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A TENTATIVE REALISTIC METAPHYSICS

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My philosophical creed is that if ever we are to have an even partially satisfactory philosophy, we shall get it only by the use of scientific methods. The materials to which these methods are to be applied are supplied by experience, not the crude experience of everyday life, but this experience as interpreted by the various special sciences. The interpretation given by any special science to the material it investigates is relevant to that material; but the question of the adequacy of that interpretation when that material is considered as only one aspect of the world revealed to us in experience is one that the special science seldom raises. What the philosopher tries to do is to fit this interpretation into a larger scheme which embraces other aspects of the world as interpreted by other special sciences. Thus the self-imposed task of the philosopher is the integration of the scientific interpretations of the world in which he finds himself. Any step he takes in the accomplishment of his task is precarious; there are too many factors of uncertainty. The special sciences are themselves constantly changing their interpretations, and even at any time the interpretation any science gives to findings in its field cannot be fully understood unless all the facts it investigates are taken into account; and it is only the special scientist who has detailed knowledge of these facts. It thus behoves a philosopher to be quite humble in his attitude toward his results. He should never infallibly know that he is right, and should always suspect that he is wrong. He attacks his problem not because he believes that he can definitely solve it, but because he is interested in it and cannot keep his hands off. He merely hopes that he may perhaps contribute something to its solution; at best the contribution will be infinitesimally small in the ultimate reckoning—and perhaps there will be no *ultimate* reckoning.

For this reason it is wise for the philosopher to content himself with being a philosopher only within very narrow limits. He will attack only one philosophical problem at a time: he will attempt to integrate the interpretation of experience given in some special science with that given in some other special science,

but he will not attempt a wholesale integration. This does not mean that he does not keep a weather-eye open for winds that may be brewing elsewhere. As a philosopher he must have that eye always functioning; but it cannot see everything. It is rather on the look out for something that may be at variance with what he thinks he sees in the immediate neighbourhood.

There are two philosophical problems that have most persistently interested me, the metaphysical and the moral problems. In a paper like this it seems better to confine myself to the former. In view of the direction in which the solution of this problem seems to lie, I am tempted to define metaphysics as the view of the world in which physics and psychology are satisfactorily integrated. Under such a definition behaviourism is metaphysical. The reason it has not recognized its metaphysical status is that for it only that metaphysics is metaphysics which is not its own metaphysics. Behaviourism is, I think, a one-sided metaphysics, which has managed somehow to lose its first two syllables with out thereby becoming identical with physics. The works of such men as Whitehead, Russell, and Broad would seem to show that a metaphysician can keep in close touch with physics without developing an evangelical fervour hard to reconcile with an impartial outlook upon the facts of experience. The metaphysics of lip-service to physics, including laryngeal ministrations, may consistently with itself prove to be neither physics nor philosophy, but mere *talk*.

Descartes and Santayana have tried to see how much of common sense they can doubt and yet have anything left. I have been trying for years to see how much of common sense one can *keep* and yet have anything scientific. As yet I have found no conclusive evidence that the space and time found in my experience are not the space and time of physical objects; of course not *all* of the latter, but at least parts of the latter. Whether any of the sensible qualities found in my experience can be regarded as belonging to physical objects is a question that I will touch upon later.

In saying that the space and the time in which I see things are actually and identically the space and the time in which

physical objects have their being, I do not mean to prejudge the question of relativity in physics. Even if the relativist's conception of space-time be accepted, still the space and time of the system to which my *body* belongs are physical, and it is that space and that time that, I believe, can be shown to be the space and time of my *experience*; or rather they cannot be shown not to be. Even if one goes so far as Mr. Eddington in suggesting that "space and time are only approximate conceptions, which must ultimately give way to a more general conception of the ordering of events in nature not expressible in terms of a fourfold coordinate-system,"¹ one need not despair of common sense. Four-dimensional space-time does not necessarily annul the difference between space and time; space and time each may keep within the higher unity its indelible character, and each is an order-system, even though each is an element in a more comprehensive order-system. If mathematical physics should ultimately find that space-time belongs to a more general ordering of nature, there is no reason to suppose that it will lose its character in the larger order. Just as the spatial character of a parabola is not lost when expressed in an equation with time as parameter, so if ultimately we shall find it necessary to express space-time in equations with an as yet unknown parameter, it is gratuitous to fear that the spatial and temporal character of space and time will be lost by reason of such equations. Mathematics mistakes its scientific function if it supposes that its equations undo the facts of the experimentalist; correlation is not annihilation.

