physico-chemical, a special agency be invoked to account for the presence of new constitutive properties, then, in the name of logical consistency, let us invoke special agencies to account for the constitutive properties within the physico-chemical—for radio-active properties for example. If a Source of phenomena be postulated, why not postulate One Source of all phenomena from the very meanest to the very highest? There remains the case of C—the synthetic whole in which cognitive relatedness obtains. This is unquestionably more difficult of scientific interpretation. But I believe that like statements may be made in this case also. What we have, I conceive, is just a new and higher type of relatedness with specific characters of its own. But of this more in the sequel. [28]

It must be remembered that A, B, C stand for *relationships* and that the related things are progressively more complex within more complex relational wholes. Relationships are every whit as real as are the terms they hold in their grasp. I do not say more real; but I say emphatically as real. And if this be so, then they ought somehow to be introduced into our formulae, instead of being taken for granted. We give H₂O as the formula for a molecule of water. But that molecule is something very much more than two atoms of hydrogen + one atom of oxygen. The absolutely distinctive feature of the molecule is the specific relatedness of these atoms. This constitutive mode of relatedness is, however, just taken for granted. And it is scarcely matter for surprise that, when we find not less specific modes of vital relatedness in the living organism, they are too apt to be just ignored! [29]

Revert now to the empirical outcome of scientific research, for as such I regard it, that new constitutive properties emerge when new modes and types of relatedness occur, and when new products are successively formed in evolutionary synthesis. This, it will be said, involves the acceptance of what is now commonly called creative evolution. I am far from denying that, in the universe of discourse where Source is under consideration, the adjective is justifiable. But, in the universe of discourse of science, I regard it as inappropriate. What we have is just plain evolution; and we must simply accept the truth—if, as I conceive, it be a truth—that in all true evolution there is more in the conclusion than is given in the premises; which is only a logical way of saying that there is more in the world to-day than there was in the primitive fire-mist. Not more 'matter and energy', but more varied relationships and new properties, quite unpredictable from what one may perhaps speak of as the fire-mist's point of view. This is no new doctrine, though it has received of late a new emphasis. Mill, dealing with causation,[55] speaks of a 'radical and important distinction'. There are, he says in substance, some cases in which the joint effect of the several causes is the algebraical sum of their separate effects. He speaks of this as the 'composition of causes', and illustrates it from the 'composition of forces' in dynamics. 'But in the other description of cases', he says, 'the agencies which are brought together cease entirely, and a totally different set of phenomena arise.' In these cases 'a concurrence of causes takes place which calls into action new laws bearing no analogy to any that we can trace in the [30]

separate operation of the causes'. They might, he suggests, be termed 'heteropathic laws'. G. H. Lewes, too,[56] in his *Problems of Life and Mind*, drew the distinction between properties which are *resultant* and those which are *emergent*. These suggestions were open to Spencer's consideration long before the last edition of *First Principles* appeared. They were, however, too foreign to the established lines of his thought to call for serious consideration.

But if new relationships and new properties appear in the course of evolutionary progress, where is the opportunity for that unification of scientific knowledge which, according to Spencer, is the goal of philosophy? To be frank, I am by no means sure that this question can be answered in a manner that is other than tentative. Perhaps we have not yet reached the stage at which more than provisional unification is possible. Such provisional unification as is suggested by a survey of the facts is that of seemingly uniform correlation in a hierarchy of logical implication. There are certain modes of relatedness which belong to the cognitive type. It would seem that whenever these obtain they may be correlated with other modes of relatedness which are of the vital or physiological type; and that these, in turn, may be correlated with those that are physico-chemical. Thus C implies B, and B implies A. The order cannot be reversed. Physico-chemical relations, *as a class*, do not imply those that are physiological.[57] The implication is not symmetrical. Spencer was within sight of this when he spoke[58] of the abstract-concrete sciences as 'instrumental' with respect to the concrete sciences, though the latter are not 'instrumental' in the same sense with respect to the former. But unfortunately he regarded the 'chasm' between the two groups as 'absolute'. And for him the proper home of properties—of all properties it would appear—is the abstract-concrete group—mechanics, physics, and chemistry. This seemingly leaves no place for a specific type of properties connected with vital relatedness as such. In fact Spencer's method of treatment reduces all modes of relatedness to the A type, the laws of which are, for him, the primary 'causes' of all kinds of differentiation and integration. Hence the laws of biology and psychology can ultimately be expressed and explained, he thinks, in mechanical or mechanistic terms. But in the doctrine of implication they are just the laws of B and C respectively, though laws of A may underlie them in a logical sense. And as we ascend the evolutionary plane from A to AB and thence to ABC—from the physico-chemical to the vital and thence to the cognitive—we find new modes of relatedness, new forms of more complex integration and synthesis, new properties successively appearing in serial order. This seems to me simply to express, in outline, the net result of interpretation based on empirical observation—though much, very much, requires to be filled in by future research. And the new properties are not merely additive of preceding properties; they are constitutive, and characterize the higher evolutionary products as such. Why they are thus constitutive, science is unable to say. Spencer, of course, calls in the Unknowable to supply the required nexus.[59] Otherwise, in each case, he confesses that 'we can learn nothing more than that here is one of the uniformities in the order of phenomena'.[60] None the less we may be able some day to establish an ordinal correlation[61] of cognitive processes with physiological processes, and an ordinal correlation of these physiological processes with those of the physico-chemical type. That I conceive to be the ideal of strictly scientific interpretation if it is to be raised progressively to a level approaching that of the exact sciences. It certainly is not yet attained. But I see no reason why we should not regard it as attainable. It will involve the very difficult determination of many correlation coefficients and constants—and for some of these our data are, it must be confessed, both scanty and unreliable.

