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Subject

A Critical Account of the Problem of Time in it's Philosophical Aspects.

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Section I — The Problem

The problem of the reality and nature of time is perhaps as old as any which philosophy has faced. From the earliest periods, right down to our own day it has maintained a position of first importance. The first demands of the religious consciousness as it emerges from superstition are for an object which in some way is above the changes & chances of everyday life. The eternal is opposed to the merely temporal. That life which is constituted by successive phases counts for nothing: it is the concern of the foolish man only. He who is wise will strive to rise beyond the being which is in time & to place himself at one with the eternal. He will seek to know the Eternal Will of God or to live in accordance with the Eternal Laws of Nature. In some way or other he must link himself with eternal being.

In their successors, one after another, the classical thinkers have asserted the central position for philosophy of the problem of time. Nor has the fashion fallen into obeyance of late years. Pringle-Pattison, in Platonic metaphor, characterises it as the greatest of the waves of difficulty he has to surmount in his enquiry. The late Dr. Bosanquet writes that, "a philosophic position is definitely characterised by the attitude adopted towards the course of time;" Of the same school of thought, Prof. Royce with equal emphasis expresses the same opinion. "Any rational decision between a pessimistic & an optimistic view of the universe, any account of the relation between God & man, any view of the sense in which the evils and imperfections of the universe can be comprehended and justified, in brief, any reconciliation of religion and life must turn, in part, upon a distinction between the temporal and the eternal and upon an insight into their unity in the midst of their difference." For Bergson & Alexander, thinkers of quite different types from the above, the notion of time is an absolutely central & fundamental conception of philosophy.

This essay is to be an attempt at a critical exposition of the outstanding traditional & current theories of the nature of time. It is desired to set these side by side, to exhibit their

relations & to see how one has arisen as a criticism or fulfilment of others which preceded it. With opinions behind us such as those just quoted above we can approach this effort with the feeling that at any rate we are dealing with a worthy subject.

Now throughout the whole content of our experience there appears, at any rate at first sight, a character which we call change or successiveness. It appears through the content of the bodily senses, in the organic sensations within the body and in the qualities of experience that belong peculiarly to the mind. Always there seems to be a movement and a transition of parts into each other; a passing away & being born, as we say. The express on it's way passes through successive positions. It is contrasted with the stations buildings & telegraph poles which it passes. They are at rest while it is in motion. Yet even they are not unchanging. They decay & fall to ruin & have to be repaired. In our own bodies there is a constant succession of sensations. We are at one time hot, at another cold; now hungry, now satisfied. Desires, ideas and emotions seem palpably to form a succession - always changing, perhaps always developing. In these facts we are presented with the phenomenon of time, & it is the successiveness common to all these predicaments that it is the purpose ~~to explore~~ of this essay to analyse.

There is however one standpoint in connection with the time problem which must be discussed right at the outset, for if the theses involved in it be true the very discussion of time becomes impossible. The argument claims to show that no such thing as time can be an object of knowledge - if this be the case then the attempt to make it the subject of discussion is futile & meaningless. We are told that the very nature of our knowledge contradicts the reality of time. The real for us is that which we know. This is the same thing with what we call truth. But truth involves the principle "once true always true." The truth therefore never changes. The real cannot change hence time is unreal.

Have we then no experience of change & succession? Were we in the ~~first~~ paragraph immediately above describing nothing at all! We shall be told that the experience of time is a mere illusion which must be surpassed if we are to apprehend the real. Time is an illusion engendered by the senses. Reason cannot tolerate it.

Now in the first place it would be admitted that we can pass from the illusion involved in the senses to true knowledge. Then it would appear that they must admit change and succession

in some part of reality even if it be only in our subject we mode of apprehension. But furthermore, they cannot banish change by calling it mere appearance. Even appearance is not a pure nothing. It is a positive reality of some kind, otherwise we simply could not think it. Even if there is a world of changeless forms the ordinary everyday world of changing + successive things is real too.

It will be said that in questioning the reality of what is condemned as appearance it is not meant to deny it's existence but only to assert that it's true nature is other than it appears. This is at best however merely a play of words. It simply amounts to an assertion of the so called true nature + a denial of the so called apparent nature. It is thus a restatement of the original position that the appearance is there nothing

Now surely we can hold it to be true that (1) changed. The proposition "the strawberry is red after it is green" is true. It is not proposed here to enter the discussion as to whether truth changes. Prof. Alexander holds that this is the case. If so then called question. But even if the principle "once true always true" hold good, the unreality of time is implied only if time involve creation + annihilation outright. This will be discussed in a later part of the essay.

But, it will be urged, the object of thought is a timeless object. The horse of biology is not this horse which was born and will die but the horse, the universal which is timeless and changeless

Now this raises the question of the status of the universal, but for the immediate purpose there is no need to enter the discussion. Whether the notion of horse which enter the biologist's discourse be this horse or the horse, it certainly ~~~~ includes the notions both of complex physiological processes + the fact that the horse is a later product of evolution than the pterodactyl. Does not the Law of Gravitation include the notion of the change of position? There certainly seem to be entities in the universe which are non-temporal ie which are different from the characters we call time. Such a ~~ one is the empirical quality of colour. Yet wherever colours occur they are spread out in time - certainly they are not incompatible with time. There may be non-temporal entities which are also timeless in the sense that they are neither spread out in time nor enter into time relations. Mr Russell holds that number + all logical entities are such. This however does not militate against the reality of time - there may be timeful entities too.

Section II —— Progressism & Absolutism (Time & the Notions of Creation & Annihilation)

Popular thought expounds the character of time through the medium of the schematism of past present & future. Time as it occurs is the fact that the future becomes present & the present recedes into the past. By saying that (B) is after (A) we are to be understood to mean that if (B) is present (A) is past. That (B) is before (C) means that if (B) is present (C) is future. The present itself contains no parts such that some are before & after others. If there were one part after another, that other would be pushed out into the past. Similarly if one were before another, that with regard to which the one is said to be before would have its place in the future. Further, the past is said to have gone & the future to be unborn. These are metaphorical terms which need precise definition. If it were merely meant that past present & future are different from each other we should yet require to know precisely in what way they are different. However it usually seems to be implied that past & future are unreal, that this is just the nature of time. But if past & future are ~~there~~ nothing why talk about them at all? It would seem that the present is to be regarded as a solid fact with relations stretching out from it in opposite directions. Yet neither of these relations has a second term, for both past & future are unreal. Both the relation of after & that of before are hanging in mid air. How to assert that an entity is related & to deny the object to which it bears the relation is rank contradiction. This popular notion of creation & annihilation cannot be used to expound the nature of time.

How the theory of evolution in biology gave rise to many attempts to express reality as a development. The future was to be regarded as unreal — reality is not "made" "given" but "in the making." It is essential to this type of theory that the future be regarded as not given. What then of the status of the past. Are the past phases of imperfection which the present stage of development ~~succeeds~~ follows to be regarded as real? If they are not then we are presented not with development but with isolated presents, so separate that we cannot even call them a group for they are

Creative Evolution p 212. (1)

Ibid p. 2 (2)

Ibid p 213 (3)

radically unrelated. The one is gone before the other arises into being. It is therefore essential for this line of thought to work out the precise meaning of past & present & their relations. The problem as it presents itself in these lines has been most systematically attacked by Bergson & the Italian Neo-Idealists.

There are contents in the work "Time & Free Will" in which Bergson seems to be arguing that in one sphere of reality at any rate viz in space, there is no succession, but this constant creation & annihilation of pure presents. At the same time however, this is not in his view the sole story of reality. In the sphere of consciousness matters are quite otherwise. Here there is a differentiation arising from the constant springing into being of new factors, this constituting the forward movement of consciousness. But the past is not lost or separated from the new. It's very nature is to interpenetrate the new. We are told that the past is continuous with & overflows into the constantly arising new features. We have a unity whose essence is to be changing & which therefore contains a qualitative multiplicity — for the earlier ~~is~~ is preserved & carried on into the later. This reality whose character is growing unity is called by Bergson 'duration'. "The more we succeed in making ourselves conscious of our progress in pure duration, the more we feel the different parts of our being enter into each other and our whole personality concentrate itself into a point or rather a sharp edge pressed against the future and cutting into it unceasingly" The unity is not static. It is a growing unity - involving continual change. Look into our own minds & see what we find. We say we find ourselves passing from state to state — then "I am warm, I am cold; I am merry, I am sad, I work or I do nothing, I look at what is around me, or I think of something else." This however is not a strictly true account, for the change is much more radical than at first appears. We spoke of <u>states</u> as if each were a rigid blocks, & of change as if it were the passage from one ~~to the~~ block to another. We seem to think that each so called state remains the same while it endures. But as a matter of fact, psychical existence just <u>is</u> change. To say "it changes" is to make a mis-statement, for mental life just is pure flux. "Let us take the most stable of internal states, the visual perception of a motionless object. The object may remain the same, I may look at it from the same side, at the same angle, in the same light, nevertheless, the vision which I now have of it differs from that I just had even if only because the one is an instant older than the other — — — — — — — — — My mental state as it advances on the road

Trinie & Free-Will p. 101.

of time is continually swelling with the duration which it accumulates." Unless mental life were transition how could motives pass into decision — their very nature as emotions is to pass into activity. They are felt as a liberation of mental energy.

How to say that the past overlaps or is preserved in the present ~~is~~ seems there self contradiction, or else vague metapher. Again what can be meant by a succession which has no distinct parts within it? Must not the beginning be distinct from the end?

Apparently Bergson's reply to such an objection would be that we exhibit not the futility of his notion but the inadequacy of language to express it. The words contradict each other & so do the meanings which we usually attach to them. But contradiction & non-contradiction belong to the sphere of reality which embodies multiplicity & divisibility. Self ~~con~~-contradiction is the predicament in which an attempt is made to fuse two distinct and separate entities. Non-contradiction is where such entities remain mutually exclusive. The notion of a round square is self contradictory. The notion of the impenetrability of matter is a case of non-contradiction. Impenetrability is not a positive quality of matter. If it were we could abstract it & think of non-impenetrable bodies as we think of ether as an imponderable fluid. It stands for the fact that parts of matter are essentially separate & cannot therefore be fused. The principle of non-contradiction only applies where there are separate parts. But this is not the case in duration. The principle of non-contradiction simply does not apply in the sphere of duration. Bergson is not therefore maintaining in duration the reality of that which is self-contradictory but rather a reality which can embody neither self-contradiction nor non-contradiction. Since however words have been made to apply in the world of multiplicity and divisibility they can only be metaphorically used in the sphere of duration.

It is then, only by a sympathetic study of Bergson's examples that we can hope to realise the meaning of the term duration. He bids us consider the structure of a melody. The parts are qualitatively different yet they permeate each other. Thus we do not experience the missing out of a note simply as the gap where that note should occur, but rather as a change in the quality of the whole tune. A melody is "a succession without separation — — — — — — a mutual penetration, interconnection and an organisation of elements, each one of which represents the whole and cannot be distinguished or

isolated from it except by abstract thought."

But is this not rather an exaggeration of what we experience in listening to a melody? It may be a continuum of sound - but even as such are not the earlier parts distinct from though continuous with the later. The later phrases of a tune are the same whether they are preceded by the earlier ones or not. This could not be the case if their nature involved interpenetration by the earlier parts. If there were such intermingling should we not get ~~a~~ in many cases a ~~shere~~ discord. It is just because they do not intermingle that the balance of the musical pattern is preserved.

Let us turn then to another of his favourite examples. Consider the experience of being lulled to sleep by a series of successive sounds, eg. the ticking of a clock. It is not the last sound that we heard that alone produces sleep. The last is no different from the first which did not have this result. Nor is it the set of individual sounds, for at any time later I can think of them and they do not induce sleep. Then the effect produced must be due to the operation of the sounds acting somehow as a whole.

Now in the first place it is to be noted that the above is an inference. The sleep is not the effect of the last stroke alone, for this in itself is no different from the first, which was not sufficient to cause drowsiness. Neither is it the whole group of sounds taken as individuals, for we can so think of the group at another time & it does not have the soporific effect on the mind. Bergson concludes that the cause of this given effect must be the series of sounds taken as a qualitative unity. But he later tells us that duration cannot be treated in argument, for inference, whether deductive or inductive, belongs to the realm of things spatial. Anyway, even granting that neither the first nor the last stroke nor yet the group of individual strokes constitutes the cause of sleep, are there no other possibilities besides the alleged unity of the sensations? May not the atmosphere of the room & the condition of both body & mind have something to do with the situation. Is it not possible that when we think of the group again the reason we are not made sleepy is that now the circumstances of the group's operation on our mind is different. Before it was an influence conveyed via the senses — now it is an experience arising through the medium of imagination. And finally may not the effect be the cumulative result of the series of sensations without these latter loosing their individuality?

Sixteen ounce weights well holed in balance a pound without ~~been~~ interpenetrating each other. The sounds in the series are heard as individuals which preserve their distinctness, & not as a coagulated mass of sensation.

Deliberation & volition are experiences which Bergson often cites as, probably embodying duration. The presented alternatives are not separate states of mind but differentiated tendencies within the single movement of conscious life. The movement swells & develops as a whole, oscillating from one pole of emphasis to another as different memories arise out of the past & weld themselves into the present activity. Finally the free action occurs "as the ripe fruit falls from the tree" & holds within itself the whole process which has led up to it.

The beauty of Bergson's language is undeniable, but it is questionable whether his poetic gift is productive of clarity. Are we to hold that indecision persists as part & parcel of the experience of a mind that is "made up?" Is it the case that while the mind clearly outlines & consents to a course of action, in that very act, constitutive of it, there is the hesitancy & inhibited transition which mark the state of conflict & indecision? Truly Bergson's "durée" is an elusive notion.

Let us consider one further example - the account of the process of attention given in Matter & Memory. When we hear a foreign language which we do not understand, we are unable even to differentiate the sounds which we hear. They seem a confused jumble - this is why foreigners always seem to speak more hurriedly than we ourselves. Thus the understanding of what the sounds mean helps to give us a clear consciousness of the nature of the sounds themselves. When we know the language, the indistinct sound gives rise automatically to an articulatory motor diagram, which schematically imitates the speaker. Learning the language consists, in its elementary stages, in co-ordinating the auditory impression with the articulatory movement which produces it. In recognising a word, the motor diagram appears in the form of a nascent muscular sensation, an attempt to articulate the indistinct sound. In this process both the auditory sensation and the motor diagram become fuller and more distinct. Clear recognition of the sound involves the attempt to utter it.

Thus far however we have only succeeded in breaking up the flow of words into it's salient features. These are still abstract and isolated. But the motor ~~day~~ diagram as it were

calls up memory images which rush forwards & project themselves into the partially recognised impressions, filling them out with meaning & producing clear & distinct perception. There is a continuous process in which vague ideas which ~~can~~ are able to pass into auditory images such as are compatible with the motor diagram, do actually effect this transition & then overlay the crude sensation, analysing it & re-synthesising it.

Ideas, which are pure recollections, automatically rush forward. Only those however that are compatible with the motor diagram succeed in passing into memory images & thence actualising themselves in concrete perception.

The clear & distinct perception of an object is an active adaptation towards it, involving two aspects. First there is the immediate stimulation of the nervous system by the external world — this factor, when its unity with the whole process is forgotten & it is separated out, is pure perceptionic sensation. As a matter of fact it nowhere exists alone for it is only an aspect of a unitary process. Then there is the reaction of the self. This consists of a nascent motor adaptation which fills itself out into actuality as pure memories concentrate themselves into it. These memories are stored up automatically. They shade off from the vague recollection of the past in its individual moments into the realm of the unconscious where the whole past is stored up in its individual detail.

This process is the central character of all conscious life, which consists of an incessant turning upon itself to meet new facts. A process in which a constant "contracting" of aspects of memory into activity upon the new sense stimulation, ~~or~~ has a counterpart in a gradual "distending" into "memory of recent perception & activity. There is this unceasing activity, with its two moments of contraction & distension, continually issuing in new experiences, but only in so far as these intermingle with & contain the past.

This account of conscious life raises psychological problems. The notion of unconscious states of mind would not find universal acceptance even at the present time. Again, what exactly is the meaning of the phrase that memories contract into perceptions? It is now a common place that ~~memory~~ perception as a concrete attitude ~~state~~ of mind involves memory — but just how? M. Bergson seems to assume that the whole content of the memory predicament is subjective & that subjective images are some how brought out from the limbo of the past & impressed on to the ~~present~~ present sensory

element. His subjectivism with regard to memory would not pass without question. These points of psychology will not be immediately pursued, but it is proposed to turn to a consideration of Bergson's application of the notion of duration beyond the facts which we normally ~~st~~ refer to as consciousness.

Duration is also the fundamental structure of all organic life. Evolution can not be regarded as merely a re-arrangement of the given. Indeed the very notion of re-arrangement, however, involves the coming into being of a radically new quality. If there are a number of pebbles arranged in the form of a star & you proceed to give them the configuration of a square, there has a new shape i.e. a new quality come into existence. Organic life is always the springing into being of new functions. Yet these are not mere additions over and above the old. They grow out of and into the old & organise them for greater activity. The brain grew up as a differentiation within the structure of the organism, it's function being to give the ~~the~~ possible activities of the organism a greater scope & a higher degree of co-ordination. It is described as analogous to a central switch board. Although continually developing, the organism is at every stage, however lowly, a unit with its own peculiar individuality, reacting within it's own limited environment in accordance with the inner plan of its nature. But, as in consciousness, the whole unitary process is not mere advance. Here ~~two~~ too we get advance which has two moments - the upward & the downward path. In organic life there is also a process of atrophy of structure & function. The keener sense of vision in the human has arisen side by side with an atrophy of the sense of smell. The powers of the organism, constantly advancing, have contracted themselves into the function of seeing & drawn themselves off from the function of hearing. Man's vision is keener & more highly developed than that of the animal. His sense of smell is less effective than that of lower creatures. The total result however is that wider & more highly coordinated activity of the organism as a whole is made possible. But even in man the potentiality is not utterly lost - as in consciousness the past is not destroyed. It may be dissipated - ~~that~~ take the form of distended memory - but it is preserved in the past unconscious. So in organic life atrophy is not ~~or shire~~ eradication. In consciousness, when the occasion arose, the memories came to the surface & passed into the present activity of perception. So in the case of an atrophied function, when the need arises, it can regain it's vigour & take its place as an effective moment in the activity

of the organism. The man who becomes ~~blind~~ blind can revive from its germ the sense of smell until it becomes almost as effective as vision in the direction of the normal human organism.

How in this account of duration - of real time - is Bergson getting into touch with the time factor of experience at all? His unity which is to hold past & present together & give us development as against pure re-creation, seems to be a unity across the present rather than through the present & past. The present unity of function of the human visual mechanism, the fact that it is a more highly co-ordinated unit than the pigment spot which preceded it in time, the fact that the two have in common the very abstract property of sensitiveness to light tell us nothing at all about the special relation of time between the two ~~things~~ structures in virtue of which we can regard them as stages in one evolutionary process.

We are not yet however at the limits of the applicability of the ~~concept~~ notion of duration. The whole field must be surveyed that no corner may be left which might perhaps supply the clue which hitherto has proved so elusive. Matter too endures. We are bidden to consider without prejudice the outer world as it is presented. We do not experience it as separate granules of matter - hard, individual, impenetrable atoms. It is presented as a continuum of sense quality. It is not indefinitely broken up into points and moments but has a quality which, with William James, we may refer to as extensity; & it changes continuously. Space as concretely presented in perception, as it is given with the qualities which occupy it, is not the separateness of the qualities but rather another quality - extensity - given with them, & interpenetrating them. We express this by saying that qualities are spread out in space.

If then the outer world is a continuum of sensory quality, how, we may ask, do we come to regard it as broken up into ~~things~~ separate objects with sharp outlines, which are mutually exclusive of each other. The reply is that this is the falsifying work of the intellect - it is the intellect run wild, overstepping its function. Intellect is a faculty developed in the life of the organism to serve our practical needs. The fact that we are active & seek to satisfy our needs gives rise to the primary breaking up of the continuum of experience into the self & not-self. First of all I live - I strive to satisfy my needs & to use other parts of experience (facts) to aid me. Sometimes I am successful - sometimes my satisfaction is withheld by reason of the ~~non~~ - ~~co~~ non-co-operation of the instrument I seek to use.

This clash generates my representation of reality as consisting of the self on the one hand, with its needs, instincts, impulses & desires, & the not-self on the other hand. The self is experienced as a structure of activities, pursuits & wants. It constantly grows but it constantly preserves a relative individuality which is its identity. Now at any time one aspect of its growing nature is dominant - it is occupied with one interest. This tends to focus growing activity in itself, so that it appears as marked off from the rest. Though in reality it is continuous with them & arises out of them. However, besides giving the ~~act~~ superficial appearance of discontinuity in mental life, each phase of the practical activity isolates from the not-self some definite point for the focus of its operations - some situation in which it can proceed to satisfaction. Thus we get the break up of the not-self into a multiplicity of objects each relative to some specific need in its particular manifestation. Pure space is the subjective form under which the real comes to be regarded as broken up for the sake of action. It is just the principle of divisibility at will & the principle of infinite divisibility.

Now since the real is a unity, in so far as we isolate any part from the rest we rob ~~it~~ the nature of that part of the fullness of its content. Our interest in practical activity generates in us a tendency to focus attention ~~on~~ on common qualities in the various aspects of reality. In so far as the present is similar to the past we can deal with it, we can adapt ourselves to it because we already have knowledge of it's nature and possibilities. But there is no pure ~~reduce~~ repetition in reality. ~~There is~~ & An absolute repetition would not be distinct from that of which it claims to be a repetition. It can only be other in so ~~far~~ as there is differentiation. If we have regard only to the similarity of objects we are abstracting from their full nature. We are neglecting the differences which mark them off from other facts & which constitute their real multiplicity. But although we are ignoring that very part of their nature which gives them multiplicity, we yet regard them as distinct from each other. Bergson says that we then apprehend them under the form of pure multiplicity ie plurality not arising out of differentiation. We are proceeding on a principle which when carried out to it's ultimate limits is the representation of a "pure homogeneous multiplicity" ie of a plurality whose elements have been progressively robbed of their nature so that they are absolutely identical in the negative ~~status~~ predicament of being devoid of all quality, & which yet are distinct in virtue of some principle other than that of qualitative

difference.

Bergson goes on to say that this principle is at the basis of number. A group of units are a pure multiplicity. They can be a plurality though they are all alike. The very units are not real individuals but only provisionally such i.e. for so long as the mind cares to regard them as units apart from the unity of the act of apprehension they can, in themselves, split up into as many fractions as you like.

Such a multiplicity is quite other than duration – it is not in time for temporal multiplicity is also qualitative unity. Then either they are simultaneous or such that each has ceased before the others can arise. In the latter case they would not form a multiplicity for we should have one at a time but never all together. When they are simultaneous. Number therefore is simply the representation of a simultaneous homogeneous group. ~~then~~

Here we get the key to Bergson's answer to the old destructive argument as to the nature of time. viz that the past has gone, the future unreal & the present a vanishing line between them. Bergson says there are as it were ∞ degrees of spatialisation. In between the intuition of pure time – duration – & the representation of pure ∞ multiplicity – space – we get a hybrid notion in which the two are intermixed. This is spatialised time. We are trying in one and the same act of thought to regard the real as a pure multiplicity & yet as a growing unity. We compromise by picturing the past as outside the present & yet as somehow existing along with it. Thus we use the mechanism of space i.e. simultaneous multiplicity. But we attempt to import some temporal features into the situation by vaguely & metaphorically characterising the past as "having gone" & the future as "not yet born." We have picked out time as a line. Any point will have points on either side of it. That which we call present has a past. We project the past on the other side of the present & call it future. The product is an illusory appearance proceeding from the fact that we have allowed the spatialising mechanism of intellect to overstep the limits of its practical utility.

Mr Russell ~~of course~~ criticises the account of number involved in Bergson's doctrine of space. He says that Bergson has not given an account of number but of groups of entities. He himself holds that number is a property of individual numbers & that these latter are properties of various classes of groups of entities. Class & class-concept he takes as equivalent and defines two as the class of all couples. How to regard the class-concept as equivalent to the class itself for certain purposes eg for convenience in labelling certain math-

mathematical predicaments, does not render the two notions identical. As a matter of fact Russell is not concerned with defining two in the sense of enpounding the internal nature of ~~a group~~ that property of any group in virtue of which it can be said to be a couple. He is concerned with establishing a useful convention which consists in substituting for certain purposes the class of entities which bear certain properties for these properties themselves. The difference between what we normally mean by definition, & what Russell, for the purposes of his mathematical logic, means by the same term, can be seen from this statement that where two properties characterise identical classes there they are themselves identical. It is doubtless good & useful for Russell & his followers to pursue this mode of enquiry & apply it in the sphere of number. Still the problem remains of what is the intrinsic nature of number & of any particular number. What also are the conditions of it's existence. In other words it is necessary to pursue also the attempt to define number in the normal sense of the term definition. This appears to be Bergson's objective. His conclusion is that what ever else is involved in being such & such a number, there is at any rate the principle of distinction on a non-qualitative basis. Since this principle is involved in all numbers, ~~presumably~~ Bergson refers to it as number. Thus there need be no essential clash between the different theories of Bergson & Russell respectively, for they each deal with a different aspect of the number situation. The one seeks the intrinsic nature of number, the other attempts the formulation of an apparatus of scientific convenience for referring to various numbers & their relations, in certain processes of mathematical deduction.

Bergson's notion of spatialisation seems to be an attack on the principle known as numerical identity & distinction. This is a sheer falsification of reality generated by intellect out of its function of serving activity. But how can a tendency to illusion facilitate action? If I am under the ~~illusion~~ delusion that a brick wall is a non-resisting entity & I act upon that principle when driving an automobile, can it be said that my activities & purposes will thereby be brought to fruition!

Any way there certainly seems to be repetition of qualities in reality. Even if closer examination with a microscope should yield differences existing but unobserved before, yet it will also reveal unobserved repetitions. It is sometimes argued that distinction without qualitative difference is meaningless. But the very fact that there appears to be a repetition of qualities disproves this assertion, even though it be

Matter + Memory p. 246 (1)

~~that~~ the case that really & at bottom this is not so (& even though really there is no repetition.) And surely that there is no repetition can only be shewn by progressively pointing out qualitative differences where none were thought to exist. So far as Bergson is concerned the doctrine of "no difference no distinction" is part and parcel of his notion of duration.

He goes on to claim that by means of the notions of duration & spatialisation he can solve certain traditional difficulties which physics & ~~mechanics~~, the sciences of matter, have continually found themselves up against. These arise out of the question of the nature of motion. Bergson himself believes in absolute motion. He says that if movement were not real our sensations of motion would ~~would~~ have no meaning. But they have a perfectly definite content. Consider the kinaesthetic sensations. They are a reality with a unique content which must be admitted and cannot be explained away. They occur & are felt as an absolute change in my own body. The muscular feelings of the movement of my arm are really & absolutely just as they are felt. The same is the case with motion as seen. The moving object as presented is qualified by a certain state which it possesses intrinsically. And to motion belongs the same character as is exhibited by mental time – it is a growing unity. "Every movement, in as much as it is a passage from rest to rest is absolutely indivisible." This is an immediate fact of perception, not a hypothesis. The movement of a limb can be presented in two ways. It may be felt as muscular sensation. Bergson thinks that so far as this goes no one would deny that it is an absolutely unitary state. Then we may perceive motion by visual sensation. Conventionally we may regard this sense content as a line traversed. Yet here too he maintains the movement is seen as a whole – the moving body is presented as actually in a state of passage.

But, it will be asked, how are we to know which body moves. When I am in the express it seems to be the telegraph poles, but when I am on the embankment it appears to be the train which embodies motion. Which of the two really & intrinsically has the property of movement.

