II.—MR. JOHNSON ON THE LOGICAL FOUNDATIONS OF SCIENCE (I.).

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Mr. Johnson's great work on Logic goes steadily forward; and the later volumes increase in general interest owing to their more concrete subject-matter, whilst they have all the technical merits of the earlier ones. It will be remembered that, in Part II., Mr. Johnson considered various processes of reasoning which he called "intuitive," "summary," and "demonstrative" induction. None of these is quite what plain men mean by "induction"; that process Mr. Johnson distinguished by the name "problematic". The present volume[1] is primarily concerned with problematic induction, *i.e.*, it deals with the same kind of questions as Mr. Keynes considers in the third Part of his *Treatise on Probability*. Fortunately for the philosophic world Mr. Johnson holds that problematic induction cannot be understood except in terms of certain *a priori* concepts—roughly, those of cause and substance—and that it cannot be justified except on certain postulates which involve those concepts. Consequently a great deal of the book is taken up with extremely valuable discussions about the categories of cause and substance and their relations to each other and to space and time. In order to illustrate his general position on these subjects Mr. Johnson has considered in some detail the application of the notions of cause and substance to minds and their processes, and so we have the curious experience of meeting elaborate discussions on the mind-body problem and on the analysis of voluntary decision in a work on inductive logic. Even if we regard these chapters as strayed revellers, they prove to be such excellent company that we are grateful to our host for giving them room at his feast. But I think that Mr. Johnson could put up a fairly good defence of their relevance. If he had left them out, all his examples of substances would have been bodies and all his examples of causation would have

[1] *Logic.* Part III. (The Logical Foundations of Science). W. E. Johnson, M.A., F.B.A., Cambridge University Press. Pp. xxxvi, 192.

been physical processes and transactions; there would then certainly have been a danger of ascribing to substance and cause *in general* certain characteristics which are really peculiar to *material* substances and to *physical* causation.

The book starts with a very full Introduction which explains in general terms the concepts, and states the results, which are to be more fully discussed in the later chapters. The rest of the book may be roughly divided into four parts. (1) Chapters I. to V., inclusive, and the Appendix may be said to deal with the more purely logical aspects of problematic induction. (2) Chapters VI. and VII. are specially concerned with the notion of the Continuant, which corresponds approximately with the traditional concept of Substance. (3) Chapters IX., X., and XI., are concerned with different kinds of causation, and with the spatio-temporal characteristics of causal processes. (4) Chapter VIII. deals with the application of causal notions to Mind. These divisions are not absolutely sharp, for Mr. Johnson holds (*a*) that cause and substance are not so much two categories as "two aspects of a single process of construction" (p. 98), and (*b*) that the validity of science depends on certain postulates in terms of cause and substance (p. xviii). Consequently the notion of a continuant cannot be fully grasped without reference to causation, and conversely. And again the validity of problematic induction cannot be adequately discussed without reference to substance, cause, and their relations to each other and to space and time. Nevertheless we must begin somewhere, and I propose to treat the subject-matter of the book in the following order:—(A) The Continuant; (B) Causation; (C) The Logic of Problematic Induction; and (D) The Application of the Notions of Cause and Continuant to Minds.

(A) The Continuant.—The term "continuant" is used correlatively to the word "occurrent". Together they make up the realm of "substantives proper," *i.e.*, particular existents. The distinction between occurrents and continuants is therefore radically different from that between adjectives and substantives. Occurrents and continuants are both substantives, and both are characterised by adjectives. *E.g.*, a twinge of toothache is an occurrent and a mind is a continuant. The former inheres in the latter, but it is not an adjective which characterises it. On the other hand "throbbingness" is an adjective which may characterise the twinge of toothache, and "irritability" is an adjective which may characterise the mind in which the toothache inheres. The word "of" is thus ambiguous; it stands for the relation

of inherence between an occurrent and a continuant when we talk of "the toothache of Smith," and it stands for the relation of characterising between an adjective and a substantive when we talk of "the throbbingness of Smith's toothache" or "the irritability of Smith".

It will be best to approach continuants by way of occurrents. Mr. Johnson draws a distinction between events and occurrents. His general intention is clear enough, though I think that there are certain points of detail which need discussion. An occurrent would seem to be a manifestation of a single determinate value of a single determinable throughout the whole of a certain temporal or spatio-temporal region. *E.g.*, the determinable might be colour, and a certain occurrent might be the pervasion of the whole of a certain area for the whole of a certain minute by a certain determinate shade of red. Now the whole of this very same area might be pervaded for the whole of this minute by a certain determinate degree of temperature also. This manifestation would be a different occurrent. But, provided that both these occurrents inhere in the same continuant, they will be held to constitute together a single event. *E.g.*, both might together make up a single event in the history of a certain heated bit of metal. If, on the other hand, the two occurrents have to be assigned to different continuants we shall have to recognise two distinct events. *E.g.*, a certain spatio-temporal region might be wholly pervaded by a certain determinate noise-quality and also by a certain determinate temperature. There would then be two occurrents. And, if the former inhered in a certain bell and the latter in a certain radiator, we should have to count them as two events and not as two constituents of a single event.

