Mr. Russell's "Causal Theory of Perception"

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Source: *Mind*, Apr., 1928, New Series, Vol. 37, No. 146 (Apr., 1928), pp. 137-148
Published by: Oxford University Press on behalf of the Mind Association
Stable URL: https://www.jstor.org/stable/2249202

VOL. XXXVII. NO. 146.] [APRIL, 1928.

MIND

A QUARTERLY REVIEW

OF

PSYCHOLOGY AND PHILOSOPHY

I.—MR. RUSSELL'S "CAUSAL THEORY OF PERCEPTION".

By M. H. A. NEWMAN.

THE twentieth chapter of the *Analysis of Matter*[1] contains a theory of our knowledge of the unperceived parts of nature, called "the causal theory of perception," which is the foundation of the system of the world set out in the rest of the book. In the present paper[2] the view is put forward that this theory requires modification if it is to be capable of sustaining the theory of the material world that Mr. Russell wishes to derive from it.

§ 1.

The subject of the *Analysis of Matter* is the investigation of the philosophical outcome of modern physics. The question that naturally arises at the outset—whether physics has a philosophical outcome, or whether there is not just physics —is closely connected with the main problem of our knowledge of the external world. It may be put more precisely as follows.

The only data for the formation of physical theories, and the only material for testing them, are supplied by our own experience: everything else is at best an inference. Even the testimony of other people is only a certain mass of sensations, interpreted by analogies drawn from the movements of our own bodies. It may therefore be held that a physical theory *is* simply the set of all predictions about our own sensations

[1] *The Analysis of Matter*, by Bertrand Russell, F.R.S., London, 1927.

[2] Read before the Cambridge Moral Science Club, December, 1927.

derivable from it: that the theory that the moon moves round the earth is simply a concise way of saying that I shall see the moon if I station myself in a certain spot to-morrow night, that some one will tell me he saw it, and all other predictions of this sort. The view held probably by most scientists at the present day is that it is their duty as scientists to see that their theories are expressible without reference to anything that cannot be observed, and in particular that inferences from one set of observable phenomena to another are not made by way of properties of postulated unobservable entities. This principle (the deliberate application of which has quite recently had far-reaching effects on physical science) is simply the principle that a proof that does not use unnecessary hypotheses is better than one that does. It does not in the least imply that there *is* nothing but our experience. When the province of the physicist has been marked off there still remains the important question whether in fact predictions about our own sensations exhaust all that can be said about the world, or whether there are other external entities which are the sources of our sensations; and if it is held that these entities exist there is the further question, what can significantly be said about them.

There are three main positions on this question; solipsism, the belief that only my own percepts and feelings exist; phenomenalism, which admits other people's mental states, but not events perceived by no one (not to be confused with the phenomenalist *method* in physics, referred to above); and the view, most akin to that of common sense, that the unperceived parts of nature spoken of in physical theories have a real existence. Mr. Russell sets out the arguments against solipsism and phenomenalism with great lucidity in the chapter we are considering (though perhaps he underestimates the gulf between phenomenalism and the belief in an "external world"). For many people the principal ground for rejecting both solipsism and phenomenalism is perhaps simply this—that it is doubtful whether anyone was ever really able to believe either of them. The belief in other people and an external world are just as much *data*, part of our mental make-up, as sensations themselves. To convince a man that he does not believe in phenomenalism what is necessary is not so much deductive argument as an illustration that will remind him what he is claiming to believe. There is no evidence, for example, that anyone was present to witness the formation of the Solar System in the way that has been deduced by Prof. Jeans from clues supplied by the stellar universe in its present state. If, then, the phenomenalist view is adopted these clues, and the other materials by which the theory was successfully tested, must be supposed to be there merely to delude Prof. Jeans and his colleagues.