As a preliminary to showing that the space and time of sensible experience can be identified with the space and time of physics, it is necessary to call attention to a classification of relations which has quite often been ignored. Relations may be *direct* or *indirect*. An example of a direct relation is similarity; an example of an indirect relation is brotherhood. When we say that A and B are similar, we do not *imply* any other relation in which A and B stand. When we say that A and B are brothers, we *do imply* that they stand in another relation, the relation of sonship

¹ *The Mathematical Theory of Relativity*, p. 225.

to shared parents, C and D. Only by reason of their common sonship to C and D are they brothers. Let us call any relational complex in which the terms are indirectly related an "indirect complex." Let us call the implied term or terms of the relation implied by an indirect complex the "condition" of the complex. Thus the condition of an indirect complex is not a member or term of *that* complex: the parents of A and B are not members of the complex "brothers"; they are members of the more comprehensive complex "family," of which the members of the indirect complex are members. The relationship of father-mother to son or daughter is by our definition the only *direct* relation found in a consanguine family.

Let us now take the indirect complex, "second cousins at common law." They are great-grandchildren of common great-grandparents. The latter are the "condition" of the relation of second-cousinship. In general, great-grandparents are not alive when their great-grandchildren are born. In such a case, the great-grandparents do not become great-grandparents until after they are dead, thus reminding one of Solon's happy man. The cousins before they are born do not have great-grandparents, and after they are born it would seem as if, by a logic often employed, they were too late to *have* them. What I mean can be illustrated by the possible answers to the question, "Have you a wife?" "Yes" means "I have a wife and she is *living*." "No" may mean "I haven't and never had one," or it may mean "I had one but she is dead" (or probably divorced). In these cases the present tense "I have" implies that the wife is living and is a wife at the time of the answer. On the other hand, ask a man how many great-great-grandfathers he has, and ten to one, if he likes to calculate, he will begin to count up without noticing the tense of the verb in your question. When it comes to accurate expression, tenses are difficult and treacherous; there are too few of them for precision, and what there are of them must often serve purposes for which they were not intended, with the result that a grammatical philosopher is misled or becomes sophistical.

The difficulty found by so many philosophers in my *seeing*

now what *now no longer exists* is, I think, exactly the same difficulty a man grammatically meticulous has in deciding whether he *has* any great-grandfathers. I postulate that a physical field of vision is an indirect complex whose condition is an organism with an optical nervous system normally functioning and whose terms are material surfaces. The surfaces of physical objects (or events if you prefer) from which light arrives at the same time at the normally functioning eyes of an organism form a collection indirectly related by virtue of their relation to the organism. Vision is the relation in which the organism stands to the indirect complex just described. Vision is not an *act* of the organism or of a mind; it is the converse of the relation in which the objects just identified stand to the organism. If vision were an *act* of the organism, it would indeed be difficult to understand how an organism could see *now* what antedates the seeing. But if vision is the relation in which an organism stands to what initiated (or reflected) the light that on arriving at the eyes of the organism sets up changes in it, it is difficult to understand how vision could fail to be later than the objects (or events) which initiated the light. Just as great-grandparents do not become great-grandparents until a great-grandchild is born to them, so physical objects do not become a field of vision until light from them has stimulated an organism through its eyes. Upon the arrival of light from objects, the organism has vision in relation to these objects, just as a child in being born is born having great-grandparents, not having had them before.¹ When I say "I see physical objects," the verb "see" does not name any act I perform on the objects that I say I see, any more than my having a great-grandfather is an act I perform toward him. I see, in having a

¹ The analogy fails in a point not relevant to our argument: my ancestors were instrumental in bringing me into the world; the objects that eventually have succeeded in stimulating my organism through my eyes did not play any such part, exceptional cases excepted. To see that all this is irrelevant, consider the case of a man who marries an orphan, thereby making two deceased persons his parents-in-law. By his act a posthumous relation comes to obtain between them, the relation of being *in common* parents-in-law. Here there is no question of an existential dependence on either side.

physical field of vision; I don't have it *because* I see. In other words, "to see physical objects" means exactly the same thing as "to have a physical field of vision."

To make this point clearer, let us take the case of a camera in act of photographing objects. Something is doing in the plate of the camera, something consisting in photo-chemical processes. Now the field of the camera may be defined as all the surfaces of physical objects, light from which eventually sets these photo-chemical processes afoot. If the camera be an astronomer's camera photographing a star-cluster, the objects in the field long antedated the processes they now have set going; and those objects did not all at the same time send out the light whose arrival at the same time as the camera makes the changes in the plate which we call photographing the stars. If it be objected that the field of the camera does not consist of the stars of long ago that sent out this light, but of the *light now arriving* from those stars, I reply that this is a matter of definition merely. If you wish to reserve the term "field of the camera" for the *light* arriving at the plate, this does not annul the fact that the dynamic relation starting from the stars and ending at the plate divides the objects of the physical universe into two classes, one consisting of the objects in this relation and the other consisting of all other objects. The camera stands to the former objects in a relation converse to that in which they stand to it; and in standing to those objects in that converse relation it has in them a *natural* group of correlata all of which long antedated its having them, and all of which presumably had various physical time-relations to each other. The time and place of its having these correlata are the time and place of the chemical changes occurring in it. The times and places of the correlata it has are not the time and place of the chemical changes it undergoes; each of the correlata had its own time and place.