This difficulty only arises, Bergson claims, because it is assumed that there are separate objects. But as he claims to have shewn the immediate datum is a continuum of sense quality. Moreover this continuum is all the while changing – but it changes as a whole. It is presented as a growing mass of content. Science in these latter days has also, he claims, thrown over the granular notion of atoms & recognises the reciprocal action of the parts of matter upon each other.

For Faraday the individuality of the atom is nothing but the abstraction of a mathematical point at which intersects an indefinite number of lines of force, which constitute the real nature of the atom. Each atom, through its lines of force, can be said to occupy the whole of matter, so that all parts are interpenetrating. Kelvin uses the metaphor of a vortex in a perfectly continuous fluid to describe the atom. But for both physicists, lines of force & vortices are only convenient symbols to represent the nature of the real to which their calculations must be supposed to apply. They are used because they suggest modification as a whole, perturbation, as it were, within a continuum, change of tension or energy ~~thus~~ rather than the bare change of position of a separate internally changeless atom. Thus what we call a motion is a phase isolated from the total changing continuum. Thus to ask whether the motion belongs to the train or the embankment is a meaningless question implying the false ~~spatialised~~ outlook on reality. The motion belongs to train & embankment as ~~one~~ differentiated moments within a growing unity of matter.

It is because science has forgotten the unity of matter & the fact that it is a temporal unity in duration, that motion has been reduced to diversity of position & the notion of the relativity of motion has arisen. If real motion could be reduced to diversity of position it would follow that diversity of position would be absolute. This however is not the case, for positions are not intrinsically different. Perceived positions are differentiated — but then they are not pure space but ~~the~~ elements of a system in which occurs extensity & heterogeneous quality. When we come to measure motion as science does, we abstract from its time element & treat it, not as a process, but as a set of different positions in space. (X) has moved if two different distances in space are involved in its space relation to (O). The motion is a function of these two. If no differences of distance are involved there is no motion. Different distances may be involved in the relation of (X) to (O) but not of (X) to (P). It will then be said that (X) moves relative to (O) but not relative to (P). Thus the doctrine of relative motion is the product of spatialisation i.e. of attempting to apply number to a time process.

However, in spite of all Bergson has to say, ~~that~~ this fact remains, that within the total changing continuum the system of reality takes that form in which the duration presented to the man in the train is different from that presented to the man on the embankment. The man in the train feels himself to be growing older, to be enjoying the scene or to be the victim of tedium. Yet it is the embankment which for him is ~~moving~~

motion whereas for the man on the embankment the train moves. Even Bergson must admit them to be at least distinguishable aspects within his one continuum of change. And if they constitute a unity it seems reasonable to seek to discover just in what precise form they are related. It is this that the theory of relative motion attempts to do. Bergson leaves the matter with the vague ~~st~~ statement that they do constitute a unity. Even if ~~modern~~ physics is given to distorting in its attempt to articulate the intrinsic nature of each ~~of~~ of these distinguishable aspects of the whole, still it does attempt an analysis of ~~the~~ their relations ~~between~~ within the whole. Even if we do not separate the two, there is surely something more to be said of them than merely that they are distinguishable but not separate. And even if we refrain from spatializing each aspect, it remains that for the man in the train the embankment moves & to the man on the embankment the train is presented as in motion. This is a fact which physics has admitted — ~~in~~ Bergson seems rather to ignore it.

However, to pursue Bergson's enquiry further; the two principles of duration & spatialisation furnish a solution of the famous Zeno paradoxes with regard to motion. Bergson discusses them as follows :-

(i) The Dichotomy — It is impossible to complete any motion, however small, for before you get to the end you must have gone half way. But before the half way point is reached you must have reached a point which marks off a quarter of the distance to be traversed. This goes on ad infinitum. To have moved at all involves the completion of the summation of an infinite multiplicity.

Bergson's reply is, that since motion is a unity it does not involve the summation of a multiplicity at all. Even if it be the fact that the completion of the summation of an infinite multiplicity is impossible, this fact is totally irrelevant to the nature of motion. However the mistake of Zeno, or of those whose theories of motion stimulated his enunciation of this paradox, was quite natural. It was the result of his intuiting motion under the form of space, i.e. of attempting to apprehend it by the intellect which regards it as a simultaneous track & as divisible at will.

(ii) The Achilles — If Achilles allows the tortoise any start, he will never overtake it however quickly he travels. For before he can catch it up he must reach the place from which it set out. But it will then have moved forward & will still

have a start of him. This process can be repeated ad infinitum but the tortoise will always be in front.

The difficulty involved seems to be that if Achilles were to catch up the tortoise there would be the following self contradiction. According to the law of generation of the parts, they must have an equal number of parts. For every part of the one there must be a part of the other. But in so far as achilles has caught the tortoise up his path will contain an extra part viz that which should have formed the separation between the two last positions. That means that no course will both have the same number of parts as the other and yet have more parts than the other.

Bergson says that the whole process which we call catching up the tortoise is a single unitary development, in which the so called first phase, where we say the combatants are separated, melts continuously into the last where we say their positions co-incide. But this process is an individual. It cannot be otherwise than it happens. To change it is to distroy it. When however we intitule it spatially we regard it as two separate tracks each of which can be broken up at will. The real process as it is given cannot be so broken up - we must take it as it is, in its own peculiar articulation. Let the relation between the two collections of parts which are the product of spatialisation be what it will, it is totally irrelevant to the nature of the real process which is not two tracks & is not a collection of parts. Zeno's second paradox is simply the product of the illusion generating mechanism of spatialisation.

(iii) The Arrow - At any instant of its course the arrow is at rest. It cannot move in the instant, for then the instant would become a multiplicity of instants. Then let the number of instants in its course be infinite, it still does not move throughout.

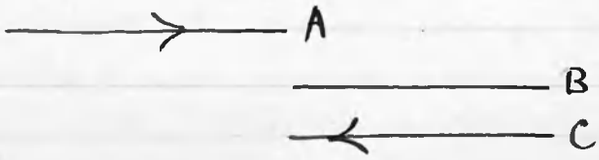
This of course Bergson condemns as a palpable piece of spatialisation. The paradox involves simply the falsification by the intellect of the unitary process which we call a moving arrow. This duration has been apprehended as a simultaneous multiplicity of positions.

(iv) The Onekoi in the Stadium — Let body (A) pass along body (B) which is at rest. Let body (C) undergo the same ~~transaction~~ transaction with regard to (B) but in the opposite direction. The two following predicaments are involved.

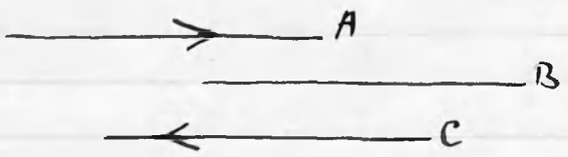
Over

* The notion of difference of rate may solve the contradiction (in fact does so) but we can't avail ourselves of it, since it is a moment of duration, so long as we retain the spatial word formulation of motion which is involved in the attempt to measure it, to regard it under the form of quantity.

Position I



Position II



Thus it will be seen that (A) passes twice as much of (C) as it does of (B) and in the same time, hence the time is equal to twice itself.

This is Bergson's exposition of the fourth paradox. Our immediate criticism he says will be, "Absurd! for in the one case the rate of ~~passing~~ passing is twice what it is in the other. If the case were that the same velocity of passing characterised both cases & still that in the ~~same~~ given time the amount of overlap effected is in one case twice the amount of the other, then the paradox might have some plausibility." Bergson's reply is that velocity is a feature of duration. As they happen, the two cases of overlapping are not separate predicaments, but two distinguishable aspects of one complex process of transition. The different velocities are differentiated rhythms within the one process. This is how they are given & occur – as ~~different~~ qualitatively different elements within a developing individual. If however we spatialise the process & split it up into two spatial overlaps & yet speak of the one time which is represented by both, Zeno's conclusion follows. Ignore the real process & treat time as space, as science ~~does~~ normally does, & all we have is two spatial overlaps one of which is twice the other. To speak of them as identical is self contradiction, to ~~re~~ re-introduce time is impossible so long as we retain the spatial form of articulation. For the scientific attitude & the normal attitude of common sense the fourth paradox is a valid reductio ad absurdum. It is only itself absurd, in so far as the spatial form is abandoned & we throw ourselves back on the ~~real~~ intuition of the process as it occurs & articulate it as a growing unity.*

We may be tempted to ask how it can be said that a railway journey from Glasgow to London is a unity such as Bergson claims to have discovered in consciousness. How can the departure from St Enoch's Station at Glasgow be said to overlap the arrival at King's Cross at London. Suppose we stand on the platform of one of the ~~main~~ many

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small country stations through which the main line express rush, is not the train's passage just the same to us whether or not we know that it is bound for London and has come from Glasgow. These facts of the two ends of it's journey seem quite outside the the movement we see from the small station platform. The reply presumably will be, that this is only the case in so far as we are abstracting and spatialising. The mere journey from Glasgow is an abstraction from the ever changing content of the material world + as such, not a true unity, for the very act of abstracting robbed it of its real content. The phrase we call "arriving at King's Cross" is only what it is because the previous course of change in the material world has happened as it has, + has led up to it. The same is true of a portion of the journey observed as the train passes through some country side station. The abstraction is here more complete. The two ends of the whole journey are only outside the observed portion because we have wrenched it from it's environment + because we are attempting to reconstruct the whole by means of the spatialising mechanism — setting the parts side by side as a simultaneous multiplicity. Motion for Bergson is not more fundamental than + even co-ordinate with qualitative change. It is a form of this latter.

In the end Bergson formulates the notion of the real as a single process always moving forward into new life - always creating. There is the background of the mechanical world, not a rigid system, but a growing unity within the whole. It's rythm is of low tension, consisting of "enormous periods of an infinitely dilated existence" where change is at a minimum (but still the very life of the reality) + where, in consequence quality + heterogeneity are almost turned into homogeneity. But at certain points within it's extent, the rythm of matter "contracts" into organic and conscious existence. Consciousness is a duration of a higher tension than matter. It's rythm is slower but it is rich in qualitative change. The system of vibrations, enormous in number, which form the physical basis of colour sensation contract into the rythm of consciousness. This latter consists in the continual rising of memory images to interpenetrate + give structure to sensation, producing concrete perception. A colour sensation is thus the contraction of a system of light vibrations. This process, it is suggested, takes place on the same lines as the one just mentioned, that which consists of the rising up of memory images to fill out sensation into perception. The whole process of matter

contracting at certain points & bursting forth into intenser activity in the form of organic life and consciousness constitutes a single growing unity with various qualities and tensions. There is a general forward movement, a continual incrementation. Hence both mechanism & finalism fail to express the nature of reality. Mechanism regards reality as essentially repetition. It is dominated by the law of causality, viz. that like produces like. If there is repetition there is no change & no time. If time makes no difference, if the later is not different from the earlier, then time is otiose and ineffective — to speak of it is mere lip service. Duration is not repetition but the continual springing up of that which is radically new & different from what has been before. The law of causation cannot be applied here so that the future cannot be foreseen — we must await until it arrives before we can know it. The necessity in the system of mechanism is just the representation of reality as one system of causes and effects which is constantly repeated. All change is to be reduced in some way to the pre-existing. There is necessity because there is nothing new — all is given. Reality is a vast simultaneous group, static & unchanging, obeying the law of number that all is there. Select one part and the rest remains for there is no change. This is the necessity of mechanism.

Finalism is no better. Instead of saying with mechanism that "Given (A) then (B) must follow, for like produces like & (A) gave rise to (B) before," it says "If you want (B) you must have (A) first." The very same reason is given however as occurred in the case of mechanism. Thus we begin with what we call the future instead of ending with it as in mechanism, but essentially the same principle is involved. Finalism is just inverted mechanism & both theories deny change growth & real time.

This general movement ~~upon~~ of growth has two moments within it, which Bergson calls respectively the upward and the downward paths. The condition of the progress on the whole is that while at some points there is a bursting forth into new life, at other points the energy seems to be drawn away for the new activity & there is a relative stagnation. There is a halt or even reversion in one locality but a further progress in another. This was clearly exhibited in the cases of consciousness and organic matter. It is maintained that it is a characteristic of matter too but in a less degree. We have seen that matter too has a duration though its rhythm is more degraded than that of consciousness.

But the fact remains that it is a duration and not something radically distinct from consciousness as the dualists thought. The particular laws of science are not true in the sense that they express the real nature of matter, for they are based on the assumption that matter is absolutely stagnant. They imply & express the principle that all is given, so that if you start at one point you can pass to all the rest of the given mass. Necessity is bare identity. Scientific laws are the product of spatialization. The likenesses which appeal to individual investigation have been abstracted & set side by side on the principle that like produces like. Thus ultimately scientific laws are based on pure space. Now pure space exists only as a form of apprehension is a tendency of the mind. It is the expression of the downward path of reality. Matter always remains a rhythm, it is always to the last creative. In all application of scientific laws there is a margin of error - this is the expression of the fact of real contingency even in matter. But matter is only a more degraded rhythm than consciousness. The spatializing tendency of the mind and the static laws which this ~~work~~ character gives rise to at best only express this fact. They are the product of ~~sin~~ representing this degradation as absolute - ~~to~~ to this extent they are false. But since the rhythm of matter is so attenuated the scientific laws are useful as compendious statements of matter's configuration. They are a basis of action but not in the strict sense articulations of the real. The intellect is a faculty which corresponds to the downward movement. It is our ~~power~~ instrument for making these compendious statements of the configuration of matter in the service of activity. But when it represents the dilution of matter as absolute & matter itself as devoid of all unity, quality & change it has imagined & arbitrarily asserted the existence of the limit to a process. So long as the intellect is formulating scientific laws only as a method of employing matter as a basis for further advance, it fulfils it's purpose. In mathematics & physics the intellect has run wild & overstepped it's function, ~~so~~ now claiming to be able to articulate reality in it's intrinsic nature & ending by the substitution for what actually occurs, of a product of ~~the~~ imagination, an ideal limit to a process.

We can now attempt to apply Bergsons analysis to the criticism of succession with which the section opened. The point was that past & future are respectively gone and unborn so that there can be no succession but only at most ~~an~~ constantly re-created present which is out of all relation to other presents. This is

separation carried to the point where we cannot assert even the existence of a mere group. Bergson himself says the future is unreal. It is not given but in the making for duration is growth. But the past is not unreal for it forms a unity with the present. Time consists in the growing of the past. Because the past is preserved there is real growth & not mere annihilation and re-creation. The suggested criticism of succession is just the product of spatialisation. It is a result of splitting up real time & just appraising past & present in a spatial intuition. The line is prolonged & future is projected on the other side from past. Then we half heartedly offer compensation by the use of such vague terms as that past is gone & future unborn, which are, if any thing at all, the admission ~~that~~ in spite of ourselves, that the facts with which we are dealing are after all not statically just apposed but really mobile.

Bergsons whole account of the nature of time depends of course on the validity of his notion of duration. In many of his examples we have found it difficult to appreciate the unity of overlapping & interpenetration. In other cases the unity that appeared was a unity of functioning across the present & really ignored the essential time problem which consists in the question of the nature of past-present & future (if it is real) & the mode in which they are bound into a unity of succession. This view seems to be re-inforced by a consideration of the two notions of distending & contracting, which are an essential feature of his system. The two movements are different at least. Now if at a later stage a contracting phase of consciousness has ~~been~~ had it's place taken by a distending phase how can the earlier and the later be said to inter penetrate or the earlier to be preserved in the ~~latter~~ later? The earlier has been supplanted by something else different from it. Bergson himself provides an answer. The past was active but no longer is so. It has not ceased to be but has ceased to be active. —— But does this not mean that the past qua active, the past as it was given & occurred ~~to~~ just has ceased to exist. Either this is the case or ~~to~~ at least it, i.e. the past, cannot be said to be included in the present. In either case we really have not touched the question of time at all. The future is unreal & we are presented with a continual coming into being of ~~to~~ new presents. The past is either unreal or at least outside the present. We have not generated the unity of succession. This point will be reverted to later on.

Meanwhile we may note in passing an attempt to articulate

time which in many respects is like that of M. Bergson – this is the philosophy of Croce & the Neo Idealists of the present Italian school. For this school of thought the real is all of one piece, it is all some grade of consciousness. But there are two main aspects viz the intellectual & the practical. They are not however separate and distinct. They are different but form a unity, the one involving the other. There is no intellectual activity without the will to know & no volition except as a response to the knowledge of the nature of fact upon and amongst which the willing takes place. The two exist together & condition each other.

On both sides the real is activity or development. As in Bergson's notion, reality is a constant advance into an unformed future – a continual addition of what is new. There is no single all satisfying object of will but only at any stage, an object which will bring satisfaction to that stage of development. But the very satisfaction only opens up new desires & volitions because it puts a new light on the real as up to that point experienced. In other words any satisfaction is only itself a stage in the forward movement of continuous activity. To quote an example from the present phase of life. One desires a motor cycle to be able to get about the country quickly and with some independance of railways & public cars. Then one finds the wind & the mud troubling one. The very fact of the satisfaction of his desire for the motor cycle gives rise to the new desire for a small car which shall afford protection from mud & wind.

The same exactly is the case on the intellectual side of activity. Knowing is always the solution of a problem. But the new solution only provides the background of a new problem of which the previous solution appear only as a partial solution. A medical man has an excellent prescription but he cannot administer it because one of the ingredients is an excessive throat-irritant. He is faced with the problem of what will counteract this influence. He finds his solution in a certain other drug. But the very solution creates a new problem for the drug which he has hit upon will not combine with the other ingredients in a water medium.

The real is essentially a development outside which there is nothing at all. There is no static and transcendent condition of the activity which will never cease just because it's nature is to be active. Satisfaction is always a phase of further activity – it marks a real gain but it still only opens up new lines of advance. Were the activity to cease there would simply be pure annihilation.

but the development is a unity. The past is not lost but enters as an element into the present, the new unity which continually arises with the progress of ~~the~~ development. The new is always grounded in the old, it presupposes the old. On the other hand the old is only truly real in its unity with the new. The doctrine is summed up in the formulae of the "Eternal Present" and the Contemporaneity of all History." Or again we are told that the old is both necessity and freedom — necessity because at any point actuality is what it is, only in virtue of the past; freedom because at every point there is new growth.

These notions are expounded as follows. A thing's existence is it's participation in a coherent totality. The full meaning of the proposition that Hannibal marched his soldiers into Italy can only be known in the light of what we know of transport and commissariat at the present day. To a modern officer it will mean more than to a modern professor of history. Past is real in unity with present. What we should normally distinguish as Hannibal's real march as distinct from our idea of it would be held by Croce to be simply an abstraction from ~~the whole~~ the totality of content of our present experience. The real past march is not lost but is taken up within the present totality of experience. It's participation in the unity of the eternal present is the guarantee of it's reality. On the other hand we can also see that present is grounded in the past. Thus the full interpretation of present perceptions arising out of the execution of excavating operations in Italy ~~would~~ might depend on the question as to whether or not Hannibal did march into Italy.

Now with both Bergson and the Neo-Idealists time is to be regarded as a growing unity. It consists essentially in the advance into an unreal future. Reality is in the making. Time is the continual addition to the real which is already given. It is held that succession involves both the reality of the past and the continual springing into being of what is new. Unless the past be real there is nothing which develops, no growth, no succession but simply a continual creation of an instantaneous mass & it's continual destruction. On the contrary, unless the future is continually springing into birth there is no mobility but a static fact. At the same time both these theories deny that elements can be related or exist except in so far as they are moments in a unity in which all parts interpenetrate and involve each other in their very essence.

But these two doctrines of the internality of relations & the

reality of increment seem to cancel each other. To a unity of inter-penetrating elements there can be no addition. To make an addition would be to change the whole - to ~~or~~ change therefore the internal nature of every part. There would not be addition but the creation of a radically new fact. The old would be ~~radically~~ outside the new because radically different from it.

In this case the old and the new could not even be in relation to each other. In no sense could the new be said to contain the old nor the old the new - they would be radically different throughout. Nor can the two be said to form a higher unity for they are themselves unities. Furthermore if this were the true predicament, ~~the~~ since the future is unreal, the present would appear as a real partial unity. It's very reality would consist in a complement which did not exist. It would have to be spoken of as adapted to a pure nonentity. The higher totality in which alone it could exist would be ~~nothing~~ itself non-existent, for the future, an element of that totality, would be itself unborn. Then if old and new are not in relation how can they form a succession - how can the one be said to grow out of and on to the other?

There seems to be a confusion in the notions of unity & growth involved in these two theories. When the aspect of growth is engaging attention, it seems to be the variety of stages ~~which~~ in the actual progress which are thought of. When however the relation of these stages in the constitution of a single process becomes the question, the argument runs off on to the nature of the cross-section of the process at any stage, & a comparison of the internal constituents of the cross section at various stages. As was mentioned above, the unity involved seems to be a unity across the present rather than through the present to the past. The peculiar essence of time seems to have been missed by ~~by~~ these thinkers just as much as it was by those they set out to criticise. ~~They~~ They really carry us no distance away from the standpoint of common sense philosophy from which we set out.

At the outset of this section it was pointed out that if we take seriously the notions of the unreality of past & future, then the notion of succession simply becomes self contradictory. The discussion immediately concluded seems to reveal the inability of the notions of Bergson & Croce to get beyond this standpoint. ~~It~~ It further throws upon us the necessity of considering the absolutist doctrine of time. It is claimed that behind this notion, absolutism, is the authority of almost all the classical thinkers — Plato Spinoza. Hegel. It denies the possibility of adding to reality or of destroying any of its parts. If this view be

creel then in so far as succession involves absolute creation & annihilation it cannot be a character of reality.

There is however a hybrid doctrine. This is traditional theism. It believes in the ultimate reality of progress & yet insists that the future shall be guaranteed to be of a certain type ie that God's purpose shall be fulfilled. The given presupposes a being outside it whom the theist call God & this being in its turn implies a future of a certain guaranteed nature. But it surely follows from this that if God be real the future is real too for God's nature is to imply the future. He cannot be related even ~~by implication~~ in the transaction of implication to a pure nothing. It matters not whether God be regarded as immanent in the given a transcendent of it — or even both immanent & transcendent as Prof Pringle Pattison seems to argue. The point is that if deity be real, then the future as related to it ~~by the relation~~ in the predicament of implication is real also.

We turn then from pure creationism to pure absolutism. The latter emphasises what it calls the implication of totality in all our experiences. The notion is that the nature of any part of experience involves the recognition of it as an element in a completed whole. The characteristic of unity has two expressions viz that of interdependance of parts & that of the legislation of the whole for the parts. These are not two separate facts but imply each other. Interdependance implies totality, the fact of completeness & the impossibility of adding or taking away. Again totality only exists in virtue of the interdependance of parts. If the elements really do interpenetrate; if we take the doctrine of Bergson & Croce seriously, there can be no addition or destruction as regards the fundamental reality. To admit either involves the self contradictory assertion that the parts are independent & that the real is split up into a there must plurality with no basis of unity whatever. Let (x) be given & (y) as yet unaddled. Then (x) is absolutely independent of (y). Then when (y) is added we shall have a pure multiplicity of absolutely independent elements.

The ~~Hegelians~~ followers of Hegel maintain that the Platonic doctrine of forms must be interpreted as absolutism. The form or idea is neither an abstract from the world of time nor an entity radically independent of it but somehow resembling it. It is to be conceived, as the account, in the Republic, of Philosophic intuition is held to shew, as the true account of ~~real~~ what appears to the senses as temporal flux. Time we are told is the moving image of eternity. With the advent of true knowledge we experience not beautiful objects which come and go but beauty in itself, &

this is eternal. This is interpreted by modern absolutists as meaning that whereas by the senses we experience beauty piece-meal (beautiful objects) in true knowledge we are aware of beauty in its totality, we appreciate all its aspects in their true unity. All forms are unified in the idea of the good — all things are inter-dependent & form a totality.

Spinoza & Hegel each in his own way & in his own terminology reaches the same synthesis. Each claims to work by a specially compelling method which is independent of empirical considerations. The one uses the geometrical method, the other the dialectical. More recent philosophy of the absolutist school, ~~has~~ while maintaining the spirit of these classical thinkers has abandoned their instruments as cumbersome & unexplicitously a posteriori.

Bosanquet works out the net in by means of the ~~real~~ notion of what he calls negativity or the positive law of non-contradiction. The point is that no two significant predicates are absolutely mutually contradictory. Opposition arises between them only within the context of their predication, but there is a place within the real for all predicates. Blue & red only contradict each other when they are predicated of the same object in the same sense, as when we assert that the same side of a cube is both blue and red in all its parts. But the surface may be red in one half & blue in another. This means that the law of predication is that everything has its place within reality & that when a thing is taken out of its place the predication of it becomes impossible. The assertion of a round-square is only the predication of roundness & squareness otherwise than in their setting.

All significant negation is grounded in occurs, within the totality of the real. To deny is to assert that a thing is other than was previously assumed. Negation is grounded in assertion. The pair "something" & "nothing" are not significant contraries. Each in its vague abstractness is a perfectly meaningless term - in them object we content has reached its limit & we are left with a purely verbal formula. Or consider the denial of ~~any~~ everything, which has been held to represent self-contradiction in its purity. But the proposition "nothing exists" has not even the verbal form of self contradiction. We are told however that it contradicts it's own claim to be a denial. It's object we significance contradicts the fact that it is an assertion. But what object we significance has it? It is perfectly meaningless existing only as an empty verbal formula having a structure which verbally contradicts the formula

"something exists". All significant self contradiction is always the fact of dislocation of systematic arrangement + where there seems to be some special form of pure contradiction we have only the perfectly positive fact of mere verbal formulae.

The contention is that predication presupposes an order amongst facts. I can only predicate a content in so far as I recognise its position amongst other facts in so far as it reveals the interrelations of real things. Take an example given by Bosanquet. On a boy I see a fishing trawler + pronounce it a large boat. Later in life, after having visited Liverpool + Glasgow a number of times I look back + assert it to be small. Which of the two is correct. Is it absolutely large or absolutely small. Surely all I can do is to predicate largeness in relation to the ~~smaller~~ boys experience + smallness in relation to the ~~latter~~ later one. Thus the content of experience is not self identical in the static or abstract sense of that term but only possesses its identity in that which is other than itself, in the fact that it is related to other things + has its own peculiar place within the system. This is the doctrine of identity in difference. The very meaning of a ~~word~~ term, the intrinsic nature of a content, its determinateness, involve its inter penetration by other terms + contents. The mere notion of large is nothing, absolutely empty + indeterminate. When however it is "large in comparison with this" or "large from the standpoint of youthful experience" it becomes endowed with meaning.

The pursuit of this line of thought, it is held, leads to the presupposition of an all-inclusive totality. The self transcendence of our experience exhibits it as a part with the self contained totality. It was expressed by Spinoza in the formula that that which is "in alio" presupposes that which is "in se". That a this should have a nature at all, should be a definite + determinate content involves the totality, for it only is a nature in virtue of the totality of "others" reflected in it. Were any part of the totality missing, each and every part would be radically different — indeed would lack determinateness altogether. Each part only is in virtue of its being an element within a unity. If any part were missing the unity would be destroyed.

Sense experience in so far as it is determinate exhibits this self transcendence. There is no self dependent fact — no part is real. It is a platitude almost, in philosophy, that sense experience omits but by but, that here the whole presupposes the part. Yet even here we differentiate between illusion and reality + this we do by testing the coherence of a suggested fact with the rest of accredited fact. Our

Bosanquet – Principles of Industrial welfare, Value p. 371. (1)

method of distinguishing illusion expresses the synthetic nature of reality. There is no mere apprehension beyond which there is no appeal, for at the lowest limit of knowledge the content passes beyond itself, only being determinate when realised within a coherent or systematic whole. Throughout knowledge, from top to bottom there is judgement passing into inference.

The argument turns on the assertion of self-transcendence of the given at any point + the interpretation of this as an interpenetration of parts. We have systematic totality. The notion of totality precludes either addition to, or destruction of any parts of reality so that if time be real we must on this theory find some other interpretation of its nature than that supplied by Bergson + Croce.