The necessity of this reference to continuants becomes still clearer when we consider mental occurrents, which have only temporal extension. It might conceivably happen that throughout the whole of a certain minute two people had precisely similar sensations of toothache. Here we cannot distinguish the occurrents spatially or temporally or qualitatively. Yet we have no hesitation in calling them "two" and not "one". And the reason is that they inhere in different continuants. I take it that nothing less than the whole contents of my consciousness throughout a certain stretch of time would count as a mental *event*. Two contemporary thoughts in my mind, or a thought and a contemporary sensation in the same mind, would, I suppose, count as two occurrents which are constituents of a single mental event.

According to Mr. Johnson events that differ in their spatial or temporal boundaries or in both are different events, even though they belong to the same continuant and manifest the same determinate value of the same determinables. Thus we can talk of the events which are parts of an event as well as of the occurrents which are constituents of the event. The occurrents which are constituents of *e* will all have precisely the same spatio-temporal boundaries as *e* itself and will differ only in being manifestations of different determinables. The events which are parts of *e* will all have spatio-temporal boundaries which are wholly contained in and not identical with that of *e*, but they may all be manifestations of precisely the same determinate values of the same determinables. Mr. Johnson does not say that occurrents have parts, but it seems clear that they will. After all an event with only one constituent would be indistinguishable from the occurrent which is its only constituent; and, if the former has parts, the latter must have them also. The rule would seem to be that both events and occurrents have parts, and that only events have constituents. An occurrent which is a constituent of part of an event will presumably be part of an occurrent which is a constituent of the whole event.

We must now raise a question which seems to me to be very important in considering the relation of a continuant to its occurrents. What constitutes *one* occurrent or *one* event? It is evident that Mr. Johnson does not mean his events to be literally momentary or literally punctual, and I suppose that the same is true of his occurrents. Every occurrent then has some temporal or spatio-temporal extension. This being so, the mere fact that it is composed of spatio-temporal or temporal parts will not prevent a manifestation of a certain determinable from counting as one occurrent. What seems to be necessary and sufficient to constitute a single occurrent is that a single determinate value of a certain determinable shall be manifested throughout the whole of a certain temporal or spatio-temporal region, and that the whole of this manifestation shall be referred to a single continuant. (When I use the phrase "temporal or spatio-temporal" I mean that the former is to be understood when we are considering a determinable which can only be manifested in time, *e.g.*, thought, and that the latter is to be understood when we are considering a determinable like colour which is manifested in space as well as in time.) When these conditions are fulfilled we can say that there is both a single occurrent and a plurality of sub-occurrents which together compose it. So far as I can see,

then, there is no reason why there should not be an occurrent which lasts for centuries or extends over acres. I am not sure that Mr. Johnson clearly recognises this. One distinction which he draws between occurrents and continuants is that the former "occur" and the latter do not. But he admits that continuants themselves can begin and end in time, and we have just seen that a single occurrent may have indefinitely long duration. Hence this distinction does not amount to much.

We must now raise the same kind of question about events. All that Mr. Johnson has told us on this point is that a number of different occurrents are constituents of a single event if they all occupy the whole of a single temporal or spatio-temporal region and all belong to the same continuant. This is no doubt true, but I think it must be admitted that we should talk of a single event where less rigid conditions than this are fulfilled. It is evident that Mr. Johnson thinks of an event in general as composed of a number of different occurrents. Now, provided that these occurrents *between them* fill up a certain temporal or spatio-temporal region, we often count the contents of this region as a single event in spite of the fact that none of the occurrents occupies *the whole* of this region. A fairly obvious example is a single performance of a certain tune. This would quite reasonably be counted as one event occupying, say, five minutes. But it consists of a series of *different* sound-occurrents; together they fill up the five minutes, but none of them lasts for the whole of the time. And the event is the tune which it is just because its various constituent occurrents do not all overlap in time, but succeed each other in a certain order. In this particular case all the occurrents are manifestations of a single determinable. And I think perhaps the notion of a single event does require that the same determinables shall be manifested in some determinate form or other throughout the whole of the period which the event is said to occupy. But it is certainly not necessary that they shall each be manifested in a single determinate value throughout the whole period, as the example of the tune plainly shows. Again, I do not see any necessity for the determinate manifestations of each determinable at a given moment to cover the whole spatial extension of the event at that moment, provided that between them they leave no part of this extension unoccupied by some determinate manifestation of some of the determinables. In fact the notion of "one event" is much less definite than the notion of "one occurrent," and it is perhaps impossible to give a satisfactory general definition of it.

