

The Columbia University Lectures

February 1904

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Lecture V
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Columbia Lectures: V.

The foregoing discussions have established the fact in a very wide range of scientific inquiry certain conceptual forms prove to be applicable, despite their relative uniformity and their logical simplicity of type. This closing discussion has to return to the problem: Why are just these conceptual forms so widely applicable? This is a question that, as our opening lecture indicated, must bring [2] us into the presence of very fundamental philosophical problems. We shall have no time to treat such problems exhaustively. I shall confine myself to hints. But even these hints, I trust, will prove fruitful to many of you.

I.

What we have found is briefly this: Whoever thinks, classifies objects, and attempts to discover the relations that exist amongst objects. Our attention was principally devoted to a study of certain conceptual forms [3] which result from the study of relations of objects. And in dealing with the relations of objects, we confined our attention to the simplest type of relations, namely to the so-called dyadic relations, – to those, namely, which exist between members of a pair of objects.

Dyadic relations, as we further found, may be classified in two ways, viz., first: into symmetrical and non-symmetrical relations; and, secondly, into transitive and intransitive relations. Intransitive relations, although they have much importance in certain regions of science and of practical life, [4] we left out of account. The transitive relations, however, we especially studied. They proved to be of the two important sub-

types, which were determined by our other fashion of classifying dyadic relations. That is, certain transitive relations we found to be symmetrical, certain others to be non-symmetrical. Of the transitive symmetrical relations, the relation of equality is one classic type. Another such relation is that of cöexistence, in case you regard any object as coexistent with itself. Of the transitive relations which are, on the other hand, never symmetrical, such relations as “greater than”, “less than”, “before”, “after”, were our favorite instances.

When, with these relations [5] in mind we turned to consider aggregates or classes of objects, we observed that we have, in the most various sciences, two very notable types of classes of objects defined and used.

Of these two types the first was to be described as follows: I may have a class of objects such that if I choose at random any pair of objects from that class, and compare them together, I find that there exists a certain fixed and constant relation R , such that one of the members of the pair in question, – let me call it i , stands to the other members of the same pair, j , in this relation R , while this constant relation R is itself transitive and always unsymmetrical relation. [6] For instance, there may be a class of objects whose members are all quantities of the same kind, and it may be the case that if I choose any pair of members of this class, say i and j ; then it always holds true that “ i is greater than j .” Or my chosen class may be a class consisting of men. And the law may hold that if I choose any two men i & j from his class, then always one of the two, say i , precedes j .

Now any class which is subject to such a law constitutes, as we saw, a single one dimensional Series of objects. Thus the quantities in [7] question would constitute a single series of quantities arranged in the order of their magnitude. The men in question,

in my other example, would constitute a single row of men arranged in some orders of precedence; and so on in case of other such classes. Any such a class constitutes then a Series.

The second type of classes is subject to another law but one closely correspondent to the foregoing one. Let there be again, a class of objects. Suppose that in case I choose any two objects, say b and c , from this class, there exists a transitive but universally symmetrical relation S , such that b is an S' of c . Then a class of [8] objects of this type constitutes what we have called a Level.

For instance, let the class in question be again a class of entities of the same kind. Let it be the law that any pair of the objects that belong to this class are equal. Then all of the quantities that belong to this class stand on the same Level. Any other symmetrical and transitive relation besides that of equality would serve to define a Level.

We thus defined two conceptual forms, viz., the Series and the Level. Our lectures have been largely devoted to pursuing how potent and how widely applicable are these two conceptual forms. Their fundamental logical structure is extremely simple. Their value both for science and for practical [9] life is inestimably vast. Their special forms are endlessly numerous.

It was impossible to illustrate the range of applications of these forms, without considering still another conceptual form, viz., that of a Transformation.

Transformations, i.e., concepts of types of change, are found in all our thinking processes. We saw, however, that classes transformations [sic] interest our thought most when they constitute either Series of Transformations, or Levels of Transformations. Whoever conceives the events of a single day's doings, studies series of transformations.