But there is this fact of change as a content within our experience, and in our synthesis of the whole, a place must be found for it. With Bergson + Croce the absolutist thinkers accept the doctrine of the Identity of Indiscernibles + equate time with qualitative change. This latter experience, according to absolutism, is a set of detached contents. A change is said to take place in a situation when there occurs that which was not contained in the ~~system~~ situation as it stood. We say that a man's character has changed when he begins to act in a way incompatible with what were ~~is~~ his habits of action. The same principle holds of more immediate perceptual experiences of change. Yet the contents are not radically separate – we express our recognition of this by assuming a persisting substance to which we attach the changing contents. We say that the man changes. Change presupposes a background of unity + identity. If it's elements were radically outside each other they could not even be in succession. Absolutism therefore proclaims time to be a hybrid notion. It is co-ordinate with space, being regarded as "externality presupposing a degree of unity which would annihilate them ~~of~~ (space + time) if it were either completed or reduced to zero." At bottom the successive contents really interpenetrate + form a harmonious whole. They are systematic + not incoherent. This of course is the very condition of their existence at all. Time is one and the same thing with error and moral evil. It is a partial experience due to our finiteness but which really in it's true nature is at unity with the whole.

Now this theory of time is at any rate inconsistent with the fundamental principles of absolutism. If unity is the keynote of reality then in what sense can disharmonies or partial dislocations be said to be real. Plato + Spinoza said that it is not real, it is

※ The other alternative, that pursued in this essay is (1)
to find a new conception of time

an illusion. But even as an illusion it is a content of experience. A distinction between disconnected experiences + experiences of disconnection will not avail the absolutist. Either way disconnection will be real — will occur as a character within experienced content. It would appear then that we must admit this inconsistency or else deny outright time, sin + error.

Bosanquet speaks of this dislocation as being "an exaggeration of a feature which is truly and fundamentally in reality." The feature referred to is differentiation + systematic structure. But can this remove the difficulty? Surely where there is an exaggeration of a feature there is not balance or harmony — there is there dislocation. There may be meaning in the proposition that differentiation constitutes unity, but what is there but self-contradiction in saying that dislocation contributes to harmony?

In connection with this point we get the doctrine of degrees of reality or levels of experience, enunciated by Plato + Spinoza + taken up in more recent times by Bradley + Bosanquet. We are told that though to prima facie experience there appears a dislocation, yet to a more profound view, all is unity and harmony. There are various stages of experience + we realise as we gain a level in which there is more comprehensive + intenser systematisation, that our experience is there all the more true and real.

Now at this point the absolutist must be careful of his terminology. It is not open to him to incorporate into his theory under this notion of levels of experience, a real development from the imperfect to the perfect. This is just what he is criticising in the systems of Bergson + Croce. The notion involves increment. Then are the levels a static plurality? This will not suffice, for reality is a unity. Then are they incorporated within one all inclusive totality? This can only be the case so far as there is no dislocation. Absolutism must either deny its principle of unity or deny outright the fact of change.*

This conclusion is enforced by a consideration of some of the examples given by Bosanquet as exhibiting the fact of levels of experience. Take the case of the man who feels sorry because he ~~has~~ thinks he has offended a friend: then later he discovers that his friend did not regard the incident as an insult but took it in the spirit in which it was acted. The emotion of sorrow will be followed by one of joy. The absolutist says that under the form of time these two appear distinct but "in the larger experience the sorrow must survive + blending with the joy give rise to a content different from either."

The lower is only real in so far as it is contained in the higher. But

Bernanquet, Principle of Individuality + Value p.p. 327-9. (1)
Both examples are from this content.

the higher is just such that it cannot contain the lower. It contains neither the sorrow nor the joy nor yet their disharmony but a radically different feature which Bernanquet calls the blending of the sorrow & the joy. William James has shown that blending of experiences can only mean the existence of some new experience quite different from all or any of the alleged blended elements. The lower & the higher cannot remain as a multiplicity — the alleged unity is the inclusion of the lower in the higher. But this is just the impossibility.

Consider again the difference between the unintellectual patient's experience of the symptoms of his disease, & the medical man's interpretation of these. We are told that "to speculation so qualified (as medical men) occurrences which are dumb and single happenings to the sufferer — — — — — — — reveal themselves as steps in a destiny & as phases of recovery and decay."

If however the symptoms are identical in both experiences, then the absolutist doctrine of abstraction or falsification is not correct. For in the lower experience they are abstracted from all that gives them meaning in the higher experience — they are dumb & single. In the higher experience they are instinct with meaning which arises from the appreciation of what we often call the underlying causes which, according to Bosanquet, weave them into a destiny. Then qua independent and dumb they are not included within that experience. We are told that they are included but transmuted. We must reply that this can only mean at least that the contents of the two experiences are not the same in that some of the lower is not included in the higher; but that it usually implies a process from one stage to the other. However at this point the absolutist usually becomes mystic. He proceeds to the description of mystical, religious or aesthetic experiences which some claim to have had; & the absolutist alters there as the key to & justification of his argument. We are told that space & time will remain space & time but gain in meaning and expression. While retaining their externality they are transmuted into an emotion. If we ask the meaning of such expressions we are referred to the enjoyment of a work of art.

Let there not in any unity of different elements be valid. Then if it be said that lower & higher together form a unity, the higher can be said to be included in the lower with as much justification as the opposite of this. But this is not the case for the absolutist.

The predicament envisaged by time is such that only the lower is included in the higher. The situation is that of whole and part rather than that of mutual implication. But equally the lower cannot be part of the higher. The higher cannot contain it without changing it & therefore does not contain it. It is not possible to fall back on the principle of unity in difference to solve this, & say that though the higher is different from the lower yet it is just the nature of the real to be in its "other". To argue thus is to abandon the basis of whole and part & fall back on that of mutual implication. It is ~~an~~ a confusion similar to that of Bergson & Croce. We might speak of it metaphorically as confusing the cross-section with the depth. And any way it is difficult to see how dislocation can contribute to harmony & unity. We cannot admit both time and the principle of ~~the~~ totality.

We see then that, on the one hand, the notions of creation & annihilation as used by commonsense and in the formula of growing unity, will not serve for the articulation of time. On the other hand, the theory of absolutism, in which the possibility of addition to the real or destruction of its parts is denied, only seems to take itself into inconsistency over the time problem.

* Bergson treats it as addition. But on the theory discussed in the present section addition would be a complex process presupposing succession. The absolutists treat succession as one with discrepancy. But it is maintained in the theory discussed in this section that succession can be a specific content within a consistent experience. It is to be regarded as a perfectly positive feature of some experiences at least - perhaps of all.

(1)

Section III — Time & the Schematism of Past Present & Future

In the theories discussed in the previous section there was no explicit distinction of the notion of succession from the schematism of past-present-future. According to ~~a recent~~ one line of thought, bowing in recent times the authority of Bertrand Russell & Alexander, this distinction is to be made. It seems to have an important bearing on the notions of annihilation and creation as involved in the time problem.

It is maintained that we are presented with a specific content which we call succession. Bosanquet & Bergson were greatly preoccupied with the problem of change. There are what we ~~were~~ or ordinarily call qualitative ~~changes~~ differences involved in change. But is there not something more, viz that there are in succession. Consider the gradual increasing in brightness of a light. There are different degrees of intensity – but there is also the fact that they succeed one another. They might be produced side by side in space & retain their internal differences yet they would not be successive. In so far as they are successive they may occupy the same space factor & yet remain distinct. This factor of successiveness seems to have been ignored both by Bergson & the absolutists*. Consider the medical example given by Bosanquet. Even though the doctor does connect up the superficial symptoms with physiological operations, the unity which is effected (whether it be the absolutist unity of interpenetration or the unity which William James calls "a strung along unity.") is in time-full. The disease is a process: there is the incipience, the climax & the convalescence & they essentially form a succession. Amongst the features which we recognise as positively distinguishing the elements are temporal factors. We have got both truth and time. On the contrary we may get both error & absence of time. In working out a problem of pure geometry where we are dealing with space & at least ignoring time, we may yet find ourselves in error. The problem of time now becomes not merely the articulation of change but the interpretation of the specifically temporal feature involved in the positive succession with which we are presented in such

Hume - Treatise of Human Nature 2. III (1)

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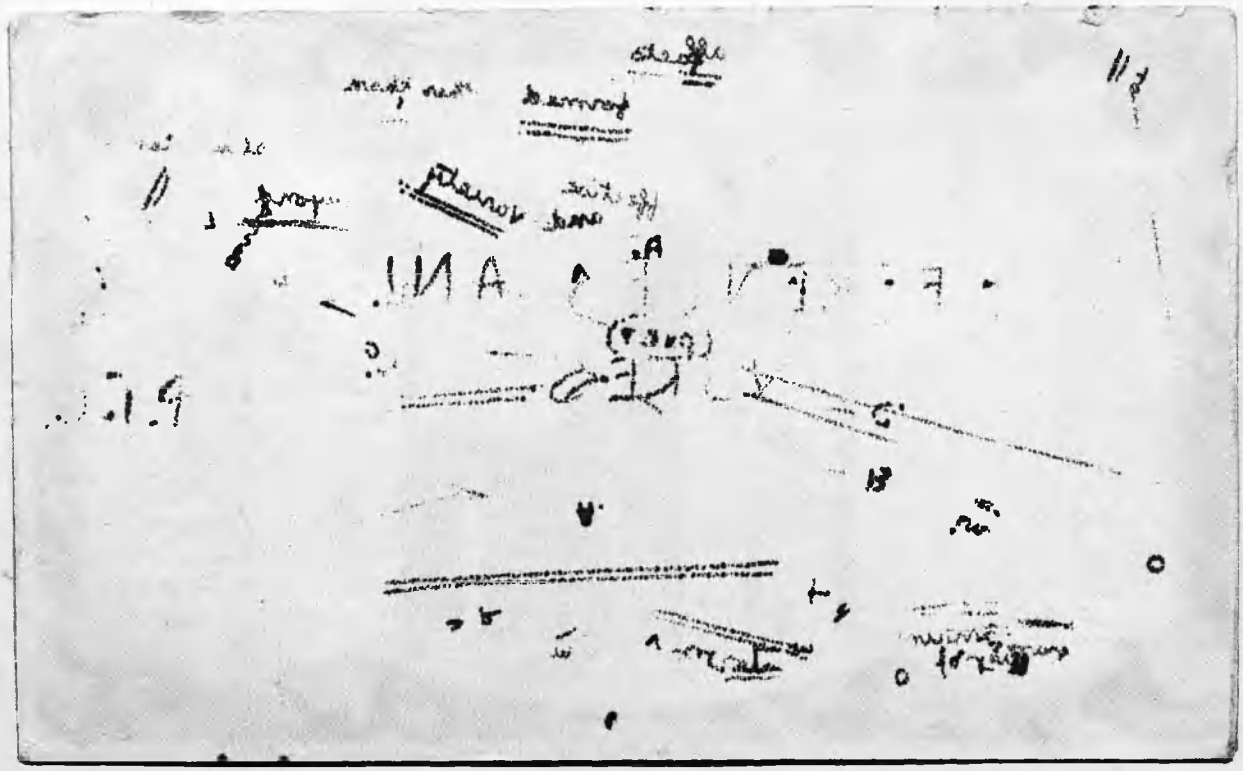


experiences as those just described

This feature is most obviously apparent through the medium of our sensibility of the external world. It is also given in consciousness, but we normally abstract from our own lives & attention is focused on external facts. We see the rapid motion of a shooting star, we hear the succession of notes as a tune is played on the piano, we feel the transition as a drop of cold water trickles over the skin. Obvious as this may seem, there has been a tendency in philosophy which has denied that succession is given through the senses - neither through the external sensibility nor in the feelings & emotions which enter into the ~~bodily~~ inner mental life nor yet in the organic sensation & bodily pleasures and pains. The English empiricists used to distinguish between the outer & the inner sensibility. The former is the experience which involves the five bodily senses the latter the consciousness of our own mental processes. It was maintained that all ~~contents~~ ordinary qualitative contents of experience first come within our experience through the medium of sensibility. But it was held that they are distinct simple contents presented to distinct acts of awareness. The granule, consisting of consciousness-of-some-simple-content, in brackets as it were, ~~that~~ was then called an impression, sensation or idea. Succession therefore could not appear in sensation for succession involves after and before. It is not a simple but a complex content. Sensationalists usually held that all experience must be built up from these primary granules. If this is so it seems obvious that we can never ~~hear~~ become aware of succession. A glance at Hume's analysis of time experience will bring this out clearly.

Hume says we are first aware of time as a succession of impressions. Each is separate for as each arrives the preceding ones have gone & the later ones have not yet arisen. Each impression is a self contained granule of experience. Thus the idea of time is ~~a~~ not "derived from a particular impression mixed up with the others & plainly distinguishable from them, but arises altogether from the manner in which the impressions come to the mind without making one of their number. Five notes played on a flute give us the impression & idea of time, though time be not a sixth impression which presents itself to the hearing or any other of the senses. Nor is it a sixth impression which the mind by reflection finds in itself. These five sounds, making their appearance in this particular manner excite no emotion within the mind nor produce any affection of any kind, which, being observed by it, can give rise to a new idea"

Ibid. (1)

The very use of the designation "Pluralism" - the reference to a "strung along universe" (2)

And the idea of time "since it appears not as any primary distinct impression can plainly be nothing but different ideas or impressions in a certain manner, that is, succeeding each other"

We will consider these statements. An impression is an awareness of sense content, so that a succession of impressions is a succession of awarenesses. But successive perceptions are not the same thing as perception of succession.

Let us turn for a moment from Hume to the account given by the French thinker Pillon. We shall see that it amounts to the same thing. There are suggestions of it in William James later works "A Pluralistic Universe" * "Some Problems of Philosophy". It is stated that our experience at any moment consists of a block of coexistent contemporaneous content. These blocks are successive but they do not contain succession. But they are not homogeneous — for they have a "rearward" & a "forward" looking end. These however are not successive but are said to refer to the past and the future respectively. Thus though the past is not part of present experience yet present experience refers to it and we thereby know what is meant by time.

Now how can a present experience be given as referring to the past unless past & present be given together. A relation surely involves it's terms. Yet according to this account, past and present cannot be ~~so related~~ presented as so related for what we experience is always coexistent contemporaneous. We are told that this reference to past & future is respectively memory & anticipation. But what is implied in these terms. Unless in the memory predominant past & present are presented together how can memory be said to be a reference to the past. Ex hypothesi memory is part of the present coexistent block of experience. As such, memory is radically distinct from the past — experience is a set of separate granules. We have a set of separate experiences — how from this alone can we achieve the experience of the contents as together

If this granular nature of sensed qua & sense content be accepted, it is necessary to supply some extra faculty as the basis of our awareness of time. For Kant ~~the~~ time is a form of the mind's intuition. Contents are given but the mind itself arranges them in it's own time — regards them as successive or simultaneous. This form of the doctrine of subjectivity of time will be discussed below. Another method for evading the difficulty is that employed by Reid. He says that we have no sense awareness of succession at all.

This at any rate is in consist ency with the first principles of the ~~granulay~~ theory. Memory it self revives them in idea & some how sets them in a time order. It arranges them, ideally in pure duration, the idea of the latter being produced by memory from within. It seems to be tacitly assumed that there is some kind of pre-established harmony between this effort of the mind and the objective occurrences. Memory furnishes an entirely new idea, yet in another place Reid says that "things remembered must be things formerly perceived and known" and again "our first acquaintance with a thing cannot be memory" It is not denied that there is objective succession but it is asserted that the mind does not know this directly, but somehow has an innate idea of it. An attempt will be made ~~in~~ later in this section to analyse the part & contribution of memory to our knowledge of time.

The doctrine of sensibility which lies behind these theories of elementary time experience seems to be a purely unwarranted assumption. Neither the content of the outer senses nor that of the inner mental experience is given as a set of separate solid atoms. Sense contents are continuous with each other. There are no absolute breaks in the sense continuum. Even the vivid flash of lightening is not an isolated event but is continuous with the sound of the falling rain which preceded it & with the experience of blurred vision which comes after it. There is no presentation of really isolated contents

It is sometimes argued that the ~~or~~ sensibility of the external world is produced as an effect of the outer body's operation upon the mind. Then we are told that in successive events the past is gone & the future not arisen when the present is in operation. Thus while the present is arousing experience of itself, the past has ceased to be operative & the future has not yet entered into any transaction with the mind. Thus neither past nor future can be presented so that we cannot be aware of succession.

This argument only proves it's conclusion if we assume that "the past is gone" & "the future is not yet born" are formulae which mean that past & future are both unreal. If this be the case then they are presented neither to sense experience nor to any other range of experience — it is meaningless to mention them. We saw, at the beginning of the previous section that these formulae, as they entered into the articulation of time, resulted simply in self contradiction. William James (at any rate in his Principles of Psychology) and Alexander both hold that if we face the facts & put

William James - Principles of Psychology pp. 609+10 (1)

aside prejudices such as those embodied in this argument just expounded we shall see that successiveness is presented, both through the medium of the bodily senses & in the inner experience of mental life. James tells us that we see that the knowledge of some other part of reality is always mixed up with our knowledge of that we call the present. Simple sensation is an abstraction: all experience contains complexity. "Lingerings of the past drop away successively & the on-comings of the future make up the loss. If the present perception contain ABCDE the next will contain BCDEF. Even though theory should lead to the selfpoint in that the mere present alone exists (but we have seen that this is not the case for such theories are self contradictory) it is certain that we never experience it. As a matter of fact, "the practically cognised present is no knife edge but a saddle-back, from which we sit perched & from which we look in two directions into time. The unit of our time perception is a duration with a bow and a stern as it were — a rearward and a forward looking end. It is only as parts of this duration block that the relation of succession of one end to the other is perceived. We do not first feel one end and then the other after, & then infer a time interval between them; but we seem to feel the interval of time as a whole with the two ends embedded in it." James calls this practically cognised present the "Specious present". It is not a simultaneous block of experience but contains temporal distinctions. We are actually presented with time transition in it — it contains successiveness.

James as we have seen claims we are never aware merely of the present. Let us look a little longer at this statement & consider it in connection with a piece of almost purely sense experience. Consider the flight of a meteor against the background of a dark sky. The whole movement is sensory & the path is seen as a whole. But it contains earlier and later portions. The earlier are not such merely as sense stimuli but as contents of immediate apprehension. Though the path of light is given as a whole we perceive the movement through it. We are aware that the meteor was at one end before it was at the other: the path is actually seen as a succession. This does not mean that it is given as a series of separate stretches. The unity and continuity are not destroyed but apprehended as timeful. The term specious present must not stand for a short line of time which is there all at once, all contemporaneous. It stands for the fact that we can hold ~~together~~ together successive facts without

passing into memory & anticipation. And the succession is not merely of subjective states. The flight of the meteor is an objective fact in outer space, given as distinct from any consciousness which perceives it.

There has been discussion as to whether within the specious present we are given past present & future or only past and present. As a matter of fact neither of these would be strictly correct; but the discussion of the relation of successiveness in general, to the schematism of past - present - future, can most conveniently come after an investigation of the place of memory + anticipation & their contribution to our experience of time.

The further question arises as to whether the distinction between succession and change is given in perception. It has usually been maintained that whether or not succession and change are different, the former can only be perceived through the latter. Now we do think of an unchanging quality as being spread out in time. We think of the duration of the yellowness of an orange. We hold that the one identical fact of being yellow somehow contains succession. On the other hand there is in connection with the orange the process of ripening & decaying in which there a change from green through yellow to black perhaps. Do we then perceive the duration of an identical quality. Consider some object of very small duration, say a flash of light. Although there may be an unchanging light quality — a red or white or a yellow-we yet perceive the beginning of the signal from the end. We perceive its temporal boundaries. This seems just as obvious as that we perceive spatial differentiation within a uniform quality. We can perceive the spatial boundaries & internal spatial differentiation of a surface which is uniformly red eg the surface of a mahogany table. As the flash begins & ends there may be, of course, a change from that which immediately precedes it & to that which immediately comes after it. But we are aware of the light quality as itself having a beginning and an end. It may be sandwiched in between changes, but these only mark where it begins & ends. The important point is that while presented as an unchanging quality it yet appears as having a beginning and an end. It is spread out in time.

This is a perfectly non-mental feature just as much as its spatial spread. Not only has it three space dimensions but it has also in some sense a dimension in time. Thus within sense experience, without the help of memory and anticipation or conceptual reconstruction pure & simple, we are presented with the distinction

between succession and change. We are not aware of pure empty succession — this is the product of abstraction. Still it is the product of abstraction & not of imagination. We can abstract the time feature from the various qualitative contents in which it is clothed as it appears in sense perception. Here we are aware not of pure succession but of qualities spread out in time & we are aware of the time feature in the predicament where a quality does not change. This constitutes duration.

Before leaving the question of the contribution of sense experience to our knowledge of time we must stop to consider James Ward's presentation of the facts. He is by no means a victim of the atomic theory of sensation. He was one of the earliest to proclaim the continuity of experience. Nor does he argue from popular theories of the nature of time. Apart altogether from such assumptions & on the basis of what he claims to be purely an analysis of facts as they are presented, Ward maintains that we have no awareness of succession through the medium of sense experience. He holds that the experience of change is not impossible without the experience of time. Time, he says, is a relation between changes & a relation presupposes it's terms but not the terms their relation. All sense data are present changes. They may succeed other changes, but the judgement that "this follows that" is not implied in the presentation of "this." Immediate experience of change is not immediate experience of time transience.

It is difficult to see much more in this argument than peculiar word spinning. It may be true that the intrinsic nature of one fact does not involve it's successiveness to some other fact, but how we are to have a purely present change, or a change without time transience it is difficult to see. Unless it be that Ward is using these terms in a sense quite different from their normal application. It may be that we can know the difference of one sense content from another without regarding them as a succession. But mere difference is not change. This latter consists at least in a succession of different entities. But even in the knowledge of the difference between contents, more is involved than merely the knowledge of the intrinsic nature of each of the contents. We must at least hold them together in thought — their relation is perceived as well as they themselves.

According to Ward our experience of time arises from two facts viz from our active attitude towards sense contents as they come within our experience & secondly the intensity of these contents themselves. In so far as processes of accommodation & of association

Ward - Psychological Principles p. 214 (1)

of memory images with percepts are involved time experience presupposes memory. In fact if there were no repetition of series there would be no awareness of time. Suppose then that the series ABCDE be presented after a succession of previous presentations. A varying amount of active adjustment of the sense organs and of other accommodatory movements, supplementary to sensation, are involved. Let small letters represent images and large letters percepts, & consider the series when presented first as (a B c d e) then as (a b C d e). In passing from the one to the other, two things have occurred. In the first place (d) becomes an intenser image in the second presentation than in the first, and in the second place, in consequence of this changed intensity, the subjective adjustments preparatory to the reception of (D) become nascent.

Now within the present perceived content we get what corresponds to an external succession. But within this present, which is regarded as the psychical present, all that corresponds to the differences of past present & future is simultaneous. The psychical present is a class of simultaneous presentations, amongst which there are qualitative differences which are to be called time marks or temporal signs." With each distinct representation (a), (b), (c) or (d) there is probably connected some traces of that movement of attention of which we are aware in passing from one sensation to another" It is not the movements of attention themselves which are the temporal signs but the "residua" of these movements. The time between two presentations is occupied by fixation. But this is not experienced as a process in a duration, a unity of successive elements, but as a "peculiar intensity" which W and calls "protensity: We experience this in an acute form in the experience which we call boredom. When accommodation takes place at the normal rate, which may vary with individuals or with species, we are not predominantly aware of this quality of protensity. When the succession of contents is so slow that it cannot call upon our normal activity, then tedium is the result; & when it is of such a rate that we cannot adjust our selves sufficiently quickly distraction ensues. Pure time experience is carved out of these two peculiar intensities, tedium and distraction, which are the residua of our processes of adjustment to new contents.

Although the protensity elements attached to the contents of our experiences are the basis of our regarding them as a series, they do not give rise to exactness of time perspective. The experience of precise time ~~duration~~ distance comes from the variation in intensity and distinctness which characterize the members of the series as

* Actual time transcends on the one hand & the temporal signs on the other. (1)

James - Principles of Psychology p.614. (2)

* Just as the intensity of a colour content is embedded in the quality itself. We seem no more to need a special time sense than to need a special sense for intensity of qualities. (3)

we pass from one to the other.

We must not however suppose that since time is presented as a series of separate acts of attention to distinct contents, that it is given as discrete. For though the objects of experience are distinct, attention is not a series of leaps but moves like a worm (towards similes) by means of successive contractions + diffusions. It is always spread out somewhere, and always shading away from some focus.

Now the contents which are referred to in Ward's account as temporal signs, + which are the basis of time experience are, on the one hand, either bodily or mental feelings of the percipient subject or, on the other, differences of intensity of quality of sense contents. But time transience *is* neither this subjective feeling of boredom nor this difference of intensity amongst sense qualities. That the two* are ~~not~~ identical Ward does not assert. Then how can these facts afford us experience of time?

If they are to be signs that we can interpret as implying succession, we must know what succession itself means. This character is not presented with the qualities of fact which are given through the medium of the senses. We must then have a special faculty of time awareness. Is there reason to suppose this to be the case? It may seem, says William James, that in the following predicament we are presented with pure time. "Let me sit with closed eyes, abstracting entirely from the outer world and try to attend exclusively to the passage of time, like one who wakes, as the poet says 'to hear time flowing in the middle of the night and all things moving to the day of doom'. There may seem under these circumstances to be no variety in the material content of our thought, and what we notice appears, if anything, to be the pure series of durations, budding as it were and growing beneath our indrawn gaze." But as a matter of fact, as James goes on to point out, this picturesque description does not tally with the facts. At all times we are conscious of a vague mass of inner feelings, of organic sensations, passing memories, subtle feelings of various kinds such as expectation, waiting etc. Time process is given as embedded in this inner content + flows through them.* There is no special sense of pure time but time is presented as a character of the content of all senses. Pure time is but the abstraction of the character of transition from its concrete setting within the continuum of fact.

But even if we had a special sense of time, + produced time from the inner recesses of the mind as an innate idea, how could its temporal signs assume their function of significance in respect to it? We could not use them as temporal signs unless

* The very use of the temporal signs as signs presupposes that we have somehow + at some-time been in direct contact with the objective time itself + have noted the signs as its universal accompaniment. How do we get this direct knowledge if not through the senses? in ordinary perceptual experience? At any rate normal perception seems obviously to supply this required experience

they themselves were given together with time. A consciousness of temporal signs plus a separate consciousness of time cannot give us the consciousness of the relation between time & its signs.* We cannot use the signs as signs without this consciousness. Moreover, how could the experience described by Ward, even if it could furnish the notion of succession, afford the basis for the distinction between succession of external objects & subjective succession of awarenesses of contemporaneous objects. In the latter, exactly the the same phenomena would occur as in the former.

Now on the assumption that time is presented as part of normal sense content an explanation of the co-incidence of the apparent drawing out of time, & the feeling of boredom, is not precluded. Is it unreasonable to suppose that both boredom and distraction arise out of conditions which at the same time give rise to a time illusion? May it not be the case that when the contents are interesting & time expanse ~~expense~~ seems short, that the attractiveness of some aspect of the objects, perhaps their brilliant colour or pleasant setting, give rise to an act of abstraction on the part of the percipient. He concentrates on the interesting aspects of the total presentation & simply ignores time. Then at the end of the process, by the very fact that the process has ended it is suddenly brought home to him that there was a time aspect to it. When he says that time has flown he is simply giving expression to his sudden & belated realisation that there was time character which somehow he ignored.

