The Status of Psychology as an Empirical Science*

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SCIENCE OF EXPERIENCE

WE turn now to psychology, the most empirical of all the sciences in the sense that it deals directly with experience as such, makes no partial selection, but embraces all experiences alike indifferently, and at their face value. Here I wish to show how scientific explanatory concepts, together with concepts which the physical and biological sciences other than psychology usually reject, are all derived from immediate experience.

Perhaps one of the best ways of developing this thesis is to consider first the historical evolution of the notion of causality, which was invoked to account for movement or change in the physical universe. An analysis was made by Aristotle, as a consequence of which five explanatory concepts were considered necessary to show how any change or movement could come about. There were the two intrinsic principles constituting the thing to be changed—'matter' and 'form'. Change means that a new form comes to actuate the matter; and it involves also the negative concept of 'privation', since before the change the alterable thing is 'deprived' of the mode of being it will exhibit after the alteration has taken place. Further than this, there are the two concepts of the agent which brings the change about, the 'efficient' cause extrinsic to the thing changed, and the reason why the agent acts, the end, goal or 'final' cause, towards the realisation of which the action is directed. Like earlier attempts, this exceedingly acute analysis of causation, applied as it was to events in the external world, is an entirely anthropomorphic one. It reads into physical phenomena, in a conceptional manner, experiences which are wholly subjective. This is at once apparent in all the examples that are brought forward to substantiate it.

Now, in the course of the development of scientific thought, first the concept of finality was jettisoned as not applicable to events in the physical universe. In the physical phenomena alone there is no indication of goal-seeking. The next concept to be dropped was that of efficiency, in the sense that one thing actually produces changes in others; for efficiency also is in fact nowhere to be found in the phenomena. We are left, then, with sequences of antecedent and consequent, conceived as equivalent in amount of energy. To be sure, temporal sequences, as well as spatial relations, are to be observed in the phenomena themselves, and even similarities that can be *interpreted* as equivalences; but they do not display energy, any more than teleology or efficiency. Most men of science go no further than this in their rejection of the concepts originally invoked to account for physical causality. Others, more mathematically and philosophically minded, substitute equations for equivalences, and causal indeterminism for rigid determinism. The history of the successive modifications of the theory of causality, thus inadequately outlined, is evidence of the de-anthropomorphisation of physical science. At every step, however, in the refinement of the physical concept, one fact emerges—namely, that at no point is it possible to dispense with concepts derived from experiences other than those actually to be explained. Aiming at ends, efficient action, energy, equations, are not found in the phenomena in question, any more than thinghood and unity, which are necessarily involved in any and every conception of causality. What, then, are those other experiences in which we have the concrete facts from which we abstract the concepts that we apply to the phenomena?

* Continued from page 843.

ORIGIN OF SCIENTIFIC CONCEPTS

Beginning with the last named, the notions of 'thing', 'same thing', and of 'unity' are derived, and can only be derived, from the immediate awareness we have of ourselves as unitary, existent and self-identical beings. When I see and handle any object, such as a book, I have visual and tactile impressions which I refer to an extra-mental thing. The visual impression, however, is not the tactile one; and neither is the book, nor are both together. Sensorially, I do not apprehend the book at all, but only 'properties' of the book. Why, then, do I think that there is a book? I interpret the phenomena, analogically with my immediate awareness of myself as affected by states, and posit a physical book with physical properties to account for the phenomena. Only later do I refine my notions of physical 'properties', and conceive them, together with the book, not as like but as very unlike the original sensory data.

The kind of mental process that occurs here is even more strikingly illustrated by another consideration. I put the book aside, and busy myself with some other matter. Then I pick it up again, and see and handle it afresh. I believe it to be the same book. But on what grounds? On the grounds of the similarity of the previous and present phenomena. To apprehend a relation of similarity between phenomena, however, is not to apprehend identity either between the phenomena or between the physical book previously posited and again posited now. There is *no* sensorial way of apprehending or of establishing identities. What happens is that again I interpret the similar phenomena, on analogy with my immediate (non-sensorial) experience of self-identity, and posit a selfsame physical book enduring in time. Finally my notion of unity also is derived from the same source of immediate, non-sensorial experience of myself, and analogically applied to sensed-things and thought-things alike.