The same is true of the astronomer who follows [10] the path of a comet, of the embryologist who studies the growth of an organism, and so on indefinitely in science, whenever an ordered sequence of events or of stages is considered. On the other hand, our interest in a set of transformations may lie in considering what features or objects or systems of relations remain invariant through all these transformations; as is the case when, for instance, the quantum of energy present in a physical system remains invariant through all the changes that occur in this system; or as is the case when, in chemical reactions, the mass of the changing matter remains invariant through all these chemical alterations [11]. In any such instances, where our interest in a set of transformations lies in taking notes of what they leave unchanged, the transformations in question are conceived as lying, in some respect, upon the same level. Other instances of levels of transformations could be found wherein our interest lies in the fact that these transformations lead us from one series to a definitely corresponding part or stage of another series, even although [sic] we not taking account of the fact that some such quantum as that of mass or of energy is remaining the [12] same. Thus, whenever any household change cooks, there are certain directions that have to be given to the newcomer, certain doubts that the housewife feels about the new help, certain well known embarrassments of the housekeeping mechanism which accompany so momentous a change; and in this sense all the transformations known as changing cooks lie upon one level; because they all occupy corresponding places in the various series of occurrences which have to do with adjusting a household to the service of a new cook.

[13] Series and Levels of transformations, then, are very significant both in science and in practical life. And when we consider how vast is their number, and how

numerous are their special forms, we are able to recall afresh the significance of the thesis with which the foregoing lecture closed, viz., the thesis that, whatever else characterizes exact science, the two fundamental conceptual forms, - or, as we may now venture to call them, the two Categories, viz., the Series and the Level, are universally present wherever exact science is present, and aid to make such science possible; while, in less exact [14] cases of thinking, as for instance, in practical life, the inexactness of the series and of the levels which can there be defined, furnishes much of the reason for the limitations of the sort of thinking which is there possible.

II.

So much then for the principal Categories, or widely applicable conceptual forms, which our empirical comparison of the work of various sciences has brought to our notice. And now for the question, Why are these Categories so widely applicable?

It is easy, without going very deep into the problems of pure philosophy to make plausible either one of two theses [15][16] regarding what it is that makes these two categories of the series and the level so widely applicable in such various regions of our experience. Notice that I do not call these two theses supposed theses. But they are at any rate apparently different theses.

The first thesis runs: ‘These categories of the Series and the Level are so widely applicable because the real world as it exists apart from our human thought actually contains series and levels, which our thought, in the first instance, simply finds there.’ The prevalence of the series and of the levels is a matter of fact. For this real world, as one may first insist, is a world in space and in time. Now time furnishes to us, everywhere, ordered series of events and does so whether our thought chooses to think in

these terms or not. The unsymmetrical and transitive relation defined by asserting that one event is the “successor in time” of another event, binds any two temporal events together, unless the two [17] are contemporaneous. Hence the time series is a sort of pattern and prototype of all series, for all reality is known to us as involuntary temporal series of events. On the other hand, space, as in Herbert Spencer’s phrase, the “abstract of relations of coexistence,” is that aspect of the real world which forces upon our attention the symmetrical and transitive relation expressed by the phrase “coexistent with” or contemporaneous with. Hence space, which again is an universal aspect of the real world, is the prototype of all the levels. So far as all parts of space, and all things or events, that, at one any [sic] time are together in space, coexist, they are all on one level. Moreover, as one may continue, space furnishes to us still other instances of levels. For, in that property of space which permits [18] the consequence of lines and so the equality of lengths, to be tested by superposition, we have the classic experience in terms of which we exemplify what we mean by quantitative equality. All physical measurements reduce in the last analysis, to measurements of lengths. Equal intervals of time can be exactly defined only by presupposing the conception of equal intervals of distance in space, - a fact of which a glance at your watchface may at any moment remind you. And even so, the mass of matter is defined in terms of the concept of acceleration, which depends on that of length. But what you mean by equal lengths measured upon lines, you may and do discover, so one may insist, by actually trying experiments with foot-rulers, yard-sticks, tapes, dividers, and other more or less exactly definable object. Thus the two classic instances of symmetrical [19] transitive relations, namely of the relations of coexistence and of equality, are furnished to you by certain of your experiences of the properties of