In this connexion one could wish that Mr. Johnson had taken some account of the very important distinction which Whitehead has drawn between "uniform" and "non-uniform objects". Whitehead argues with great plausibility that there are some characteristics which can be manifested throughout any spatio-temporal region however small, and that there are others which need a certain minimum of space or of time or of both for their manifestation. Mr. Johnson seems to confine himself in discussing occurrents to uniform characteristics, and my attempted definition of what would constitute a single occurrent presupposes this limitation. If we want to drop this we shall have to modify the definition somewhat as follows:—"We can speak of a single occurrent provided either (*a*) that we are dealing with a uniform determinable and that this is manifested in a single determinate value throughout the whole of a certain spatio-temporal region, or (*b*) that we are dealing with a non-uniform determinable and that this is manifested in a single determinate value in every part of a certain spatio-temporal region which is large enough to allow of its being manifested at all". Perhaps another way in which Mr. Johnson might have dealt with this question would be to make all occurrents to be manifestations of uniform determinables and to count all manifestations of non-uniform determinables as events and not occurrents. A tune, *e.g.*, is an example of a non-uniform characteristic, whilst a note may, for the present purpose at any rate, be taken as an example of an uniform characteristic. And it might be said that the characteristic of being such and such a tune can belong only to an event whose constituents are a series of occurrents each of which is characterised as such and such a note.

We now know approximately what Mr. Johnson means by an "occurrent," and we can see that there is no doubt that such entities exist. Now he takes it as an axiom that all occurrents are to be referred to one or more continuants (p. xxi). I am not clear about the connexion between this relation of reference and the relation of inherence already mentioned. I should suppose that an occurrent could *inhere* in only one continuant, but Mr. Johnson is perhaps thinking also of occurrents which consist in the fact that two continuants enter at a certain time into such and such a determinate spatial relation to each other. Such occurrents might fairly be said to be referable to two continuants, and it will be a verbal question whether we choose to say that they "inhere" in both. Mr. Johnson's typical examples of continuants are the material particle and the individual mind.

It seems to me that the notion of the continuant is best approached through Mr. Johnson's treatment of change. I will collect his most important statements on this point. (1) A continuant is not a mere collection of occurrents; occurrents are "constructed by thought into an unity by virtue of the nexus of causality". (Introd. § 4.) A continuant is "what continues to exist throughout some limited or unlimited time, during which its various states and its outer connexions with other continuants may alter or keep unaltered". (Introd. § 5.) The antithesis between occurrent and continuant corresponds to that between transient and permanent. This does not mean, however, either that there must be a certain determinate value of a certain determinable manifested in all the successive phases of a given continuant, or even that a continuant must have a certain unchanging property throughout the whole of its existence. *E.g.*, a mind is a continuant, and one of its habits is a property of it in Mr. Johnson's sense; but this habit may change without the mind ceasing to exist or becoming a different mind. The persistence of the continuant is "something behind even the possibly changing properties". (VI. § 2.) Any continuant has several modes of manifestation, each of which is a determinable. Its category is fixed by these fundamental determinables, which Mr. Johnson compares to the "attributes" of Spinoza (wrongly, I think; since Spinoza's "attributes" are certainly substantival and Johnson's "determinables" are certainly adjectival). Throughout the whole of its existence a continuant is manifested by *some* determinate value of *each* of these determinables. (VI. § 1.) It is no part of the notion of a continuant that it shall last for an indefinitely long time, or have no beginning and no end. Scientists do indeed ascribe this endlessness to their ultimate particles; but their justification, if any, must be purely empirical. They also ascribe unchanging properties, *e.g.*, a constant electric charge, to their ultimate particles; but, as we have seen, such constancy of property is no part of the notion of a continuant, and does not seem to be true of those continuants which are minds. (VII. §§ 2 and 3.) Finally, we come to Mr. Johnson's explicit account of change. In order that we may speak of "change" it is necessary that two successive and differently characterised states shall be conceived to belong to "an existent which continues to exist within both periods of time to which the change refers. And it is for this reason that we call such an existent a *continuant*." (VII. § 5.) We must not say that the *continuant* changes, for, by hypothesis, it remains permanent throughout the change.

We must not say that the properties of the continuant change; for they may quite well remain unaltered. And we must not say that any individual occurrent manifestation changes; it simply is what it is, and is succeeded by another when it ceases. What we have to say is that "the colour of so-and-so" or "the shape of so-and-so" changes. Thus, change always involves an adjectival determinable (such as colour, shape, etc.), and a "substantival determinandum," *viz.*, the continuant "so-and-so"; and it consists in the fact that, whilst the continuant is manifested throughout the whole of the period by *some* determinate value of this determinable, it is manifested by *different* determinate values of it at different parts of the period. (VII. § 6.) Thus, the essential point which Mr. Johnson is here insisting on is that, whilst change requires the *adjectival* identity which is supplied by a single determinable, it equally requires a *substantival* identity which is supplied by the fact that the successive occurrent manifestations of different determinate values of this one determinable belong to a single continuant.