Let us now turn to a consideration of the contribution of memory to our experience of time. Three grades, as it were, of memory have been distinguished. First there is what has been called physiological memory. This is defined as the persistence of a nervous excitation after the stimulus is past. It has been suggested by James that this is the ~~basis~~ physiological basis of our experience of time in perception. This however is a matter quite irrelevant to the present point at issue. Then there is immediate memory. This we are told is the awareness of the immediate past. The sound which we heard a second or so ago but which we are not hearing now is still an object of consciousness. The mode of awareness differs from that in which the object was first presented as content of sense awareness, as sense datum. Alexander calls this phenomenon a quasi memory. "For instance, the first words of a sentence which are still in my mind at the end or the middle of the sentence. It would be there mis-description to say the idea is first present & then referred to the past. The object involved is a past object. Yet it is not a memory for though retained from the past it is not, like a memory, recovered from the past."

Lastly there is ~~&~~ memory proper. This is the predicament to which in ordinary language the term memory is usually restricted. We may be aware in memory either of a state of ourselves or of an object outside the self. ~~to~~ Traditional psychology makes no radical distinction between the two predicaments but Alexander thinks otherwise. Let us discuss first the predicament of memory of an object & then turn to consider Alexanders doctrine of memory of a state of the self.

When we are remembering an object we can distinguish within the total predicament the act of mind which we call remembering, & which is present and secondly the object remembered, which is past. Further, we say that the object is part of our personal past. This means that the object has been previously experienced by me as a content of perception, that I now have as part & parcel of my memory state the consciousness of this fact. Thus all who know the history of Rome, experience the death of Caesar as a past event, but no one now remembers the event. In the memory predicament however, the object which constitutes the object of precisely the present act of memory is in the past. It is given us as an object which is earlier than the act which knows it. The lapse of time may result in distorting the object as it appears, a similar effect to that of distance in space upon an object of perception. When to this is added the influence of subjective prejudices, the memory object may in its appearance be highly distorted. It may even be the case that memory in general is by no means a trustworthy instrument of knowledge But even at it's worst, it is not radically different from perception at the level of conceptual analysis - we are subject to error in all phases of experience. Thus, as Alexander says, memory is nothing but the object "revealed through the mist of intervening time." It is the real thing as it really is — physical to memory as it was physical to perception, physical in the only sense in which any thing can be physical viz that it embodies the laws of physics. Alexander speaks of the object's pastness being "given in it's face." He does not mean that the object of memory is, as such & apart from incidental distortion, different from the object as perceived. What is meant is that though the object once was perceived it is now presented as really & actually earlier than the so called present remembering. It is the same object, still seen in it's relation to the past perceiving, but now also seen in it's relation to the present remembering. It's time character consists in that it is earlier than the present act of remembering. Even ~~once~~ when we perceived the object, it was then characterized though we

failed to release this — but then our knowledge is never complete. But the memory object is never a separate isolated content. We fill in, as it were, the object environment. We may fix attention on some circumscribed locality, but from the focal point consciousness is spread out, fading away into a marginal area in which we are more or less vaguely aware of other events both extending into further time beyond the remembered object, and temporally intervening to connect it up with what we call the present. In the total predicament of memory we are, as in perception through the senses, presented with the fact of succession. But we are now in contact with a wider extent of the real as spread out in time. The remembered object is known as a member of a succession, as earlier than but yet as connected up with, by means of intervening successive contents, that which we call the present.

Memory has been described as the reference of a present mental image to an image which is contemporaneous with the act of remembering, to a previous percept. Now in the first place it is not the case that memory consciousness always involves an image — there is imageless thinking. Secondly even where a present image is involved this must not be taken to mean that in memory we are not aware of an area instinct with succession. The very possibility of reference of a contemporaneous image to a previous percept presupposes that we are conscious that we once did perceive the object in question. Surely it is just in memory that we have this awareness. The only knowledge I have of previously perceiving an object is that I can remember doing so. The only extra mental content is object of, my consciousness of my previous perception of the object, is this previous object itself. It is related to two different mental acts on my part. First there is the act of perceiving with which it appears to be contemporaneous. Scientific reflection shews that it is slightly earlier even than the act of perceiving. Secondly & later there is the act of remembering, than which the object both is and appears to be earlier.

The temporal sign theory is useful also in the exposition of the memory predicament. There are those who seem determined at all costs to ignore this fact of successiveness. It is said that in memory we are not in direct contact with a previous object of perception at all. The immediately presented content is an image which is contemporaneous with the act of remembering. This latter contains as part of its total nature certain specific characters which, as in the case of perception out lined above, are called

temporal signs. From these, it is said, we infer that we perceived the object once before. Now this reading of the situation presupposes that we know that the Subjective characters are ~~subjective~~ signs of the fact that the past object was perceived before. But we cannot know this unless there is some means of their being presented together with the object, in its character of being of an earlier date. But this is just what we mean by saying we remember the object. We may use different words to express the situation but we can not get away from the fact that there is a situation which we call memory & ~~it~~ in which we are peculiarly aware of an object existing in our more or less remote past.

It was noted above that Alexander distinguishes between the mode of apprehension of a remembered object & a remembered state of the self. This distinction is one aspect of a general distinction between the modes of knowing external reality & the way in which we become aware of our own mental lives. The former is contemplation and the latter enjoyment. This distinction of course extends to memory and ~~[illegible]~~ necessitates a special treatment of the predicament of remembering the states of ones own mind. We are told that the complete predicament of memory of a state of the self, involves first the act of remembering. This act gives the remembered state a peculiar attachment to my present consciousness of my personality. This act is present & is enjoyed in the present. Secondly there is what Alexander calls "the enjoyed imagination of the past state." The past state qua state of the mind is not contemplated but enjoyed. It is enjoyed however, not as present but as past. It is revealed neither in the mind's present nor as the mind's present but is a past enjoyment as it is enjoyed after the lapse of time. Thus a remembered emotion is not a present feeling aroused by ~~the~~ a remembered object which previously excited a similar emotion. Consider the memory of a feeling of shame I ~~was~~ once felt when I committed a social blunder. "The more vividly I represent the circumstances the more intense the emotional excitement becomes and the more completely it includes the bodily expressions proper to the emotion, & invades me. Still the personal experience is detained in attachment to the past, and despite the urgency of the feelings, I am lost in the past and the whole experience, object side & subject side alike, has the mark of the past."

Now the distinction between contemplation and enjoyment is very difficult to appreciate - few besides Alexander would admit it. One can but confess in ones own experience an inability to see the radical difference between remembering a past object and rem-

Alexander, Spence, Time + Deity I p 125. (1)

embracing a past mental state. There is difficulty in understanding precisely what Alexander means.

First of all then, with regard to that part of the total predicament which Alexander calls specifically the act of memory. We are told that all acts of mind are correlated with objects — "without an object a mental state is nothing." What then is the object of that feature which is specifically the act of remembering a past mental state? It cannot be that past state itself for a mental state cannot become an object of thought. The object of that feature which he calls "the imagination in enjoyment of the past state" is the past external condition which gave rise to the remembered state. Are we to suppose that this is also the object of the specific act of memory? Alexander does not tell us. If so how will it differ from what is specifically the memory of the past object only? We can remember a past external situation without remembering the ~~or~~ subjective response we made to it. Presumably the difference will lie in the added feature which has the function of somehow connecting the past mental state with present felt personality. But if so, then this new feature, being a mental state, must have its object. Is this the same past objective environment? If so we seem to be getting an unwarranted multiplication of mental processes. It is difficult to find in one's own experience this double-barrelled memory of an object. On the other hand it is difficult to see what other object shall fill the vacancy.

Turn then to the other feature of memory of a past state — that which Alexander calls the "enjoyed imagination of the past state" and, "the imagination of myself which I have when I remember myself." Does this mean simply those features of the past state which I now remember, so much of that previous mental state as I am now aware of having experienced? If so it is rather a twisted & cumbersome terminology that is used. But he speaks of the ~~past mental state~~ remembered state as being the past enjoyment as it is enjoyed after the lapse of time? How to enjoy a mental state & to live it seem to be the same thing — enjoyment & mental existence are identical. Then surely to enjoy a mental state after the lapse of time is simply to have a later mental experience. It looks then as though the emphasis is present after all. If ~~all that~~ what is meant is a protest against the notion that a remembered state of the self is only a present feeling, so far agreement with Alexander is difficult to withhold. But he has used an unduly cumbersome terminology if this is his end. So far as his statement represents the assertion that a remembered mental state is

Bradley - Appearance & Reality p. 268 (1)

really a past state of mind his point seems obviously correct. So far as the position is complicated by misinterpretation on the distinction between contemplation and enjoyment, it is difficult to see any meaning in it.

Now the extent of time that we perceive, the extent of the feature of successiveness in the real, that is experienced through the medium of the senses is very limited. Through the operation of our power of memory we are presented with a wider expanse of time. But in our wider knowledge the once perceived succession now appears as part of a more extended time. We realise that it is one extent from which our perception has selected parts. By the processes of conceptual analysis & reconstruction time is revealed an extent of succession, that is inclusive of all we perceive and remember and of much more besides. We know that Caesar was killed by Brutus in a certain manner in a certain place. We neither perceive this event and it's relation to our present nor yet remember it. But we know that it occurred long before we were born. We may not know it in all its details, but in so far as we do know it at all it is presented as earlier than that which we call our present. It is the business of the historian to exhibit by means of conceptual analysis & synthesis, phases of reality that are earlier than those we call our present. In the same way, in predicting we are through conceptual thought processes made aware of events which we neither perceive nor remember and which are presented as after our present. Thus the scientist will predict the appearance of a comet before it occurs. His thought can only be consistent in so far as he includes time in so far as he conceives the future event as after his act of predicting. If he thinks of the two as simultaneous his thought will be self contradictory.

In history & prediction there is revealed to us a broader range of the time feature than in both memory & perception. As experience develops we come to realise the bits of succession which we have perceived as all parts of one single whole. We envisage the bits as continuously flowing into each other & forming one single piece. Bradley raises the possibility of there being many times. The time of the story of Sinbad the Sailor & that of the dream of the opium smoker are not the time of normal experience. The clock time of a dream may be very short while the dream time itself may be intolerably prolonged. A similar phenomenon arises when we are eagerly awaiting an event. We say time goes slowly — a "watched kettle never boils" is the saying in Yorkshire. All

Alexander - Space, Time & Deity II p. 233. (1)

such times are different yet all are equally objective says Bradley. What is there against the possibility of a time in which the whole order of things is reversed – in which death occurs before birth?

Surely however these predicaments present not the spectacle of many diverse real times but various sets of events all claiming to belong to one objective time. But these claims have to be adjusted. Some events of this type do not have their position in time determinately ~~you~~ stated. On the other hand some may be fictitious or ~~[illegible]~~ semi-fictitious events claiming to have a definite place in real time. Such are the events of historical novels. But if the event is fictitious it simply does not happen at the date at which it claims to occur. The date may be real + may be occupied by another event altogether. In a fairy story or a dream we get a set of events in a temporal order and the whole thing is fictitious. Tedium is only the feeling-tone accompaniment of a time illusion, in which real time appears as much longer than it actually is. To quote Alexander, "The synthesis by which in experience we discover the unity of space or time shews us at the same time how much of our space or time experience is mere idea or illusory or erroneous" These cases raise no specific difficulty with regard to the nature of time – they are merely examples of the distinction of truth and error in the matter of time. As to a suggestion of the reversibility of time, the notion seems almost meaningless. If death were to occur before birth we are not presented with a reversal of time itself but only of qualitative happenings in time. Time itself would not be reversed unless what we call earlier were to occur after that which we call later. This is pure ~~cont~~ self contradiction. The fact is that time is presented as a feature of reality involving both earlier + later. ~~It~~ Within the fact of successiveness as it is given, what we mean by "being after" is the reverse sense of what is meant by "being before." This is the fact to be accepted – the notion of reversal of this is self-contradiction if not a purely meaningless statement. Apart from it's given structure time simply would not be time; but it is questionable whether the particular form of nullification suggested by the formula of reversal, is even conceivable.

We can now turn to the question of the relation of this feature of successiveness in the time aspect of reality, to the schematism of past-present-future. Bertrand Russell + Alexander agree in regarding perceiving + remembering as recognisably different subjective attitudes. The bodily accompaniment in the form of accomodatory feelings + organic sensations are quite different in the two cases. In memory there is not the ~~e~~ sensation arising out of the

process of adjusting the sense organs. Memory however is characterised by a specific feeling of familiarity with the object — to quote Alexander again, "a peculiar experience of the appropriation of the object to our present consciousness". This does not occur in the act of perceiving except in so far as that process is recognisably complicated with memories. It is not of course suggested that perceiving and remembering are states in mutually separate rigid contrast + that at some definite point we are aware of a sudden change from the one to the other. But they are distinguishable, they are recognisably different just as are the primary colours met in the spectrum, though these latter are connected up with each other through the medium of a continuous stretch of intervening colours. So too is memory as a mental state, continuous with perceiving through the intermediate stages represented by quasi-memories. How perceiving selects a limited portion of the presented feature of consciousness. Remembering selects a different portion. When the perceiving and the remembering enter into a total act of mind the remembered content is seen to be earlier than the perceived content. Now in normal practical life attention is focussed through perceiving. The remembered is only within the marginal ~~one~~ field of consciousness — it is for the most part not noticed. It is not to be expected therefore that we should fall into the habit of overlooking the ~~past~~ remembered reality + come to endow the perceived with a self-existent status. Bertrand Russell + Alexander suggest that the reflection into reality of the differentiated mental activity involved in time awareness is the basis of the past present + future schematism. The present is the perceived, the past is the remembered. We come to extend these + think of the present as all that is simultaneous with the perceived + the past as all that is before the present. An object can thus be present to one act of mind and past to another. Thus we get a meaning given to the notion that present can become past. Since the remembered object is usually within the marginal field of consciousness we see why the past is said to be gone. It is no longer the centre of our awareness. Thus again we can see why, though the past is before the present we yet say that an object is present before it becomes past. In the total content of a given mind or act of mind, the remembered object we is before the perceived. Yet an object becomes a perceived content before it is a remembered content + the perceiving of it is a previous mental act to the remembering of it — this is just an empirical law of mind.

Now though in this discussion we have given a theory

of the meaning of past + present, what of the future? On this point Russell + Alexander part company. The former holds that the future is not selected by any specific ~~recent~~ mental attitude which is peculiarly appropriate to it as memory is to the personal past. We know, he says, the meaning of "~~after~~ before" + we have formed by extending the notion, the concept of "all time prior to the present. On the same basis we class together all time that is after the present + this becomes the future. The whole of the future is there in the same position as the non-personal past + unperceived present (i.e. those features which enter into the notions of past + present in their extended form) that is, it is inferred. It is the product of conceptual analysis + synthesis.

Alexander holds, however, that corresponding to memory we have a specific attitude of mind turned as it were in the temporal direction of things after the present. This attitude of mind he calls expectation, but he does not work out this suggestion in the same detail as he applies in the case of memory. The following considerations suggest themselves to the writer as relevant.

Perhaps there is a ~~physiological~~ counterpart to physiological memory in the dawning of stimulation + the incipient movements of accommodation which are preparatory to the awakening of full sensation. As to ~~memory~~ a counterpart of immediate memory, can we say that we have an experience of the form of immediate expectation, when, for instance, during the hearing of one phrase of a melody we have the feeling of the imminence of the next. We should probably be told we have heard the music before + that all we do is to project the past. This may mean something or it may only be a metaphor. Anyway we seem to be aware of the next phrase not merely as a past perception, nor just as different in musical quality from the present, but also in the sense of its immediate oncoming. By using the term projection we can only mean that attention is being directed from the present, out upon contents that are later than the present. Even in hearing a new time there is this expectancy. The mind moves out to meet the developing ~~motif~~ theme. Of course we do not so readily perceive a future object which is radically different from one we have already ~~had~~ experienced, one to which we are accustomed. But it is just the same way our powers of perception are dislocated in the face of a radically new content.

Alexander does however give a more detailed account of the subjective experience which it is alleged is the counterpart of what we have called memory proper. Consider some such experience as looking forward to a holiday. We are aware of

Alexander, Space Time & Deity I. p. 118 (1)

* or rather, the habit of making the distinction (2)

our own future. We are looking at a situation which is later than the present & which we regard as one that we are about to enter in the attitude of percipient. It may be said "But you may not get your holiday." Of course this is so, & in exactly the same way we sometimes think we remember facts which we never really did experience. We are the victims of error and illusion no less in memory & perception than in anticipation, but we do not deny that anything at all that is perceived or remembered is unreal.

Alexander holds that the expectation predicament involves a specific act of mind. Thus," The mind reaches out towards the imagined future event and as the expectation becomes more distinct and intensive, the image rises out of isolation and is incorporated with the self. At first there is an image with a future mark but relatively disconnected with the personal life. Gradually it acquires intimacy, becomes warm with personal attachment and is attended by emotion - - - - Expectation is a kind of desire where aim is not practical, but theoretical" We have a specific subjective attitude, different, & recognisably different, from the attitudes involved in memory & perception. This new attitude is directed upon what, within the total content of awareness, is after the perceived. In due course we come to entitle the notion, & the future, which began by comprising the expected, now is constituted by the class of all objects that are after the present. We can explain the distinction of ontological status of future & present on the same lines as the distinction as applied to past & present.

We can now return to the question which was left over in our discussion of perceived succession viz as to whether or not the specious present comprises past present and future or only past and present. A specious present is a perceived portion of time. My total perceptual activity is a portion of my total mental activity. It is broken up into various acts of perception which provide the basis of the distinction between my various specious presents. Each present contains an objective and a subjective element. Both of these are suffused with succession. The subjective aspect may include both expectings & remembrings as well as perceivings. This may not always be the case - there seems no reason to suppose that it is. In this sense the specious present may include both past, present & future. It may include those mental processes from which this ~~abstract~~ schema of distinctions is reflected into time. ~~The~~ Any specious present does not however

include the objects which are presented to the ~~sam~~ acts of memory & anticipation which are included in itself. In this sense the specious present, strictly speaking, includes neither past nor ~~present~~ future

The question might however be pressed, in the form of whether or not the objective specious present includes elements which are contemporaneous & ~~to~~ with or later than the act of perception. The physiological conditions of perception seem to ~~with~~ dictate a negative answer to the question in this form. But this is only an incident of our nervous & mental nature. It is a case of that selectiveness which characterises all our activity & in no fashion implies the unreality of the future. It means that the act of perceiving is as such sensitive ~~to~~ only to objective features that immediately precede itself.

Before leaving this question of the meaning of past - present - & future & the relation of this schematism to time itself, i.e. the feature in reality which we call successiveness, let it be noted that it is not suggested that perception, memory, ~~and~~ expectation and conceptual thought are four distinct faculties. It is necessary only that they be recognisably different forms of mental functioning. ~~It~~ This is quite consistent with regarding them on their purely cognitive side as levels of development of a single activity. Even so they can be differentiated. The point is that they are felt as different & they reflect this difference into time itself, resulting in the distinctions of past present & future. We can even abstract from the mind & yet apply the schematism. We can regard any part of time as dividing all time into three parts - itself the present, that which is earlier being the past and that which is later being the future. Prediction or knowledge of the future will then amount to awareness at any given present, of facts which are after the act of awareness itself. We may thus refer to the object of prediction as the future, remembering that the vague notion that the future is in some way an attenuated kind of reality or perhaps even absolutely unreal, ~~is~~ ~~only~~ represents only a peculiarity of our subjective acts of awareness, viz that for the most part, & particularly in most of our practical life, attention is focussed through the medium of perception. It is significant that in scientific & philosophic discourse, in those experiences where conceptual thought opens up breadth of vision, the schematism of past present & future finds no place. Thus in the great speculative philosophies the reality of time is denied. The root of this is the ignoring of the real time feature, that which

has in this section been called the character of successiveness in reality, & through the failure to make the distinction between time & the schematism of past present & future.

The standpoint of this section is that all time is equally real. Before leaving the point we must face up to the criticisms levelled against the notion ~~that~~ in more or less recent times, by the apostles of the theory of real addition. Croce & Bergson deny that we have any knowledge of the future at all. This of course is in consonance with their doctrine of creative reality. If the future is unreal, to speak of knowing it is simply meaningless – we only know, therefore, the past and the present

Now it would ~~com~~ seem, prima facie, that we must obviously have the power of prevision – in various degrees of course. The scientist regularly predict solar events. It was possible to predict the advent of the first Labour Government before it took Office – politicians & newspaper editors did so. We claim to be able to predict the responses of ourselves and others in given situations.

Bergson says that true knowledge, experience of reality, is what he calls dynamic knowledge. It consists in actually living the experiences. In this experience we simply wait upon the growth of content. To predict would be to short-en the process of experience, to leave out some of its ingredients and thus to change it as a whole and in every part: for it is a unity. For Bergson, prediction is not fore-knowledge but substitution of a different present. This standpoint is just an aspect of the doctrine of growing unity. If I had knowledge of the future it would be related to my present state of mind. It would thus come within the present unity for all relations are internal. The present would be changed and with it the whole process. There would be no fore knowledge but simply a substitution of a different present. This doctrine of growing unity has already been discussed & rejected. In so far as the denial of knowledge of the future is based on this we may reject that denial also.

Bergson says that it is by inference that we claim to know the future; he turns therefore to a criticism of this process. His conclusion is that inference, of its very nature, can give us no knowledge of time at all. In inferring the future, the method of procedure is that of representing the future as necessarily involved in conditions which are known as past & present. In so far as necessity enters into the transaction it is only an example of the spatial illusion. Consider the necessity involved as between the elements of a calculation; it is simply the fact that the calculation is

the formula of an unchanging totality. The implication between the various factors of a calculation is simply the fact that the elements are given together and that they do not change. Nothing is involved but the bare static multiplicity of number. This latter cannot be used in the articulation of time because it (number) excludes change. Consider the so called predictions of the physicists – these inferences are always based on calculations. Then since they are the representation of reality under the form of number they will ignore time. That this is the case is seen from the fact that a change in the time aspect of the situation could occur without resulting in any change in their calculations. These latter would remain the same even if we speeded up the whole process of the universe (clocks included of course) to twice as fast. We should change the speed of the process but this would not be reflected in the calculations – therefore they take no note of time at all.

Prediction on the basis of cause & effect receives the same criticism. All such prediction is based on the principle of "same cause same effect" ie it involves repetition. But where there is no change there is no time. Knowledge based on the principle of cause and effect is the intuition of a static multiplicity. Cause implies effect only because the two are juxta-posed in such a static multiplicity. There is repetition, no change, no time. Inference on the basis of cause and effect is simply the representation of reality under the spatial illusion. Not only is it the case that there is no time involved as amongst the different individual cases of a given causal sequence, for there is no change from one to the other, but as between any given cause & effect there is no succession. The so called sequence is not a sequence for they are represented as juxtaposed – as a static totality, distinct but both given. Hence we can sum them up in a formula. The cause implies the effect only because the two are always given together. They exclude time, so that if this is your mode of predicting the future you are really just ignoring time altogether.

The essence of this criticism of inference as a mode of knowing time is the identification by Bergson of time with change. This latter is interpreted, through the concept of duration or growing unity, as involving some addition. Hence follows the incompatibility of time and totality. Space simply stands for totality, as Bergson says, "all is given." Already we have criticised & rejected the formula for duration, in the previous section of this essay. Moreover it has been argued that change & time are not identical. If we conceive time as successiveness, then to assert the incompatibility of time & totality,

is simply to run full in the face of given facts. A causal sequence may be the objective content of one single experience. It may constitute the limited pattern of reality on which attention is fixed, the whole sequence being given together. Yet it is spread out in time. The physicists' calculations are simply the articulation of number patterns which are spread out in time. They do not deny the time feature but their predominant interest in measuring time is in comparing given successions. Thus whatever change occurs in the respective entities compared they will not note it unless it issues in a change of relation between the two.

It will however be urged that even if we disagree with Bergson's doctrines of growing unity, his identification of change with succession & his notion of spatialisation, it yet must be admitted that the so called knowledge of the future by inference is simply the assumption that a connection of contents which has occurred in the past will continue to be repeated. But this is mere assumption - all we really know is the past repetitions of our plan.

Now it is not proposed here to discuss in full the nature & implications of knowledge. Some assert there is repetition in reality - some put their faith in the identity of indiscernibles. But however this may be, the fact remains that there are predicaments in which, if we think consistently we must regard some event as existing later than the act of thought itself. If such knowledge involve repetition then we are not merely making an assumption that a certain repetition will continue, but we have a revelation of a future event which actually continues that repetition. Of course I may be the victim of error as to peculiar future events, but this does not distinguish ontologically the future from the present & past. And even if it be the case that I can only predict the future in so far as it resembles the known past, this may be only a mark of human limitedness of powers. But consider some such predicament as the prediction of a weird event. Say the situation immediately after the general election in which preceded the Labour Government of last year. After the election, but before this party took office, it was predicted by politicians & newspaper editors that they it would do so. Was the whole knowledge of in this respect, of those who predicted, nothing more than an acquaintance with the present ambitions of party politicians, the present state of public opinion, the records of party leaders & the present strengths of parties in parliament? Over and above all this, the coming of the new government, the first of it's kinds in this country, was seen as an actual future event. It might have been seen

only in it's partial nature, but in so far as it did come within knowledge at all it was as a future event, & as something quite distinct from & over & above the past & present facts which also entered into the content of knowledge at the same time. The mental act of experiencing was present but part at any rate of it's object was future.

One further point will be discussed in this connection. It has been argued above that time is known through perception, memory, anticipation & inference. We have already said that we do not imply separate & distinct subjective faculties. Are we then to be regarded as producing a variation on the traditional theme of the distinction between direct & indirect knowledge. In this connection Bertrand Russell distinguishes between knowledge by acquaintance & knowledge by description. He regards perception and memory as modes of direct knowledge of time i.e. as acquaintance with time. But he says that the future is known only by description - it is inferred from present and past as after them. How this distinction between direct knowledge & indirect knowledge is not implied in the account given here of our knowledge of time. I of course in so far as we had knowledge at all of the future, even indirect if that could be, we could not deny the reality of the future. But it is difficult to see the significance of this distinction. If anything intervenes between myself and my object, then I simply do not know that object but that something else. To say we know (A) qua related to (B) means that we do not know (A) at all but only that to which it is related plus the relation - and this seems self contradictory for a relation involves it's terms. If I know that it is (A) which is related to (B) then my knowledge of (A) will be direct just as that of (B). It will be said that I know (A) through (B). This can only mean two things. Either I know (A) & (B) & bear a certain relation to each other - perhaps that I have chosen to let the one represent the other. The relation will be symbolic relation. But my knowledge of both is immediate - the two are presented in their relation to each other. If, on the other hand, I really know only the one it is futile to speak of my knowledge of the other through it.

We have contended above, however, that much of the future as well as much of the past & present is known through the medium of inference & conceptual thought. Now knowledge is a unique relation between subject & object. Perception, memory, anticipation & conceptual synthesis may be psychologically different. It was contended above that memory, perception & expectation are, qua acts of mind, felt as different. But their epistemological function

is the same. They put us into cognitive contact with objective fact. They are the media through which reality is revealed to us, though they operate with differing degrees of effectiveness. Of them all, inference, conceptual Synthesis is the medium of our being presented with the most comprehensive content. The subjective acts of mind may be different, but the knowledge in which they issue, the cognition of fact is the same throughout. Of course the facts known at one time differ from those known at another, & the area of fact open to one medium will be more or less comprehensive than that open to another.

The main conclusions of this section are that there is a specific content of experience to which the name succession has been attached. The schema of past-present-future is not essential to its apprehension but is rather a reaction of the mind upon it. Thirdly that there is no implication in succession of annihilation & creation — the contrary theory has only held vogue because there has been a failure to distinguish between succession & the schematism of past-present-future. In the next section we pass to a treatment in greater detail of the implications of the nature of the character of succession.

Locke - Essay on Human Understanding 2. XIV. 3. (1)

Section IV – The Articulation of Time.

In the last section a survey was made of a line of thought which distinguishes succession, as the real time fact, from the schematism of past present & future. This latter itself presupposed succession rather than furnished a system of concepts for its exposition. Past present & future were to be regarded, not as time itself, but as the mind's attitude to time. The question arose as to the intrinsic structure of this character of succession, & to this aspect of our total problem we now turn.