Passing to the explanatory concept of energy,

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still in general use in the sciences of Nature, we find that this also is not to be discovered among the particular selected sensory phenomena with which they deal. This concept of physical energy refers to a postulated persistent entity ('same thing'), constant in amount, which may be transformed from one state to another, and is capable of doing work in bringing about physical movements. To what source in experience can we trace this notion? It is not sensorially apprehended in the physical phenomena observed. It might at first sight seem that it should be traced to kinæsthetic experience, or the sense of effort in bodily activity by which different kinds of work are done; that we read this analogically into the physical phenomena, and project the result into a 'physical' world. But this cannot be a true explanation, because, like the properties of the book just considered, the sense of effort experienced in one case is only similar to the sense of effort experienced in another. It can in no sensory way be shown that they are identical. Likewise, the body, in the same way as the book, in any successive pulses of sensorial apprehension, displays no more than a relation of likeness. Accordingly, I appeal again to my immediate non-sensorial experience of self-identity, in which I discover an active self energising in one way or another. It is true I do not find any perpetual and unbroken continuity of self-consciousness; but, whenever I am conscious, notwithstanding all the changes that take place in the phenomenal world, including those of my own body, I am conscious of the same unitary and self-identical I. Can we find the basis of the concept of energy here? I maintain that we can, in the sense that this self does actualise, or energise, in different ways, now perceiving, now judging, now resolving, now enjoying, and the like. From this I infer that a self which does all these things can do any one of them, even if it is not actually doing that one at the moment. Here I find, in immediate living experience, the source from which the abstract concepts of energy and dynamism are drawn; and these concepts, applied to the phenomena of motion or change, become those of kinetic and potential energy, and are projected upon an extra-mental world of things which we have conceived on analogy with ourselves.

There are other lines of approach to the development of the thesis I am maintaining than the one I have taken; but I have chosen this because it most readily allows me to stress my point. Had we worked backward in the history of the evolution of the notion of causality, instead of forward as we have done, we should have found that we were leaving the region of remote inference for that of proximate inference, and this again for that of experience pure and simple, until at last we reach the immediate experience of the self as actively engaged with its mental objects. We should have reached then the central core, so to speak, of all experience. Here we find, not merely a concept nor a phenomenon, but an actual thing, or active substance existing in itself, from which the notions of thinghood, substance and activity are abstracted; we find here an efficient cause actually producing its effects, such as remembering a forgotten event or altering the character of phenomena by willing to do so, and from this the concept of efficiency is derived; we find a substantial cause in multiform relations with sensed-things and thought-things, among which is the goal relation, whence the idea of finality or teleology arises.

From such experiences as these, to which we apply relations likewise experienced, we derive proximate inferences such as those of retentiveness or mental energy. From them also, as well as from our immediate experiences of the apprehension of relations and the production of correlates, we infer the proximate principles of noetic eduction. And, lastly, from them again, by further applications of relations to them, to phenomena, and to correlates already produced in our thought, we reach the far more remote inferences of which use is made in the sciences of Nature; for here we refer our experiences to transexperiential, extra-mental causes. But the grandiose system of the natural sciences as a whole stands in virtue of these original experiences; and it would crumble away into less than dust did they not guarantee it.

It is for this reason, provided the meaning of the term be not limited to sensory experience only, but be extended to all and everything that may be experienced, that I maintain that psychology is the most empirical of all the sciences.

Kinematic Design in Engineering

FEW if any of the mechanical engineers of last century can have imagined that the academic kinematic theories of Willis, Reuleaux and Maxwell would ever be applied to machinery. Strength and solidity was their ideal, and when portions of structures were to be united, large areas of contact with numerous strong bolts formed their standard practice. The same idea was followed in moving mechanisms, as shown in large flat lathe beds and crosshead guides, and long, closely fitting, rigid bearings. Realising that this practice necessitated very perfect fitting, they developed the art of producing large flat and cylindrical surfaces to a very high pitch of perfection, and their success has been shown by the accuracy and endurance of early British machine tools.

Modern mechanical construction has called, however, for constant increase of accuracy, and the limitations of the old method began to be revealed by the distortions produced by the forces required to secure contact over large areas, and by the stresses resulting from temperature changes.

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