We must here note a much-discussed departure on Spencer's part from his earlier position. On the first page of the *Biology* in the earlier editions, and in the last, we are told:

'The properties of substances, though destroyed to sense by combination are not destroyed in reality. It follows from the persistence of force that the properties of a compound are resultants of the properties of its components, resultants in which the properties of the components are severally in full action, though mutually obscured.'

There is no hint here of Mill's heteropathic laws nor of Lewes's emergents. But in the last edition a special chapter is inserted on the Dynamic Element in Life. We here find a tardy recognition of the presence of specific vital characters.

'The processes which go on in living things are incomprehensible as the results of any physical actions known to us.... In brief, then, we are obliged to confess that Life in its essence cannot be conceived in physico-chemical terms.'

I speak of this as a tardy recognition; but it is one that does honour to the man; it is a frank admission that his previous treatment was in some measure inadequate, which a smaller man would not have had the honesty or the strength of character to make. Of course it is traced down to the Unknowable. 'Life as a principle of activity is unknown and unknowable; while phenomena are accessible to thought the implied noumenon is inaccessible.' Still, certain specific characteristics of living organisms are explicitly recognized as among the accessible phenomena; and these cannot be conceived in physico-chemical terms. But did Spencer fully realize how big a hole this knocks in the bottom of the purely mechanical interpretation of nature he had for so long championed?

There remains for consideration the place of the cognitive relation in Spencer's philosophy of science. We need not here discuss his transfigured realism. Apart from the customary references to the Unknowable, of which what is knowable is said to be symbolic, it comes to little more than laying special emphasis on the truism that what is known in the so-called objective world involves

the process of knowing; from which it follows that, apart from knowing it the objective world cannot be known. From this Spencer draws the conclusion that terms in cognitive relatedness have their very nature determined in and through that relatedness, and cannot *in themselves* be what they are, and as they are, in the field of cognitive symbolism. This may or may not be true. I am one of those who question the validity of the arguments in favour of this conclusion. Since, however, the philosophy of science deals only with the knowable—of which the so-called appearances with which we have direct acquaintance are the primary data—we need not here trouble ourselves with the controversy between realists and symbolists. Even on Spencer's view the world as symbolized is the real world *for science*.

Now one way of expressing the fact that the cognitive relation is always present where knowledge is concerned is to proclaim 'the truth that our states of consciousness are the only things we can know'.^[64] But it is a terribly ambiguous way of expressing the fact. What is here meant by a state of consciousness? So far as cognition is concerned it is, or at any rate it involves, a relationship between something known and the organism, as knowing—for Spencer assuredly the organism, though a so-called inner aspect therein. Of course it is a very complex relationship. It comprises relations in what is known, and relations in the organism as knowing. Hence Spencer defines life, psychical as well as physical, as 'the continuous adjustment of internal relations to external relations'.^[65]

'That which distinguishes Psychology is that each of its propositions takes account both of the connected internal phenomena and of the connected external phenomena to which they refer. It is not only the one, nor only the other, that characterises cognition. It is the connexion between these two connexions.'^[66]

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So far well. Cognition is a very complex network of relatedness involving many terms. What are these terms? For Spencer the internal terms are ultimately nervous (= psychic) shocks in highly integrated aggregates; and the external terms are, proximately at least, things in the environment. But both alike are spoken of as states of consciousness. There is surely an opening for ambiguity here. Sometimes, too, the words subjective affections are used in place of states of consciousness. 'Thus we are brought to the conclusion that what we are conscious of as properties of matter, even down to its weight and resistance, are but subjective affections.'^[67] Well, these states of consciousness, these subjective affections, fall into two great classes—the vivid and the faint. The former, which we know as sensations, accompany direct and therefore strong excitations of the nerve-centres; the latter, which we know as remembered sensations, or ideas of sensations, accompany indirect and therefore weak excitations of the same nerve-centres.^[68] And then we are told that the aggregate of the faint is what we call the mind, the subject, the *ego*; the aggregate of the vivid is what we call the external world, the object, the *non-ego*.^[69] It would seem, then, that the aggregate of vivid *subjective* affections is the *objective* world so far as knowable. To say the least of it, this terminology is somewhat perplexing.