Ordinary unreflective thought usually has recourse to the metaphor of a stream to express the nature of succession. It seizes upon the general fact of something happening, something going on, which yet seems to include some kind of permanent objects, the ordinary empirical substances such as books or billiard balls. These are thought of as in some way resisting the onward flow of time, and yet in due course being carried down it's stream.

Obviously such a notion is just pure metaphor and nothing more. The difference between the boat which I now own, & that which I used to have but which was broken up for firewood & used for kindling the domestic fire, because it was leaking beyond repair, & the difference between a boat at anchor & one which is floating down the stream, are not merely identical.

This notion of time as a substratum in which events are ~~born~~ carried along is not alien to philosophical and scientific circles to. Of course before it is admitted here, it does a more useless garment which we call precise definition. Consider the following excerpt from "An Essay concerning Human Understanding" of John Locke:- "It is evident to any one who will but observe what passes in his own mind that there is a train of ideas which constantly succeed one another in his understanding, so long as he is awake. Reflection upon these appearances of several ideas one after another in our minds is that which furnishes us with the idea of succession, & the distance between any parts of that succession, or between the appearance of any two ideas in our minds is what we call duration." When there are no successive ideas there is no consciousness of duration. Thus a man who is asleep is not aware of the passage of time, & if we concentrate attention

on any unchanging object, Locke says we become oblivious of time. He "ventures to presume" that if a man in waking life had but one unchanging idea, he would have no time experience. This he adds is not a premise of his argument but a speculation arising out of it.

This amounts to saying that our mental life is a set of mutually exclusive states between which are empty time distances. Such distances, he goes on to assert, must be conceived by intellect as all included within the vast sea of pure duration. This latter is of infinite extent, infinitely divisible and of uniform rate. God occupies the whole of this duration, but the pure duration in itself, apart altogether from whether it is occupied by any event, must be regarded as infinite. Ordinary empirical events are to be regarded as somehow situated in this uniform flow & are said to mark it out into lengths. These latter are times — an hour, a week, a day, a year.

Now in any case the account of mental life is simply a travesty of the facts. There is no more widely accepted doctrine ~~of~~ in present day psychology, than that consciousness is continuous, and not a set of separate mutually exclusive states. If this be the case, then whether pure duration be anything or not, it is certain that it is not presented as the quality less distance between separate states of consciousness.

Yet it may be the case, conceived as a hypothesis, that the character of successiveness which appears in conscious life is due to the fact that the quality of consciousness is situated in a stream of pure duration. This is a theory for the interpretation of succession. It may be true even though Locke's account of the appearance of pure duration be false. Let us turn therefore to the intrinsic character ascribed by Locke to his alleged fact of pure duration. We shall need to find in his account, precise definitions of uniformity of flow, infinity of extent & infinity of divisibility. Then we shall require to find out first what is meant by saying that events are situated in pure duration.

According to his own definition a succession of events is uniform when the intervals of duration between its members are equal. But obviously uniformity in this sense cannot belong to pure duration. This definition of uniformity presupposes pure duration and cannot therefore, without circularity, be used to express the nature of duration. Perhaps however the uniformity of pure duration is simple, & therefore incapable of definition by analysis. If this be the case it will only be possible to denote it. Locke says that absolute uniformity is the presupposition of time measurement. Thus we can regard two successive portions of a duration as equal only if they can be regarded as occurring.

uniformity. But in time measurement the only uniformity required is that of some succession of events eg. the movement of the second hand of a watch. What then is this other underlying uniformity which belongs to pure duration itself? The truth seems to be that Locke has reified an abstraction. Successiveness is embodied (ie) in various rates just as extension is diversified in various sizes, ~~areas~~ lengths areas & volumes. He has abstracted the bare notion of successiveness from the concrete variety of successions with their different rates, transformed it into a separate thing, a pure succession, & the notion of uniformity of rate represents the fact that its rate does not vary at all, simply because it has no rate which can vary. What Locke calls an empirical succession or a succession of events is simply a concrete predicament of succession - rate - quality.

As to infinity of extent, Locke says that what he means is, that by adding ~~to~~ together its finite parts, ~~or~~ one by one, we could never exhaust the extent ~~nature~~ of time. But how can the mere process of addition assure us we can ~~be~~ never come to the end? It may be that however far any one has gone there is still some time left, and we can go ~~fo~~ further. But this does not prove that the end of the process cannot be reached. ~~albeit process is~~ This fact of still being able to add, only proves that up to this point the summation is incomplete. Will it be said that even if the process of successive addition will not prove that the sum cannot be completed, yet it remains that this, which is what we mean by infinity, is the case with time? If in return it be asked "How do you know?" we shall be referred to an actual process of attempting to count. The definition of infinity is at best only a negative - we are told, not what it is but what it is not. Furthermore the ~~test~~ proposed test of its applicability to time is just such that it cannot satisfy this purpose.

Lastly there is the notion of infinite divisibility. We are told that time is infinitely divisible & yet that its parts are not separate. The statement is vague & unanalytic. Both the notions of infinity & infinite divisibility will be discussed later in this section, in their modern presentation by such philosophers of science as Dedekind & Cantor. Bertrand Russell has laid open the conceptions of these thinkers to English readers. Meanwhile we conclude that Locke's analysis is simply a mixture of abstraction & vague unanalysed notions of so called common sense.

A theory resembling in some respects these notions just discussed is the theory of Kant. It distinguishes time from the things in time and treats the former as an independent affair. It takes its stand on the fact that the character of succession involves a distinctness &

togetherness of parts. In succession we get distinct parts, it is said, which yet constitute a unity. The various parts bear to each other relations of "being after" & "being before". In so far as it is change which is under consideration, it may be thought that the differences of quality which are involved will supply such distinctness amongst successive events as is ~~~~ necessary to their becoming the terms of the relations involved in succession. But there is also the fact of the duration of a given quality. This seems to imply that in spite of the singleness & self identity of the quality, yet it attaches to a predicament which involves succession. Something more therefore is involved, even in perceived succession, than the differences of quality which constitute change. The following hypothesis has been formulated to account for these implications of time as it is perceived.

Let there be two kinds of entities involved in a given concrete time predicament or succession of empirical events. The first are time positions, while the second have position in time. The first are called instants. They constitute a series generated by the simple transitive asymmetrical relations of priority & posteriority. Any given instant is either after or before any other instant, and no instant can be both after and before any other. If (A) is before or after (B) & (B) is before or after (C) then (A) is before or after (C). Secondly if (A) is after (B) then (B) is not after (A). The members of the second set are the normal qualitative contents of experience which constitute the characters of empirical events, e.g. blueness, pleasure etc. They each bear to one many or all the instants, a simple intransitive asymmetrical relation called "being at". The combination of an instant with a qualitative content gives rise to an event. Any event in virtue of its instant is unique. Two events are simultaneous when they possess a common instant. When they have different instants they are successive. Thus the relations of "before" and "after" and "being at" are simple. On the other hand simultaneity is complex, being analysable into the predicament of ~~being~~ characterisation of two events by a common property. Succession too is complex. Two events are successive in so far as they include different instants. One instant can qualify many events but any event can only have one moment. A normal empirical substance is a complex of event elements each differentiated by a ~~diff~~ its unique instant.

No instant must itself be supposed to contain succession, otherwise the theory, as a purported explanation of succession, is circular. In other each instant, if not itself a solid or simple entity, at least must contain such entities in its constitution. This is laid down as a general presupposition of the relational predicament. A relation

* Although instants are not in empirical succession – this is the predicament in which empirical qualities are at different instants — still the term succession is used for brevity to signify the predicament in which instants are arranged on the basis of the relations of priority & posteriority. No instant is itself a complex predicament of this type

must have terms. If these latter progressively break up into terms in relation we have an infinite regress throughout which we are presented with relations but no terms — a self contradictory predicament. Since the relations of priority & posteriority presuppose ultimately some simple terms & since the instants are terms of these relations, the hypothesis is made that the instants are simple solid entities.

What we call persistence or duration is not a character of instants, but of certain empirical events (perhaps all) It consists in the fact that an empirical quality bears the relation of "being at", to each of a series of instants. A ~~not~~ meaning is given to the notions "coming to be" "& ceasing to be". In the theory of instants they signify, not that time involves annihilation and creation, but only that a persisting object has temporal limits. They imply respectively that when an entity persists, there are two instants to which it bears the relation of being at, & which are such, that the one is before all instants other than it self but between which & the persisting object there is the relation of being at; and that the other is after all instants other than it self but to which the object bears the relation of being at.

It has usually been held to be self-evident that the series of instants is infinite in at least the sense that it cannot be exhausted by successive enumeration. This is a negative character- it tells us not what the series of instants is but what it is not. Only comparatively recently has any attempt been made at a positive definition of numerical infinity. This, in its relation to the time problem will be discussed later in this section.

Before however passing to this aspect of the subject we must review various objections which have been raised against the notion of an instant. Thus it is said that the instant contains no succession. Then it cannot be regarded as persisting. But instants must be regarded as coming into existence & ceasing to be. If then they do not persist then they are pure non entities. How this objection turns on the following propositions:- (1) all entities that are in succession* have the properties of coming to be and ceasing to be (2) Only persisting entities can come to be and cease to be We are then told that either instants persist & if so the theory involves a vicious circle, or they do not persist & then the theory is self contradictory. The ~~see~~ reply is that while the second proposition is true, the first is false. An instant is just that entity which, while capable of taking it's place as an element in succession, does not come to be or cease to be, but is the condition of the predicament implied by those terms in so far as they have a definite & permissible

meaning.

Reid says that the instant is a mere mathematical point, a there nothing + that a mere plurality of nothings is not a duration. Indeed the latter part of this statement is scarcely worth making. But the former is false. The instant is not a duration, but then why assume that only enduring features are real. Here Bradley gives a turn to the objection. An instant then is admitted to be non-durational. Then a plurality of instants cannot form a duration. a multiplicity of cases of no-duration cannot be a duration any more than a single case. Now this too may be admitted + yet constitute no argument against the theory of instants. It is not contended that the mere repetition of instants constitutes duration a succession. But when we have a multiplicity of instants ordered by the relations of before and after we just have the conditions from which succession and duration can arise.

Those who believe in the principle of the interpolarity of relations will deny the possibility of a set of distinct entities which are nevertheless formed into a single series by external relations. Bradley's real argument turns on this point. - it will be discussed later in this section when we consider the nature of the time relation. If Bradleys doctrine be valid it will hold against both the theory of instants and the traditional relational theory of time. It's discussion will therefore be reserved until after our exposition of relationism.

Leibniz objects that the notion of instants contradicts his principle of the identity of indiscernibles. And again that it contradicts the principle of sufficient reason. For since the instants are identical God could have had no reason for creating the world at t_1 rather than at t_2. There are various difficulties amongst of this second argument — the notion of creation would not be universally admitted, there is vagueness in the use of the term "world" + finally there is the unwarranted assumption that the series of objects in time is not co-extensive with time itself. But apart from these considerations, both these arguments of Leibniz imply that the instants are identical contents. But this assumption is not made by those who hold the theory, nor is it necessary to the theory of instants. All that is assumed is that there is a set of instants which form a temporal series. Whether these terms be in themselves different contents is irrelevant to the theory. The theory implies whatever are the conditions of diversity but no specific theory as to these conditions. The truth or falsity of the principle of the identity of indiscernibles makes no difference to the theory of instants.

Zeno's famous paradoxes about motion have been thought to constitute objections to the theory of instants. Apparently the original text of the arguments has not been preserved, but only certain scattered & scanty references to them, and an account given in Aristotle who, since he reproduced them only for purposes of criticism, is not regarded as a too trustworthy exponent of the original. Consequently there has been much discussion as to what exactly is the form & purport of these arguments. This essay is not interested in the philosophy of Zeno as such, so that only certain interpretations of the various paradoxes viz those which have a bearing on the special problem in hand, will be considered. Whether or not these are correct interpretations of the historic originals does not matter here. It is the ~~the~~ two traditionally known as the third & the fourth, the arrow & the runner in the stadium, which seem relevant here. They refer to the internal nature of the instants & this is the aspect of the theory now at issue.

The argument concerning the arrow in flight has already been discussed in connection with Bergson's special treatment of it. To reproduce it:- the instant contains no succession, hence the so-called moving arrow cannot move within any instant which helps to constitute the duration of its flight. Nor can it move between the instants for it's motion consists in the fact that it is at different instants at every point of the track it passes through. Thus throughout its course it is at some instant. If it cannot move in any one, nor between, then then it does not move at all. On the theory of instants motion is ~~possible~~ impossible.

The plausibility of this argument depends on the interpretation of motion. There is a sense datum which everyone recognises. The theory of instants however, claims to get behind this & tells us that this sense datum is simply the perception, subject to the limits of our sensibility, of the fact that an entity is occupying different positions at different times. Until the notions of continuity invented by Frege, Cantor & Dedekind were formulated motion was regarded as the occupation of consecutive points at consecutive instants. With the theories of continuity of the thinkers just mentioned, the notion of continuity takes the place of consecutiveness in the definition. Rest is not simply being at an instant, but being at a series of instants, which for ~~the~~ former thinkers satisfied the conditions for consecutiveness but which for later theorists must satisfy the conditions for continuity. This specific notion of serial continuity is discussed later in this section. It is claimed that the continuous transition which is normally regarded as characterising motion as

it appears to the senses is simply a blur arising out of the persistence of after images. The feasibility of this solution depends upon whether or not the series of instants can be clearly and consistently articulated & whether the sense datum of motion demands interpretation through this hypothesis rather than any other.

The fourth argument, that concerning the archer in the stadium, seems to consist in citing a special critical case which is held to invalidate any theory of motion which involves the notion of instants. It turns on the same feature as the argument concerning the arrow viz the indivisibility of the instant. The reading given immediately below is different from the one used by Bergson in the exposition of his theory of motion. This is the argument that seems relevant here:- Let there be three rows of bodies of equal size situated with respect to each other as depicted in diagram I & of which the two lower are moving with equal velocity in opposite directions.

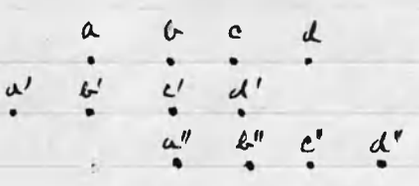


Diagram I.

At the next instant let them assume the position formulated in Diagram II

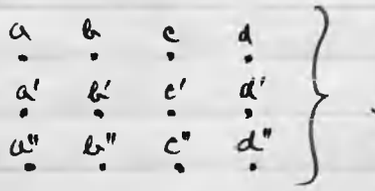


Diagram II

Now in position II (c') is opposite (c) on the one side & (c'') on the other. Then it has passed (b''). Then since the instant is temporally indivisible a second instant is involved in the transaction in ~~the transaction~~ in which (c') becomes opposite (c'') viz the one at which it is opposite (b''). Now the passing on the part of (c') from it's position opposite (b) to that opposite (c), is one and the same with it's passage from the position opposite (a'') to that opposite (c''). This involves that two instants are the same as one instant. This is self contradictory therefore motion is impossible in so far as it involves the notion of indivisible instants.

Developments of the theory of instants as a result of the doctrine of continuity mentioned above, would meet this argument by repudiating its basis & in the predicament of consecutiveness of instants. According to these later theories there are series which possess the property known

as compactness is they are such that between any two of their members there are to be found other members. If this is the case such a series will not have consecutive members. It is maintained that time & space can be regarded as series of this nature so that the alleged critical case of Zeno simply would not arise. There would be no next instants so the case would be simply irrelevant so far as time is concerned.

It is claimed that this property of compactness is not an invention specially designed for getting over difficulties with regard to time & space. It is said to have first been discovered amongst the series of numbers and then applied as a hypothesis to the nature of space & time. We are told that the series of all fractions arranged in order of magnitude possesses this property. Consider $\frac{1}{2}$ & $\frac{1}{4}$ —— between them is $\frac{3}{8}$. Again between $\frac{1}{2}$ & $\frac{3}{8}$ is $\frac{7}{16}$. There are no next fractions in this series.

This alleged property may at first sight seem to be blatantly self-contradictory. We are assured however that the notion of the compactness of a series contradicts not itself, but only an illegitimate prejudice, which is characteristic (but quite naturally) of the opinions on this matter of those who are philosophers only and not mathematicians as well. The experience of the usual run of mankind is limited, in the main, to series where terms are consecutive. It is series with consecutive terms that they take most notice of. This generates the habit of belief that a series cannot be other than one of ~~compact~~ consecutive terms. This is natural & pardonable but no more true than would be the belief of a central African savage that all men are black. With these assurances from authorities like Bertrand Russell acquiescence would seem most becoming.

The notion of compactness involves an infinity of terms as between any two terms of a series which possesses it. The question of the positive theory of numerical infinity will be considered later in this section. Meanwhile assuming that the notion is tenable Bertrand Russell suggests the following as a precise interpretation of the real fact which corresponds to the so-called sensible continuity of motion:- A body is in motion is at a position at any instant; but to be at (P) at (t) does not mean to be at rest at (P). To be at rest at (P) is to be at (P) for every instant of a given finite time stretch. A motion is continuous at (t), if at (t) a body occupies (P), and a stretch $(P_1 - P_2)$ which holds (P) within it can be found so that from (t_1) which is before (t_0) to (t_2) which is after (t), and inclusive of

both, the moving body is within $(P_1 - P_2)$ however small this distance may be. If the body jumps in the course of it's motion, then where $(P_1 - P_2)$ is less than the jump, the ~~be~~ above law will not hold. Let the body jump from (P) to (Q). Then (t_2) must be the instant at which it occupies (Q). The body is to be in motion all the while. Then if it occupies a time between (t) and the instant at which it is at (Q) it must occupy a point at this time – otherwise it is not in motion. But it cannot occupy such a point for then it would not jump from (P) to (Q). But if at (t_1) it occupies (Q) then at (t_2) it will be outside $(P_1 - P_2)$. Of course if it came to rest at (Pt) then from (t_1) to (t_2) it would all the while be within $(P_1 - P_2)$. But then we should not be dealing with motion, but with a transaction consisting of two motions whose mutual limit would be a rest. The occurrence of the predicament which constitutes the test would not here imply continuous motion, for it would not be motion within which it arose, but a transaction more complex. The above is Russells definition of continuity of motion at an instant. Where a motion is continuous at all it's instants it is continuous as a whole.

Russell suggests that the definition of motion as the occupation of consecutive points at consecutive instants precludes the possibility of variation of velocity. We must pass from one point at one moment to the next point at the next moment. If we try to go more slowly ie to take longer time to traverse the given distance determined by two consecutive points we must include more instants. Then either there will be instants at which we do not occupy a point or we must occupy one point at many instants. In so far as either set motion ensues there is not motion. If we wish to go more quickly ie to traverse more space in the given time we shall either have to hop over points or occupy points without occupying times. Again this will not constitute motion.

But it must be noted that the alleged presented fact of no any velocity does not constitute an empirical proof that the time series is compact. We do not perceive the distinct instants and points, & are told that the apparent confluence of the parts of a motion or change a duration is simply blurred perception. Now once this principle of blurring has been admitted, what is the objection to admitting that there is strictly only one velocity & explaining apparent variation of velocity as blurred perception of transactions involving rests & jumps. Alternatively, we might distinguish between continuous & non continuous motion & admit only one continuous velocity, explaining the given variety of velocities as the appearance of either non-continuous motion or again as a transaction consisting of motions and rests.

However, ~~if~~ even if we persist in the assertion that the

the condition of motion is the occupation of consecutive points at consecutive instants, the fourth Zeno paradox (the arrow in the stadium) would seem to constitute no objection. The total predicament I is simply followed by the total predicament II. At one moment the system of space relations of each entity to the others is one thing, at the next moment it is quite different. This implies no passing in a non-existent between. At one moment the position is such that (c') occupies a position opposite (a''). At the next moment it occupies a position which is next to it's former position and in which it now finds itself opposite to (c''). There is no difficulty in supposing that this is the full statement of the case and that nothing has happened in between the two instants. To ask how the transition from one point to the other takes place is simply an inadmissible question. It is based, so far as this theory of motion goes, on ~~a~~ encumbering strict definition by the vague notion of fluid continuity alleged to characterise motion as it is perceived.

The other two of Zeno's arguments, those concerning the course of Achilles and his race with the tortoise, constitute no direct objection to the theory of instants, but it is claimed that the difficulties they involve are solved by the application to the time series of the positive theory of infinity. The first of these two proceeds as follows:- However small the course may be, motion over it involves traversing an infinite number of points one by one. We can divide the course into two. Then ~~so~~ the two halves can each be bisected. This gives rise to an infinite number of consecutive points. But we cannot traverse an infinite number of points in a finite time, hence motion is impossible.

Now assume that the premise about infinite divisibility of space is true. Assume also the theory of instants and the doctrine that motion consists in the occupation of different points at different instants. Traversing a series of points will consist in the fact that they are occupied by a body at different instants. The plausibility of the argument now rests on the assumption that a finite time cannot contain an infinite number of instants.

The argument known as ~~the~~ "Achilles & the Tortoise" presents difficulties on a number of counts, two of which seem relevant in the present juncture. The point of the argument is that the law of generation of the courses which Achilles & the Tortoise must traverse respectively involves that there be an infinite number of successive predicaments in which there is a distance between them. This is supposed to preclude the possibility that Achilles overtakes the tortoise.

A consideration which has been thought to involve this is that although the successive distances which intervene between the

competitors diminish progressively, yet since they are infinite in number they can never be got through, and a situation reached where the positions of the two runners co-incide. The question is as to what is the precise meaning of such a phrase as, "such that they can never be got through." If this means that it is logically impossible for there to be a term beyond an infinite series it is, we are told, untrue. The series of fractions between $\frac{1}{2}$ + 1 has an infinite number of terms. Thus we get $\frac{1}{2}$, $\frac{3}{4}$, $\frac{7}{8}$, $\frac{15}{16}$ - - - - - -1. Beyond this series of fractions is 1 itself. In the same way the diminishing distances in the Zeno argument have a limit to the series which is beyond the series itself. This is the point at which the positions of Achilles and the tortoise co-incide, is the point at which the distance which separates them is zero.

It may be held, however, that the crux of the matter is that this series of distances cannot be successively traversed. It is assumed that if they can only be traversed in an infinite time this is equivalent to the impossibility of traversing them. And it is held to be obvious that they cannot be traversed in a finite time. However the first alternative is not obvious. ~~Has~~ anyway it is proposed to pass it over for the present & consider the second one. Here we are in part up against the question which is at the basis of the previous argument about the impossibility of traversing any course, viz. the question whether that a finite time ~~should~~ can comprise an infinite number of parts. In this case however there is a further complication. Since each distance is finite it will presumably be correlated with a finite stretch of time. The distances are mutually exclusive and successive, so that if we can traverse them in a finite time, we must assume that a finite time span can contain an infinite number of successive finite parts.

These considerations, together with the account of continuity put forward above, necessitate a discussion of the possibility of an infinite collection of instants. In the first place we must know quite definitely & precisely what is meant by infinity. The traditional notion is vague if not self contradictory. Locke and Kant defined the numerical infinite as that where number cannot be completed by successive synthesis, ~~or~~ ie. by successive additions of one. This has already been mentioned. At best it is only a negative definition.

In comparatively recent times there has been formulated by mathematical philosophers, what is known as the positive theory of numerical infinity. An infinite class is defined as one which is reflexive. A class is reflexive if it includes a proper part which can be regarded as similar to the whole. Two classes are said to be

similar when they can be arranged so that for every member of the one there is one and only one member of the other. Of course any number of classes may be similar. The relation of "being married" is the basis of two similar classes, at any rate in numerous countries. The two classes are husbands & wives respectively. For every husband there is one and only one wife. An infinite class is one which includes a sub-class which is similar to the including class itself. Such a class it is claimed is presented in the set of all natural numbers. We get

1 , 2 , 3 , 4 , 5 , 6 — — — — — — n — — —

Now we can get another set of numbers by multiplying each cardinal number by two. This operation generates the similar series 2 , 4 , 6 , 8 , 10 — — — — 2n — — — —

But this latter series is the set of all even cardinal numbers. It is therefore included in the first set. Here we get the predicament of a class reflected into itself.

We shall of course at first sight declare this property of reflexiveness to be self contradictory. But, as in connection with the notion of comparableness, we are told we are merely elevating the subjective condition of unfamiliarity into an objective law. Our experience is normally limited to the recognition of comparatively small finite classes. But this does not preclude the possibility that there are classes which have other properties than those embodied in these familiar finite classes. The positive theory of infinity, we are told, is not self contradictory but only runs counter to one of our settled habits of thought — a mere prejudice.

When an argument turns on the question of self contradiction or various prejudices it is difficult to deal with it. Almost all we can do is either believe, or else assert the opposite with all persistence. However let us look at the notion of positive infinity a little longer. It is true that we cannot by successive additions of one, ascertain the number of an infinite collection. In other words we cannot count it. This fact has been thought to constitute an objection to the regarding of the infinite as a number. Kant & many other less important thinkers have maintained that the notion of number presupposes counting. An analysis of the act of counting, however, seems to reveal just the opposite. To count is added together as one at a time is the act of correlating, each to each, the terms of a given collection with some of the natural numbers from one onwards, in their natural order. It is then assumed that if each term of the set to be counted is correlated with one & only one natural number, and that if these latter, from one onwards, occur in their natural order

then the last natural number used, gives the number of terms of the given collection. Now this assumption proves correct in the case of the natural numbers, i.e. those which we usually call finite. But it does not follow that it must always be the case; if for instance we are dealing with classes involving numbers other than the natural numbers. The special point at issue here is that counting is a complex process presupposing the natural numbers + a certain law of their nature which is technically known as inductiveness. Not even finite numbers depend upon counting so we cannot argue that all numbers, finite or otherwise, depend upon this process.

In this connection, counting is often confused with the process of enumerating. But enumerating is strictly only a part of the process of counting viz that part which consists in correlating the given set of entities with the numbers. Now it is only in so far as the number of a collection of terms is one of the series of natural numbers, that it can be ascertained by counting the terms. But it is possible to enumerate (though not to count) completely some infinite collections. The number of all finite numbers is an infinite number. It cannot be ascertained by counting the finite numbers. Thus if we had a set of terms equal in number to the set of all finite numbers we could correlate each to each the terms of the respective sets. Then we should have completely enumerated our given set of terms but yet could not count them.

It is usual however to use the term enumerate in the less literal sense of "to mention individually." The question arises as to whether by this method we can realise the meaning of a given, hence of any, infinite class. Furthermore if we are unable to do so will not the ~~not~~ term infinite class be meaningless to us. The mere notion of reflexiveness in itself does not preclude the possibility of recognition by enumeration in this second sense. Each of the terms of an alleged infinite collection is to be regarded as a perfectly definite and distinct individual. So far as this goes mentioning all the terms individually is not logically impossible. But it is psychologically impossible. If however human beings existed for an infinite period of time, or if the duration of a single human act of mentioning were such that a human life, could contain an infinite number of such acts then enumeration of an infinite collection would be psychologically possible. It is to be noted that so far as this question is concerned the larger finite numbers are in exactly the same predicament as the infinite numbers. To mean

Berenguer. Logic I p. 177 (1)

could enumerate the collection of "all present inhabitants of the earth" or even of all present inhabitants of China".

From this psychological impossibility the conclusion is drawn by Bosanquet, that an infinite collection essentially lacks the totality which is involved in any collection as such. The group of objects here are (A), (B), (C) and (D) and no others. The group involves limitation as to totality. But an infinite collection we are told is essentially (a) and (b) and (c) and (d) etc. It is essentially indeterminate. It lacks completeness. Hence the notion of an infinite collection is condemned as self contradictory.

In reply it might be contended that this so called absence of totality exhibits merely the psychological impossibility of knowing it by the method of mentioning its terms individually. The collection itself is just that set which it is. It is all those which are composed in it and no others. There is no indeterminateness or indefiniteness about it. It is to be noted that those who object to infinite collections on these grounds just stated do not seem to have realised that their arguments apply to the larger finite numbers.