space. As for what we have called “levels of transformations”, the space-world also presents them to you in their most familiar form, whenever you observe that any solid body may be moved about freely in space without altering any of its dimensions. Thus then, the so-called “axiom of free mobility”, which asserts that movements in space do not as mere movements alter the form of the objects that are found in space, expresses the most familiar generalization that experience furnishes to us regarding [20] a set of transformations such that they leave certain real things or aspects of things invariant. All the transformations of such a set lie upon one level.

In brief then, just as the time-series is the prototype of all series, so the space-world is a sort of primal locus of levels. To be sure, we do possess the concept of contemporaneous events, even apart from our concept of space, as the coexistence of feelings and of sensations in the same psychological instant exemplifies. So that time seems to present levels. But this instance of purely temporal levels derives most of its interest for science from its relation to the facts of the world in space. And still more obviously, space comprises within its countless serial orders of [21] objects, - the points on a line, - the successive sections of a solid by a series of planes, the inestimably numerous series of physical objects in the real world; and so on indefinitely. But the serial order of things in space, it may be insisted, seems to be a secondary result of their coexistence; because we are able to run over the various parts of space in successive series of acts of our own, while serial order in time is the most essential characteristic which holds true of events, viewed just as events.

In any case, however, as one may thus insist, the real world in space and time, so soon as we enter it, appears to us to be a realm of series and of levels. The prevalence of

these categories in our thought [22] is then, at least in great part, a result of their prevalence in the temporal and spatial order of the real world.

Yet not even thus do we exhaust the sense in which the real world appears to be the realm where our two categories are found to have been at home, even before our human thought ever set out upon its quest for order. For these two categories of the series and the level have a still deeper relation to the innermost structure of reality, so far as reality is in any way accessible to our science. This namely, is what the modern doctrine of energy shows us. For the changes of the energy of any system follow a certain determinate series, according to the law [22a] that such quantities as the temperature of the various parts of a physical system tend towards equality, through the transfer of heat from the hotter to the colder parts of the system; while, as we also know, water runs down hill, electrical energy tends toward a distribution that abolishes differences of potential, and so on. Thus, in general, the energies of the world tend to a certain level of distribution, - a level never actually attained within the range of our experience, but always definable with reference to a certain serial order of unstable distributions of energy; while the events of the physical world form series such as always approach the ideal level of distribution.

[23] Thus the events in the physical world do not merely form series, but also form series which have determinate relations to certain levels. The familiar fact of the existence of the sea-level, as is an approximately constant fact of terrestrial nature, - a fact which the tides and the winds and the currents endlessly disturb, but which varies only within certain relatively narrow limits, - this fact is itself but a special instance of the way in which the real world forces upon our attention the existence of certain

approximate levels of the distribution of certain forms energy, as well as the existence of a tendency of energy to reassume distributions when they have become disturbed.

[24] Yet it is not only the theory of energy that thus exemplifies the importance in the real world of the categories of the series and the level. The series upon which the modern doctrine of evolution insists, are real, and they are characteristic of large regions both of the inorganic and of the organic worlds. If the doctrine of evolution is in any form sound, then there are real series of organic forms and processes whose order determines every detail of every living organism. Your own organic characters, for instance, are what they now are because of the whole series of your ancestors, back to the remotest of times.

[25] And that mingling of coexistent characters, derived from various amounts, which constitutes your organic temperament is an instance of a level, due to the correlating of many series, or again, the geographical distribution of the organic forms, that are at any time present on the earth's surface, constitutes a level that nature draws across countless such evolutionary series such as determine the sequence of organic forms.

Why, however, should I multiply these illustrations of the real significance of our categories. Every science furnishes its own examples. Mendelief's arrangement of the chemical elements is a combination of series and levels; and it stands for a system of natural facts. The law of supply and demand in economics is a statement of a tendency towards a certain level and of a tendency which also determines certain series of economic events. [26]

III.