Now in the theory I propose as to the physical field of vision, the objects "seen" are analogous to the objects photographed. "Seeing" is analogous to the relation in which the camera while photographing its objects stands to the objects it photographs.

In seeing an object, I do nothing to it; it has succeeded in doing something to me. When I see, I am indeed doing, but this doing is not my seeing. The analogy fails *linguistically*, only in that the verb "to photograph" does not, except by implication, express the relation in which the camera stands to the stars while it is photographing them; it expresses the changes taking place in the plate which will later result in a developed negative, whereas the verb "to see" does express the relation in which my organism stands to the stars, and does not express but merely implies what is taking place in my organism.

If it be objected that we sometimes have vision of only one object, and that therefore we may not properly define the physical field of vision as the class of objects from which light arrives at the eyes and starts physiological processes, I am willing for the sake of argument to concede the point. I should then define a vision of that object as the relation of an organism to that *one* object, a relation which is the converse of the relation in which that object stands to the organism in having started processes which finally result in stimulating the organism.

Now a logical definition of a thing is not that thing itself. So our proposed definition of vision is not vision itself. It is possible to define many classes which as classes are artificial. Thus I can classify all the events in the universe into two groups, one consisting of all the events that occurred within the twenty-nine minutes that began forty-seven hours and thirteen seconds after the birth of any of Julius Caesar's ancestors, the events having occurred at a distance from the relevant birthplace of not less than two thousand three hundred fifty-three miles, and of not more than fifty-two thousand three hundred eighteen miles and eleven inches. There is *logically* such a class of occurrences, which of course would have to be defined more precisely if we accept the theory of relativity. But such a classification is wantonly capricious and so far as we know does not correspond to any natural, i.e. dynamic, grouping in nature. On the other hand, the class consisting of all the ancestors of any person is a natural class, corresponding conversely to a certain dynamic cleavage in nature, i.e. converging lines in the

"advance of nature" give rise to a grouping of points of departure *retrospectively* considered. So also it is with the class of surfaces of physical objects that have sent out light that reaches the eyes of an organism at any time.

But this is not the whole story of the naturalness of the latter class. So far as we have gone, the only difference between the physical field of vision and the field of a camera, as we have defined them, is found in the difference between a camera and an organism with eyes. Is this the only difference? *No!* In the case of the indirect complex whose condition is an organism with eyes, the group, in addition to being a natural class considered retrospectively, is a natural group from which all *consideration* of anything takes its departure. In fact, there would be no science of physics and no logical classification were there not in nature such a natural group. Whatever else the physicist is, he is an organism which under proper conditions has a physical field of vision as an integral natural group, and he begins his studies by starting from what is in that field of vision and in other fields similar in character. In other words, such sense-fields are the natural premises of all knowledge, and whatever later passes for knowledge may not contradict these premises. No other groupings which he later comes to recognize as natural may involve the denial of the epistemologically more fundamental natural character of such groups. Groups of this latter sort are first in the order of knowing even though they are late in the order of being: they are the most "primitive" and most natural groups we know. We do not discover them by logical construction; we start from them as the aboriginally given. Later we discover by logical construction how to classify them. Nature has been kind to us in sparing us the futile labour of making a physical universe out of whole cloth. To adopt and adapt a splendid personification from Mr. Santayana (*Scepticism and Animal Faith*, p. 191), Nature says to Knowledge: "My child, there is a great world for thee to conquer, but it is a vast, an ancient, and a recalcitrant world. It yields a wonderful treasure to courage when courage is guided by art and respects the limits I have set to it. I should not have been so cruel as

to give thee birth if there had been nothing for thee to master, nor so fatuous as to think thy task could be accomplished by one who had no foothold in the world to be won. In giving thee senses I give and will continue to give thee parts of that world, as vantage ground from which thou art to advance to thy conquest."

A concept which has become familiar to all readers in the literature of relativity will aid us in formulating our theory, whether or not we accept the theory of relativity as valid. In this theory a spatio-temporal "interval" between any two events has zero-value if it is such that the same ray of light can be present at both events. Thus the event of the departure of a light-ray from the sun and the event of its arrival on the earth have a zero-interval between them, i.e. no interval at all. For relativity this interval is physically more fundamental than the time-lapse of eight minutes or the distance of ninety odd millions of miles separating the two events. Speaking relativistically, we may say that nature in our physical fields of vision includes surfaces which are separated by zero-interval; and the primitive unity of such fields is a unity that does not have to be undone when in physics we come to separate the events into time and space. Nature does not distort herself in giving us all these objects *at once in space-time*; it is we who are responsible for any mistake when later we come to the conclusion that what is thus given is all *at once in physical time*. The philosopher may find the greatest value of relativity in its insistence on the fact that the concept of physical simultaneity is a logical construction which comes about as a result of our operations of measurement of velocities. Physical simultaneity is a matter of definition; it is not a "datum" given aboriginally in experience. Any classification of events as physically simultaneous, if it is to have relevance to observation and experiment, may not make null and void the relation of spatio-temporal "at-onceness" in which events stand as they are given in the field of vision of the observer.