Now the notion of a Continuant, according to Mr. Johnson, is also very closely connected with that of Causality; and the connecting link between the Continuant, as what persists through change, and the Continuant, as a factor in causal laws, is to be found in these peculiar adjectives which he calls "properties". These characterise all continuants and no occurrents. The point is this. An occurrent wears its heart on its sleeve. It has no characteristics beside that one which it manifests; for its whole nature is to be such and such a determinate manifestation of such and such a determinable throughout such and such a spatio-temporal or temporal region. But a continuant, *e.g.*, a mind or a bit of gold, is always thought of as *capable* of manifesting itself in numberless alternative series of occurrents beside that particular series in which it *actually has* manifested itself. Of course, these alternatives, though infinitely numerous, are all confined within definite limits which are characteristic of a given kind of continuant. *E.g.*, a bit of gold and a bit of silver are each capable of behaving in innumerable different ways, but one set of alternatives is characteristic of gold and another of silver.

Now a property of a continuant is a statement of what it *would* do under certain assigned conditions. It is not an actually manifested character; but expresses "a definable group of manifestations, not as actual, but as *potential*". "In ascribing a property to a body we imply that a certain formula can be asserted of the processes in which the body is concerned, which formula remains unchanged on the different

occasions in which the process takes place." (VII. § 7.) This statement, however, has to be qualified by the recognition of variable *properties*, as well as variable *manifestations*. The elastic constants for a body would be examples of "properties"; and they do remain constant throughout numberless repetitions of processes of stretching and compressing. Nevertheless, if the body be stretched beyond its "elastic limit" or heated beyond certain limits of temperature, these properties change. And of course this feature is the rule, rather than the exception, with the properties of psychical continuants. Still, the variations of the properties of a continuant when circumstances change beyond certain assignable limits obey laws and are characteristic of the continuant. The laws of the variation of first-order properties might be called "second-order properties," and so on. When Mr. Johnson talks of the continuant as "something behind even the possibly changing properties" it seems to me that he is forgetting his own distinction between properties of various orders. It does seem to me that the persistence of a given continuant requires the invariability of properties of higher order, even though it be consistent with the variation of its lower-order properties.

It is now fairly easy to see how Mr. Johnson supposes the motion of Continuant to involve that of Causation. The continuant, as we have just seen, is capable of manifesting itself in an infinite—though not an indefinite—plurality of alternative ways. We feel the need of some explanation for the course that it actually takes out of all these alternative possibilities. Even if it continues to manifest itself throughout a stretch of time in one unaltered way, we want some explanation of why it does this rather than manifest itself by a series of qualitatively different occurrents. And, still more obviously, if it manifests itself by some particular process of change, we want to know why *this* rather than another and rather than mere quiescence. Such questions have no meaning and can expect no answer except in terms of the category of Causation. We think of one state of a continuant as always determined in part and sometimes wholly by other states of itself. And when a state of a continuant is not wholly determined by its own previous states in accordance with purely immanent causal laws we think of the other determining factor as consisting in its variable relations to other continuants with specific natures and properties of their own. If you ask: "What is the nature of the continuant silver?" you will be referred to the article on "Silver" in a chemistry book; and there you will find nothing but

causal formulæ stating what bits of silver *do* in presence of various other continuants, such as Chlorine, Oxygen, etc.

I think there is no doubt that Mr. Johnson is right in holding that the notion of Substance involves the notion of Property (as distinct from actual manifestation) and that the notion of Property involves that of Immanent and Transeunt Causality. He compares his Continuants to Aristotle's Material Cause, his Occurrents to Aristotle's Occasional Cause, and his Properties to Aristotle's Efficient Cause. Occasionally he speaks as if he thought that a continuant could be *defined* as a set of occurrents connected with each other by immanent causation. Thus, he says that "occurrents are constructed by thought into an unity in virtue of the nexus of causality". (Introd. § 4.) Again, "The unity . . . ascribed to the continuant is a causal unity of connexion. . . ." (VII. § 13.) "An observed or assumed causal formula, under which the character of these manifestations may be subsumed, is the sole ground for regarding them as manifestations of one and the same continuant." (*Ibid.*) "Certain manifestations between which an unique kind of relation can be predicated constitute a genuine whole or unity to which the name 'continuant' is given. This type of relation, which constitutes the unity of a single continuant, is conceived primarily as one of immanent causality. Transeunt causality is the ground for asserting a plurality of continuants whose manifestations can be said to belong to one universe of reality." (*Ibid.*)

These statements seem to me to be plainly exaggerations of one side of Mr. Johnson's view, and to be consistent neither with facts nor with his main position. The last sentence quoted is of course ambiguous. It might mean merely that transeunt causality is the ground for asserting that a plurality of continuants (*recognised as such on other grounds*) do nevertheless "belong to one universe of reality". With this interpretation it is harmless and very likely true. But this is not the most natural interpretation. The statement suggests that transeunt causality is the ground for distinguishing a plurality of continuants, as well as for assigning them to a single universe of reality. And this seems false in fact and also circular. It is plain that I regard the earth and Sirius as two distinct substances without any thought of causality between them. And it seems impossible to understand the distinction between immanent and transeunt causality unless one already has the notion of a plurality of continuants; so that the attempt to ground the distinction between the states of a single continuant and those of several different continuants on the distinction between immanent and transeunt