But does not a collection presuppose its members. Can we know what is meant by this collection of three men unless we know Jones + Brown + Robinson? If we must so know them individually, then at any rate we must say that we have no positive knowledge of infinite collections. They may exist but we know nothing of them – they are a bare possibility. We know merely that they cannot be counted + cannot be enumerated (i.e known by attending to their individuals) Then shall we say that the term "the inhabitants of China" has no positive meaning for us? This must be the case if enumeration is the condition of knowing a group, for no one has enumerated them. Again are we using meaningless terms when we speak of "all the fractions between 0 + 1." But here we get references. There seem two suggested ways out of the difficulty. The first is to assert that we can know the individuals without going through the process of attending to each one. The second is to deny that knowledge of the individuals is involved in knowledge of the group. The former seems untenable so we turn to the latter

It may be thought that Russells doctrine of classes meets the situation. He distinguishes between extensional + intensional definition of a class. collection. The former consists in attending to the members of the class collection in their individuality. We are told that

whereas extensional definition is only possible some-times (not being possible for human beings, as at present constituted, in the case of infinite classes) intensional definition is always possible. What then is this intensional definition of a collection.

In some cases it is obvious that with a given group there is associated a property which characterises each of the members of the group and in virtue of which they are grouped together. This is the case in such instances as that of "the inhabitants of China" or "the fractions between 0 & 1." Mr Russell says that this is always the case. "Brown, Jones & Robinson all of them possess a certain ~~property~~ property which is possessed by nothing else in the whole universe, namely, the property of being either Jones or Brown or Robinson." Russell seems to hold that extensional definition is less fundamental than intensional definition. He speaks of the enumeration of the property which characterises the members of a collection, as the definition of that collection.

Now if this is to be taken to mean that the fact that a property is repeated can be reduced to the intrinsic nature of the property, it seems quite false. In symbolic logic definition seems, in some cases at any rate, to have a peculiar & special meaning. The theory of the reduction of classes, stripped of its highly technical terminology, seems to amount to the principle, that for statements which are nominally about collections we can substitute, & with a view to convenience in certain symbolical representations of processes of reasoning, statements about the implications of the properties which characterise the entities comprised in the classes. In other words, the relation of the class property to the actual multiplicity of instances is such that the former can be used as a symbol of the latter. Such substitution may be convenient provided there is a bona-fide class property. In the case of the group of "Jones, Brown & Robinson" cited above from Mr Russell's treatment, the alleged property itself seems only to be a case of enumeration. And the whole question is one of convenience in the use of symbols. A bona-fide class property may be conveniently incorporated in a mechanism for symbolising the group of individuals which that property characterises. But the property is not the given collection of instances. Before we can use the property as symbol we must also know of its repeatability: we must know the collection apart from the property. If to know the collection involves enumeration of the individuals comprised in it, then no infinite collection can come within human knowledge.

Certainly we claim that we know what we mean by the term

"unbaked ants of china." If this notion is significant it seems that, so far as the question of enumeration goes, infinite classes may be possible too. The following suggestions occur. Can we distinguish between not only a property and its diverse instances, but also between the diversity of the instances and the fact that it is these particular ~~instances~~ individuals in which the property is diversely instanced. We are to be able to distinguish between a property, the individuality or self identity of its instances & the diversity of one instance from another. Alexander seems to think that such a distinction is possible. Now in some cases at any rate a collection is based on the fact that all its members have a certain property. If this character does not involve enumeration in its expression, and if further it ensures the distinction of the class in question from all other classes, then such a collection can be defined as the "totality of diverse applications of the given property." Such a property can be known from consideration of a single instance. What is meant by diversity of instances & totality of such diverse cases can be realized from consideration of a small finite group of instances. Diversity & totality will be the same in all groups independently of the number of instances involved. The term 'totality of diverse applications of a given property" would then be perfectly significant & would define certain characteristics of a particular group. Nothing further would be added to what we know of the group aspect of the situation if we were also aware of the identity of each individual member. We can in some cases know things about the collection of instances of a property, without needing to know anything more than the nature of the property. Thus, since "being a husband" involves, in monogamous countries, "having only one wife" we know that the class of husbands is similar to the class of wives. It may also be possible to know, from the nature of a property, that the class of all its instances exhibit reflexiveness. Thus if the above suggested distinction be tenable it may be significant to speak of an infinite collection even if we cannot enumerate - (know in their separate individuality) its terms. When we know what is meant by "being a fraction between 0 & 1" we shall be able to speak of the collection of such fractions. Whether it has been shown that this group has the property of reflexiveness is another matter. But it is the notion of infinity as applied to time that is the special concern of this essay. Assuming that the notion itself has been shown to be plausible we now turn to the question of infinite classes and instants.

The particular point which lead to this discussion of the meaning of infinity was the question as to whether or not a finite time could contain an infinite number of instants. It is urged against the affirmative answer to this question that it obviously involves the complete summation by successive synthesis of an infinite series. As such it is impossible. The question turns on what is meant by "complete summation by successive synthesis". It is true that we could neither count nor notice individually the members of an infinite collection of instants. This however does not render the notion of such a collection self contradictory. There seems no reason why the relations of "before" and "after" should not be able to generate an infinite series.

The argument is similar to that propounded in the antinomies in the Critique of Pure Reason. The point there at issue is to prove that time past cannot be infinite in extent. The argument is that if time past be infinite it contain an infinite number of instants, then at every instant an infinite series will have elapsed ie been completely summed by successive synthesis.

Again, as in the argument just discussed the question is as to the meaning of successive synthesis. If it means simply that time past is a succession, where is the objection to supposing that it comprises an infinite number of instants? We have no reason to believe that the past in all its parts has been counted or enumerated by human beings as we know them now. If successive synthesis has reference to these meanings, then the argument is nonsense. Perhaps however it refers to the fact that any given instant is the last of a series. It is sometimes asserted that an infinite series cannot have a last term. But what this usually means is that the series cannot be completely enumerated, and there is no reason to suppose that the set of instants which are earlier than a given instant can be so enumerated. So far as series themselves are concerned it is necessary to distinguish between last terms & terms which are later than all others. The former, in the sense of upper boundaries, may belong to series other than the series of instants, the latter are peculiar to the series generated by the time relation. Any given instant is the upper boundary of the series of instants that are earlier than it & the lower boundary of time that are later than it. But upper boundaries may be, for instance, greatest terms, or next inclusive terms, according to whether the serial relation is respectively that of magnitude or part and whole. & even though the past has an upper boundary in the present it may comprise an infinite number of instants. Thus the series of fractions that are

* Or at any rate that the objections urged against this notion (1)
are invalid.

less than a half, in order of magnitude, has an upper boundary in $\frac{1}{2}$ + yet has an infinite number of terms.

The question of the infinity of the extent of time, stated in precise terms, is really that of whether the series of instants comprised by past + future has a lower + an upper boundary. It is held by those who now believe in the theory of instants that there is no self contradiction in answering this question in the negative. For would the solution be specially invented for time. Consider all those fractions where square is greater than 2. Let them be arranged in a series in order of magnitude. The series will be infinite + will obviously have no upper boundary – just as the series of natural numbers has no upper boundary. But this series of fractions will have no lower boundary either. For by descending we can get fractions whose squares are respectively nearer + nearer to 2 as their squares respectively differ from 2 by amounts less than any assigned amount however small. But there is no lower boundary for there is no fraction $\sqrt{2}$. In this series we get neither upper nor lower boundaries. The same is the case with the time series.

Assume then that time itself, + past + future, are sub-classes of it, are infinite in the senses described above: yet we shall be told that the times we are normally acquainted with, eg the durations of empirical object + the extent of empirical activities are all finite. The question arises as to whether a finite time can include an infinite number of instants.

First of all then is there any part we evidence for supposing that this question must be answered in the affirmative? The popular answer is that any stretch of time is obviously infinitely divisible, and contains therefore an infinite number of parts. If we request "How do you know that such a stretch is infinitely divisible?" we are referred to the process of progressively splitting up such a stretch. But surely this process, though it might prove the stretch to be divisible a finite number of times is just such that it cannot prove the stretch to be infinitely divisible. It is a process which is equivalent to enumeration. We could not carry it out to exhaust the infinite divisibility (even if such existed) of a given stretch. As a matter of fact, however far we may carry the process of dividing we have only a finite number of parts each possessing a finite magnitude, however small this may be.

Now if a stretch which is finite in magnitude does not possess an infinite number of parts then the notion of compactness cannot be applied to empirical time. This is a possible

city which must be explored.

The question to be discussed is the import of divisibility of time with regard to time magnitude. There are some who would contend that the question does not arise at all because there is no such thing as time magnitude. Leibniz says that when we assert that (B) arrived a longer time than (C) after (A) all we mean is that (B) is after (A), but (C) is both after (A) and before (B). We cannot divide the relation of (B) to (A) at the point (C). We cannot say that the relation of (C) to (A) is less than that of (B) to (A)

Now even assuming no time magnitude it would be legitimate to ask whether or not between any two given temporally distinct entities there could be an infinite number of other entities. We should then be able to regard time as ~~a compact not cont~~ compatible with the generation of a compact series. But consider the predicament which is expressed by saying that to day the opera was longer than it was yesterday. The reference to magnitude in this case does not appear to be so readily annulpable out of existence. It has been maintained however that time magnitude is nothing objective but only a subjective feeling — for instance of tedium or, on the other hand, of ease of mental transition. It was urged in the previous section that even if there are these subjective modifications, this does not preclude the possibility of an objective fact of magnitude to which they are specifically & definitely related.

But is not magnitude of time a relation of the process and not an inherent property of any given stretch of process? Thus if we say that the opera lasted four hours, is anything more implied than that it's commencement & ending were simultaneous respectively with two successive positions of the hands of some watch, & that between these two the hands assumed other positions in a certain order? It is true that all this occurs but the question is as to whether the fact of time magnitude is not something over and above the process. We seem to be aware of some property in a given process in virtue of which it is less or greater than or equal to some other process. This we call magnitude. The process just outlined in the paragraph is that of measurement in the expression of a given quantity in terms of number & of some other process agreed upon as a standard. This is a mechanism of accurate comparison. But in respect of what, do we compare the processes by it's aid — surely in respect of magnitude!

On the point at issue viz the question of time magnitude & it's implications for divisibility of time, we find a time honoured argument which again seems to have had it's origin with Zeno. It:

(1)

* The point being, apparently, that each finite stretch, qua comprising an infinite number of infinitesimals, will ~~be~~ contain the largest possible magnitude which can be made up of infinitesimals.

proceeds as follows:- either the parts of a finite time have magnitude themselves, or they have not. If the former be the case the number of parts cannot be infinite, for then however small each might be the total magnitude would be infinite. If however the ~~last~~ second half of the alternative is the case, even if there were an infinite number of parts the total stretch would have no magnitude, for the mere addition of any number of no-magnitudes cannot give rise to magnitudes.

This argument turns on two assumptions viz (1) the sum of an infinite number of magnitudes is an infinite magnitude & (2) the sum of an infinite number of entities which possess no magnitude, has itself no magnitude. The first mode of criticism is that of drawing a distinction between magnitudes. It was urged that proposition (1) is true for finite magnitudes but not for infinitesimal magnitudes. These latter are such that an infinite number of them can give rise to a finite magnitude.

However the notion of infinitesimal magnitude has been condemned as self contradictory, as involving that all finite magnitudes are equal. An infinitesimal is, nevertheless, an entity possessing some magnitude. Then all infinite collections of infinitesimals will have the same magnitude*. This at any rate assumes that all infinite numbers are equal – a predicament which modern mathematical logic denies. But what is the meaning of the term infinitesimal. All the quantities which occur in scientific measurement are finite. The notion seems to be nothing more than the assumption of something or other which will just serve the purpose of dispersing of the difficulty involved in infinite divisibility. If so, it is not a genuine concept in but simply a case of covering up a difficulty with a new word.

Thus far the first horn of the dilemma has not been demolished. Let us examine the second. The point is that the summation of entities which have no magnitude does not give rise to magnitude. In so far as the argument relies upon this it is equivalent to apply it against time. A succession is not a mere sum of instants but a set of instants ordered by a serial relation. Does it follow that because individual instants possess ~~no~~ no magnitude then the complex whole which we call a series of instants cannot possess this property either? We are here led to an account of how time magnitude is treated in the theory of instants.

A magnitude is defined as that which is greater or less than something else. Magnitudes are not equal but quantities may be. This is the case when they are characterised by an identical

magnitude. An actual yard stick is a quantity of matter. It's length is a magnitude. Two separate yard-sticks are two distinct quantities of matter but they possess an identical magnitude. In virtue of this they are equal. Quantity is magnitude particularised.

Each magnitude is a simple and indefinable entity. More than this, only magnitudes of the same kind are greater or less than each other. A magnitude of pleasure is not greater than a magnitude of space or time.

Now there are some series such that between any two of their terms there is a relation which we call distance. This relation says Russell does possess magnitude. In the time series one event is presented as being more or less recent than another is the distance between the one & the present is greater than that between the other and the present. Thus a succession is to possess magnitude not in virtue of the number of instants it comprises, but in virtue of the distance between its boundaries.

All this seems quite contrary to our ordinary notions. It seems must obvious that we do split up time magnitudes and add them together. Can we not divide an hour into sixty minutes & reconstruct it by adding them together? Certainly there is some meaning in this way of speaking – it refers to some actual process; but the terms will need precise definition. Consider then a succession of say an hour's duration. It is a series of instants with two boundaries. The distance between these is an hour; and is indivisible. But the stretch of instants which these two enclose, includes sub-stretches, & these latter will have boundary terms between which the respective distances may be less than an hour. It is true that a given stretch includes a number of such sub-stretches, but it is not true that the distance between it's bounding terms can be divided up into the distances between the boundaries of the included sub-stretches.

It is conventional to express magnitude by means of number. Suppose we have a stretch bounded by (a_0) & (a_{60}) & out of which sixty included sub-stretches of the following form have been selected :- $(a_0 \text{——} a_1)(a_1 \text{——} a_2) - - - - - - - - - - (a_{59} \text{——} a_{60})$ Let each sub-stretch possess the same magnitude of distance as between its boundaries. It is a mere convention that we express the magnitude of $(a_0 \text{——} a_{60})$ as sixty times the magnitude of each sub-stretch. This latter magnitude has a definite relation to the magnitude involved in the including stretch and we express this relation by the ratio $\frac{60}{1}$; but to regard the ~~magnitude~~ quantity $(a_0 \text{——} a_{60})$ as divisible into sixty ~~magnitudes~~ quantities such as

$(a_0 - a_1)$ is merely to confuse either distances with stretches or magnitudes with their conventional expressions.

If this analysis be correct then where is the difficulty in supposing that two terms where distance embodies a finite magnitude enclose a stretch that comprises an infinite number of terms. And if the enclosed stretch be infinite may not the series of its terms be compact? Where a stretch is a stretch from a compact series it will be infinitely divisible.

In all series there are terms intervening between any two where distance is not a minimum. Conversely where there are intervening terms the distance is not a minimum, for that series. Where a series is compact there will be no minimum distance. In other words, there is a distance less than any assigned distance however small that may be. How however small these distances become in the time series, we do not reach a point where we find a new kind of magnitude. If the magnitudes with which we are normally acquainted are to be called finite then these smaller & smaller magnitudes must be described as finite too. They are finite because they obey the same laws as the magnitudes to which we normally give the name finite. Infinitesimals have been defined as magnitudes which are less than all finite magnitudes. It seems to have been assumed that the proposition, "there are magnitudes less than any assigned finite magnitude" is the equivalent of "there are magnitudes less than all finite magnitudes". These two are obviously not equivalent.

Thus, assuming that by a finite time we mean at any rate such periods as we normally experience and measure, nothing has been found to preclude the possibility that a finite time contains an infinite number of parts. There is as much empirical ground (and as little) for supposing that a period of time is infinitely divisible as for supposing that a stretch of space has this property. This clears Zeno's argument with regard to the impossibility of completing any movement however small.

We return then to the argument about Achilles and the tortoise. The special point arising out of this argument may be expressed as follows, viz. that it raises the question as to whether two instants, where distance is finite, can enclose a stretch, which includes an infinite number of consecutive sub-stretches such that their respective boundaries, each possess a finite distance. Expressed in this new form the predicament presents no obvious difficulties. The apparent absurdity of the proposition as originally stated arose from a vague feeling of its contrariness to popular prejudice.

Russell claims that by accepting compactness as the essential

Numbers for Russell, though real do not exist. ~~but~~ If it can be shown that numbers involve infinity in this numerical sense, then this notion of infinity is established as valid somewhere in reality. There is then further question as to whether it is valid of existence + especially of time. This is an empirical question.

nature of continuity we can avoid a time honoured antinomy which is served up by both Leibniz and Kant. It proceeds as follows:-

Thesis — the parts of the continuum are indivisible. The continuum is itself divisible, hence composite. But the composite presupposes the simple for composition is accidental.

Antithesis — the parts of the continuum are divisible. Any portion we can take, however small it be, is divisible again.

Now it may be that both thesis & antithesis are true but unproved. Russell contends that by adopting the notion of compactness we may hold both conclusions to be true without incurring self contradiction. The parts, in the sense of logical elements, of a compact series are simple in that they are not analysable in terms of the series. Neither instants nor their relations to each other are further analysable into temporal parts. But the parts of the antithesis are not these logical elements, not instants and their relations, but sections included between cuts. In a compact series such sections are always stretches of terms and therefore analysable & also divisible into further sub-sections. There is no contradiction because we can distinguish between the parts which are simple & the parts which are complex & divisible. There are two senses of the term parts viz logical elements and sub-stretches. There are two senses of the word divisible viz logically ~~[illegible]~~ complex & inclusive of sub-stretches. There is no contradiction in holding that the logical elements are unanalysable while at the same time holding that ~~the~~ a given substretch is further divisible into included substretches. It is the notions of employed in the theory of instants which make valid & significant these distinctions.

It is to be noted that though in the main the traditional objection to the hypotheses that a given time contains an infinite number of instants, & that time past & time future are series which respectively have no lower & upper boundaries, are invalid, yet these assumptions have not been proved. Russell holds that all supposed a priori proofs of the existence* of infinite classes are invalid. The question at issue in this essay is whether or not time involves these infinites. This will be an empirical question.

Now thus far the great virtue of the theory of instants has seemed to be the clear cut distinctness of its concepts. But it is also necessary, along with the attempt to achieve precision in details, to see that fundamental concepts are not vague. The fundamental notions of the theory of instants are the time relations and the instants which are their terms. The instants are distinct from each other but the relations bind them into a serial unity.

Succession is not a character of the relations nor of their terms, the instants, but of the series which is the instants bound into a unity by their relations. This is pure succession is time it self. As we saw at the outset, empirical succession, that which we normally call succession, the ~~quoted~~ perceived succession of qualified events, is more complex but involves pure succession a time. But there is a tradition in philosophy, represented most clearly in more recent thought, by Bradley, which denies the possibility of unification under these conditions. The notion that a relation can bind together distinct entities is declared to be self-contradictory. This line of thought will be discussed later in this section.

Before proceeding to it, however, there seem to be objections which are peculiar to the theory of instants. The instants as well as the relations are essential. We are entitled to ask what is meant by an instant. This is the first step in the empirical enquiry. Usually my datum figures most prominently in the definition; it has no magnitude, no duration, no succession, no sense quality. All that seems to be said which is positive is that the instants are the terms of the temporal relations. They were introduced to account for the apparent temporal differentiation involved in a persistent object. Now we must be careful that our procedure here is not the same as that of the invention of infinitesimal magnitudes ie merely glossing over a difficulty by coining a word. In such there is no real solution. The same arises in the case of the alleged relation of "being at" which is also an essential element in the theory under discussion. In both cases there must be a genuinely new concept and it must be shown that this affords a solution & how it effects this.

Now only when ~~a relation~~ an entity is complex can it be defined analytically, is a dogma held by Russell. To define in this manner is to effect an exposition of the parts & their relations. In the case of simple entities, this mode of definition cannot be pursued. We shall have to use demonstration rather than definition. The exposition of a simple entity will consist in exhibiting its relations to other independently known entities. This appears to be the method of procedure so far as there occurs any positive definition of instants. We are to understand by this term, those entities which are the terms of the relations of priority & posteriority & between which & qualified empirical events there holds the relation of "being at." This latter relation is not enough of it self to define instants because it will not provide a basis for differentiating them from points. The qualified events, a sense of them are also said to be at.

~~at to~~

points in space.

But this alleged demonstrative exposition is not definition. It does not exhibit the content of the simple notion. It is merely a question of turning the mind's eye upon the alleged indefinable. But there must be something positive for the mind to appreciate when the effort of directing has been made. The instant however seems the barest of all abstractions. We cannot construct it in imagination because it has no sense quality and imagination can only work with the materials presented ~~by~~ through the senses. We cannot in imagination somehow transport ourselves behind the phenomena.

(4) These considerations bring us to the discussion of the relational theory of time. Those who hold this view maintain that instants and the relation of being at are pure fabrications. They deny that the empirical succession of events is analysable into the fact that the successive events have different time positions or that simultaneity is the complex predicament in which complex events are presented as having a common time character. They hold that experience presents not only the simple relations of posteriority and priority but also that of simultaneity, but that the terms of these relations are the individual qualified contents of experience themselves. The successive sounds which constitute a tune are themselves, as concrete qualitative presentations after & before each other. An event is not the predicament in which a qualitative content ~~is~~ has the relation of "being at" to an instant, but it is the fact that an individual qualified content bears time relations to other such contents. Time itself is not a series of instants but a set of specific relations which individual empirical objects bear to each other.

Now it has been held that the ~~so~~ so called time relations as observed between empirical objects cannot be said to have the same formal characters as those claimed for the relations in the theory of instants. It is pointed out that empirical substances persist and can recur and in virtue of these facts the time relations which attach to these objects cannot be mutually exclusive and cannot therefore constitute a series. It will follow that simultaneity is ~~neither~~ not transitive and symmetrical & that priority & posteriority are neither transitive nor asymmetrical. Consider a red light which persists as the illumination of ~~a red bulb~~ an electric bulb, which an explosion occurs. Let the bulb become illuminated before the explosion occurs, & not cease to be illuminated until after the explosion has taken place. Then the red light is before, simultaneous with & after the explosion. Or let

1916 - An article in the "Monist" - the plea being that the implications raised, may be contrary to what we normally suppose to be the nature of time but, that does not render them untrue a self contradictory.

(1)

a green flash occurs before the explosion, then occurs simultaneously with it and finally occurs after it. The green light too will be before, simultaneous with & after the explosion. Here we are told are two cases in which all three time relations hold between two identical objects or events. Then the time relations are not mutually exclusive. Either then we must reject the relational theory or drastically remould our ideas of time.

Consider now the relation of simultaneity. Suppose that two successive explosions occur while a red light persists. Let the light be (x) & the explosions (y) & (z). It is possible for (x) to be simultaneous with both explosions & yet for these two not to be simultaneous with each other. If (x) is simultaneous with (y) & if simultaneity is symmetrical then (y) will be simultaneous with (x). Then if simultaneity were transitive, since (y) is simultaneous with (x) and (x) with (z) then (y) should be simultaneous with (z). But this may not be the case – it would not be so in the instance quoted here. Then simultaneity is not transitive and symmetrical.

Ironically, for the relational theory, posteriority and priority cannot be held to be either transitive or symmetrical. Let (x) occur before (y). Since (x) may occur after (y) it is possible for (y) to be ~~before~~ before (x). Then "(x) is before (y)" & "(y) is before (x)" may both be true. Then priority & posteriority are not asymmetrical. Again let (x) be before (y) & (y) before (z). It is possible for (x) to occur after (z). Then since it is possible that though (x) is before (y) and (y) before (z) yet (x) is after (z), it follows that priority & posteriority cannot be transitive.

It was Russell who first raised these questions of persistence & recurrence & their implications for the relational theory of time; at first as objections to the theory. Then later* he chose to accept them as fact & proceeded to amplify them. If we are going to hold to a relational theory of time & if persistence & recurrence are temporal features then we must give them a relational construction. The following definitions are given. An entity persists in so far as it is simultaneous with two entities which are not themselves simultaneous, and in so far as it is also simultaneous with all entities that are before the later & after the earlier of these two. An entity recurs, in so far as it is simultaneous with two entities which are not simultaneous with each other, & further is not simultaneous with all entities that are earlier than the later & later than the earlier of these two.

Now it is quite true that we may not repudiate a theory just because

it surprises or shocks us. But a theory must give an account which really represents the facts. But the above account certainly does not seem to do full justice to the facts as they are presented to us. Within what we call a persistent object we seem to discern temporal differentiation. It begins before it ends. This alone is sufficient to constitute its duration without reference to some object outside the persisting totality. This same fact seems to reveal a further inadequacy in the theory of instants. According to this latter we are presented with qualities which contain no time but which have the relation of "at" to a time which is outside them. But the qualitative contents of experience seem themselves to be temporally differentiated. The red illumination is not fully described by saying that it is related to something outside itself which is a succession, but it has in some sense a time dimension of its own. As a patch of red light it begins + ends + is spread out in time.

Can this phenomenon be expressed consistently with a relational theory of time. A persisting object is to be a succession. Then it will be a set of ~~[illegible]~~ events bearing to each other the relations of before and after. These entities themselves must not persist for it is persistence we are attempting to define. Then the ultimate time terms will be non-enduring ~~[illegible]~~ granules. Now Russell has asserted that all individual events do persist. But he produces no evidence in support of this general statement. It is true however that some individual events do persist. Further more ~~[illegible]~~ it seems to be the case that the time relations characterise persisting substances. We shall need, then, to be able to describe one succession as after, before or simultaneous with another. Is there any objection to this — to the assumption that of two complex entities, each constituted by terms in succession, the one is one complex, before the other one complex. Then the one complex will be before the other, and each of the successive parts of the one will itself be before both the other complex and any of the successive parts of that complex. The parts themselves will of course be non-successional qualitative granules. Thus far there seems no objection. We are not overturning the perceptual datum but suggesting a conceptual interpretation of this.

The question immediately arises as to what account we shall give of overlapping. Here we shall get a complex A which, perhaps, one part is before, another part simultaneous with and a third part after some other object. Then the whole complex itself will not have any of these relations to the other object in question?

Yet there will be objects to which it will bear all three relations. Is there any objection to supposing that there are different series within the one time order? Then some objects will be members of more than one series. The ultimate granules will be members of all series. This will not be a contradiction of the traditional relational theory which regarded simultaneity as transitive + symmetrical + priority + posteriority as relations which at any rate can generate a series. It will be of the nature of an addition which is quite consistent with the traditional theory + which at any rate does not seem to outrage the facts as does Russells interpretation. The hypothesis does not commit us to the notion of conflicting time series. It is not asserted that mutually inconsistent time characters can with equal legitimacy be asserted of a given set of events, but only that events as a whole form not one temporal series but a complex of such series. Of a given pair of events we may be in one serial aspect of the whole complex and another in some different aspect. This will be the case where one of our events overlaps the other. Yet different serial aspects will include common events.

Consider now the feature of recurrence. Is it not the case that individual objects are just those entities which can not be repeated. Objects may possess a common property — we may, if we choose, say that this is repeated in ~~it~~ the individual case — but the individual itself is not repeated. Thus we not say that the principle of numerical identity is the guarantee of the non-recurrence of the individual. If the suggestion which constitutes this amplification of the relational theory be correct then the time relations will be mutually exclusive. Simultaneity will be both transitive and symmetrical + posteriority and priority will be capable of generating a series. Unless the concepts used in articulating the hypothesis contain contradictions beneath the surface, then this theory seems more to represent the facts as they are presented than does Mr Russell's account based on non-mutually-exclusive time relations.