Having decided that there is, in some sense, an external world, Mr. Russell proceeds to his main task, which is to find what exactly that sense is. The result involves the notion of *structure*, or *relation-number*, which he has introduced into the philosophy of science to its very great advantage. Although it is now a familiar notion its place in the argument that follows is so fundamental, and its explanation so easy, that I shall venture to recall the definition.

For our purpose it is not necessary to define the single *word* "structure" but only what is meant by the *statement* that "two systems of relations have the same structure". Let a set, A, of objects be given, and a relation R which holds between certain subsets of A. Let B be a second set of objects, also provided with a relation S which holds between certain subsets of its members. The two systems are said to have the *same structure* if a (1, 1) correlation can be set up between the members of A and those of B such that if two members of A have the relation R their correlates have the relation S, and *vice versa*. For example A might be a random collection of people, and R the two-termed relation of being acquainted. A *map* of A can be made by making a dot on a piece of paper to represent each person, and joining with a line those pairs of dots which represent acquainted persons. Such a map is itself a system, B, having the same structure as A, the generating relation, S, in this case being "joined by a line". The important feature of the definition, brought out by the example, is that it is not at all necessary for the objects composing A and B, nor the relations R and S, to be qualitatively similar. In fact to discuss the structure of the system A it is only necessary to know the *incidence* of R; its intrinsic qualities are quite irrelevant.[1]

[1] Among systems of *n*-termed relations those with the *structure of an n-dimensional sphere*, element, or other space can be distinguished. Consider, for example, the case of a *society* (2-termed relation, "acquaintance") consisting of four people A, B, C, D, in which A knows B, B knows C, C knows D, and D knows A, but the other two pairs are unacquainted. The structure may be mapped by four dots on a circle, neighbouring dots representing acquainted people. We may therefore say that such a society (or more generally any connected society of which every member knows precisely two others) has a *cyclical* structure. Now just as a system of two-termed relations, like being acquainted, has a 1-dimensional graph, *i.e.*, a map consisting of *lines*, a set of three-termed relations is represented by a 2-*dimensional* complex, every three related objects being represented by the vertices of a triangle belonging to the complex; and among these

A point to be emphasised is that it is meaningless to speak of the structure of a mere collection of things, not provided with a set of relations—*e.g.* of a set of dots not connected by any lines. Further, no important information about the aggregate A, except its cardinal number, is contained in the statement that *there exists* a system of relations, with A as field, whose structure is an assigned one. For given any aggregate A, a system of relations between its members can be found having any assigned structure compatible with the cardinal number of A. Thus the only important statements about structure are those concerned with the structure set up in A by a given, definite, relation.

Mr. Russell's analysis of our belief in the reality of the external world is based on the observed fact (which is also his main ground for rejecting phenomenalism) that if a number of people are together and, as we say, look from different directions at the same object their experiences are related in a particular way. The percepts of all these observers can be organised as part of a 3-dimensional manifold so that they lie about a centre, similar percepts being assigned neighbouring positions. In fact the percepts obey roughly what may be called the laws of perspective in the space in which they have been placed. The percepts do not of course fill up the space; there are only percepts here and there, where there happens to be a percipient. According to phenomenalism these are all that really exist, but Mr. Russell is exploring the opposite view, that it cannot be regarded as fortuitous that the percepts form part of a centrally organised structure: the rest of the constituents of the system are also real, although they cannot be perceived. Mr. Russell's statement of his fundamental assumption is as follows:[1]

> Confining ourselves, to begin with, to the percepts of various observers, we can form groups of percepts connected approximately, though not exactly, by laws which may be called laws of "perspective". By means of these laws, together with the changes in our other percepts

systems those with *spherical* structure can be distinguished, just as *cyclical* structure could be distinguished for systems of 2-termed relations. I mention these facts to make it clear that to say that a system has, for example, spherical structure, whether 2 or 4-dimensional, does not presuppose the location of the system in a space- or space-time continuum. It is a purely logical property of the system itself.

Such properties of systems of relations have been the subject of mathematical researches for about twenty years, under the name of Combinatory Topology.