Now in the physical field of vision the events which are at "zero-interval" from the conditioning organism have the relation that

I shall name "visual simultaneity." When I see a star through the branches of a tree, the star and the branches are visually simultaneous, although in physical time they are separated by hundreds of years. There is no contradiction in this statement; those who find such contradiction either regard the seeing as a present *act* which has the star of *long ago* as its *present* object; else they fail to see that physical simultaneity is a matter of definition. Once recognize that the verb "to see" belongs to the class represented by the verb "to relate" rather than to the class represented by the verb "to strike," and the difficulty of the first group of puzzled thinkers disappears. Similarity and posteriority can relate a man to his great-grandfather; in thus relating them they do not do something to the *past now*. What similarity and posteriority can be in the way of relations, there is no logical reason why vision cannot be. It relates an organism to what has physically preceded it. When this relation occurs, the organism is said to "see" the physical objects to which it is thus related. As against those who fail to see that *physical* simultaneity is a matter of definition, perhaps nothing argumentatively effective can be said. They have a self-evidencing intuition that is proof against dispute.

A more mathematical way of stating what we have just said is to assert that what is called physical simultaneity is simultaneity treated mathematically, i.e. an event at any place is given a time-coordinate equal to the coordinates given to certain other events in other places. What I call visual simultaneity can be treated mathematically by a distribution of equal coordinates to a different set of events, the two distributions, however, retaining the same order of temporal sequence. The difference is analogous to the reference of points in a plane to two different frames of reference, one rectangular and the other oblique, both of them having their X-axes and their origins respectively coincident. Except for points on the X-axis, the abscissa of any point referred to one frame is different from that of the same point referred to the other frame; but the difference of reference does not disarrange the serial order of points in the X-direction. Even so the difference between physical time and

visual time treated mathematically is a difference as to the events which at different places shall have the same time-coordinates as the events at the origin; it is not a difference as to the temporal order of the events. It is the same time-order that is visual and physical; but the same time referred to different temporal planes of simultaneity. By a plane of simultaneity is meant all the events at different places which are regarded as having equal time-coordinates. Any plane of simultaneity is logically as good as any other. The two planes of simultaneity, the one physical, the other visual, intersect at the physiological events that condition the physical field of vision. Just what these events are, it is not necessary nor is it as yet possible to state in detail. All that we need do is to say that somewhere along the line of physiological changes, beginning with the stimulation of the eyes and ending with muscular response, the planes of simultaneity of visual time and of physical time intersect.

Before going farther it may be of help to contrast our theory with some others now held. Behaviourists make vision consist in the muscular processes which take place in the organism; our theory recognizes these processes and also their relevance to vision; but it denies that the relevance is an identity. The processes are one thing, the vision another. Without the processes, no vision; but the vision is not the processes. The American critical realists (in general), together with the happily non-American Mr. Broad, distinguish, indeed, between vision and the physiological processes that condition it: for them what is in the field of vision stands in spatial and temporal relations, but the space and time in vision are *not* the space and time of physics; the world of each organism's visual experience is a world of its own, both as regards qualities and seen relations. Mr. Russell takes such a world with all its qualities and seen relations and puts the whole thing in the physical space of the brain of the organism concerned. The view I have been presenting of the physical field of vision is more closely allied to that of the new realist than to any of the others. For instance, Mr. Holt (*The Concept of Consciousness*, p. 182) says: "We have

seen that the phenomenon of *response* defines a cross-section of the environment without, which is a neutral manifold. Now this neutral cross-section outside of the nervous system, and composed of the neutral elements of physical and non-physical objects to which the nervous system is responding, by some specific response—this neutral cross-section, I submit, coincides exactly with the list of objects of which we say that we are conscious." Leave out reference to "non-physical objects" and "the neutral manifold," and restrict the statement to the time and space relations of the physical objects which initiate physical processes that finally stimulate the organism through its end-organs to response, and the statement would express our view quite correctly. But when Mr. Holt goes on to say: "This neutral cross-section . . . is consciousness," I fail to follow. I should rather say that the consciousness in vision, for example, *is* the vision, which, as we have repeatedly observed, is the relation in which the organism stands to the objects in the cross-section defined. This, however, may be a mere difference in terminology.

