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Considerations on the Principles of Epistemology (1937)

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Comments:

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|[279] In epistemological discussions, two doctrines oppose each other: that of a priori knowledge, and that of exclusive empiricism. The a priori view is characterized by the claim that we possess knowledge about nature that is originally contained in reason but comes to actuality only through sensory stimulation. This knowledge, when brought to full consciousness, can be expressed in the form of general laws in a definite way. This doctrine furthermore claims that those general laws that are knowable a priori include the principles of the exact natural sciences and that, in particular, the method of the construction of physical theories is determined by them in an unambiguous and definite way, so that, after having found these principles, no further development of theoretical physics occurs in any essential sense.

Thus, according to Kant, classical kinematics constitutes the necessary framework for all of physics. Kant also regards the principles of Newtonian

dynamics as final principles of physics, and in this way the task of research in physics is restricted to finding mechanical models for explaining the different phenomena.

(There are even further restricting conditions which, according to Kant, can be inferred: thus, e. g., that each fundamental force has to be a central force, and also that there must be immediate action at a distance.) |[280]

In any case, in this extreme form the a priori doctrine cannot be brought into harmony with today's physics. To adopt it, one must either reject the ideas of today's physics in principle, or one must weaken the a priori standpoint by giving the principles maintained to be a priori valid such a liberal interpretation that they become compatible with present-day physics.

The former attitude appears to be a doubtful dogmatism. The following reasons, however, speak against the other procedure.

1. Even if the formulation of the principles can be maintained using a liberal interpretation, by doing so one will, for the most part, loose an essential element of the persuasiveness of the principle.

Thus, for instance, the principle of the conservation of substance is connected to the idea that substance is that of which a concrete thing consists. If one now interprets this principle so that it only expresses the validity of conservation laws, then the idea is surrendered, and the principle has no a priori persuasiveness at all.

We can illustrate this state of affairs with the law of the conservation of electric charge. As a consequence of the idea of substance this law would have to say that the positive and the negative charge are preserved individually. According to today's physics, however, the law is valid only in the sense that

the algebraic sum of positive and negative charge remains constant. This is certainly a conservation law as well, but it has nothing to do with the idea of substance and has no a priori plausibility at all.

2. The possibility of retaining the wording of a principle in the face of changes in basic physical attitudes depends on the particular property of the (at the time) new theories, and $|^{281}$ it can hardly be assumed as certain in advance that it is always possibile to preserve the formulation.

In view of this situation, one seeks a philosophical view that releases us in a radical way from the necessity of retractions or unsatisfying defenses.

An extreme empiricism aiming at completely reducing science to the immediate data of perception presents itself as such a radical standpoint. According to this view, once one discards all the unnecessary and doubtful components, science consists of nothing else than an arrangement and combination of sense data according to the criterion of greatest possible clarity.

One should, however, point out against this position that mere classifications of sense data do not immediately result in objective states of affairs and connections. The mental process that leads from immediate sense data to the determination of objective facts is anyway not so simple. This has been emphatically asserted by Kant, and we must agree completely with him in this case.

Moreover, such extreme empirism is totally incapable of making the method of testing scientific claims by means of new experiments intelligible. Especially the fact that very small effects of observation can cause a revolutionary change in scientific theories shows how far the procedure of natural science is from a mere registering of sense perceptions.

A moderate empiricism takes these facts, which speak against extreme empiricism, |[282] into account. On the one hand, it presupposes as given the kind of objectivity with which we deal in everyday life, but also in experimenting. Furthermore, it does justice to the essential role of the assumptions by means of which statements are conjectured which, according to their form, make claim to universal validity .[1]

However, a moderate empiricism of this kind leaves open the epistemological questions concerning, on the one hand, the formation of the everyday view of nature (the "morphological world view," according to the designation by Fries and Apelt) and, on the other hand, the formation of hypotheses and theories.

In this way we are led back to our previous formulation of the problem: to look for a philosophical position concerning empirical knowledge which fundamentally excludes the conflicts with the progressive scientific conceptions to which we are led by the Kantian theory of a priori knowledge. We can formulate the question somewhat more precisely as follows: is a radical detachment from such restrictions, as they follow from Kant's apriorism for the methodology of science, compatible with the preservation of the essential ideas of the Kantian critique of reason?