[1] P. 216.

> which are connected with the perception of bodily movement, we can form the conception of a space in which percipients are situated, and we find that in this space all the percepts belonging to one group (*i.e.*, of the same physical object from the standpoint of common sense) can be ordered about a centre, which we take to be the place where the physical object in question *is*. . . . The essential assumption for what is commonly called the causal theory is, that the group of percepts can be enlarged by the addition of other events, ranged in the same space about the same centre, and connected both with each other and with the group of percepts by laws which include the laws of perspective.

What is being asserted may perhaps be made clear by the following analogy. Suppose that a large white screen were discovered, and it was found by experimenting on small portions of it, that a red pattern emerged under suitable treatment. If the developed parts of the pattern seemed to fit naturally into a simple scheme covering the whole screen—for example, to be parts of a system of concentric circles—and if there was no reason to doubt that the developed parts were random samples, it would be reasonable to infer—even if for some reason the rest of the screen could not be treated—that there was in fact a set of complete concentric circles incorporated in the fabric of the screen, which would become visible if properly developed. In this analogy the developed parts of the circles correspond to our percepts, the inferred parts to the postulated unperceived events, which make up the full group which *is* the physical object.

It will be noticed that in Mr. Russell's statement a space is to be postulated or constructed in which the percepts are situated, instead of simply asserting the structure itself to be that of a 3-dimensional manifold in the sense roughly indicated in a preceding footnote. Even if a more elaborate theory of space-time is to be constructed later I think this form of the statement is preferable here: Mr. Russell has perhaps at this point overlooked the power of his own instrument. However, this is a minor point, and may in any case be a verbal misunderstanding.

The existence of unperceived events having thus been assumed we turn to the question: What can be known about these events? The answer given by Mr. Russell is most clearly set out in the following passage:—

> . . . I wish to examine now . . . how much we can know about unperceived events, assuming the causal

> theory of perception. It is sometimes urged that an unperceived cause of a perception must be a mere *Ding an sich* or Spencerian Unknowable. This seems to me only very partially true, if we accept the usual canons of scientific inference. We assume that differences in percepts imply differences in stimuli—*i.e.* if a person hears two sounds at once, or sees two colours at once, two physically different stimuli have reached his ear or his eye. This principle, together with spatio-temporal continuity, suffices to give a great deal of knowledge as to the *structure* of stimuli. Their intrinsic characters, it is true, must remain unknown; but we may assume that the stimuli causing us to hear notes of different pitches form a series in respect of some character which corresponds causally with pitch, and we may make similar assumptions in regard to colour or any other character of sensations which is capable of serial arrangement.
>
> . . . Except when we are studying physiology or psychology, we may suppose that what is happening in a place is what a person would perceive in that place, provided we use in inference only those properties of the percept which it shares with the stimulus. . . . Nothing in physical science ever depends on the actual qualities. (pp. 226, 227.)

Briefly: of the external world we know its structure and nothing more. We know, about things that are *not* percepts, the kind of things a blind man could be told about a picture, as opposed to the additional knowledge of intrinsic quality that we have of percepts.

This differentiation between the two sorts of knowledge is very attractive. It overcomes the difficulty about knowing what is by nature unknowable, for it admits that we can know nothing of quality, while *structure* can be inferred from such plausible assumptions as that the stimulus must be at least as complicated as the percept,[1] or that a certain similarity exists between cause and effect when both are complex,[2] or that other assumption that has already been used, the reality of the remaining members of the centralised groups (physical objects) into which certain sets of percepts fit. The meaning of the distinction is quite clear owing to the precision of the definition of "structure," and it does seem, on reflexion, that this is the kind of significance to be attached to our belief in an outside world. We believe that something is going on in the same sort of way when we are not there. A powerful

[1] *Cf.* p. 340. [2] P. 249.

instrument is also provided for the interpretation of all that is significant in our beliefs about unperceived events—including a number of questions which modern scepticism might be inclined to pronounce meaningless.