Before taking up the question of the qualities found in the physical visual field, we must consider some other problems. The physical field of vision is, of course, not our only sense-field. Physical objects stimulate the human organism through many sense-organs. When this occurs there is a physical field of sense-objects including all the objects that have initiated the stimulations. However it may be in infants, whose sense-fields I cannot investigate, my adult sense-field is *unitary*. To call a physical object in such a complex field a *seen* object and another a *heard* object is to imply a belief that the former is in the field because of my eyes, the latter because of my ears. *But the heard objects are in the same space and the same time with the seen objects.* If it is argued that this is the result of laboriously acquired coordinations in infancy, the statement may be true; for the sake of argument let us grant that it is true. From such a concession it does not necessarily follow that the space of sight and the space of hearing are originally different spaces. I suppose that infants, as well as grown people, who go to sleep in a *seen* familiar room and wake up in a *seen* unfamiliar one have to do a good

deal of coordinating to get the two *seen* spaces connected into one visual space; and if preliminary coordinating is proof of lack of original identity of the spaces ultimately coordinated, an infant begins life with a good many more spaces than he has sense-organs. Not finding it necessary to have quite so many different spaces and times, I agree with Mr. Russell when he says: "The direct logical importance of investigations into the origins of our mental processes is *nil*."¹ And on that account I find of no logical value practically all the chapter toward the end of which this sentence occurs. Much of this chapter is devoted to the thesis: "In physics there is only one space, while in psychology there are several for each individual"; the thesis is established by appeal to the fact that infants have to coordinate the originally different spaces of each sense-field. Mr. Russell admits that "an immense theoretical reconstruction was required" before the theory of relativity was achieved; and yet he himself accepts the objectively unitary character of the space-time of relativity. What was this theoretical reconstruction but a stupendous coordination. Coordination may result in the *discovery* of unity as well as in the *production* of unity.

When we take into consideration not merely the physical field of vision but any integral physical field of sense, say of vision and of audition, we have a sensible simultaneity of objects, as in the case of hearing the whistle of a not too distant locomotive while still seeing the steam coming from the whistle. In such a case the whistle heard is physically prior to the steam seen. This example shows that according to our theory the relativist's zero-interval cannot be identified with all sensible simultaneity. This is because the relativist deals almost exclusively with what Mr. Russell calls "sight-physics."² The correlation of sensible simultaneity with physical simultaneity requires consideration of the varying velocities of propagation from physical objects to the sense-organs of an organism.

But not all objects in a sense-field are sensibly simultaneous.

¹ *The Analysis of Matter*, p. 154. The next two quotations made above are from pages 144 and 195.

² *Op. cit.* pp. 160 ff.

Some are there as prior to others, even though some are there as simultaneous with others. The time therein is a stretch of time and not a durationless instant. The sensible stretch of time is what William James signalized as the "sensible present." Unfortunately his description of it contained an inaccuracy which, I cannot but think, proved fatal in that it has led to many mistakes in recent philosophies. The passage in which this mistake occurred is so famous that full quotation is unnecessary. I will quote only one sentence, trusting to the reader to supply the context from memory. Speaking of this sensible present, James says: "We do not *first* feel one end and *then* feel the other *after* it." (I have italicized the words which seem to me to be mistaken.) It is generally just the other way around: we *do* first feel one end and then feel the other after it. For instance, in looking at an electric sign in which the bulbs are successively illuminated I see first one point of light and then another, and then another; while *still* seeing the first I come to see the second; while still seeing these two I come to see the third. The experience is *not* "a synthetic datum from the outset" in the sense that what I see when I see the third is exactly what I saw when first I saw the first. The seeing of all three *becomes* a synthetic datum when the third sign is seen as illuminated. The confusion perhaps arises from the fact that most specious presents follow upon other specious presents, each, when it is, being a synthetic datum.

An analogy will make my point clear. Take a short tube, open at both ends, and pass it lengthwise through water. At any time there will be water in the tube, but some of the water will be just passing into it, and some just passing out of it, while between the two ends there will be water all of which is unambiguously within the tube. But of this water that toward the forward end *entered* the tube after that toward the rearward end; but after it has entered, it is in the tube together with the rest that is in the tube. The water in the forward end is analogous to what is later in any specious present; that in the rear end is analogous to what is earlier in the specious present; all the

¹ *The Principles of Psychology*, I, 608 ff.

water in the tube at any time is analogous to the whole of the specious present at any time; the water lying in any perpendicular cross-section is analogous to what is sensibly simultaneous in the specious present. The priority of any object *in* a specious present with reference to any other object therein is due to its *earlier entrance into the field*. In general the specious present does not come by jumps, each replacing its predecessor *in toto*. There is continuity of sequence. This continuity is just the fact that there is at any time a hold-over to greet a new-comer. It is not continuity as defined by the mathematician. Royce and Santayana, each in his own way, has allowed himself to be misled by James on this point; thus the former got the *totum simul* of the Absolute Experience, and the latter the "speciousness" of the specious present and the changelessness of change.