causality would seem to be necessarily circular. Nor do I think that Mr. Johnson really means to do this. Elsewhere he asserts that the relation of occurrents to their continuant is absolutely unique (VI. § 1). He also asserts strongly in VII. §§ 8 and 9 that a most important ground for referring certain phenomena to the same continuant is that they occur in a certain spatial or temporal or spatio-temporal order which is found to be maintained and repeated under varying conditions. This is obviously true, and clearly incompatible with the assertion that "an observed or assumed causal formula . . . is the *sole* ground for regarding (a set of manifestations) as manifestations of one and the same continuant". Lastly, in summing up his view at the end of VII and defining his position in comparison with Kant's, Mr. Johnson says that he regards substance and cause, not as two categories, but as inseparable factors in a single category; and, in all his treatment of causality, he clearly holds that it is as impossible to understand cause without reference to substance as it is to understand substance without reference to cause. (It is of interest to point out that he also says here—VII. § 13—that the permanence of substance just is "the permanence in its mode of functioning," whereas Kant rested it upon the permanence of a particular manifestation, *viz.*, mass. This, Mr. Johnson thinks, made it difficult for Kant to deal with such continuants as minds and organisms, and led him to deny that psychology could ever become a science. On these remarks there are two comments to be made. (1) If the permanence of substance just is "the permanence in its mode of functioning," it can hardly be true that the continuant is "something behind even the possibly changing properties". (2) I should have thought that mass was a *property* and not a *manifestation;* in which case Kant's position would not differ in principle, however much it might differ in detail, from Mr. Johnson's.)

I have now given the best account that I can of Mr. Johnson's various statements about the Continuant. It remains to make a few remarks about this concept. I think we should all admit that the distinction between Occurrents, Events, and Continuants answers to facts which we have to recognise. Many, if not all, occurrents do cohere in bundles; there is a plurality of such bundles; we talk of a certain bundle persisting in spite of the fact that successive slices of its history differ qualitatively from each other; this combination of identity with variation is what we understand by change; the identity is largely a permanence in modes of behaviour, and as such introduces a reference to causation;

and so on. The only point on which there can be serious controversy is about the right analysis of the Continuant. The following views would seem to be theoretically possible. (1) That each continuant contains one persistent substantival entity, which is not an occurrent, and that all its occurrents stand in an unique relation to this. I understand the Pure-Ego theory to assert this about psychical continuants. It seems clear that Mr. Johnson rejects this analysis. (2) That a continuant is a complex consisting of no substantival entities except occurrents interrelated in certain ways; and that a set of occurrents do not form a continuant unless they are interrelated by a certain unique relation which cannot be reduced to causal, or spatio-temporal relations, or relations of qualitative likeness, or to any combination of these. It would, of course, be possible that this unique relation does not, or even cannot, relate occurrents which are not also related in the other ways mentioned. This seems to me to be Mr. Johnson's view. (3) That no relations are needed to constitute a continuant except certain relations of causality, resemblance, and spatio-temporal continuity, among a set of occurrents. (I assume in stating this alternative that the causal relation is not reducible to mere *de facto* regularity of sequence and concomitance.) This third alternative is not, I think, Mr. Johnson's view; though he sometimes makes statements which look as if he held it. (4) That ultimately no relations are needed to constitute a continuant except relations of spatio-temporal continuity and qualitative resemblance between a set of occurrents. This view is supposed to have been held by Hume, and it is explicitly rejected by Mr. Johnson.

In discussing these alternatives it seems to me to be important to consider physical and psychical continuants separately. Mr. Johnson seems to assume without question that, because they are both continuants, there must be *one* unique relation between occurrents and their continuants which applies equally to both cases. But, on the face of it, it is quite plausible to suppose that the relations of states of a mind to tha mind are different in kind from the relations of states of a body to that body. It is perfectly possible that one of the four theories mentioned above might apply to the physical Continuant and another to the psychical Continuant; and in fact this would be asserted, I suppose, by most people who hold the Pure Ego theory of the former. Let us begin with the physical continuant.

Mr. Johnson takes the material particle as the fundamental physical continuant. Now a material particle is commonly

supposed to keep its shape and size constant throughout its career; to rest or to follow a path in space which is continuous, in the sense that there are no gaps in it; and to manifest at any moment throughout the space which it then occupies the same determinate value of a single determinable. So far then the material particle is simply an uninterrupted spatio-temporal series of momentary occurrents each exactly like the others in every respect except in date and possibly in spatial position. Neglecting its spatial extension, it could be represented by a line in space-time of a certain definite shade of colour throughout its whole length. This uniformly coloured line must have no gaps in it, but it might be straight or curved and it might have sudden changes of direction. A plurality of different material particles would of course be represented by a number of different lines in space-time of the kind just described. These lines might intersect at certain points, such intersections representing collisions between the particles, but otherwise they must be distinct from each other. What more than this is needed to constitute a single material particle and a plurality of distinct particles?