Of such questions that of the *existence of atoms* provides a good example, for on the one hand an atom can certainly never be perceived—it cannot be defined on the same lines as a physical object by means of its "aspects," for it has none; on the other hand the evidence for what is ordinarily called its existence is as strong as for any one piece of scientific theory. It was amassed largely before the rise of the quantum theory, and has been unaffected by the storms that have since swept over physics. Mr. Russell says a good deal about the *structure* of atoms, but does not touch this simpler question. We wish to know whether any significance can be given to the statement that "matter consists of atoms," and if so whether it is true. I think the meaning is something like this: A system of related things may fall into a number of groups in such a way that a very good idea of the structure is obtained by first considering the structure of each group separately and then the structure of the whole set when these groups are considered as individuals. For example, the collection of passages, halls, and tubes forming the Underground Railways of London, with their stations, is a system whose complete structure would be best indicated by giving the design of each station separately, and then a map of the kind that one sees about London, on which each station appears as a single dot. This property of the Underground Railways might be expressed by saying that "it consists of atoms," namely the stations. (The allusion is of course to the current physical use of the word, not to its derivation. Mr. Russell would say the second kind of map is *semi-similar* to the railway.) The property is evidently a purely structural one, and although, as with all important properties, there is no sharp dividing line between systems which have it and systems which have not, that does not destroy its utility. The question of the atomicity of matter is the question whether that part of the world where we say matter is located has an atomic structure in this sense. I believe this is a real question, to be answered by consideration of the evidence, not a matter of definition; and I should say the answer is in the affirmative.

Mr. Russell himself uses his apparatus to analyse some of the fundamental notions of physics in a somewhat similar way, though he is concerned in the first place with more primitive keywords—physical object, percipient, matter and so on.

§ 2.

In spite of the many advantages of Mr. Russell's division of knowledge I do not think it can be upheld in the form he gives it unless we are prepared to return to the view that really there is nothing of importance that can be said about the external world.

The trouble is the view that *nothing* but the structure of the external world is known. As it is important to make sure of Mr. Russell's views on this point I will quote two further passages.

> Thus it would seem that wherever we infer from perceptions it is only structure that we can validly infer; and structure is what can be expressed by mathematical logic (p. 254).
>
> The only legitimate attitude about the physical world seems to be one of complete agnosticism as regards all but its mathematical properties (last line of p. 270).

And I will recall a sentence already quoted:

> We may assume that the stimuli causing us to hear notes of different pitches form a series in respect of *some character* which corresponds causally with pitch.

These statements can only mean, I think, that our knowledge of the external world takes this form: The world consists of objects, forming an aggregate whose structure with regard to a certain relation R is known, say W; but of the relation R nothing is known (or nothing need be assumed to be known) but its existence; that is, all we can say is, "*There is* a relation R such that the structure of the external world with reference to R is W". Now I have already pointed out that such a statement expresses only a trivial property of the world. Any collection of things can be organised so as to have the structure W, provided there are the right number of them. Hence the doctrine that *only* structure is known involves the doctrine that *nothing* can be known that is not logically deducible from the mere fact of existence, except ("theoretically") the number of constituting objects.

The generating relation of the structure of the world as conceived by Mr. Russell I take to be what he calls "causal continuity," *i.e.*, if we make a map in space, exhibiting the structure, the parts that are near each other in the map are those that represent events causally continuous with each other. But the introduction of this name does not help us, for if Mr. Russell's principles are to be upheld this statement must be merely the *definition* of causally continuous: if anything were directly known about its nature we should know something not structural about the external world.