This character of sensible continuity, with sensible priority, sensible simultaneity and sensible posteriority in the continuity, is doubtless due to the fact that the physiological processes that are the condition of the field have what is called an *akoluthic* character. They are not physically instantaneous, but have a duration in which they wax and wane. While these processes continue, the physical objects that through intermediaries initiated the processes remain in the field. Here, then, we have an important difference between sensible time and physical time, in addition to the difference we have already noted between physical and sensible simultaneity. The measured physical duration of the physical object may not be equal to its sensible duration. A light-flash that occupies at its source an infinitesimal fraction of a physical second may occupy a second in sensible time. Does this difference force us to say that the two times cannot be identical? Not unless we say that the time in which a dead man remains a father-in-law is not the same time as that in which he lived.¹

Let us now consider the relation between physical space and

¹ A deceased father of a woman remains the father-in-law of her husband so long as she remains the latter's wife. The father-in-law may have died at the age of twenty-two, and may later *remain* a father-in-law for fifty years.

the space of a sensible field. The classic objection to a realistic theory of sensible space is based on the differences in shape and size a penny has as seen from different points. It is assumed by objectors that a physical penny in physical space is only circular; but the seen penny is rarely (if ever) circular; the conclusion is that the seen space of the penny is not the physical space of the penny. Mr. Broad¹ has stated this objection as forcibly as any one. He distinguishes between the "sensible form" of the penny, which is, of course, a variable, and the "geometrical property" which is exclusively circular, and which is an "intrinsic" property of the penny. The latter can be defined, the former can be identified only by exemplification. Now presumably a definition for Mr. Broad ties down what is defined to *exclusive* conformity with the definition. That the circularity of a penny is a geometrical property of it I do not deny. I cannot, however, concede the claim that it is an *intrinsic* property, if by that is meant a property the penny has without regard to relations in which it stands to other things, or a property it has in all relations to other things. The classical definition of circularity is most obviously a relational definition; the definition tells what a circle is *in terms of measurement by a rigid measuring-rod*, applied in the plane of the circle; Euclidean equality of distance has no meaning except in terms of measurement. The property thus turns out to be *extrinsic* with a vengeance. This is not to deny that the circle has the property Mr. Broad's definition gives it; it does have that property, but it has it only in a certain reference. Apart from that reference, the property is meaningless. Euclid's geometry was largely metrical; but there is a Euclidean projective geometry. The projection of a circle upon another plane is as much a geometrical property of a circle as its metrical properties within its own plane; and its projection on such planes is as much a *physical* property of a physical circle as its "circularity," as the amount of light reflected from a penny in different directions proves. Try it on the camera. As has been often pointed out, the shape of an object is the shape it has where it is, but it is not that shape just by itself without

¹ *The Mind and its Place in Nature*, pp. 170 ff.

reference to anything else; it has, where it is, different shapes from different places. What, for instance, is the "intrinsic" shape of a man's face? The shape it has in profile or *vis-à-vis*? Is a tube round or straight? These and many other similar questions lead one to be very suspicious of "intrinsic" geometrical properties. An "intrinsic" property is intrinsic only when one is so familiar with a standard reference that one uses it absent-mindedly.

What is true of shape is also true of size. Is the sun large or small as compared with the moon? In terms of linear measurement it is vastly larger; in terms of angular measurement made from some spot on the earth as the apex of the angle, it is about the same size. So it is with sizes in general. A man at any distance from you is *physically*, from where you are, twice as small in any dimension as he is when at half that distance. Again, try it on the camera. Our usual method of measurement of familiar objects is by superposition of a measuring-rod; but this is only one way of measuring; and the size got by any measurement is always relative to the way in which the measurement is made.¹

What has been said in the last two paragraphs is not equivalent to the assertion that a thing has no properties. So far is it from having no properties, that it has many more than any standard description recognizes. It *has* all the properties that *in any relation* it has, but it has each only in the relevant relation. The contention that properties are relative is not the contention that properties are relations, as Thomas Hill Green apparently supposed. Just as a man is a father in one relation and a son in another, without being the relation of fatherhood or of sonship, so an object is big in one relation and small in another without being the relation of bigness or smallness. So much is anything what it is only in relation to other things, that I find it difficult to believe that any one thing *just by itself* could be even that one thing.

It has been urged against the view which identifies physical and sensible space, that when light comes to our eyes through a refracting medium the object is not, in the space of the field

¹ See Bridgman's *The Logic of Modern Physics*, especially pp. 66 ff.

of sense, where it is in physical space; hence the two spaces are not one space. Here we have in another form the same problem. A physical object as a source of light arriving at another physical object is for the latter something that electromagnetically was in the direction from which the light came. In other words, direction in physical space is not just one simple thing. We have accustomed ourselves to a standardized description of physical space conceived on Euclidean principles, and when we find that our description does not fit the facts, we say that the facts are not in physical space. The sensible brokenness of a "straight" stick in water is a case in point. The "new realists" have not wearied of pointing out that in the optical space of the camera the stick is just as much broken as it is in sensible space. Physical space is not a rigid container of physical objects. It is a system of relations, and what holds of physical objects in one of these relations does not necessarily hold of them in some other of these relations. There is no reason for believing that the visual space of physical objects for human beings differs from the optical space of the same physical objects for cameras placed where the human beings are.