And yet, as I must insist, - there is another thesis regarding our two categories which it is certainly necessary for any one to consider who has once learned the lesson that Kant's analysis of human knowledge has taught us. This thesis is that the prevalence of these two categories, the Series and the Level, is due, in our science, to the nature of the human intelligence, and not to anything that can be understood apart from the consideration of this nature of the human intelligence. Whether this thesis is really opposed to the preceding thesis, namely to the thesis that the real world furnishes the true basis for these categories, - that may remain for the moment, a question. The solution [27] of that question depends, of course, upon what you ultimately mean by talking of the real world at all. But postponing for the moment that issue, let us proceed to consider what evidence there is for saying that the wide applicability of the concepts of series and of levels, in our science, is actually due to the fashions of procedure of the human intelligence in its dealings with phenomena. This thesis at any rate appears to contrast sharply with the foregoing thesis. But let us consider the evidence for it dispassionately.

We spoke, but a moment since, of space and of time as the regions where the concept of the level and that of series find, respectively, their primary and natural expressing. Space we then found to be the great locus of levels; and time we regard as especially [28] the realm of series. Space, as we saw, contains also series as well as levels; but that appeared to us be at least largely due to the fact that we can consider the parts and the elements of space successively. Time permit levels, and this seems to be due to the fact that contemporaneous series of events can in some cases be apprehended by the mind even when we do not refer these events to different regions of space. But

such apprehension of coexistence apart from spatial relations, seemed to us to be of less importance in our experience of reality.

But now when we review the [29] very facts which we thus summarized, we see that our account of them borrowed its whole meaning from a certain conception which we are accustomed to use when we talk of the real world, namely from the conception that the real world consists of an order of things and of events in space and in time, either this conception is or is not well founded, it is certainly is no direct expression of what you and I experience from moment to moment. For the space-world that we assumed as the real world, when we defined space as the locus of levels, is not identical with the space world that at any moment we have forced upon our perception. On the contrary, the spaceworld of [30] the geometer, and of physical science, is known to us mortals as a highly artificial construction of our own intelligence, - a construction of whose validity we feel very sure, but whose reality no direct momentary experience of ours ever can suffice to demonstrate. It seems fair then to say that it is the way in which we ourselves are irresistibly disposed to conceive which gives what we call space and time their characters.

For consider: The space-world, as you conceive it, contains, countless coexistent objects which you do not now observe. You conceive, for instance, that the portion of this room which is behind your back coexists with the portion that is in front of your eyes. I defy you, however, with your present sense of sight, to observe at any one moment, or through any one act of apprehension, [31] that the whole of what you thus conceive to be true about even the visible parts of this room is a visible fact or is apprehensible in terms of any other direct sensory experience. Turn your head to see whether the wall behind

you is observable and the blackboard in front of you will disappear from your view.

Undertake to verify the fact that your left hand neighbor is a being visibly coexistent with yourself, and your right hand neighbor at once tends to cease to be visible. It is precisely as impossible to see in any one act that all the visible things in this room actually coexist, as it is to see your own ears. And the reason for this failure to observe a coexistence which you all the while are irresistibly impelled [32] to conceive, and of course to regard as real, is, in case of your two ears, and of the other visible objects not now directly seen by you, very much the same. The coexistent objects present in this room are objects of a possible attention on your part. This possible attention you can direct now to this, and now to that object. But the field of your attention is notoriously and extremely narrow. Only within that narrow range can you ever verify that coexistence which you conceive to be characteristic of your space-world. If however you ask why so potently and powerfully believe that this coexistence [33] which you can verify only for so narrow range of objects, actually holds true of the indefinitely vast range of objects that you conceive to be present in the space of the real world; then the answer is that you conceive this to be true because certain very deep needs of your thought seem to you to require the assumption of the truth of this conception. You need namely, at every moment, to conceive of all the material objects in this room as in certain respects upon the same level of coexistence. As a fact you can only see first what is in front of you, and then, turning the head, what is behind you. [34] But in your conception, for reasons which I have no time at present to analyze exhaustively, you need to conceive of what is in front of you as coexistent with what is behind you. Hence you conceive as upon one level coexistence what experience presents to you only serially.