The only possibility of combating this objection seems to be to deny the truth of the proposition about relation-numbers on which it depends, namely that given an aggregate A, there exists a system of relations, with any assigned structure compatible with the cardinal number of A, having A as its field. This involves abandoning or restricting Mr. Russell's own definition of a relation, namely, the class of all sets $(x_1, x_2, \ldots x_n)$ satisfying a given propositional function $\phi(x_1, x_2, \ldots x_n)$.[1] If this definition is retained our assertion is clearly true. For example if a, α, β, γ, are any four objects whatever, a relation which holds between a and α, a and β, and a and γ, but no other pairs is the set of all couples, x and y, satisfying the propositional function

$$x \text{ is } a, \text{ and } y \text{ is } \alpha \text{ or } \beta \text{ or } \gamma \quad . \quad (1)$$

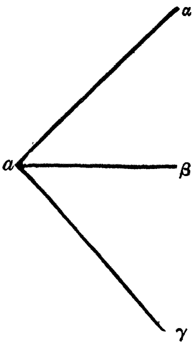

FIG. 1.

It may, however, be held that "real" relations can be distinguished from "fictitious" ones; that the example just given is a fictitious one, while the generating relation of the structure of the world is real; and that there is *not* always a real relation having an assigned structure and a given field. Here "fictitious" has a well defined sense; it means that the relation is one whose only property is that it holds between the objects that it does hold between; *i.e.*, the propositional function defining it is of the type (1) above.

Now if an aggregate A consists of objects of which nothing is known but their existence (supposing such a statement to have a meaning) it cannot, I think, be shown that there is a system of "real" relations with the field A and structure W. Even the assigning of names in such an aggregate is difficult to justify. We cannot say "Let this be a and that b," for there is no possible way of explaining the reference of "this" and "that". But it is not necessary for the present argument to contemplate aggregates about whose members nothing at all is known. The question we are considering is whether any information about the world is conveyed by the statement that it has the structure W with reference to some relation R between its events, where R is now restricted to

[1] There does not seem to be a definition of multiple-termed relations in *Principia Mathematica:* but there can be little doubt from the definition of a 2-termed relation (P. M., vol. i., *21·03), that the one given above represents Mr. Russell's views.

be "real"; and the answer is certainly negative if it can be shown that given any other logically possible structure, W′, there is also a system of real relations among the events with the structure W′. *We may assume, then, that at least one possible structure* W *is known;* and this provides the means of naming the events. For the "map" by which the structure W is specified must consist of identifiable, and therefore nameable, objects; and each event can be given the name of its correlate in the W-map. Having once assigned names to events, we can easily set up systems of relations with assigned structure, which though perhaps *trivial,* undoubtedly are not *fictitious* in the sense that was precisely defined above. An example will perhaps suffice. Suppose there were only four events, which with the help of the known structure W were given the names a, α, β, γ, and that the assigned structure W′ is that set up by the "fictitious" relation (1) above (see Fig. 1). A "real" relation generating W′ is "denoted by letters of different alphabets". A similar device can obviously be used whatever the number of events and the structure W′. The defence is therefore driven back from the fairly safe *fictitious-real* classification to the much less tenable "trivial" and "important"; for any further attempt to exclude undesired classes of relations by describing them one by one seems bound to fail.

There is a passage in Chapter I. of Mr. Russell's book, dealing with the interpretation of physics, in which the word "important" is discussed with a view to a somewhat similar application. It must be explained that Mr. Russell uses the word "physics" in a rather singular sense. The propositions which constitute our notion of the laws of nature themselves form a related system with a certain structure, the generating relation being in this case logical implication. It is this purely logical structure that Mr. Russell calls physics. The finding of objects for which the theorems are true is merely "interpretation". If there are such objects, physics (*i.e.*, presumably, physics according to the current beliefs of physicists) is true, if not it is false. There may, of course, be not only one but several sets of objects for which the abstract theorems are true. The one which is of interest for science is distinguished by Mr. Russell as the "important" one.

> Usually, in such cases, although many different sets of objects are abstractly available as fulfilling the hypotheses, there is one such set which is much more important than the others. . . . The substitution of such a set for the undefined objects is "interpretation" . . .