The suggested hypothesis is not a return to the theory of instants. It dispenses with the relation of "being at" + involves the new feature that time order is not a single series but a complex of series. It refuses to distinguish between empirical succession, alleged to consist in the complex predicament of qualitative contents "at" different instants, and pure succession arising from the instants arranged in the relations of priority and posteriority. Nor does the new theory analyse simultaneity into the fact of having a common

instant. In accordance with the traditional relational theory, simultaneity, priority & posteriority are simple relations holding between the qualitative events themselves, whether these be persistent events or event particles. It is not held that these latter are perceptible but they can be conceived as granules of quality, themselves containing no time differentiation. They are the basis of the presented phenomena of the succession of events & of the successiveness within ~~events~~ persistent objects. Then there seems to be a hypothesis which gives an account of the perceived phenomena. We shall later see how that we are compelled to dig beneath this ~~notion~~ notion of relation ~~also~~ as used in this exposition so that the relational theory, even in this emended form, will be seen to have something of the nature of symbolism in it rather than ultimate truth.

However we turn at the present moment to other aspects of the relational theory. It has been suggested that the account given can help us to see our way through the problem which opened the way to our discussion of the relational theories, viz. the empirical problem of applying the hypothesis of instants to empirical time. Of the instants we know that they are not qualitative events, but what they are, in themselves, we have hitherto been unable to find out. They form a series & we have seen that the notion of compactness of a series is in itself plausible. It is claimed therefore that the series of instants is compact. The relation of the instants to qualitative events we call "being at"; but again, just what is the intrinsic nature of this relation we do not know. The question is then as to whether, from the events as the relational theory claims they are presented, we can infer a basis of a ~~compact~~ compact serial order.

Before proceeding to this discussion there are certain other questions which seem relevant at this juncture. We must discuss them from the standpoint of the relational theory. With regard to the number of entities which are the total field of the time relation; there has been no empirical evidence produced to show whether it is finite or infinite.

Then there is the question as to whether we can give a satisfactory interpretation of motion on this theory. Motion in general will consist, for this theory in the fact that an entity successively accepts different spatial qualifications. The question will arise as to what is meant by spatial qualification. There is, corresponding to the theory of time under discussion a relational theory of space. The consideration of this however is outside the scope of this essay. A further question however, viz. that of the interpretation of variations of velocity, must be discussed. M. Bergson held that time itself

has velocity inherent in it. However we saw fit to disagree with this general account of time. Normally we regard velocity as a complex predicament in which time is one element. The velocity of a moving body is a relation between a magnitude of space and a magnitude of time. We say that it traverses so much space in such & such a period of time - we say the express travels at sixty miles per hour. A rate of change is a predicament in which a period of time is related to the number of differences of character which arise in a ~~body~~ substance in that given time. But does time it self possess rate or velocity? If we are to avoid ~~error~~ a logical circle in our argument we cannot attribute to time velocity in the same sense as it characterises motion. An entity may persist & endure, but is there any sense in speaking of the rate at which it endures. Yet endurance is the fact that the substance contains time.

These considerations raise the further question of the attitude of the relational theory to the alleged property of magnitude in time. Physical science is particularly interested in this aspect of the time problem. It's aim is to express qualitative characters of phenomena as functions of the distances and time lapses which hold between them. Thus the law of gravitation states that two material bodies attract each other with a force which is directly proportionate to the product of their masses and inversely proportionate to the square of their distances. Hence if attraction is really analysed into the velocity and direction of approach which the bodies take upon themselves, i.e. the distance they will traverse and the time that will elapse before they meet. The general procedure involves the notion of magnitudes applied to time. But not only this, for science aims at precise formulation of these magnitudes; hence it has developed a system of expression of the relations between phenomena by means of mathematical formulae. It uses number as the universal language for expressing these relations

In this connection two problems arise. The first is that of the experimental verification of the formulae. This answers the question of whether or not they work. It is for each special science to invent it's own peculiar methods for this purpose & it requires the special-ised knowledge & aptitude relevant to each of the respective special sciences to discuss this question. Secondly however there is the question of the meaning within the whole of experience of the general scientific procedure. This at any rate is partly a philosophical question. It is for philosophy to test the consistency with experience as a whole of the ultimate notions which underlie

the scientific procedure in general. There is presented ~~the~~ a problem after the fashion of that which Kant set himself to solve. The question is "What must be the nature of time, in order that the formulae which we use may have significance as applied to processes which are actually given?" It is for philosophy to take the concepts of science & examine them in the light of a disinterested analysis of our actual time experience & it's place in experience as a whole.

As a matter of fact the theory of instants seems really to have arisen as a philosophic construction designed to meet the needs of science. It is the conception of just such an entity as would generate time magnitude in a form capable of expression through the medium of number. The account of time magnitude is simple and precise. Each instant is distinct and any two instants determine a precise magnitude. The position in time & the time relations of any object are then perfectly definite. The series of instants is just such as is capable of complete correlation with the series of numbers so that each instant can be precisely and unambiguously named. The procedure of assigning co-ordinates is rendered consistent with the nature of actual time. Time magnitudes can be expressed ~~by means~~ as functions of the numbers used for naming & ~~count~~ denoting the instants, & mathematical formulae become a possible universal symbolism for time. It was seen above that acceptance of the theory of instants does not involve necessarily the further assumption that this series is compact. Yet compactness is unhesitatingly attributed to the series & staunchly defended. It was seen that there seemed no more reason against time possessing this property than for it. Then why did these, who are scientists par excellence, not withhold judgement on the question. The reason seems to be that the scientist would like time to possess the property, for it provides the basis for the use of convenient types of mathematical formulae in the expression of the quantitative aspect of time relations. It ~~is~~ provides the basis for the application to time of the calculus & continuous functions. Thus in formulating the theory of instants, the scientists & their philosophical proteges must have to some extent allowed their wishes to fatten their thoughts.

It is easy to see therefore why, more recently, the following problem has been given some prominence at the hands of Russell and those who think like him, viz "How on the basis of experienced time can we construct that which presents the serial properties of the instants?" This brings us back once more to our problem of whether the theory of instants can be applied to empirical

time. We have to find a meaning for the term instant & ~~the~~ "being at" and one which is not inconsistent with the fact that the time relations hold directly of the qualified events. Mr Russell suggests the following method of combining the theory of instants and the relational theory & thus satisfying the empirical demand and the needs of scientific procedure. He takes his stand point from his own analysis of the time relations, as not involving mutual exclusiveness & not having directly the properties which will serve to generate a series. The construction proceeds as follows:-

Consider a group of events such ~~that~~ all its members are mutually simultaneous, & such that no event outside the group is simultaneous with all the events included in the group. Such a group of events will be defined as an instant. If we represent simultaneity by overlapping lines the following diagram will express the predicament.

a ———————

b ———————

c ———————

d ———————

e ———————

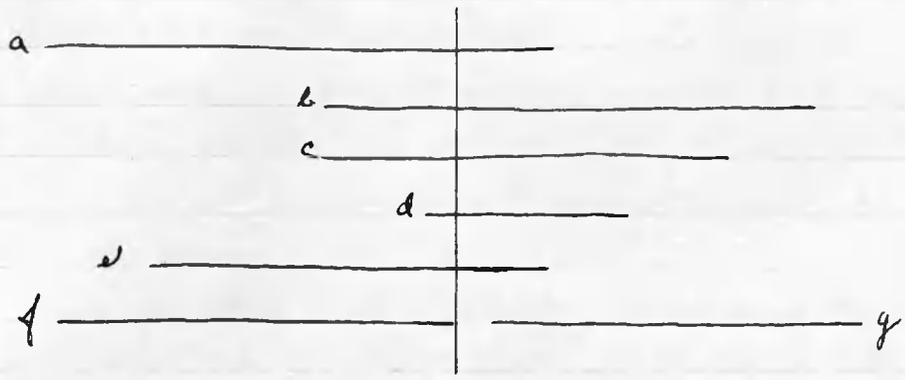
f ——————— g ———————

The group which constitutes the instant will contain (b, c, d, e, f) for all these are simultaneous with each other. (a) & (g) are not members of the instant because (a) is not simultaneous with (c) (e) & (f) & (g) because it is not simultaneous with (f) (d) & (c).

An instant will neither persist nor recur. According to Russells attitude, on which this theory is based, both persistence and recurrence involve that the entity which either of them is said to characterise shall be simultaneous with something else. But if all the members of an instant were simultaneous with a given entity, that entity would ipso facto be a member of the instant. There is nothing therefore with which an instant can be simultaneous, therefore it cannot recur & persist.

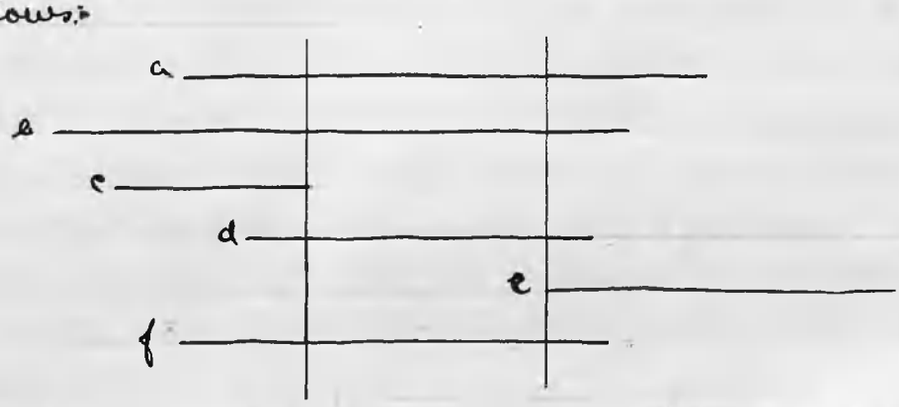
The next step in the construction is the definition of instantal contemporaries. These are the events which are simultaneous with a given event and are not wholly after any thing else which is simultaneous with it. The diagram over the page will illustrate the predicament.

Russell – Our Knowledge of the External World p. 120 (1)



Let (b) be the given event. It's initial contemporaries are (a), (c) (d) (e) (f) but not (g) for (g) is wholly after (f) which is simultaneous with (b). We are told that an event is at an instant in so far as it is a member of a group of mutually simultaneous events such that no event outside the group is simultaneous with all the events in it. Further, we learn, it is guaranteed that every event is at some instant provided that the following principle is true viz. "that any event wholly after some contemporary of the given event, is wholly after some initial contemporary of the given event." If this principle be true then the initial contemporaries of the given event will also constitute its first instant.

Consider now two events such that the one is before but not simultaneous with the other. The one is said to be "wholly preceding" the other. Two instants are successive if an event in one wholly precedes some event in the other. The diagram will be as follows:-



(a, b, c, d, f) and (a, b, d, e f) are two different instants. They are successive because (c) wholly precedes (e)

Russell goes on to assert that if the following assumptions are made the instants as so defined are constitutive of a series. The alleged requisite assumptions are three:-

(1) No event wholly precedes itself

(2) If one event wholly precedes another, and that wholly precedes a third, then the first shall also wholly precede the third. Let (a), (b) + (c) be three events + (X), (Y) + (Z) three instants in which they occur respectively. If (a) wholly precede (b) + (b) wholly precede (c) then (X) will be before (Y) + (Y) before (Z). Russell says that

Russell Knowledge of the External World p 120. (1)

Ibid p. 149 (2)

if wholly preceding be transitive then priority + posteriority, as applied to instants will be transitive too.

(3) If one event wholly precede another it is not simultaneous with it. Without this the instants are not successive

(4) Of two events which are not simultaneous one shall wholly precede the other.

We see then that the very condition of the successiveness of the new instants is that there shall be events such that the one is before the other but not simultaneous with it. But if we once allow that simultaneity, posteriority and priority are not mutually exclusive what guarantee have we that this predicament will ever arise — much less that it will arise in all cases. It may be that the new instants cannot persist or recur. If however events can persist + recur the time relations are not mutually exclusive. Then what is the guarantee that there are successive instants. It is difficult to see how Russell can construct himself a time series so long as he retains ~~is~~ his particular brand of the relational theory.

Again assume that (a) is before (b) but not simultaneous with it, + that (b) is before (c) but not simultaneous with it, what guarantee have we that (a) does not recur simultaneously with (c). If this is the case (a) will not wholly precede (c). This raises difficulties for the second of Russells principles.

The final character required by the new instants to make them quite scientifically desirable is that they should form a compact series. With regard to this point, Russell lays down different conditions in different places. They are as follows:- (1) there is compactness if, "given any two events of which one wholly precedes the other, there are events wholly after the one + simultaneous with something wholly before the other." The diagram of the situation will be as follows.

E_1 _____ E_2 _____

_____

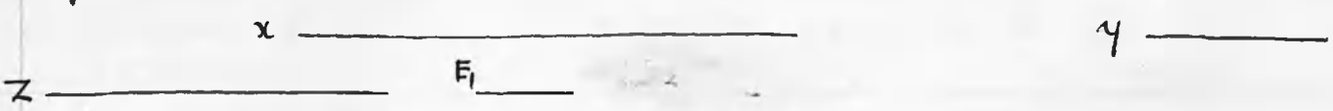
_____

_____

_____

(2) compactness arises where "if (x) wholly precede (y) we can find an event (z) simultaneous with a part of (x), which wholly precedes some event which wholly precedes (y)." In this latter definition Russell seems by implication, in his use of the term part, to admit the phenomenon which has been referred to above

as the temporal differentiation of an event. Anyway the following will be a possible diagrammatic representation of the second definition.



Thus in the second definition it is stated that compactness, that involves given any two successive events there must be at least one event which is simultaneous with the earlier of the two. So far as the first definition is concerned compactness itself does not involve simultaneity under these conditions. There are two different definitions and there is no suggestion of reconciliation. Nor is there any attempt to show what empirical evidence there is for holding that either of the two defines actual predicaments which apply universally amongst events.

Ironically, how on his rendering of the relational theory will Russell interpret the phenomenon of time magnitude? Even if he were able to construct a series from his new instants, he would again run counter to the presented facts, if he attempted to base time magnitude on the ~~the~~ serial structure of his set of instants. Any particular succession seems intrinsically to possess magnitude, apart from any reference to all the entities with which it and it's parts are simultaneous. If however our own suggestions for the amplification of the relational theory be admissible, a means of solving this difficulty ~~will~~ seems to be presented. The class of all event-particles includes sub-classes consisting of all mutually simultaneous event-particles. Let each such class be an instant. There are no difficulties about succession and serial order of instants, because the problems of persistence & recurrence have been solved without assuming that the time relations are not mutually exclusive. Now the class of all event-particles includes other sub-classes, which are series. The relation of simultaneity will generate what might be called parallel series whose members are successive. In virtue of the relation of simultaneity, parallel series will either be similar to each other or ~~similar to part of~~ such that of a given two one will be similar to part of the other. Any single series or part of any series may embody it's own magnitudes as properties of the relations of distance involved in it's terms. Since the series are similar, they can be compared with each other in respect of magnitude. We can then assign a meaning, in consistency with our interpretation of time, to such statements as that the opera was longer

yesterday them today. The comparison will be established directly between the two complex successional entities themselves, & will not require an intervening reference outside the entities. This is in accordance with presented fact. Whether such series are to be regarded as compact we leave as much an open question as it turned out to be in the hands of Mr. Russell.

New section (5)

However the relational theory is not yet safely home. At the end of our discussion of the theory of instants, the ~~was~~ question was raised as to the nature of the time relations: ~~to~~ to this aspect of the problem we now return. Time presents a unity of distinct elements. The problem is as to how this fact of temporal differentiation shall be ~~at~~ reconciled in its fundamental nature. In the two theories discussed it was held that succession consists of distinct elements which are held together & constitute a unity in virtue of the temporal relations between them. This alleged predicament raises philosophical questions which have been the source of much discussion. We turn first to Leibniz's contribution in this respect. He holds that since time contains distinguishable elements it is a compound. It therefore contains multiplicity. Ten him all composition is accidental to the elements compounded. That which is compounded presupposes its elements. These can exist apart from their composition, but this latter feature only is, in so far as these are real elements. The parts themselves therefore are indivisible — otherwise they would be compositions — hence mutually exclusive. They cannot overlap for in themselves they contain no common parts. If they had common parts they could not be simple for they would contain that in them which is common & that which differentiates them. Simplicity involves mutual exclusiveness. But if they are mutually exclusive how can they form a unity? How in the theory of instants and the relational theory it was held that there are entities called relations whose very function is to constitute a unity from distinct facts, & yet to preserve the features of distinctness of the parts. We must however be quite sure that this is not just another case of covering up the difficulty by inventing a word — assuming it is solved & making use of a new term whose only real significance can be that we have a lively hope that there is something or other that will as a matter of fact effect the solution.

Here Leibniz breaks away from the analysis presented in the two previous theories. He holds that all ~~predication~~ judgements must have the subject-predicate structure. All reality is therefore divided into two orders viz those which can enter judgements only as subjects and of which predicates can be affirmed, & secondly those entities

which can be predicated of subjects. The former are substances and the latter are attributes. Thus whatever is meant by relation must be reducible either to substances or their attributes. Now in general, a relational predicament is a unity of distinct elements. The elements themselves will be distinct substances in which in here distinct predicates. There is here no unity. The unity, says Leibniz is in the mind. It is the predicate of the mind which apprehends the distinct substances. Relation in general is the awareness of entities which in themselves are distinct.

This general philosophical position is behind Leibniz's analysis of time experience. Two aspects are involved in time. "First there is duration. This is the representation of the distinct predicates of another substance. The substance really has, in itself, distinct predicates, and duration is the appearance of these to another substance. The monad which apprehends is said to reflect the states of the other monad. The reflection is not constituted by the states of the reflected monad, but is a purely subjective occurrence in the apprehending monad. Yet in so far as it ~~really~~ reflects something which really is, it is described as a well founded appearance — "phaenomenum bene fundatum."

Secondly there is in our experience ~~the feature~~ of time, that feature which Leibniz distinguishes as time itself. It is in this that posteriority and priority are embodied. Again the relational aspect is purely subjective. But it must reflect something in other substances. The attributes of these substances are distinct. We are told that succession is the representation of these attributes in their logical dependance one upon another. Dependance however is not a relation between the predicates but is reducible to their intrinsic nature. One depends upon another in that this other is qualified by a character which Leibniz calls actuity. Now we can as a matter of fact distinguish between the two following predicaments:- (α) the representation of one entity as being dependant upon another + (β) the representation of that entity as being later than the other. How does this distinction arise if the two predicaments are objectively the same? Leibniz says that the temporal form of consciousness is a confused apprehension of logical dependance. Actually it is simply a mis-apprehension of a really objective predicament. Hence it is described as purely ideal — ens mentale.

Leibniz holds that all substances are mutually independant. This is supposed to be involved in the principle "nec true always true." All predicates are predicates of subjects and

each subject has all it's predicates eternally - they express just it's very own nature. If then it contains all it's predicates within itself it is the victim of no interference. Since time relations are nothing more than logical dependances (in so far as they have an objective counterpart & are not mere representations) it follows that substances in no sense of the term are related in time, nor are the predicates of one substance so related to those of another

How this analysis is quite otherwise than what we take to be our immediate experience of time. Where we perceive the firing of the shot to be followed by the wounding of the victim the successiveness so seems as much a part of the objective predicament & distinct from the act of apprehension as are the report, the flash & the staggering of the victim. It may be however that this is only prima facie experience, which must be reconstructed if we would get a more ultimate facts.

Let us return then to Leibniz's analysis. Substances and attributes are distinct. Diverse substances embody ~~does one~~ different attributes But the diversity of the substances must be something other than the difference of the attributes, for substances & attributes are distinct. If substances were not in themselves diverse, there would be no plurality of substances but only one substance. Thus diversity of substances is a predicament over & above difference of their attributes. It is not itself a substance - another substance would be diverse from the rest. Then it seems that Leibniz must either forgo pluralism or accept an diversity, a reality which is neither substance nor attribute.

The principle that all relations are modes of apprehension leads to still more paradoxical results. If this be the case it follows that beliefs that objects are related in themselves are untrue. The truth is merely that we believe the objects to be related. Then is it the case that the beliefs that objects are not related are true? It cannot be so. In so far as the object of our belief is a plurality of entities, the belief is false, for if it were true, the entities, since they are many, would be in themselves diverse. This theory of relations precludes the possibility of a single object of thought other than the act of apprehension. Such an object, if real, would be in itself diverse from the act of thought. We cannot even ~~exp~~ have a state of the mind other than the immediate present Here is ecstasy run with a vengeance.

Now the root of this theory of relations is the doctrine that all judgements are of the subject-predicate form. This logical theory is not accepted by modern thinkers. In all such propositions as "Leeds is nearer to Glasgow than London" it is held that we have cases

Kant, Critique of Pure Reason – Max Müllers Translation p. 24. (1)

which do not present the subject-predicate form. This removes the motive for the subjective doctrine of relations & to this extent we can hold that time relations may really hold between distinct entities, constituting them into a unity. And if this be the case, we need no longer assume that the objective counterpart of the successiveness of succession is not a predicament involving the relations of priority and posteriority themselves. We shall not be driven to attempt to identify these with the relation of implication in ground and consequent, and it will be possible to assume that diverse substances are related in time even if they are mutually independent. Whether Leibniz has proved that substances may be independent is another question which does not seem relevant here.

Besides these logical & metaphysical considerations there are other matters of detail. Thus Leibniz seems to give no account of the phenomenon to which we normally give the name duration. This is not an element of successiveness but itself a concrete slab of succession. Again all mention of the phenomenon of simultaneity is left out. Substances are said to co-exist but there is nothing more than that they do not interfere with each other in there actually are many substances.

Before leaving the question of subjectivity of time relations we must look at the special reasons which lead Kant to accept the doctrine, as stated in his notion of a priori intuition. He holds that the content of sense experience contains no succession. We are presented with successiveness neither in the sensations of the outer world, nor ~~with~~ in our immediate awareness of our own inner states. We cannot turn our eyes upon reality & thereby experience ~~it's~~ the time aspect of it. "Time is not an empirical concept deduced from experience" & "we" could not be aware of the co-existence & succession of objects "if the representation of time were not given a priori" It has been held that Kant only means here to assert the logical a priority of infinite time to finite times. This however departs entirely from what Kant himself says. There is no mention at all of the distinction between finite & infinite time. The point at issue is merely the representation of time — the very appearance of time at all.

Now Kant held, as was the fashion of his day, after Locke and Hume, that immediate sense experience is made up of unrelated simple units. But in being aware of objects as co-existing and in succession, we are aware of facts in relation to each other; in this case the relation being temporal. Then

these must have been added to the facts from somewhere. Kant explains that what we have done is to interpret the sensations in the light of a subjectively given representation. He is in fact arguing for the psychological a priority of time, that time is in some fashion an innate idea. Time is one of the "subjective conditions of sensibility" & these latter are "ready in our hands" and "necessarily preceding as the form of the subject's receptivity of all intuitions of objects." The key note of the argument is the assumption that the given is simply indivisible separate granules.

A second argument proceeds as follows:- Only if we regard time relations as subjective forms of apprehension are synthetic a priori judgements possible. Only if time has this nature can we understand the apodictic certainty of the two propositions (1) time has only one dimension & (2) different times are not simultaneous but successive. This argument ~~is~~ is developed in the later Critique as the "Transcendental Exposition." In it's later form in Kant's second edition of his work, it states that only in virtue of the fact that time is a subjective condition of sensibility, do the synthetic necessary propositions of mechanics, the science of motion, hold good. In neither form however is the argument valid. It is difficult to see why the fact that time has the peculiar nature stated in the two propositions above, should render time a subjective mental character. Neither these two laws nor the laws of mechanics have any more ~~certainty~~ necessity than belongs always to what is actual ~~or~~ whether that be mental or non-mental. Even if time were a form of mental apprehension no difference as to inherent necessity would be made. It would simply have the character of time, & things perceived would in exactly the same way obey the laws of mechanics. All that involved time content however would be a determination, but only factual, of the mind.

Two more arguments are directed by Kant to the proving that time is a subjective form of apprehension. Only on this hypothesis, he says, can we explain the psychological fact of the inability to imagine time as having gaps. But surely a more reasonable explanation is that our powers of imagination are limited by the objective order of nature - or at any rate are not wholly independent of this. We cannot imagine a hill, other wise than with a valley, or a black & white surface otherwise than as not having it's colours intermingling. Then is it going to be argued that hills and valleys are in the mind & the black & white surfaces are mental characters?

The final further reasons are given for supposing time to be

Ibid. p. 24. (1)

* The point is not that time, like Leibniz's God, logically determines its own existence. (2)

a subjective condition of the mind. "We cannot take away time from phenomena in general though we can well take phenomena out of time." The argument seems to assert that, as a matter of fact, we can think without thinking of sense objects ie. phenomena, but we cannot think without having time in mind. If we think of objects at all we must think of them in temporal relations. On the other hand we can think time without objects ie. we can represent an empty time. If it does not contain phenomena it must be empty because, on the principles of Kant, we can think no other objects than phenomena. The argument is not that time is objectively necessary because the non-temporal is inconceivable. Anyway Kant himself admits the possibility of other beings who are not endowed with our forms of apprehension, ie the point is not that time is logically* necessary. The argument is then, that because we cannot think except in terms of time, but can think without representing phenomena, then time is a subjective character. But, even if it be true that we do represent empty time, but never timeless objects, the inferred conclusion would not follow unless no other hypothesis were possible. Is it not possible that time characterizes all phenomena, but, as a purely objective feature, is not restricted to them. This would account for the alleged fact.

Last of all Kant makes the following point. Time is an apriori intuition because in the representation of it, the whole precedes the parts, but in facts presented to the senses the parts precede the whole. The question is as to whether it is logical or psychological priority that is referred to. Now there are facts presented in sense experience, eg. a pattern or a picture or a chord of music, in which the whole is logically prior to the parts. This character therefore will necessitate no differentiation of time from the other contents of sense experience. The argument might have plausibility if it were true that psychologically, times are abstractions from time first represented in its totality. But this is not true - our notion of time as a whole is built up bit by bit from our perception of parts of time.

The conclusion so far then, is that neither Hegel nor Kant have established the subjectivity of the time feature of reality. There have been no valid grounds furnished for rejecting the notion that time is an objective predicament in which distinct entities are held together by relations which operate between them. We turn now, however, to the more recent criticism of this alleged predicament, at the hands of Bradley. He says that if the assumptions involved be taken really seriously they give rise to a mass of

self contradictions. We turn then to follow his argument in detail. Terms apart from relations are impossible and relations apart from terms are impossible & yet equally so is the predicament of terms in relation. In effect we are presented with an antinomy. We get :-

Thesis — Terms and relations are impossible apart from each other :- (1) Terms in isolation are never presented in experience. The so called isolated term is a content which is always accompanied with an act of mind we call abstraction. All experienced contents are related in some way so ~~how~~ it is to be proved that they are independent of their relations.

(2) Anyway a plurality of terms presupposes relatedness of terms. We cannot have many terms unless the individual terms are diverse. Now we cannot predicate diversity of any of the terms. If we do that, the term must include both itself and that which is other than itself i.e. it will at least be a multiplicity of aspects. Then the primary plurality will presuppose some term which includes the diversity involved. As such this term is a secondary plurality and therefore will presuppose a further term as bearer of the diversity again involved. This term again will be a plurality and again a new term will be involved to contain the ~~the~~ required diversity. We shall never find a term which can stand alone. There is an infinite regress amounting to the denial of a subject for the predication of diversity. Therefore diversity must be a relation external to the terms. Terms apart from relatedness are impossible.

(3) A relation without terms is impossible. This seems to be asserted by Bradley as a self evident truth. He personally cannot conceive a mere relation & when others say they can then "discovering with my own ears no trace of harmony I am forced to conclude to a partial deafness in others." A relation without terms then is self contradictory.

Before passing to outline the antithesis let us attempt to find the value of these arguments. Now the first one asserts that all experienced contents are related. The point must be granted, for what do we mean by "experienced" if not in the relation which we call "cognition" to the mind. But it does not prove that there are not unrelated & unexperienced objects. It may be impossible to prove this. Anyway until it is done there is no proof of the ~~general~~ universal law "any individual content whatever is related". It has been maintained that though we never experience the unrelated yet we are presented with contents

which appear as independant of their relatedness. Now if a content is independant of a relation it can exist apart from that relation. To prove however that a term can exist apart from all relations it will be necessary to prove that it is independent of all its relations.