No doubt our knowledge of the external world involves a subtle and intricate inter-relation of what is experienced vividly and what is experienced faintly—of what is actually presented and what is ideally re-presented. The distinction between them is a valid one. But when Spencer equates this distinction with that between the external world and the mind, as he does in the passages to which I have referred, the validity of his procedure is seriously open to question.

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It must be confessed that an adequate analysis of cognitive relatedness on scientific lines is not to be found in Spencer's works. I am not sure that it is yet to be found in the works of any other philosopher, though there are many signs that the difficult problems it involves are receiving serious attention. This much seems certain, for those who accept the spirit, though not perhaps the letter, of Spencer's teaching: that there it is as a constitutive mode of relatedness in the realm of nature, and that, if it forms part of the evolutionary scheme, if it is present in the conclusion, so far reached, though it was absent in the physico-chemical premises, if it is to be included in a philosophy of science it must be dealt with by that philosophy on lines strictly analogous to those on which any other relational problem is treated. Firmly as we may believe in the reality of Source, we must not call to our aid some psychic entity, some entelechy, some *élan vital*, to help us out of our difficulties; for one and all of these lie wholly outside the universe of discourse of science; and not one of them affords the smallest help in solving a single scientific problem in a manner that is itself scientific.

We have seen that Spencer believed that the task of psychology is to investigate the correlation of external and internal relations, and, in that sense, itself to correlate them within a scientific interpretation. Now the outcome of the former correlation is some form of behaviour or conduct on the part of the organism. No doubt such behaviour affords data to be dealt with in subsequent cognition. But it implies the prior cognition which leads up to it; and it is this prior cognition, abstracted from the behaviour to which it leads, that we have to consider. It is so terribly complex that it is difficult to deal with it comprehensibly in a brief space. Let me, however, try to do so, at least in tentative outline. There occurs, let us say, an external event in the physical world, such as the motion of a billiard-ball across the table; and when during its progress this stimulates the retina, there is an internal physico-chemical process which runs its course in retina, optic nerves, and the central nervous system. We may regard these two processes, external and internal, as *so far*, of like physical order. With adequate knowledge the two could, in some measure, be serially correlated as such. But the physico-chemical processes in the organism are not only of this physical type. They are vital or physiological as well. And this makes a real difference. Of course this statement is open to question. But I, for one, believe that there

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are specific relations present in physiological processes, *qua* vital, other than those of the physico-chemical type—relations which are effective and which require a distinctive name. So far I am a vitalist. At some stage of evolution these new modes of effective relatedness came into being, whereas in the fire-mist and for long afterwards they were not in being. None the less when they did actually come into being, under conditions of which we are at present ignorant—though not so ignorant as we were—they were dependent upon, and, for our interpretation, they logically imply, the physico-chemical relations which are also present. In any given case they further imply, through heredity-relatedness, the evolutionary history of the organism in which they obtain. This so-called historical element in biology no doubt involves a characteristic vital relationship. But, I take it, the physico-chemical constitution of any inorganic compound, and of any molecule therein, has also its history—has relationship to past occurrences within its type, which have helped to make it what it is. Still, in the organism the relation to past happenings has a quite distinctive form which we deal with in terms of heredity. See, then, how we stand so far. The internal physiological process implies a long chain of heredity-relationships through which the organism is prepared for its occurrence. It also implies a physico-chemical basis, an underlying[70] physico-chemical process. And this implies as a condition of its occurrence, the external event, the passage of the billiard-ball across the table. In a broad sense we may say that the inner process knows the external event which is a condition of its occurrence. But we have not yet reached cognition of the psychological type. [38]

Before passing on to indicate, in tentative outline, the nature of this higher mode of relatedness, I pause to note two points. The first is that knowing in that extended sense which I have borrowed, [71] is essentially selective in its nature. The physiological process, in the case I have taken, knows only that external event which is directly before the eyes and which is serially correlated with changes in the retinal images through the stimulation of specialized receptors. Of other external events it has no such knowledge. Compare this with the gravitative knowledge—if a yet wider extension of the meaning of the word be permitted—which the earth has of the sun and all the other members of the solar system—nay more, in degrees perhaps infinitesimal, of all other material bodies in the universe. The motion of the earth in its orbit implies the whole of this vast field of gravitative relatedness. The existing orbital motion at any moment implies, too, the preceding motion which it has, in a sense, inherited from the past. Abolish the rest of the universe at this moment and the earth's motion would cease to be orbital. In virtue of its 'inheritance from the past', it would continue at uniform velocity in one direction. The continuous change of direction and velocity we observe, is a response which implies gravitative knowledge. In a sense, then, the whole solar system is known by the earth as it swings in its orbit. [39]