> The difference between an important and an unimportant interpretation may be made clear by the case of geometry. Any geometry, Euclidean or non-Euclidean, in which every point has co-ordinates which are real numbers, can be interpreted as applying to a system of sets of real numbers—*i.e.*, a point can be taken to *be* the series of its co-ordinates. This interpretation is legitimate, and is convenient when we are studying geometry as a branch of pure mathematics. But it is not the *important* interpretation. Geometry is important, unlike arithmetic and analysis, because it can be interpreted so as to be part of applied mathematics—in fact so as to be part of physics (p. 5).

I have quoted this passage because the problem of the "interpretation" of physics has an apparent similarity to the problem that has arisen concerning the external world. In the one case we have to distinguish between the aggregates in which systems of relations with a given structure hold, in the other between the systems of relations that hold among the members of a given aggregate. But Mr. Russell does not really in his case have to rely on a primitive idea, "importance," to distinguish one interpretation from another: a *criterion* is available in the fact that one interpretation involves our percepts and the others do not. In the present case we should have to compare the importance of relations of which nothing is known save their incidence (the same for all of them) in a certain aggregate. For this comparison there is no possible criterion, so that "importance" would have to be reckoned among the prime unanalysable qualities of the constituents of the world, which is, I think, absurd. The statement that there is an *important* relation which sets up the structure W among the unperceived events of the world cannot, then, be accepted as a true interpretation of our beliefs about these events, and it seems necessary to give up the "structure—quality" division of knowledge in its strict form.

There is one further point. The argument that has here been used against this division proceeds from a denial that there is a classification of relations (*e.g.*, into "trivial" and "important") with these properties:

(*a*) the classification is applicable to relations between unperceived events;

(*b*) if C is the class to which the generating relation of the world-structure W is held to belong, it cannot *be logically demonstrated* that there is another relation of the class C that generates an assigned structure W'.

But even if such a classification could be established a further piece of justification of Mr. Russell's division would be necessary. Evidence would still be wanted to show that there are *in fact* structures W′ which are not set up by any relation of class C; for our experience of aggregates consisting of objects of known character would lead us to expect the reverse.

The conclusion that has been reached is that to maintain the view that something besides their existence can be known about the unperceived parts of the world it is necessary to admit direct apprehension of what is meant by the statement that two unperceived events are *causally adjoined, i.e.*, happen near each other, temporally and spatially, or overlap, or do something of the sort. The central doctrine is then that while of percepts we have a qualitative knowledge, of other events all that can legitimately be inferred is their structure with regard to a certain directly known relation which may be called "causal proximity".

The object of this paper is to show the necessity, on internal grounds, for modifying the "clear-cut" theory of which some account was given in § 1, not to discuss the evidence for or against the amended form. But certain parts of Mr. Russell's book (especially Part III.) suggest that in spite of the passages quoted at the beginning of this section it is really after all the modified theory, with a "directly known" generating relation, that he wishes to put forward. It must therefore be pointed out that in its second form the theory lacks many of the advantages of the clear-cut form. In particular Mr. Russell's claim to have avoided the difficulties of the "Spencerian unknowable," which confront every theory of the unperceived world at its outset, cannot be upheld. It is no longer beyond doubt that all the terms in the enunciation of the principle have a clear meaning; the relation of causal (or spatio-temporal) proximity is presumably only known to us in the first place from experience of "proximate" pairs of *percepts*, and from this a concept of proximity must be derived general enough to provide the material for a theory of the constitution of atoms. In this respect the theory is at a disadvantage when compared with phenomenalism, for there can be no doubt of the meaning of the statement that other people's percepts exist, since it refers only to entities of a kind we are acquainted with. On the other hand, a breach having once been made, it may be asked why other non-structural properties should not be "directly known": the way is open for an attack from the idealist side. It appears, then, that although a modified form of Mr. Russell's theory makes an important assertion about our knowledge of the external world, a good deal of further argument will be necessary to show that this assertion is true.