This formulation of the problem suggests a separation between two essential aspects in the conception of Kant's theory of experience: the idea of considering our empirical knowledge not as a mainly receptive procedure, and

[1]Most scientifically oriented philosophers today advoate a moderate empiricism. Rudolf Carnap, who initially maintained an extreme empiricism, has recently turned towards a moderate empiricism.

also not as an immediate observation, but rather as a product of our mind stimulated by sense impressions; and on the other hand, the assumption that in this product of the mind everything essential is determined by invariable fundamental properties of the mind. |[283]

This last assumption comes from the fact that Kant's conception of his theory was guided by the following consideration: the principles of the exact sciences are knowledge a priori. As such, they are understandable, however, only if they express conditions of the possibility of experience. At work here is, on the one hand, the conviction of the a priori epistemological character of the principles of geometry and mechanics, i. e. exactly the aspect that we had considered as problematic, and furthermore, the view that there could not be knowledge a priori of how things that are independent of us are "in themselves", the argument that constitutes "formal idealism" as it is called by Fries in his criticism of it. This Friesian criticism is correct. Regardless of it, however, Fries upheld the essentials of the Kantian theory, and indeed almost strengthened the subjective turn in epistemology. Like Kant, he was concerned with understanding the standpoint of classical mechanics, which he also took to be the final scientific view of nature, as philosophically necessary, and at the same time tried to differentiate it, in its jurisdiction, from the religious world view. Both goals seemed to have been realized most successfully by Kant's change of perspective in his notion of the "Copernican revolution."

If we now allow the principles of Newtonian mechanics not to be a priori knowledge, then we give up the Kant-Friesian formulation of the problem, and we will—while keeping the idea of the productive role of mental activity

in the knowledge of nature—replace the extreme position according to which "intellect prescribes nature its laws" with a more unprejudiced one.

Such an unprejudiced position seems to be given in the first place through the doctrine of mathematical knowledge and its relation to physics. It is obvious that the laws of geometry go |[284] beyond what can be determined by or inferred from observations. On the other hand, a view which ignores the essential role played by our experiences of the motion of rigid bodies for the formulation of the axioms of geometry cannot be satisfactory (as already shown in particular by von Helmholtz). We can do full justice to the special character of the intuitive formation of ideas in geometry (i. e. formation guided by intuition) without in the process excluding the very plausible thought that this formation of geometrical ideas takes place in connection with the mental processing of basic observations given by the handling of rigid bodies. Furthermore, it must absolutely be granted that the idea of space, and more so the idea of time, constitutes a form of our intuition, and that it cannot be reduced to sensations and concept formations. The recognition of this state of affairs by no means forces us to assume that physical spatiality and temporality are only derivable from our forms of intuition, and that their lawfulness is determined by these forms of intuition.

In freeing ourselves from this presupposition, physics gains a considerable freedom of speculation; the narrow mechanistic framework is replaced by the framework of the mathematical as such. Accordingly we can conceive the task of physics generally as enquiring into the facts of nature with respect to how far mathematical laws can be discovered in them, and how far through such laws a homogeneous understanding of the connections becomes possible.

In a certain sense we come back in this way to the old program of the Pythagoreans. Admittedly we have to aviod hypostatizing the mathematical in a mystical way, as they supposedly did. According to its nature the mathematical cannot |[285] be the actual itself but only something connected to the actual.

On the other hand, we are not prevented from acknowledging that this element of the mathematical can be found in reality, even independently of our cognitive constitution. Therefore we also need not understand the doctrine of a "division of truth under different worldviews" (according to an expression of Apelt) as reducing the significance of physical knowledge. Such a limitation of validity is unavoidable if mechanistic physics is taken as a basis, because of the claims of exclusiveness and completeness inherent in the mechanistic view of nature. For our view of physics, in contrast, in which only the mathematical form of concept formation and of the connection counts as a general characteristic feature, but not the carrying out of a specific view of nature taken as a basis, those claims become invalid.

As a further consequence of this way of looking at things, it turns out that the naive view—we will briefly call it our "ordinary view of nature"[2]—gains in importance. In the Kantian philosophy, and also in Fries, it appears as a simple preliminary stage of the scientific view. In dropping the assumption of a specific physical view of nature, our ordinary view of nature gains the role of a fixed starting point to which even theoretical research has to return

[2]The expression "morphological world view" is a bit misleading because it evokes the understanding that the characteristic feature of this standpoint can be found in its restriction to shapes.

again and again in experimentally motivating its concept formations and assumptions. In particular, this ordinary view of nature has the following characteristics.

1. In it the complete constitution of the idea of object is already carried out; it contains therefore also the intuitive |[286] geometrical representation and the intuitive "construction" of the spatial order of objects, as well as everything that is necessary for handling things in experiments.

2. It encompasses all those concept formations for describing and explaining the external and the internal world which are laid down the ordinary colloquial language. In particular fundamental concepts like matter, life, consciousness, cause, chance, etc. find an unproblematic application.