We are now ready to take up the question of the seen qualities of physical objects. Is the seen redness of a physical object, for instance, a quality that belongs to the physical object when it is not in a field of vision? Most of the arguments used to prove that it does not so belong are based on the theory that a physical object, if it has any colour at all, can have only one colour at any one spot on it at any one time. That theory is a huge assumption. Colour is a relative quality; it is relative to the kind of light that is emitted or reflected from the coloured object. A "red" object is not red in the dark, nor in a room lighted only from without, whose windows absorb or reflect all the red rays. The same spot of a "red" object may be red from one direction and not from another according to the kind of light it reflects in the two directions. The experience of a jaundiced person proves nothing, since the crystalline lens of such a person may have become temporarily impervious to most of the light-rays. If redness is a physical quality, the red object is red where it is,

but that is not the whole story; it is red where it is *from other places*, as Mr. Russell urges in another connection. The only facts that give me pause when I am inclined to assume that redness is a physical quality that an object would have from the place where an eye is even if the eye were replaced by some photo-sensitive object, are the facts of colour-blindness. If we only knew enough of the physiology of colour-blindness, we could in all probability resolve the question. But I understand that no theory of colour-blindness is adequate; meanwhile, is it not wiser to let the question remain unsettled than to settle it dogmatically?

If it be said, as it often is, that the physicist has proved that physically no object has colour, I should reply with the question: "When and how did he prove it?" In his mathematical treatment of the physical world he *ignores* qualitative redness and replaces it with frequencies of wave-length, *after he has got started* on his mathematical equations. If this be proof, then a surveyor, in ignoring the fertility of the soil or the mineral deposits underneath, proves that there are no such things, when his problem is only to find the boundaries and the area of a plot of ground. What the physicist is justified in ignoring in the physical world is not necessarily non-physical unless we adopt Mr. Russell's convenient definition of a physical object as what physics is concerned with. In this sense X-rays and many other things became physical objects only a short time ago; and so far as we know colours may some of these days become physical qualities.

I am content to leave the problem unsolved for the reason that, unlike the new realists, I do not think that we can successfully maintain that everything appearing in a field of vision is physical. It perhaps will have been observed that heretofore I have spoken of "physical fields of vision." This unusual turn of expression was purposively adopted in view of the fact that there are other fields of vision, as for instance in dreams and in delirium. While I believe that there is every reason to suppose that in normal waking experience the surfaces of physical objects are bodily in the field of vision, there is also every reason to

suppose that they are not always the only things in the field. Visual images are frequently there. I am credibly informed that in some fields of vision with an alcoholic organism as condition there are snakes (or is it *rats*?) as well as physical pyjamas and doctors and nurses, whereas from the fields whose conditions are the organisms called doctors and nurses the snakes are absent, but the pyjamas are present therein. From personal experience I can testify that just now there is in my field of vision a something (much like an old friend of mine) sitting in a chair, and I am sure it would not appear in a field of a camera placed anywhere in the room, although the chair could be made to appear in it. Such a thing I call a visual image.

In such cases I find that the seen spatial and temporal relations between the image and physical things are just the kind of relations that obtain between physical things and physical things. I therefore say that images are in the same visual space and time as physical objects. Why should I not? They are not physical objects, but that is no reason why they should not be where they are seen to be; in fact, it is a reason why they can be there. In general, dealing macroscopically, we say that no two physical objects are in the same place at the same time. This is an empirically ascertained fact, not an *a priori* necessity. But the very same empirical basis that justifies me in saying that we cannot put a physical chair where a physical table is without displacing the latter, justifies me in saying that an image can be where a physical object is without displacing the latter. Shakespeare was true to the kind of life Macbeth was leading, when in Macbeth's field of vision he put Banquo's ghost, shaking his gory locks at him, in the physical "place reserved" for the living general. The difference between physical things and images is not that they are in different spaces, but that they behave differently in the same space. A physical object is to be defined in terms of other relations than the merely spatial and temporal ones. These other relations are dynamical. This is the reason why we say that Banquo's ghost was not physical. If it had been physical, it would have reflected light and thus got into the field of vision of anyone whose

normally functioning eyes were directed toward the place reserved. The question often asked of a holder of my theory, "Why, if your image is where you say it is, do I not see it when I look there?" is very simply and consistently answered by saying that the reason is to be found in the fact that my image is not a physical object and therefore does not send light to your eyes. For the same reason my visual images cannot be photographed and my auditory images cannot be phonographed. The fact that they cannot be recorded by physical instruments proves that they are not physical; it does not prove that they are not where I see them. I cannot see any reason why the space-time which physical objects inhabit may not have as temporary denizens at seen places all the images that all the gentle reveries and wild ravings of men (and of animals if necessary) have found in it. "There may be more things in heaven and earth, Horatio, than are dreamt of in your philosophy." The recognition of them as there does no harm if they are recognized for what they are, such stuff as dreams are made of. They are where they are *as the result* of physiological processes. With regard to them it would seem as if an epiphenomenalistic interpretation would hold. There is no physical reason why an alcoholized physiological organism may not give rise to such physically ineffective and therefore non-physical things as hallucinated snakes or rats which, when they are, are where they are seen to be.