From this point of view, it would appear that the world of what is sometimes called pure experience presents to you rather series of various sorts than those levels of coexistence which constitute the world of physical facts at the latter coexist in space. And your belief that the facts do coexist in space would appear to be due to certain needs [35] of your own intelligence, - needs which guide your interpretation of the realm of phenomena. And so far the concept of the level, to say the least, would appear to be forced upon you, in this respect at all events, because of your character as the intelligent interpreter of your experience. This however is what the present thesis asserts of the categories now in question.

But to the considerations thus advanced there is, however, a familiar answer which to many minds does indeed seem once more to indicate for the conception of the levels of coexistence a character relatively independent of your own thoughtful way of interpreting your experience. This answer is as follows: Objects are [36] on a level when, as we have said, any two of these objects stand in a certain constant relation which is both symmetrical and transitive. Now it is true that I cannot now see that the objects in front of me and the objects behind me visibly coexist in the same field of vision. But I can indirectly establish through my successive acts of perception transitive symmetrical relation between these objects; and I can do so thus:- I can first look at one of them, then at the other, and then back again. Hereupon I find that the objects are such that I can pass from either of them to the other, so that I can set them in either sequence in my visual experience and this, it will be insisted, is a fact that is not dependent upon my will. For unless [37] these objects are such as are usually said really to coexist in space, I in general cannot do this. Thus if, to use Kant's famous instance of Kant's, I were observing

a ship that was down stream with the current, I could first see the ship higher up the stream, and then lower down the stream; but I could not in this case reverse the order of my perceptions, and see it first lower down the stream and then higher up. In the case of the floating ship I should accordingly be observing what is called a real succession. For the relations presented to my experience from without would then be essentially unsymmetrical. I should be dealing with a real series, and not with a level. In case, however, of the [38] coexistent parts of a whole, present in visible space, I have indeed primarily an experience of serial succession; but this succession, in just this case of the coexistent parts of the whole, I find to be essentially reversible. If a is one visible object present in a given space, and b is another, I may find indeed that for me, a and b never visibly coexist at any one instant for my sight. But I also find that in my experience, according as I look this way or that, the sight of a may first precede the sight of b and may then follow the sight of b, so that, for me, the empirically given relation between a and b is expressed by saying that “In my order of perceptions a is at pleasure either the predecessor of b or the successor [39] of b, or is both the predecessor and the successor of b. Now this relation, which, whether I will it or no, I find to be the true relation of a and b (e.g., of the parts of this room), is indeed a symmetrical relation. For although the relation “successor of” is unsymmetrical, the relation “predecessor and successor of,” or the relation “either predecessor or successor of, indifferently” is a symmetrical relation. Now, as one may hereupon insist, it is just this which experience actually shows us to be the relation between any two visible things which coexist in space.

Thus, once more, as it may be asserted, the levels of coexistence are vindicated as facts which the objective [40] order of our experience forces upon us, and which accordingly are not due to the mere needs of our interpreting intelligence.

Now it will be noted, in any case, that this particular method of vindicating for the levels of spatial coexistence a character that in certain respects is not dependent upon the fashions in which our human intelligence works in our interpretation of facts, is a method which ascribes to these levels of coexistence a peculiar and rather unexpected character. We had supposed, while we were talking of them [41] as well-known aspects of the real world, that the symmetrical relations which made them real were direct and comparatively simple facts of experience. We now see that these levels are given to us at best only in an indirect way; and that, at least in the case just now in question, the symmetrical relation which make the level real is given to us in the form of a complex of two unsymmetrical relations, each of which is the converse of the other. To say "a coexist with b" now means "a may be made, in my experience, to follow b or to precede b, indifferently." From this point of view, unsymmetrical relations and consequent series, would [42] be, for us, the primal facts of our experience. Levels would result, not in general from the directly observed correlation of numerous series, but from the discovery that certain series of facts in our experience are reversible. The narrowness of our consciousness forbids us to correlate many facts at once. But, from this point of view, we can and do experience many series of facts. We discover the reversibility of some of these series. But if a given series is characterized by some unsymmetrical relation R , the reverse of this series gives us a second series, containing the same terms, but characterized by the converse of the relation R . Call this new relation "R-converse." Then