I think that Mr. Johnson would say that a series of occurrents represented by any one such line may fairly be called the *actual history* of a material particle, but that something more is involved in a *material particle itself*. Let us call such a series of occurrents as I have been describing a "strand of history". There is no doubt that there are strands of history, that there is a plurality of them, and that a physical continuant is at least a strand of history. Any particular strand of history will be represented by a line of a certain particular form, and, if we generalise a little, we may imagine the colour of the line varying as we pass along it from past to future. Now another essential factor in the notion of a continuant is that the particular direction of any small element of the line and the particular "shade of colour" which marks this is completely determined causally. It will always be determined in part and sometimes wholly by the corresponding characteristics of the part of the same line which immediately precedes it. And, when it is not wholly determined by these, the remaining determining factors will be the characteristics of contemporary slices of other strands of history. Thus a physical continuant is at any rate a strand of history such that the characteristics of each short slice of it are determined always in part and sometimes wholly by those of the short slice of the same strand which immediately precedes this one. Is there anything further to be said about the physical continuant? Yes. (1) The

immanent causal law is here uniform throughout the whole strand of history. No matter what has happened to the particle, its velocity and direction will be determined once more by its immediately previous velocity and direction in the same way as before, so soon as it is again left to itself. (2) We can usefully distinguish between (*a*) the actual manifestations, (*b*) the private properties, and (*c*) the public properties, of any continuant. The actual manifestations are the actual occurrents which are observed or assumed to form one strand of history, distinct from other such strands, in virtue of their spatio-temporal and qualitative continuity with each other. The private property of the continuant is the law according to which the character and position of later occurrents in such a series are determined by those of earlier members, provided that the series is allowed to develop without interference. This involves "potentiality" in two senses. (i) The series may never in fact be allowed to develop for a moment without interference. (*Cf.* the history of a particle under gravitational attraction.) Or, even if it does develop without interference for considerable periods, there will be certain critical points at which its history suddenly takes a new turn through outside agency. (*Cf.* the history of a particle which is not continually attracted by others, but occasionally runs into them and rebounds.) Thus the notion of "private property" and of "what it would do if it were left alone" is generally a hypothetical ideal limit. (ii) Even during those periods when a strand of history is developing without external interference the actual series of occurrents is, in a sense, only one of an infinite set of alternatives each of which would be equally a manifestation of the same private property. Given the private property (*e.g.*, the first law of motion) *and* the character of any one occurrent in the stretch, the characters of the other occurrents in this stretch could not of course be other than they are. But we must regard the private property, I think, as an universal of a peculiar kind, which inheres in a series of manifestations as a whole, just as a tune inheres in a series of notes. Given the pitch of any one note, those of the rest are determined if this tune is to inhere in the series at all; but the same tune can inhere in an infinite number of other series in which the correspondingly placed notes have different pitches.

The public properties of a continuant are laws about what character the next short slice of a certain strand of history will manifest if the slice that immediately precedes it in the same strand (*a*) has such and such a character, and (*b*) stands

in such and such a spatial relation to a contemporary slice of another strand having such and such a character. All such laws have to make mention of (or tacitly assume as understood) some private property of the two continuants concerned. For they take the form:—"If a certain term, in a certain series of occurrents which *would* have continued in such and such a way if left to itself, comes into a certain spatial relation with a certain term in another series of occurrents which *would* have continued in such and such a way if left to itself, then the first series *will actually* be continued in such and such another way." The logical order is from Actual Manifestations, through Private Properties, to Public Properties. All these are no doubt essential to the complete notion of a physical continuant, and, so far as I can see, nothing more is necessary; but this particular order must be maintained among these three factors on pain of a logical circle. One cannot understand what is meant by a public property of a continuant unless you have already distinguished this from other continuants and have ascribed certain private properties to each. And, since the notion of a private property is essentially bound up with the notion of what the continuant would do if "free from *external* interference," it presupposes that we have already recognised that certain occurrents form a single strand of history and that there is a plurality of such strands, before we apply causal notions at all. Nor can I doubt that, in the case of physical continuants at any rate, this recognition and distinction rest on the fact that we can observe that certain successive occurrents are bound together by spatio-temporal and qualitative continuity, whilst certain contemporary occurrents are separated spatially by gaps in which no characteristic is manifested, or a characteristic widely different from both those which are manifested by the two occurrents.

There is one point which, I think, is worth making before we leave public properties. Both public and private properties are "characteristics of higher order," like a tune; *i.e.*, they cannot be manifested in any one occurrent, but only in a series of occurrents each of which manifests a suitable "first-order characteristic". Now, of first-order characteristics some are pure qualities (*e.g.*, a certain momentary shape or colour), whilst others are relations to occurrents in other continuants (*e.g.*, the momentary distance between two particles). We may regard the private properties as higher-order characteristics analogous to pure qualities, and the public properties as higher-order characteristics analogous to relational first-order characteristics. It is true of course that