But where did the dream-objects of last night find their place in the space in which physical objects are? I don't know; but if the unconscious victim of an accident is taken to an unfamiliar hospital, can he say, when he comes to, where in physical space he is? Is his inability to say a proof that he is not somewhere in physical space? I rather suspect that the objects of a dream are in the space neighbouring the dreamer's body; but there are sometimes not enough data to make a good map of the locality. An adequate account of the whole matter, including the question as to the whereabouts of Shakespeare's Coast of Bohemia, would take more space than we have left. We may conclude our discussion of this topic by saying that while there

are many problems requiring more detailed treatment, a sense-field in general includes physical objects and objects not physical, all in the same space and time, and *none of them*, in general, in *the brain* of the organism which is the condition of the field. The latter are in the brain only by metonymy; what *is* in the brain is only the physiological condition of their being in the sense-field. They are "functions" of the nervous system, not in the sense that they are nervous processes, but in the sense that they depend on the nervous system for their being, and that they change with changes in the nervous system. They are not "functions" in the sense of being acts that the nervous system performs. The ambiguity of the word "function" has led to many mistakes.

Images are not the only transients in space-time which thus depend on the physiological organism. It is not necessary to list such "functions"; we may name a few. Desires and emotions belong to this class. Specific processes take place in an organism when it desires and when it has emotions; but these physical (physiological) processes are not the only "desires" or "emotions." Physiological hunger is different from hunger as it appears in the field of sense. Theoretically a physiologist with appropriate instruments could discover the former; only the organism itself discovers the latter. In this case certain nerves are stimulated by the processes taking place in the intestines as the result of lack of food, and at some time in the course of the nervous excitation thus arising the quality known as hunger appears in the sense-field. The hunger that I sense no one else can have in his field of sense; he may see my grimaces and my writhings; he may by proper devices discover glandular secretions. But none of these things nor all of them added together are the hunger as it is in my sense-field. There is no profit in discussing the question which of these things is *the* "hunger." That question is merely a lexicographical question; and lexicographically either the outwardly observable facts or the inwardly sensed fact is "hunger." The point is that the proposed reservation of the word "hunger" for what is outwardly observable, if adopted, does not abolish the quality of hunger as it is in the sense-field

of the organism whose physiological processes and secretions can be detected by another.

Unfortunately it is not possible in this paper to deal with perceptual fields as distinct from sense-fields, nor with thinking. The rest of this paper, according to the specifications of the editors, must deal with autobiographical details, stressing the influences which, so far as I know, have been most powerful in determining my philosophical thought. My first impulse toward philosophy was a reaction against theology, in which I had been schooled. Foremost among the positive influences I take pleasure in naming the association I had with Professor G. H. Howison. I have strayed far from the Kantian school in which in his day he was a dominating personality; but, as Nietzsche said, one ill requiteth a master if one remain merely a pupil. I owe to Professor Howison my first living interest in philosophy, and also my acquaintance with Hegel which has proved most useful. Anyone who has studied Hegel sympathetically and thoroughly may violently revolt against his system; but rebels often carry away much that is positive from that against which they rebel. It would be a hopeless task to name the philosophers of the past to whom I owe much. For the last twenty-five or thirty years the debts of which I am most conscious are to my colleagues like Creighton and to my other contemporaries; those to whom I owe most are those with whom I do not find myself in greatest agreement. I had already begun to work toward a realistic philosophy before I became acquainted with the collaborated volume *The New Realism*, but the writings of the members of this group and a paper by Woodbridge helped me very greatly in my subsequent thinking. Perhaps it was William James, whom I met in 1897 when he delivered in Berkeley, California, his famous address, "Philosophical Conceptions and Practical Results," who first of all set me to questioning the satisfactoriness of idealism; at any rate I should name him as the most influential factor in giving direction to my thinking for the next decade and perhaps ever since. Naturally, John Dewey came next in the order of time as well as in the order of power. The persistent criticism with which I have confronted these two men in my

private thinking is the best proof of the influence they have had on me. To pass by the name of Bergson would be to do him a serious injustice without his knowing or caring. Einstein and the relativists, Whitehead and Russell, have been the latest influences. My greatest regret in my present philosophical work is that I have not had an adequate training in the higher mathematics and in mathematical physics. If I mistake not, the metaphysics of the next generation, as that of the seventeenth century, will be in the hands of those who have command of a knowledge of mathematical physics.

In naming my creditors I should be ungrateful if I were to omit mention of my former and present pupils from whom I have learned more than they have learned from me. When "blue books" come in, and I am tempted to assent to the cynicism of the professor who said that a university would be a glorious place to work in were it not for the students, I have only to look back upon my former pupils to see that it is the living contact with young minds that perhaps alone can keep an older mind from growing hopelessly senile.

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CONFESSIONS OF AN ANIMISTIC MATERIALIST

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