what [43] experience shows us, in case we discover a level, would be, in general, that any two of the objects that we are considering, belong both to the R and to the R-converse series, and so, are such that either one of them, say i, is “both R and R converse” of the other, say of j. The relation “both R and R-converse of”, is however a symmetrical relation?

Do we actually discover the existence of levels in this way? I have no time to devote to this question any adequate consideration. But any student of the modern psychological theories of our consciousness of space knows how much evidence there [44] is in favor of this general proposition, so far as the various levels of our space consciousness are concerned. I am not disposed, however, to generalize at this point hastily. Our general argument has, at the moment, only this interest in the issue. We are considering whether our assurance that the real world contains series and level is due to the characters which our experience of the real world forces upon us, apart from the special interests and modes of interpretation which characterize our own intelligence. In defense of the thesis that the usefulness of the concepts of series and of levels is due on the whole [45] to the needs of our own interpreting intelligence, we pointed out that the unity of the world in space, - the classic instance of a level of coexistence, is an unity that we never find directly given, but do nevertheless conceive as real. And we suggested that this whole concept was apparently due to the internal needs of our own conceptual process, since to believe as we do in the unity of the world in space involves countless beliefs about the real world which no direct experience of ours ever verifies, but which our sense of the reasonableness of our convictions somehow seem to require. In brief, we need, it was suggested, to conceive certain facts as on a level. Hence we do so.

But to this contention the reply is made that although experience does not present to us at once the unity of the real world in space, experience does [46] indirectly teach us that the things in space have symmetrical and transitive relations. And (so it was further asserted), experience does this by presenting to us certain reversible series of experiences. It is, in brief, by going back and forth between places that we learn of their coexistence. It is because of the reversibility of certain of our movements, and of their results, that we learn of the properties of space. And the suggestion is made that perhaps all our consciousness of levels (in so far as these exist on a scale too vast to be grasped at once within the narrow unity of our consciousness) is due to our experience of reversible and series [sic], and to our experience of the contrast between these and the irreversible series which we also find in our experience.

[47] Well, let us for the moment admit this entire conception, and so admit that our assurance of the reality of such levels as are too vast and complex for us directly to observe, is reducible to our assurance that certain series possess a reversible character. Then the problem is to what makes the concept of the series and of the level so potent reduces itself, provisionally, to the single question: What makes the concept of the series so potent?

IV.

Here however, at length, we meet with a decisive issue. The prototype, at least in the realm of our ordinary experience, of all empirical series, as we observed in the earlier part of our statement, in the time-series. [48] Now what assures us of the reality of the time-series. In the form of time-series all series reversible and irreversible, just in so far as they are observable by us at all, must come to our empirical consciousness. In the

temporal succession of our own experience we must search through the various regions of space, must test equalities of all kind, must observe dependencies of all types, must take account of all transformations that experience furnishes to us, must in brief acquire the materials upon the basis of which all our notions of the real world are formed. Thus whatever be the logical nature of serial order, our experience of serial order has to be a temporal experience. But, when do we experience the reality of the sequence of events in time. Now? Yes, if you mean by the now [49] experienced sequence the brief span of the contents of the present moment. But we certainly do not now experience what happened during the nineteenth century. We now conceive that certain events then happened. We do not now perceive yesterday's events, nor, yet tomorrow's. Our conception of those events is obviously an interpretation of certain given memories, images, names, suggestions, interests, hopes, demands. The present time does indeed involve an experience of a relation between the earlier and the later content of our present passing consciousness. We conceive this relation as extending indefinitely into both past and future, and as being universally both unsymmetrical and transitive. That is, a character of this relation which our present consciousness suggests, we universalize, we define as holding for all earlier and [50] later temporal events, and so we conceive that all which ever has happened to us, or which ever will happen to us forms a single series of experiences. In other words, we constantly conceive of that unity of a single experience of which Kant so well tells us. It is only by virtue of conceiving this moment as a stage in the united process of a single experience that we get any possession at all of the concept of the real series of temporal events, just so far as that series extends beyond the narrow [illegible: faded] series of the present moment.