even private properties essentially involve relations among the occurrents of a single continuant, but at any rate they do not involve relations to other continuants. A tune may not unreasonably be called a "quality" of a series of notes *as a whole*, though it is also of course a relation between the several notes of the series. In this sense an immanent causal law may be regarded as a "quality" of a series of occurrents as a whole. But public properties are all, from the very nature of the case, relational. They ought properly to be expressed by doubly-suffixed symbols, such as p_{12} and p_{21}, where "1" and "2" stand for the interacting continuants. This is obviously so in the case of such public properties as coefficients of friction or of restitution; a body does not have a coefficient of friction of its own in abstraction from all information about the particular body that it is in contact with. Yet, on the face of it, there seem to be exceptions to this rule. Mass is a public property, for it only exhibits itself in the interactions of one body with others. Yet we generally regard it as a pure quality, and do not symbolise it by m_{12} or m_{21}, but by m_1 and m_2. But it is no real exception. What happens is that in this particular case we find that $m_{12} = m_{13} = \ldots m_{1n}$; that $m_{21} = m_{23} = \ldots m_{2n}$; and so on. Under these very special conditions we can do what we cannot do with coefficients of friction or restitution, *viz.*, drop the second suffix and ascribe to each continuant a mass, characteristic of itself, which it carries into all its transactions with other continuants. Such peculiar public properties as this might be called "quasi-private"; and they form a connecting link between purely private properties, like the law of inertia, and purely public properties, like coefficients of friction.

I have now made such comments as have struck me on the notion of a physical continuant. It remains to say something about psychical continuants. Before doing so, however, it will be well to mention the distinction which Mr. Johnson draws between simple and compound continuants and between two kinds of compound continuants in the physical world. The only simple physical continuant is the material particle. This has no "inner states" (Introd. § 7) or "no inside" (IX. § 6). It can only change its external spatial relations to other particles. (*Ibid.*) But a single continuant-occupant may be a system of sub-continuants or sub-occupants. A molecule and a gas on the Kinetic Theory would be examples of such compound continuants. (VII. § 9.) Composite continuants can have internal states, though simple particles cannot. Temperature is quoted by Mr. Johnson as

an example. But he says that all such internal states reduce to variable arrangements or movements of the ultimate particles of the compound continuant; so that it is evident that by "temperature" he does not mean what we feel when we touch a "hot" body, but what physicists suppose to be going on within such a body at the time. (IX. § 6.) In fact he would certainly hold that the sensible quality of temperature only characterises "sensations," and that these are mental and not physical occurrents. Now there are two kinds of compound continuant. In one the identity of the whole through time depends on its continuing to be composed of the same particles. This, Mr. Johnson says, is exemplified by any ordinary inorganic body. (IX. § 6.) On the other hand, a complex continuant may go on existing "although none of the parts which appear from time to time to constitute the whole can be said to preserve their several identities". . . . "The law . . . according to which the character of the continuant at one time can be exhibited as depending on its character at another time may be the ground for asserting continued existential identity, although the material components of the continuant are not themselves continuant." (VII. § 4.) Mr. Johnson appears to have organisms in mind here, for he says (IX. § 6) that an inorganic body is one that continues to be composed of the same particles, whilst an organic body is one which continues to preserve the same form throughout changes in its material. (It may be remarked that this would make crystals organic bodies, as it stands.)

The following comments seem worth making on these statements. (1) The suggestion that the "material components" of a compound continuant may in certain cases be "not themselves continuant" is ambiguous. It might mean simply that, while they continue to *exist somewhere or other*, they cease after a time to form part of this particular compound continuant. This is the view that is usually taken about organisms or crystals and their component parts. But it might mean something much more radical, *viz.*, that the components literally came to an end after a time and that other components literally began to exist and took their place. This alternative is not generally contemplated for physical continuants at any rate. (2) It is unfortunate that Mr. Johnson has not said more about the beginning and ceasing of continuants. There is, of course, no particular interest in the mere breaking up or coming together of a compound continuant whose simple components existed before and will exist after it. But Mr. Johnson seems to leave it an open question whether even simple continuants may not begin and cease. It is to be left to the scientists

to decide "on empirical grounds". Now about this I must say (*a*) that, *if* simple continuants can begin and cease, we have here a perfectly new kind of "change," and presumably a perfectly peculiar kind of "cause" which fall quite outside the concepts dealt with by Mr. Johnson. (*b*) That it seems plain to me that scientists ascribe endless duration to their ultimate particles, *not* on empirical but on *a priori* grounds. There could be no possible empirical ground for ascribing endless duration to anything. The real situation is rather as follows. Scientists ascribe endless duration to the ultimate physical continuants, *whatever these may be*, on the *a priori* ground that the coming into being or the ceasing to be of simples involves a kind of change and a kind of causation which are quite inconceivable to us. The only empirical question is whether certain continuants which they have recognised on empirical grounds, *e.g.*, atoms, or electrons, can be identified with the assumed ultimate and endless physical continuants which have had to be assumed on *a priori* grounds. (*c*) I must also point out that the expression "material particle" is ambiguous. As used in books on dynamics, which is the sense in which Mr. Johnson seems often to use it, it stands admittedly for a fiction, *viz.*, a mass-*point*. But, as used for anything that scientists could conceivably be said to believe in on empirical grounds, it must stand for a material continuant of finite spatial dimensions, however small. (3) Lastly, I would like to ask whether a light-wave of definite frequency would not have all the characteristics which Mr. Johnson demands of a continuant; and, if so, whether he would count it as a material continuant or would hold that there are continuants that are neither material nor mental.