The second point may be introduced by a question. Granted that we may say, in a very liberal sense, that the earth in its motion has this gravitative knowledge—is such knowledge accompanied by awareness? We do not know. But the point I have in mind is this, that the question itself is vague. Awareness of what? There must be awareness of something; and a definite question should be directed towards the nature of that something. For example: is the earth aware of its own motion? Or is it aware of the solar system? Or is it aware of the relation of the one to the other? If it be said that the second of these is meant when we ask whether the knowledge is accompanied by awareness, well and good. The answer will serve to define the question. Take now a case of biological knowledge. Are the plants in the cottager's window, when they grow towards the light, aware of a process in their own tissues? Or are they aware of the sunshine? Or are they in some measure aware of the connexion between the one and the other? To all these questions we must answer, I suppose, that we do not know. But it may have been worth while to ask them in a definite way. [40]

We pass, then, to cognition in the usual acceptance of the term—to what we speak of as knowledge in the proper and narrower sense. My contention is that this is a mode of relatedness which science must endeavour to treat on precisely the same lines as it deals with any other natural kind of relatedness. At some stage of evolution it came into being, whereas in the fire-mist, and for long afterwards, it was not in being. None the less when it did come into being, it was dependent on, and for our interpretation it logically implies, underlying physiological processes, as they in turn imply physico-chemical processes, in each case serially correlated. It is pre-eminently selective. And just as any physiological process, however externally conditioned, is grounded in[72] the constitution of the organism, as such, so too is any cognitive process grounded in the constitution of the organism as one in which this higher type of relatedness has supervened. Again, just as the physiological constitution implies a prolonged racial preparation, describable in terms of that mode of relatedness we name heredity, so, too, does any cognitive process imply, not only this racial preparation of the biological kind, but also an individual preparation of the psychological kind—implies relatedness to what we call, rather loosely, prior experience—which itself implies a concurrent physiological preparation.

Now there can be no doubt that awareness is a characteristic feature of the knowledge of cognition, whether it be present or absent in knowledge in the more extended sense. We must just accept this as what appears to be a fact. In science we do not pretend to say why facts are what they are and as they are. We take them as they are given, and endeavour to trace their connexions and their implications. Accepting, then, awareness as given, we must ask: Awareness of what? It is sometimes said that cognition is aware of itself. I am not sure that I understand what this means. If we are speaking of the cognitive relation, which is an awareness relation, the question seems to be whether a relation of awareness is related to itself. But of course if a field of cognitive relatedness be regarded as a complex whole, any part may be related to the rest, and the rest to any part. That kind of self-awareness—if we must so call it!—is eminently [41]

characteristic of cognition in the higher forms of its development. On these terms cognition is aware of itself—though the mode of statement savours of ambiguity.

Let us next ask whether there is awareness of the underlying cortical process. If we are speaking of direct awareness, apparently not. The correlation between the two is only discoverable through a very elaborate and complex[73] application of further cognition in interpretative knowledge. We only know the correlated cortical process by description, as Mr. Bertrand Russell would say,[74] and never by direct acquaintance.

Parenthetic reference must here, I suppose, be made to psycho-physical parallelism. But it shall be very brief. The sooner this cumbersome term with its misleading suggestions is altogether eliminated from the vocabulary of science the better. The locus of the so-called parallelism is, we are told, the cortex of the brain. But the cortical process is only an incident—no doubt a very important one, but still an incident—in a much wider physiological process, the occurrence of which, in what we may speak of as primary cognition, implies events in the external world. It is of these events that there is direct physical, physiological, and cognitive knowledge. Of course there are also inter-cortical relations which underlie the relations of those ideal cognita (Spencer's faint class) that supplement the primary cognita which imply direct stimulation of sensory receptors (Spencer's vivid class). It is questionable whether any form of cognition, properly so called, is possible in their absence. Now I see no objection to labelling the fact (if it be a fact) that the cognitive process implies a physiological process in which, as in a larger whole, the cortex plays its appropriate part, by the use of some such convenient correlation-word as psycho-physical; but only so long as this does not involve a doctrine of parallelism; so long as it merely means that cognition implies, let us say, certain underlying cortical changes. Of course it implies a great deal more than cortical process only; but this may perhaps be taken for granted. My chief objection to the word 'parallelism' is that it suggests two separate orders of being, and not two types of relationship within one order of being for scientific study.[75] We do not speak of parallelism between physiological and physico-chemical processes. We just say that scientific interpretation proceeds on the working hypothesis that there is a correlation of such a kind that physiological process implies a physico-chemical basis. So too, I urge, we should be content to say that scientific interpretation proceeds on the working hypothesis that there is a correlation of such a kind that cognitive process implies a physiological basis.