In vain then, do you point out that we believe in the coexistence of the things of the real world because experience constantly forces upon us the fact, given apart from our conceptual processes, that some of the series of events that occur in time are reversible, while some are not. It is in vain, I say, that you do this, in case you thereby seek to relieve our whole system of human experience of its character of being a system that is [illegible: faded] we accept through and through [illegible: faded] because the needs of our intelligent process of thoughtfully interpreting what is now given to us, force us to define our experience as a system processing [illegible: faded] and to accept [illegible: faded] because it comes to us merely from without, as a brute fact of an external order, but rather, because we are always engaged in interpreting the data of the present experience within the fold of our own idealizing activity. The fact is that we believe the real world to contain series, because without conceiving [52] series of facts we cannot make our present life as thinkers and as active beings intelligible to ourselves.

At any instant namely, we have something given to us, and we need to do something with this which is given. That is, the present datum means something to us, implies something, leads over to a deed of some sort, arouses a response, sets us at the business of idealizing its contents. And we proceed to idealize these contents by giving them a place in a system; and so any present datum can get a place in our attention only in case it somehow cooperates in our business of defining our own purposes as thinkers who conceive our world as a system. Now it happens that when we undertake to define these purposes of our thought we do so by conceiving of series of [53] activities, and of data correlated to these activities. These conceived series of data and of activities, are the

stuff out of which we weave our whole conception of reality. And the conceived reality therefore contains for us series, because we need to conceive that it does so.

So then over against the thesis that the real world in space and in time everywhere shows us fact serially arranged, we may and must set the equally verifiable thesis that the real world in space and in time is never given to us as a directly experienced datum at any moment of our lives, but is always [54] conceived as a system of possible experiences, or of experience not now our own; while this system we always now conceive in accordance with the present requirements of our thoughtful activity. One of these present requirements, however, involves the conception of series of past and future experience, and of endlessly numerous ranges of possible experience. Hence we conceive the real world as a system of serial orders of data. We conceive some of these serial orders as essentially [54a] reversible, and some as not reversible. The reversible series in their totality constitute that realm of actual or of possible experience which we most commonly conceive as the world in space. The irreversible series especially characterize the world of time-sequence. But that we thus at any moment conceive our world, or that in any other way we conceive series and levels as present in it, is due, at each instant, to the thoughtful interests which then and there determine the fashions of our conceptual activity.

[55] What applies to the spatial and temporal order in general, applies equally well to the special range of serial orders, and of levels, such as the series and levels involved in the doctrine of evolution, or those involved in Mendelief's arrangement of the chemical elements. All such objects are to any human thinker, when he thinks, not in their wholeness, presented content of his experience of reality. They are conceived

objects, which he conceives thus because by conceiving these thus he gives to the conceived system of our human experience [56] systematic order and wholeness. All such objects then express our human conceptual needs, as we define those needs at any moment of our experience.

V.

So much in general for the thesis that the use of the conceptions of series and the level in our sciences is due to the needs of our thought in its undertaking to conceive our experience as a system.

In fact, how can you undertake to conceive your present experience as a stage or a transitional phase [57] in a system of experience? Only, of course, by conceiving, as you always do, that your present experience is a sign or symbol of contents of experience not now present to you. You see the headings in the newspapers. They are signs to you, either of events in the war in the far east, or else by intentions on the part of the newspaper correspondents that you should believe thus or thus about the war in the east. You see a star in Perseus, glowing for a few nights and then fading. That light becomes a sign to you [58] of far off cosmic events, i.e. of content that might have been experienced by you had you been, as observer otherwise situated in the universe.