I pass at length to the psychical continuant. Mr. Johnson takes the individual mind as the only example of a psychical continuant. He holds that there are *purely* immanent processes in minds, though none in material particles, and that psychology is concerned with such processes. (Introd. § 7; VIII. § 1.) The self differs from the material particle in two other respects. In the first place, its properties alter as time goes on, whilst a particle is supposed to keep its properties unchanged throughout its career. Secondly, two different particles may have precisely the same determinate value of the same property, *e.g.*, the same mass or the same electric charge; but two selves never have the same determinate value of any property. I take this to mean roughly that, *e.g.*, Smith and Brown may both be bad-tempered, but that the two will never exhibit just the same degree and kind of anger when placed in identical circumstances. (IX. § 6.)

Mr. Johnson holds that bodies not only *have* sub-continuants of which they are composed but also that they *are* sub-continuants in larger material systems. "Physics is at first provisionally monadistic, but it becomes increasingly monistic, in the sense that the entire range of physical phenomena come to be systematised as immanent to the whole." (Introd. § 7.) But he holds that minds are not sub-continuants of larger psychical continuants. "Psychical reality remains essentially pluralistic, and cannot be formulated monistically." (*Ibid.*) If we reflect, I think we can see two reasons for this distinction. In the first place, the spatial relations *between* what would be called "different bodies" are of precisely the same kind as those *within* what would be called "a single body" and between its parts. There is no essential difference between the solar system, as a whole composed of planets, and a drop of water, as a whole composed of molecules. On the other hand, there is not the faintest analogy between the relation of Smith's mind to Brown's mind at a given moment and the relation of Smith's feeling of toothache to Smith's contemporary perception of the newspaper. Secondly, bodies which are separated in space are linked by various kinds of transeunt causality; and this is analogous to the transeunt causality which links the parts of a single body. The sun attracts the earth; the molecules in the earth attract each other; the atoms in each molecule attract each other; and so on. But, apart from alleged rare cases of telepathy, there seems to be no direct transeunt causality between minds at all. We may therefore fully accept Mr. Johnson's assertion that psychology is irreducibly pluralistic, merely remarking in passing that here we have a clear case where "transeunt causality is" *not* "the ground for asserting a plurality of continuants," as he seemed to suggest in VII. § 13.

But there is an interesting question which Mr. Johnson hovers round and never explicitly raises. Granted that a mind *is not* a sub-continuant in any larger psychical continuant, is it certain that a mind is not a complex continuant which *has* sub-continuants? In the first place, of course, there are the alleged cases of multiple personality; and there is the distinction which is drawn by certain people between the "conscious" and the "unconscious" parts of a normal mind. But, apart from these doubtful matters, Mr. Johnson admits that there is something very much like transeunt causation between various mental processes belonging to a single mind. Thus, a process of deliberation and a process of sensation might go on simultaneously and without interference in the same mind for some time, and then one might modify the other. (VIII. § 1.) In such cases it is not clear

to me why the two processes should not be regarded as sub-continuants, and the mind as a compound continuant of which they are constituents. It is true that these processes probably could not exist out of this mind. But then Mr. Johnson has not made the possibility of isolated and independent existence any part of his definition of a continuant; and, if he had done so, the claims of the mind as a whole to be a continuant would be endangered, since it is highly plausible to maintain that the mind is existentially dependent on the body even if we agree with Mr. Johnson that there are mental processes to which there is no detailed bodily correlate.

There is just one other remark to be made before leaving the psychical continuant. What determines whether a number of mental occurrents, having the same temporal limits, constitute one event? Mr. Johnson's answer is that they must belong to one psychical continuant. This may be true, but it is not very helpful. Now, when the corresponding question was raised about physical continuants, Mr. Johnson was not content to give the corresponding answer. He there referred us to identity of spatial boundary as a criterion, though he did suggest tentatively that it might be insufficient if two bodies could literally be in the same place at the same time. (Introd. § 6.) Now ought we not to assume a fundamental and indefinable relation of "psychical coincidence" corresponding to the equally fundamental and unanalysable relation of "spatial coincidence"? Two physical occurrents are constituents of a single physical event if their temporal limits be identical and they be also spatially coincident; two psychical occurrents would then be constituents of a single mental event if their temporal limits be the same and they be also psychically coincident. There will then be symmetry between the account of the psychical and of the physical continuant. But there will be one important point of difference. Spatial coincidence is one determinate among others under a single determinable. The others are of course intersectance, continence, contiguity, and complete spatial separation. But psychical coincidence seems not to be a determinate under any determinable. Two psychical occurrents would seem either to be psychically coincident or to have no psychical relation to each other at all. But it is perhaps just conceivable that there may be something that might be called "psychical intersectance or continence" in some cases of co-consciousness or of telepathy.

(To be continued.)