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It may be said that Spencer accepted the so-called identity hypothesis which does not lie open to the objection that it suggests two orders of being. He believed[76] 'that mind and nervous action are the subjective and objective faces of the same thing', though 'we remain utterly incapable of seeing or even imagining how the two are related'. Well, we may call them in one passage the same thing, we may speak, in another passage, of the antithesis between them as never to be transcended, and we may try to save the situation by reference to duality of aspect. But this kind of treatment does not help as much towards a scientific interpretation. It is true that, in yet another passage, speaking of the correlation of the physical and the psychical, Spencer says:[77] 'We can learn nothing more than that here is one of the uniformities in the order of phenomena.' Then why not leave it at that? And if there be a constant and uniform correlation which is 'in a certain indirect way quantitative', it would seem that we *do* see, as far as science ever professes to see, 'how the two are related.' We see, or conceive, how they are related in much the same way as we do in the case of the connexion between the physiological and the physico-chemical, and in numberless other cases. Both parallelism and identity will have to go by the board in a philosophy of science. They must be replaced by the far more modest hypothesis, which seems to express all that they really mean for science, that cognition always implies certain physiological processes in the organism.

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If we do speak of mind and nervous action as two faces of the same thing, it seems pretty certain that the one face is not directly aware of the other. When we speak of awareness in cognition we must therefore, it appears, exclude any direct awareness of concurrent physiological processes. Of what, then, is there awareness? Primarily perhaps of some occurrence in the external world. But the difficulty here is that, in the simplest case of human cognition there is awareness of so many things and in such varying degrees. There may be primary awareness of events in the external world (Spencer's vivid series), awareness of the relations involved in these occurrences as such, of the relations of these to ideal re-presentations of like kind (Spencer's faint series), of the relations of any or all of these to behaviour as actually taking place or as ideally re-presented; and all in different degrees within a relational meshwork of bewildering complexity, which we have not, as yet, adequately unravelled. The essential point to bear in mind is that the cognitive relation always involves relatedness of *many terms*, and that its discussion involves the analysis of what, in the higher phases of its existence, is probably the most complex natural occurrence in this complex world.

[44]

I cannot here follow up further the difficult problem of cognition[78]—save to add one or two supplementary remarks. First: it is, I suppose, fairly obvious that any given field of cognitive relatedness comprises *all* that is then and there selectively cognized. Just as, in the very extended sense of the word 'knowledge', the earth knows, in gravitative fashion, the whole solar system, as does also any one of the planets, so, in the restricted sense, is knowledge co-extensive with all that is, selectively, in cognitive relationship with the organism or that part of the organism which is the locus of awareness. I speak here of the locus of awareness in just the same sense as I might speak of the earth as a locus of gravitative knowledge of the solar system. The locus of awareness is just a specialized portion of the whole relational web. In other words, the relatedness is of the part-whole kind, where whole means rest of the whole other than the specific part. In any such

integrated system the part implies the whole—which, by the way, is quite a different matter from saying that the part includes the whole, or, as I understand the words, is equivalent to the whole. But, whereas gravitative knowledge is reciprocal—the sun knowing the earth in the same fashion as the earth knows the sun—cognitive knowledge is not reciprocal. My cognitive awareness of a spinning-top does not imply that the spinning-top is in like manner aware of me. The part knows the whole in a way that the whole does not know the part. The relationship of the part to the rest of the whole is not reciprocal or symmetrical. This we must just accept as a given feature of cognitive relatedness.[79] [45]

Another very important point is that cognitive relatedness is effective. By this I mean that just as, when the earth is in gravitative relation to the sun and the other planets (the constitution of nature being what it is), changes take place because the parts of the system as a whole are in this field of effective relatedness; so too, when the organism is in cognitive relation to its environment, changes in this system also take place just because a part of the whole system is in cognitive relatedness to the rest of the system. That means that the cognitive relation really counts—that it is not merely an epiphenomenal accompaniment of changes which would be precisely the same if it were absent. The 'sum of energy' presumably remains constant. There is no necessary interference with physical principles. But we know of so many cases in which the direction of change may be changed without any alteration of the 'amount of energy', as the phrase goes, that I see no reason, based on physical science,[80] for denying this kind of effectiveness, within a field of cognitive relatedness, if the facts seem indubitably to point to its existence. To assert that the presence or absence of cognitive relatedness makes absolutely no difference appears to me, I confess, little short of preposterous; to urge that it may be brought under the rubric of physico-chemical relatedness surely involves the ignoring of differentiating features, which science should not ignore. But, on the other hand, to invoke an immaterial psychic entity[81]—unless this merely names the relatedness itself[82] as gravitation names the gravitative relatedness—appears to me quite unwarranted in the scientific universe of discourse. [83] [46]

I must, however, draw to a conclusion. I cannot but think that Spencer failed to bring cognition and the conscious awareness it involves into really close touch with the rest of his philosophy of science. No such double-aspect theory as he accepted affords a satisfactory avenue of scientific approach. But where Spencer failed, who has come within measurable sight of success? We are only just beginning to see our way to stating the problem in such a form as to bring it within the purview of science. What we must insist on, as followers, at a distance, of Herbert Spencer, is the treatment of this type of relatedness on lines similar to our treatment of other types of relatedness within one order of nature.