3. In it there are neither reductions (e. g. from the qualitative to the non-qualitative), nor isolations of domains of objects. Everything given is regarded as connected. The heterogeneity of the material and the mental does have detrimental effects because the connections are pursued only insofar as they present themselves empirically. Nor does the relation of sense qualities to perception and the resulting illusions cause fundamental problems for this view; everywhere the concept formation and the language adapt to the given circumstances. (We say, e. g., "this dress looks yellow in daylight," or "this piece of cloth feels soft.")

A considerable part of empirical science, in particular physics, fits well into the ordinary view of nature. Some philosophers do not grant the possibility

of transcending our ordinary view of nature by physics at all. In this sense, Ernst Mach, for example, was opposed to atomism.

The tendency to such a restriction to the framework of our ordinary view of nature is very understandable, since that view brings with it the advantages of intuitiveness and formal coherence. On the other hand, we have to realize that the coherence, however important it might be for $|^{287}$ our practical life and for our emotional disposition towards the world, nevertheless has a perspectival nature comparable to the unity of a landscape. And we must furthermore recognize that the procedure adopted by speculative physics, when it goes beyond the ordinary view of nature, is a consistent continuation of the methods by which we achieve our objective grasp of the world around us and our knowledge of causal connections, already within the ordinary view of nature. We shall demand of a philosophical conception of knowledge of nature that it account for the basic methodological conformity of the process of physics, both in its early stages and in the newer speculative physics.

If we look for a suitable epistemological standpoint with respect to this task, the following complementary aspects appear on the basis of the former considerations.

1. The standpoint has to be chosen in such a way that it grants research the necessary speculative freedom. The activity of research should not be regarded as a mere application of a fixed schema in advance but as a continually renewed intellectual production.

2. On the other hand, speculative freedom cannot be understood as arbitrariness; one must do justice to the rational element in research, which presents itself to us especially in the complete and fully developed parts

> of physics. The formation of a new physical view must be understood as an interpretation in which reason, so to speak, reacts to a given situation of experience; whereby, in each case, the interpretations obtained in earlier stages of research, in so far as they have proven to be successful and have become fixed, appear as something belonging to the situation.

According to such a conception we are admittedly not in a position to determine the contribution made by reason in the form of a priori principles to empirical knowledge. At best one can be successful in characterizing it by formulating regulative maxims of research; but this is doubtful as well.

In any case, however, we consider rational interpretation to be an essential element in the development of empirical science—of course, not in those specious proofs (which are in a bad sense rationalistic and which Mach justly criticizes) where, in a situaiton where experimental experience is needed, one instead tries to obtain a result by a clever deduction, but rather in the heuristic mode of thought and wherever one introduces new interpretative general concepts, thereby preparing the ground for new types of understanding. Examples of such general concepts are found in the idea of atomism; in the method of explaining regularity with the help of the concept of probability; in the modification of the concept of matter with the help of the concept of field; in the introduction and application of the concept of energy. Furthermore, examples are also found that make possible the integration of different fields to a unified theory: the integration of the phenomena of gravity and astronomical processes of motion; the integration of optics and electrodynamics; the integration of geometrical mass measurements and phe-

nomena of inertia with gravity; and finally the latest conception of wave and corpuscular phenomena as two aspects of one and the same reality.

If we compare the view presented here with the two antagonistic opinions of pure apriorism and pure empiricism described at the outset, we find that it differs from these opinions by dropping a presupposition common to both, namely, the presupposition that reason, insofar as it is important in empirical knowledge, would have to play a role through a priori knowledge. We |[289] can represent this connection, following Leonard Nelson, with the help of a logical schema:

Note: Should there be some sort of diagram here? check German.

- Dogmatic assumption A: if reason is essential for physical knowledge it must play a role through principles that are recognized a priori.
- Fact F_1: The rational element is not dispensable in research in physics.
- Fact F_2: There are no a priori determined principles in physics.
- Apriorist consequence of F_1 and A: There are a priori recognizable principles of physics.
- Empiricist consequence of F_2 and A: The rational element is dispensable in physics.
- Solution: Reason plays a role in physical research, not through a priori principles, but in the progress of concept formation and explanatory methods. |[290]

On closer inspection, abandoning traditional rationalism in this way proves to be not only compatible with acknowledging the significance of the rational, but also favorable to it. Kantian philosophy resulted in a devaluation of the scientific view of nature as a consequence of its restriction of natural research with respect to its method and its validity.

Schiller facetiously sums up the Kantian view as follows: "In the theoretical field there is nothing more to find."

We will do better justice to the significance of the rational by not treating as final a specific temporal conception of nature, but rather by accounting for the kind of development that occurs when a creature mentally confronts its environment, as well as all other living things.