Surveying his work as a whole, we may confidently assert that Spencer brought to a conclusion a great task, and was himself great in its execution. The present generation can, perhaps, hardly realize how potent his influence was on the thought of the latter half of the last century. Many of his conclusions ran counter to those which were, in his day, widely accepted. If only they seemed to him to be true, however, he held to them with a tenacity which his opponents branded as obstinacy. But as he himself said:

'It is not for nothing that a man has in him sympathies with some principles and repugnance to others. He, with all his capacities, and aspirations, and beliefs, is not an accident but a product of his time. While he is a descendant of the past he is a parent of the future; and his thoughts are as children born to him, which he may not carelessly let die. Not as adventitious therefore will the wise man regard the faith that is in him. The highest truth he sees he will fearlessly utter; knowing that, let what may come of it, he is thus playing his right part in the world.'[84] [47]

NOTES [48]

[1] *Fragments of Science*, vol. ii, p. 132.

[2] *Essays*, vol. i (American reprint), p. 3.

[3] *Op. cit.*, p. 32.

[4] *Op. cit.*, p. 58.

[5] Cf. W. K. Clifford, *Lectures and Essays*, vol. i, p. 95.

[6] *More Letters*, vol. ii, p. 235.

[7] *Memories and Studies*, p. 139.

[8] *Ibid.*, p. 140.

[9] *Autobiography*, vol. i, p. 212.

[10] James, *op. cit.*, p. 124.

[11] *Autobiography*, vol. i, p. 211.

[12] *First Principles*, Sixth (Popular) Edition, p. 446 (hereafter F. P.).

- [13] *Principles of Psychology*, Third Edition, vol. i, p. 508 (hereafter Ps.).
- [14] Ps., vol. i, p. 627.
- [15] *Ibid.*, p. 158.
- [16] F. P., p. 155.
- [17] Ps., vol. ii, p. 484.
- [18] There is '*intrinsic* force by which a body manifests itself as occupying space, and that *extrinsic* force distinguished as energy'. F. P., p. 150.
- [19] 'Divest the conceived unit of matter of the objective correlate to our subjective sense of effort and the entire fabric of physical conceptions disappears.' F. P., p. 151 note. Cf. Ps., vol. ii, pp. 237, 239.
- [20] F. P., p. 171.
- [21] e.g. 'Social changes take directions that are due to the joint actions of citizens determined as are those of all other changes wrought by the composition of forces.' 'The flow of capital into business yielding the largest returns, the buying in the cheapest market and selling in the dearest, the introduction of more economical modes of manufacture, the development of better agencies for distribution, exhibit movements taking place in directions where they are met by the smallest totals of opposing forces.' F. P., pp. 193-6.
- [22] *Creative Evolution*, English translation, p. 53.
- [23] *Op. cit.*, pp. 385, 6.
- [24] According to Dr. Carr's interpretation of M. Bergson, 'The whole world, as it is presented to us and thought of by us, is an illusion. Our science is not unreal, but it is a transformed reality. The illusions may be useful, may, indeed, be necessary and indispensable, but nevertheless it is illusion.' *Problem of Truth*, p. 66.
- [25] *Creative Evolution*, p. 389. [49]
- [26] 'But, when I posit the facts with the shape they have for me to-day, I suppose my faculties of perception and intellection such as they are in me to-day; for it is they that portion the real into lots, they that cut the facts out of the whole of reality.' C. E., p. 389.
- [27] *Creative Evolution*, p. 389.
- [28] *Op. cit.*, p. 387.
- [29] *Introduction to Metaphysics*, English translation, p. 8 and *passim*.
- [30] e.g. 'Organisation can only be studied scientifically if the organised body has first been likened to a machine.' C. E., p. 98. Science is, I think, generally used by M. Bergson for *intellectual* knowledge in contradistinction to intuitional knowledge.
- [31] F. P., p. 184.
- [32] *Essays*, vol. iii, p. 14.
- [33] *Essays*, vol. iii, p. 366.
- [34] F. P., p. 156.
- [35] 'There remained to assign a reason for that increasingly-distinct demarkation of parts, &c.... This reason we discovered to be the segregation, &c.... This cause of the definiteness of local integrations, &c.' F. P., p. 440.
- [36] F. P., p. 43.
- [37] *Essays*, vol. iii, p. 47.
- [38] F. P., p. 176.
- [39] F. P., p. 154.
- [40] *Proceedings Aristotelian Society*, 1912-13, p. 1.
- [41] *Popular Scientific Lectures*, English translation, p. 254.
- [42] *Lectures and Essays*, vol. i, p. 111.
- [43] 'But when we ask what this energy is, there is no answer save that it is the noumenal cause implied by the phenomenal effect.' F. P., p. 154. It is towards this and like statements that my criticism is directed. There can be no objection to the treatment, by physicists, of energy as an entity in the sense given below in note 82. Those phenomena to which $1/2 mv^2$ has reference are fundamental realities for physical science.
- [44] In a statement of the law of gravitation we may substitute the words 'in a degree' for 'with a force'; we may speak of 'the measure of attraction' instead of 'the force of attraction'.
- [45] *System of Logic*, Bk. III, ch. v, § 3, Eighth Edition, vol. i, p. 383.
- [46] *Ibid.*, § 3 and § 5, pp. 379 and 389.
- [47] Ps., vol. ii, p. 93; cf. p. 97. One has now, however, to add the realm of subsistence.
- [48] As a more technical example the following may be given:—The difference in

properties of isomers is caused by difference of internal molecular structure notwithstanding identity of chemical composition.

[49] If we take spark as cause and explosion as effect there is obviously no proportionality between the cause and its effect. Thus M. Bergson speaks of the spark as 'a cause that acts by releasing'; and he adds that 'neither quality nor quantity of effect varies with quality or quantity of the cause: the effect is invariable'. *Creative Evolution*, p. 77. Compare what Spencer introduced into the Sixth edition of F. P. (pp. 172-3), concerning 'trigger action which does not produce the power but liberates it'. According to the treatment in the text there can be no 'proportionality' unless both ground and conditions are taken into account.

[50]

[50] Spencer says (F. P., pp. 169-70) that 'the transformation of the unorganised contents of an egg into the organised chick is a question of heat' ['altogether a question of heat', in the Third Edition], and tells us that 'the germination of plants presents like relations of cause and effect as every season shows'. But he also says that 'the proclivities of the molecules determine the typical structure assumed'. Obviously here the 'heat supplied' falls under (3) of the text, and 'the proclivities of the molecules' is his notion of what should fall under (2).

[51] See Index to F. P., *sub verbo* 'integration'.

[52] e. g. 'Diminish the velocities of the planets and their orbits will lessen—the solar system will contract, or become more integrated.' *Essays*, vol. iii, p. 28. Mere condensation is often spoken of as integration. But then the term is used with bewildering laxity. Cf. James, *Memories and Studies*, p. 134.

[53] I retain in this connexion the current term physico-chemical. It seems that the basal type of relatedness here is electrical. It may be said that when we come down to the atom the *things in* relation are electrical, are electrons, are positive and negative charges. So be it. But is it not the *electrical relatedness* that is constitutive of the atom as such?

[54] 'A large number of physical properties', says Nernst, 'have been shown to be clearly additive; that is, the value of the property in question can be calculated as though the compound were such a mixture of its elements that they experience no change in their properties.' But other properties are not additive. 'The kind of influence of the atom in a compound is primarily dependent on the mode of its union, that is, upon the constitution and configuration of the compound. Such non-additive properties may be called constitutive.' Quoted by E. G. Spaulding in *The New Realism*, p. 238.

[55] *System of Logic*, vol. i, Bk. III, ch. vi.

[56] *Problems of Life and Mind*, Series II, p. 212.

[57] Of course if a particular physico-chemical change (*a*) is correlated with a particular physiological or vital change (*b*), then (*b*) implies (*a*) as (*a*) implies (*b*). The statement in the text refers to the implications of classes of change. There may be physico-chemical relatedness without any correlated vital relatedness; but there does not appear to be any vital relatedness which is not correlated with physico-chemical relatedness.

[51]

[58] *Essays*, vol. iii, pp. 31, 55.

[59] *Ps.*, vol. ii, p. 484.

[60] F. P., p. 178.

[61] An ordinal correlation is one that couples every term of a series (*a*) with a specific term of another series (*b*) and *vice versa* in the same order in each. Cf. Spaulding in *The New Realism*, p. 175. I shall sometimes speak of such correlation as serial.

[62] *Principles of Biology*, Edition of 1898, pp. 117, 120.

[63] *Op. cit.*, p. 122.

[64] *Ps.*, vol. i, p. 208.

[65] F. P., p. 61. Cf. *Ps.*, vol. i, p. 134.

[66] *Ps.*, vol. i, p. 132. James well says 'Spencer broke new ground here in insisting that, since mind and its environment have evolved together, they must be studied together. He gave to the study of mind in isolation a definite quietus, and that certainly is a great thing to have achieved'. *Memories and Studies*, p. 140.

[67] *Ps.*, vol. i, p. 206.

[68] *Ps.*, vol. i, p. 124.

[69] F. P., p. 120. *Ps.*, vol. ii, p. 472. Cf. *Ps.*, vol. i, p. 98.

[70] The word underlying is used in the sense of occupying a lower position in the logical hierarchy above indicated. If any one likes to speak of the physico-chemical and the vital as two aspects of one process, he is free to do so. And if he likes to say that the vital is caused by the physico-chemical, let him do so; but he must define the exact sense in which he uses the ambiguous word cause. The word inner in the text means within the organism.

[71] See S. Alexander, 'On Relations: and in particular the Cognitive Relation.' *Mind.*, vol. xxi, N. S., No. 83, p. 318.

[72] I have avoided the use of the word determine. It would be well to distinguish between that which is *determined* from without, that is, conditioned, and that which is

determinate, that is, grounded in the constitution. I am here, I think, in line with Bosanquet. (See *Principle of Individuality and Value*, e. g. pp. 341, 352.) I have also avoided all reference to teleology. Without committing myself to the acceptance of all that Mr. Bosanquet says in the fourth lecture of the series to which reference has just been made, his treatment, there, appears to be on right lines. There is no opposition in teleology, so treated, to what is determinate. Indeed, such teleology is the expression of the logical structure of the world, or, as Spencer would say, the universality of law. For just as higher types of relatedness imply a substratum of physico-chemical processes, so do all events imply the underlying logic of events. Cf. W. T. Marvin, *A First Book of Metaphysics*, ch. xiii, 'On the logical strata of reality.'

[52]

[73] Cf. *Ps.*, vol. i, pp. 99 and 140.

[74] *Problems of Philosophy*, ch. v; cf. *Proc. Aristotelian Soc.*, 1910-11, p. 108.

[75] It should be distinctly understood that I here speak of one order of being in reference to the phenomena dealt with by science, including the cognitive phenomena discussed in the text. Whether we should speak of the Source of phenomena as constituting a separate order of being is a question I cannot discuss in a note. Does the logic of events imply a Logos? That is the question in brief. But, since the implication in question is not of the scientific kind, I may leave it on one side in considering a philosophy of science.

[76] *Ps.*, vol. i, p. 140.

[77] *F. P.*, p. 178.

[78] I have confined my attention to the cognitive type of relatedness. Other higher modes supervene when the course of evolution is traced further upwards. Indeed, cognition is only part of the underlying basis implied by the richer forms of distinctively human relational life. Spencer has much to say of them in his *Sociology* and his *Ethics*, though he fails to realize that the phenomena he is dealing with involve essentially new constitutive features in man and in society. Can music or any form of art be discussed in terms of cognition only? I merely add this note to show that I am not unaware of the patent fact that when we have reached the cognitive type of relatedness, we are nowhere near the top of the evolutionary tree.

[79] The part which is the centre of awareness, may be spoken of as *experiencing*, in contradistinction to what is *experienced*. It is clear that such experiencing is always correlative to what is experienced actually or ideally (Spencer's vividly or faintly). The centre of awareness is either the cortex, or some specific part of the cortex, or (more generally) the organism as owning the cortex, in each case in accordance with the universe of discourse.

[80] Few physicists would, I think, be prepared to deny that, within a field of effective relatedness, there may be, and very often is, guidance without work done or any change in the 'amount of energy'. What physicists are concerned to insist on is their cardinal principle that every physical change involves physical terms in physical relatedness. This can be fully and freely accepted in accordance with the doctrine of implication sketched in the text. It is when Life or Consciousness is invoked to play the part of a non-physical term, or thing, which acts and reacts as if it were a physical term or thing, that physicists enter an emphatic protest. Cognitive relatedness among physical things may well be effective in guidance. To claim its presence must not, however, be regarded as in any sense equivalent to a denial of underlying physico-chemical relatedness.

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[81] Until those who seek to furnish evidence of the existence of discarnate spirits can make some plausible suggestions as to the nature of a comprehensible scheme of correlation which shall serve to link the discarnate with the incarnate, one is forced to enter their results in a suspense account. It is of little use to proclaim the existence of 'facts scorned by orthodox science'. The so-called facts must be incorporated within a consistent scheme, before they can claim a place in the fabric of scientific truth.

[82] As the word entity is now often used, for example by Mr. G. E. Moore, cognitive relatedness may be termed an entity. 'When I speak of an entity I shall mean to imply absolutely nothing more with regard to that which I so call, than that it *is* or *was*—that it is or was contained in the Universe; and of anything whatever which *is* or *was*, I shall take the liberty to say that it is an entity.' G. E. Moore, *Proc. Aristotelian Soc.*, 1909-10, p. 36.

[83] I have no space to discuss the physiological differentiation which is implied by the effectiveness of the cognitive relation. It involves, I believe, the differentiation of a superior cortical system from an inferior system of nervous arcs. I have dealt with it in some detail elsewhere. See *Instinct and Experience*.

[84] *F. P.*, pp. 91-2.

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