Now Bradley argues that where contents are related, the relations arise out of the intrinsic nature of these contents. If their natures were not involved then the relations would not be true of just these contents. Then since the relation issues from the very nature of the terms, we cannot have these terms unless they give rise to the relation. Where the relation is not, the terms cannot be; otherwise the relation would have been present too.

The reply will be that though the relation may be true of just (A) + (B), yet both may be independant of it. Red may be to the left and in front of white, and then my stroke may put him to the rear and right. But he is still red although he is not to the front and left. Well then let us consider: whatever else independance may mean it is taken to involve in this case that (A) can exist apart from a given relation to (B). Now either the part is real or unreal. If (A)'s relation to (B) is annihilated, then that part state of (A) which bore the relation is also gone. Then the present state is not that (A) but distinct from it that something distinct from (A) should exist without (A)'s particular mode of relatedness does not prove that (A) itself could exist under these conditions. If however the past is real, and (A) has preserved it's identity throughout, then it is included in (A)'s nature to be related to (B) in the given specific way. (A) is such that it is related to (B) and so long as it preserves its identity will remain in this relation.

This argument is not expounded by Bradley but is in the spirit of his discussion. It does not however prove that all entities ~~contents~~ whatsoever are dependant upon relations, but that such entities as are related are not independant of the relations which characterise them. Bradleys first + second arguments together seem to give rise to a reductio ad absurdum of the proposition that there are unrelated entities. From these two arguments it follows that if there be an unrelated ~~content~~ entity it is the only reality and is unknown. This involves the self contradiction that we know nothing. This proposition is self contradictory because it claims itself to be a piece of knowledge. Again this is not an aspect which is developed by Bradley. If however it be correct we can assert that there are no unrelated terms + further, on

the basis of the argument of the previous paragraph, we can assert that no terms are independent of their relations. Then we must admit that there can be no terms apart from relations and no relations apart from terms.

We resume Bradley's argument, then, by taking up and expounding his antithesis

Antithesis – The predicament of terms in relation is equally impossible.

(1) Consider the aspect of the question arising out of the intrinsic nature of terms which are alleged to be in relation. On the one hand they presuppose the relations and on the other they are presupposed by the relations. They contain therefore a plurality of aspects. Any term which is in a relation contains an aspect which is a basis of its entering into the relation + an aspect which is a result of ~~the~~ being related. (X) is coloured; this is the basis of its comparison with (Y). But as a result of this comparison it is different from (Y). The primary relational predicament presupposes each of the terms which enter into it. But each of the terms is a plurality + therefore another relational predicament. This again will presuppose its terms, each of which will be a third relational predicament. There is a vicious infinite regress. The primary predicament presupposes terms + the regress is tantamount to denying that there are any.

(2) Consider the aspect of the problem which is constituted by the relatedness. How shall we conceive this in succession. Either it is internal to the terms or it is external to them. If it is a predicate of one only it does not connect them. If of each respectively the same is the case. Then can it be common to both. If so either each contains also a part which is not common or it does not. If the latter be the case they are not different and so cannot be the basis of relationship at all. If the former be the case then each ~~aspect~~ splits up into a plurality of aspects viz that which is common to both + that which is not common – thus is generated another infinite regress. If however the relation be external to the terms it cannot be said to relate them. If it be really outside them, it is absolutely distinct from them and it has nothing whatever to do with them. It is therefore a relation without terms. If this is to be avoided another relation must be provided to relate it to each of the terms. But the same ~~old~~ difficulty of externality will arise again and there will be again generated an infinite regress. The first relation will presuppose a relation at either end to ~~relate~~ relate it to the terms. These subsidiary relations will presuppose other relations and so on ad infinitum: the regress is tantamount to a

denial of connectedness.

We turn now to consider the implications of Bradley's antithesis. The first of the two arguments presupposes that terms that are in relation are not independent of their relations. This was shown in our development of the arguments of Bradley's thesis. It might however be asserted that the distinction between the term as basis and the term as result of relation is unfounded. It will be maintained that the real predicament is that (A) + (B) as such are distinct, each has its own nature: yet there is the relation connecting them. The opinion otherwise is the result of the attempt to place the relation in the terms under the form of a predicate of relatedness. Consider the example given. (X) does not contain two predicates viz colour + difference from (Y). The case is that (X) + (Y) are both coloured. The difference is the fact that they are not isolated but connected. Besides this they are compared, but comparison is a mental process which, though it does not produce the relation of difference yet is involved in the discovering of this.

There seem to be two objections to this line of argument. In the first place the arguments for the thesis cannot be simply ignored It may be answered that presupposition does not express the transaction as between relations + terms or terms + relations. Rather they must be regarded as interdependant. Then we must in turn ask how we are to think of this interdependance. As the latter part of the second argument for the antithesis shews, we can regard it neither as ~~one~~ internal nor ~~one~~ as external to the respective entities which it characterises. Now for the second objection. This criticism of Bradley's notion of mutual presupposition as between terms and relations, contains the implication that a relation is outside its terms. There are the distinct terms and then there is that which is other than them because between them and relating them. This is the conception of relation which gives rise to the last infinite regress expounded in the second argument for the antithesis.

Bradley in his proof his antinomy as a criticism of the notion of distinctness or separation. This has to be regarded as an appearance, the real itself being a unity ab initio. His position is the complete antithesis of that of Leibniz — it is unity which is objective + distinctness which is the subjective illusion. For his conception of unity and reality he goes to the absolutist tradition. Reality is a differentiated totality — contents overlap and interpenetrate. This is their fundamental nature so that the function of relating simply is not needed. To speak of contents is false, if by the use

of the plural form we mean to imply that the elements exist in separation from each other. Each only is in its other. The appearance of distinctness is due to our abstracting differentiated moments from their content.

This standpoint however, as was argued in a previous section, implies the impossibility of partial knowledge, for this is simply an abstraction from the whole. According to absolutism everything enters into the nature of each thing. Thus an abstracted content is one which has lost its nature - a shere nothing. In so far as it has any positive nature everything will enter into it and therefore it is not abstracted. Then we can only know anything at all in so far as we know everything. Yet even the absolutists have to admit the absurdity of this. We are up against that which, in the earlier section where this was discussed in greater detail, we averred to be the central stumbling block of absolutism, the problem of error.

Now we are in this essay concerned specifically with the nature of time. Our problem here is the articulation of time unity so as to escape Bradley's strictures & the difficulty of absolutism, & yet without doing outrage to our immediate experience.

Consider then the colours as they are presented in the spectrum. Or, alternatively, a surface which present a smooth even shading of greys from black to white. Within such a space span no ends are visible at which the presented whole is divided into parts. It is presented as a whole, as a unity. But this does not mean that it is absolutely homogeneous; on the contrary it appears to be radically differentiated. The first half inch can be distinguished as different from the last half inch. It is not correct to describe the differentiation as intermingling & overlapping. We can consider the first half inch without reference to the last half inch. They do not overlap. In making this selection we do not falsify the part which we consider alone. It is itself a continuous piece, retaining its internal differentiation just as when we consider it in its environment. We do not, in selecting, deny its continuity with the rest, we simply ignore it, but in so doing do not falsify that of which we take account. Like Bradley we assert unity ab initio & therefore escape all the contradictions arising out of the notions of distinctness and relatedness: but we also deny the overlapping of the differentiated elements & therefore do not rule out the possibility of abstracting

Perhaps it will be argued that if we can isolate parts

the whole itself must have parts. But to think a thing after a certain fashion does not imply that the thing really is as I thought it to be. We must draw the distinction between discovery & fabrication in cognition. If we make parts in the continuum rather than discover them it will not contain them in itself. The continuum itself contains no visible ends, no separate parts. Our fabrication may be of different degrees varying from ignoring to positive misapprehending. When we choose to attend to the first half of the spectrum only, and neglect the rest any separation that occurs is not in the continuum itself but is only the reflection upon it of our apprehending. The half we apprehend is itself continuous with the rest but we have restricted our vision, our outlook. But we have not falsified what we have apprehended. On the other hand we may consider the spectrum as divided into a certain number of parts, say the blue, the orange and the red. We may find it convenient to do so at first, merely for the sake of some practical business in referring to it. But is the spectrum itself divided into mutually ~~different~~ exclusive parts with ends? All this is supplied by our imagination — we have placed ~~out~~ ideal cuts across it. It is we who have cut out & fenced in certain areas. In so far as we assert the spectrum to be divided into three we are in error. But our apprehension is not mistaken ~~through~~ through and through. We may yet see the internal nature of our ~~fence~~ artificially fenced off areas as it really is. We often take up an attitude which is mid-way between ignoring & downright error. Even if we do place ideal brackets round certain parts of the continuum we cannot, in spite of ourselves, forget the original continuity, so we supply a plus sign between the brackets. This sign we call a relation.

But we shall be pressed further. You do however admit parts — then is there not discreteness. We must reply that we are subject to the exigencies of language. We say there are parts but that the parts are continuous, they are given together as units, as a differentiated unity as opposed to a homogeneous unity. We are not asserting the ~~unit~~ identity of me-ness and manyness. These are the verbal formulae we find ready at our disposal, to express such a phenomenon as the colours in the spectrum or a surface bearing a smooth and even shading from black towards white. This phenomenon is altogether different from a set of labels of colour discretely disposed about a surface, or placed end to end. The former we desire to refer to as a continuous plurality. There is no need to strain at the name if we

exhibit the phenomenon. Of course Hume held that where there is difference there is distinctness and separation. But is this anything more than a dogma? The burden of the present argument is to point out that differentiation is possible without separation. A phenomenon is presented which we claim to be thus characterised. Then the principle that differentiation implies separation will be a pure prejudice. Hume had been reared in the scientific atmosphere of his day – how far was he a child of this?

More serious is the empirical objection based upon psychological experiment in which it is asserted that the spectrum is really a series of small self-coloured patches, between any consecutive pair of which there is a minimal difference. If each is undifferentiated & if any two are radically different they must be mutually exclusive. There can be no intermediate shading off of the one into the other for the difference that separates them is minimal. Then the spectrum, in final analysis, is not a unity but a set, a multiplicity, of mutually exclusive parts.

However it is the case that the phenomenon appears as a differentiated colour unity & not as a plurality of different colours. The question is as to whether the experiments in question have proved that this apparent unity is ~~not~~ really a multiplicity, or rather that below a certain point we ourselves fail to discriminate differences. May it not be that a being of higher powers of perception would appreciate differentiation in what, for us, are ultimate colour granules. The use of the microscope reveals such differentiation. And it can be shown that there is differentiation below the ~~for~~ limit of our powers of discrimination. If our shades (a), (b), (c) & (d) can be arranged so that no two consecutive ones are distinguishable, but such that (a) is distinguishable from (c) & (b) from (d). Now if (b) is distinguishable from (d) & (c) is not then (b) is different from (c). Similarly (d) is different from (c) & (a) from (b). Here are indistinguishable differences. Can we not argue from the appearance of the whole in this phenomenon which we call a differentiated continuum that parts which appear as undifferentiated are not really so? Then the apparently minimal differences will really stand for the limitedness in a certain direction of our powers of perception. There will be no ultimate homogeneous blobs & what we have called the relation of a minimal difference separating shades will really be a continuous shading of one colour into another.

This is an attempt to expound a current notion of the continuum through the medium of colour experience. The

"spectrum is a colour continuum i.e. a differentiated unity of colour. A self coloured patch is not a colour continuum because it is not differentiated. It will however be spread out in space and time. This notion of the continuum has been used by various recent writers as a basis for the interpretation of time experience. William James seems to have led the way with his doctrine that time relations are of the same stuff as the events themselves. Lately the line of thought appears in the constructions of Alexander & Whitehead. Time is held in presented under the form of a differentiated unity. The differentiation is not that of colour or of sound but just such as constitutes the specific nature of time.

It has already been pointed out in a previous section how James argued, in his Principles of Psychology, that the perceived datum of time is not an instantaneous atom, not a knife edge, but a span of fact differentiated into after & before. We do not feel one end in isolation & then the other, as separate from it & after passing through a kind of vacuum. It is only within the unity of the specious present, the perceived time span, that we appreciate this differentiation on the basis of after and before. The datum of time experience is presented under the form of differentiated unity. Events are not isolated contents linked together by a fine chain of relations, made of some kind of ethereal stuff. They are differentiations within one fact of existence & time is one order & mode of differentiation. What we call time relations are, James held, made of the same stuff as the events. They are the temporal differentiation of other contents. We may concentrate attention on some points of the presented field, but these are not, in themselves, separated from their environment. They are made temporally continuous by the successiveness inherent in less distinctly apprehended contents, & by the subtle but ever present movable inner experience of organic sensations, feeling tones and emotions. The presentation of an object as past, in memory, does not change the object intrinsically. It is the same object as was hitherto perceived. Nor is memory the revelation of an empty relation. The truth seems to be that at first we are only vaguely conscious of the pastness, but our knowledge grows as we are able to make it continuous with the present, by building in an intervening continuum of contents, all themselves intrinsically spread out in time.

Succession then, is to be regarded as the fact of continuous temporal differentiation. But this is not all. The differences are ordered: this we normally express by such terms as that time

※ We may here note how the continuum theory is a supersession of the relational theory. It was seen that the latter could be so rendered as to represent some features of our time experience. But the discussion of the notion of relation showed that some amplification was necessary. As was remarked above, the relational theory is rather of the nature of a symbolic conception than an articulation of the real nature of time. It is the product of the reflection of our own mental process. It consists in the expression of time through the medium of our subjective process of apprehending which consists in selecting & piecing together. Thus the relational theory is a case of attempting to express the continuum through the medium of brackets & plus signs.

is "continually going on" & that it is irreversible." The same feature is expressed by Russell in ~~enforcedly~~ his doctrine that the time relations of "being before" & "being after", in the series of instants, are mutually exclusive & are transitive asymmetrical relations. Time order has two aspects or senses viz those of preceding and succeeding, expressed by saying that concrete succession involves both the relation of "being before" & that of "being after." The one has the reverse sense of the other. Time does not appear to be the only different kind fact which possesses intrinsic order — the same phenomenon arises in the case mentioned above of the passage of black to white through a smooth even shading down of grey. The two senses here are expressed by the terms lighter & darker. It has been maintained however, by Alexander, that all order has its root in the nature of time. We do not propose to discuss this. The point at issue is that the time continuum is ordered – it presents this special feature in its differentiation.※

Any time span which we separate out from the whole is characterised by a specific property which we call magnitude. This is given as one aspect of the time span. Russell differentiated magnitudes from all other properties by the fact that they alone ~~have~~ are the terms of the relations of "greater than" & "less than". Whitehead analyses these relations into the fact that if any one be taken as a standard all the others can be expressed as functions of it by some real number (x) is two feet in length or a yard is three feet. But is not this a failure to distinguish between magnitude and the measurement of it. If however Bradley's criticism of relation be valid we shall have to reformulate the definition of magnitudes. Why not reverse the procedure & define the so called relations of greater than & less than in terms of the given specific property magnitude? The terms greater than & less than will then be alternative modes of expressing that mode of differentiation which is specific to the property we call magnitude. We shall have to admit that this form of differentiation is ordered. & quality will then stand for the predicament in which a given magnitude is repeated in many instances.

Another of our problems is that of how, on the basis of the continuum theory, we shall attempt to account for the scientific procedure of expressing time characters through the medium of number formulae. We cannot now correlate mutually separate numbers with distinct instants or event particles. We shall return to this question in the next section & discuss there the recent suggestions of Whitehead.

Finally consider this: time does not appear to be the whole of reality. There seem to be besides it features which are different from it in nature i.e. non-temporal features in reality. The old idea was that space is a system not only different from time but quite separate and independent of it. Again the so called empirical qualities, colours, sounds, smells etc., appear to be something more than successiveness. In the theory of instants they were regarded as being outside time but as related to it by the relation of "being at". The truth seems to be that though time is a distinguishable aspect of reality it is not separate from the other aspects. This has already been expressed in this essay by saying that both space and empirical qualities are spread out in time. The shape of an empirical substance endures while its colour contains temporal differentiation — it begins and it ends.

The combination of time with the non temporal gives rise to simultaneity, qualified succession, temporal overlapping + velocity. Just as space + empirical qualities are spread out in time so time is spread out over space and empirical qualities. A given time block is differentiated spatially and qualitatively. An empirical substance is at least (whether it be anything more or not) a selection from this space-time-quality fact. The question arises as to whether all or only some time is spread out in space. Traditionally the mind has been regarded as most emphatically non-spatial: this point will arise again below. Any way so far as time character is concerned, three conditions can arise amongst different aspects selected from the total space-time-quality fact. First such aspects may possess totally different time characters. They are then successive aspects. They may however have a common time character i.e. they may be aspects of the spatial or qualitative spread of a single time span. In this case they are simultaneous. Lastly they may possess a common time character but one or more of them possess also a time character which is not common to all. There is then overlapping as to duration. Rate and velocity are also complex predicaments arising out of this spreading out of time in the non-temporal and of this latter in time. A given velocity is a transaction which involves a given magnitude of time and a given magnitude of space. We say the express moves at sixty miles an hour. Rate involves a magnitude of time + a number of non-temporal factoring phases in a process of change. Both rate + velocity are more complex predicaments than time but time enters into them.

This fact of the combination of time with the non-temporal raises

two further questions. The one is as old as philosophy whereas the other has only come to prominence with the scientific developments of the last few years. The first is the question as to whether there are objects which are not even spread out in time ie timeless objects. This question does not seem to come within the scope of this essay. In so far as the assertion is made that no objects are spread out in time we are up against a quite different proposition to one which we have already attempted to discuss. The second question is as to the precise meaning and implications of the term "Spreading out" ie what are the conditions of the existence of time, space & the features we have called empirical qualities.

In the hands of Prof. Alexander this problem has given rise to a peculiar doctrine of the nature and conditions of time continuity. This we now propose to examine. In the end the very continuity of time is made to depend upon the unity of time and space within the continuum of fact. This given fact Alexander starts from, viz. that time & space as presented are not separate realities but aspects of one continuum of fact. Consider the percept which we call the path of a shooting star. It is a unity and yet is differentiated for it contains both dates and localities. It's extreme left actually possesses the ~~fact~~ intrinsic property of being earlier than it's extreme right. Just in the same way it's successive ~~positions~~ possesses the property of being to the left of it's decrease. Yet the movement is a unity. Space exists in time and time is spread out in space. The space of the path is just as much temporal as are the light qualities of the path. In the same way it's time is spatial. This unity characterises space and time universally says Alexander. We experience ourselves in the midst of a continuum of change in which space is shot through with time & time extended in space. The shape of a body endures as much as does it's colour. On the other hand it's duration has a shape just in the same way as it's colour has. The positions which it occupies are dated - they exist as place-dates ie as differentiations within that selection of the general continuum of fact which constitutes the thing's existence.

Alexander proposes the hypothesis that all change is motion. The continuum of fact is at bottom a mass of motion. In a way this conception appears to be a general notion of the principle of the kaleidoscope. Here the changes of colour pattern which one sees, are effected by the continual movement of pieces of glass. The changing colour scheme is really a complex pattern of movement. So reality is the kaleidoscope. To it Alexander gives the name Space-Time, signifying that it is the unity of the two aspects

space & time which hitherto in philosophy have tended to be regarded as separate. For Alexander the path of the shooting star considered above is the universal type of reality. It is the unresolvable fact from which we start & from which all that is experienced springs. Space & time do not become united in motion — they are united ab initio, so that motion is a more fundamental reality than either.

Motion is essentially unity of difference or differentiated unity. This is expressed by Alexander through the medium of the notion of point-instants. The earlier-right in the movement occurs as an element in a passage from earlier-right to later-left. The notion of point instants stands for this differentiated unity. The point instants are not motions but elements of motion i.e. they express the intrinsic nature of motion as such. They are distinguishable, for they are differentiations; but they are not separate, for they only occur within a unity. They are not infinite essentials, but infinities of division in the sense that, no matter how small a piece of motion we take, it will be found to contain point-instants in it will be a continuum, a differentiated unity.

The unity of all point instants, i.e. the systematic nature of space-time, depends upon a feature which Alexander calls intrinsic repetition. This is the fact that in the system of point instants we do not get a given point characterised by one and only one instant, nor vice versa. On the other hand any instant is characterised by many points & any point by many instants. Imagine a series of puffs of smoke travelling in the same direction. A later one will occupy the same position as an earlier one at a later date. Thus the position i.e. the space feature is repeated in time i.e. is characterised by many instants. Similarly any one puff at any moment of its existence in a given volume i.e. that moment is spread out & repeated over a system of space differentiations.

How the function of intrinsic repetition as the mediator of continuity is outlined as follows:- Both the aspects of space-time viz space & time exhibit the features of distinctness & togetherness of parts. They do not possess these features in their own right for it is space-time which is the differentiated unity, the continuum. Space alone is the abstract notion of togetherness while time alone is the abstract notion of distinctness. Neither pure distinctness nor pure togetherness constitute continuity which involves unity amongst distinct parts. We are never concretely presented with mere space or mere time but with space-time. What appears to us in sense perception is not a pure succession but an enduring empirical substance which has shape & bulk. Take for example the human

Alexander - Sense Explanations; Articles in Mind N.S. 120. (1)

body. What do we mean by a concrete part of the body's time is by an instant? We mean a group of contemporary parts disposed in a spatial pattern. Alexander expresses this by saying that the instant is repeated in space & this repetition in space, he tells us, constitutes the instants content and structure. Again what is meant by a substance's duration i.e. by the continuity of it's successive phases? There is no pure duration but only enduring substances. Duration consists in the fact that the spatial structure occurs at many instants. This predicament is the repetition of space in time. But it is not merely time which owes a debt to space - the opposite is the case too. Space and time are nothing without each other just because they are united ab initio. Space itself is bare togetherness - but the space which occurs in concrete presentation is differentiated. This is due to the fact that it is variously dated - it is broken up by time.

Now within total Space-Time each instant is repeated at every point & each point at every instant. In other words, all space is spread throughout the whole of time & all time throughout the whole of space. But the real is not a series of space-blocks ~~or~~ each at a single but distinct instant nor is it a set of streams of time each flowing through a single but distinct point. In such a predicament the requisite repetition could not occur. As it actually occurs each block of space is variously dated and each stream of time variously localised. The real concrete piece of space-time is a perspective. The notions of total space at an instant and total time in a point are abstractions from the system of real perspectives. The fundamental predicament which is the true nature of space-time is called by Alexander "Intrinsic Repetition." We may not say that points bear to instants some relation which we might express by the term "at." This would make points & instants and relations more fundamental than space-time. But the contrary is the case viz. all forms of relation & space & time arise out of space-time. The point & the instant are abstracts: the concrete fact is the point instant. Alexanders own words on this doctrine are as follows:- "I say (1) that an instant could not be part of a duration if there were no element with it which is non-successive, (2) that this is not enough. In order that a point should endure it must occur at many instants and in order that ~~one~~ instants should be successive each must occupy many points." And again, "Intrinsically contemporary points are for me the points - - - - - - which are occupied by one instant and give the instant it's structure"

* of course if the discussion of Bradley be valid the features expressed by the terms asymmetrical & transitive will be features of the differentiation of reality but cannot ultimately be articulated through the concept of relation.

We may think that empirical qualities enter into the nature of an empirical substance besides spatial and temporal determinations. For Alexander however such qualities, the colours sounds etc of sense perception, all reduce without remainder to space-time itself.

Now the unity and differentiation of space + time occur respectively in specific modes. Succession is irreversible and of uniform direction ie. if (B) is after (A) it cannot also be before (A), and if (B) be after (A) and (C) after (B) then (C) is not before (A) but after (A). This apparently is the same predicament as Russell expressed by saying that succession involves asymmetrical transitive relations of priority and posteriority. On the other hand the form of space is tridimensionality. Alexander goes on to say that neither space nor time in themselves contain the ground of their respective structures as thus outlined. So far as space itself goes the three dimensions are independent. Perhaps this would be illustrated, though Alexander himself does not use this example, in that we usually regard it as a fact, that change of position in one dimension does not involve change of position in another. I seem to be able to move from right to left of a body, without involving any accompanying change of position in so far as it is defined in terms of above or below, and in front or behind. Similarly he holds that there is no ground within succession itself for its irreversibility and uniformity of direction. In itself it need neither be the one nor the other, yet might equally be qualified by the one without the other.

Anyway, even in spite of the authority of Alexander, the statement about time seems scarcely as plausible as that in respect of space. It is true that an ~~asym~~ asymmetrical* relation need neither be transitive nor yet enter into the predicament we call succession. Such a one is that of father to son. Nor need a transitive relation be either an element of succession or possess the character of being ~~asymmet~~ asymmetrical. Equality is a case in point. Thus being asymmetrical involves neither successiveness nor transitiveness. The latter in it's turn involves neither of the former. But can we conceive successiveness apart from the other two. It seems meaningless to speak of succession which involves neither transitiveness nor the property of being asymmetrical. Alexander's notion of pendulatory movement of time seems to derive any meaning it may have from spatial metaphor. He makes use of a line and points on it to represent the relations of each other of successive temporal phases. What he says really amounts to something

like this.' If we represent before by 'spatially to the left' and after by 'spatially to the right', then if time were peculiar in its occurrence, and (A) were before (B) and (B) before (C), yet (C) might be represented even on the left of (A). But this diagramatic representation does not exhibit to us ~~[illegible]~~ peculiarity of time.

Alexander however claims to be able to exhibit the interdependence of the tridimensionality of space with the irreversible uniform order of time. In this connection four arguments are propounded. The first sets out from the given irreversibility of time. It is assumed that irreversible time spread out in one dimension only, must take the form of motion in a straight line. In such a predicament it is obvious that time cannot be repeated in space, so the conclusion is drawn that more than one space dimension is necessary, but that the assumption of a second dimension is sufficient to guarantee the possibility of repetition of irreversible time in space. This property of irreversibility involves therefore a second dimension.

The crux of this argument is the assumption that irreversible time spread out in one dimensional space must constitute motion in a straight line. One critic of the argument suggested that if time be many motion repetition can be secured without a second dimension. Thus let there be successive puffs of smoke. One might reach a given point at a certain time while a successive one (a perhaps one in the opposite direction or one of different velocity?) might reach another point at the same time. Alexander replies that this example presupposes three dimensional space and objects. Now this is undoubtedly the case, but surely it is only in the concrete setting of the illustration. The principle involved – does this presuppose three-dimensional space? Alexander claims however that he is later able to show that such a predicament as the one described would only be possible in so far as the different motions constituted what he calls different perspectives. We should then have different motions with a common space character, but this will only be possible in so far as they have different centers of reference ie constitute different perspectives. This ~~suggestion~~ resolves itself into the question as to whether time can be in-dimensional perspectives. Now in any perspective time is irreversible. Moreover each perspective is a concrete portion of time and therefore contains intrinsic repetition. But repetition of time in space is impossible in a one dimensional perspective if time be irreversible. This is a new demand: repetition is not enough but we need repetition in each perspective. This mode of meeting the objection can only be fully assessed at a later stage, when the notion of perspectives has been developed within the theory. The assumption that irrever-

erable time spread out in one dimension takes the form of motion in a straight line proceeds from the general hypothesis that the real is motion. Any perspective as a concrete part of time must be made up of motion.

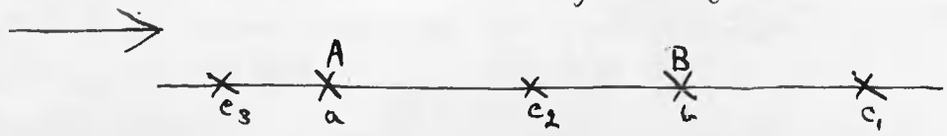
The second argument purports to show how that the fact of two dimensions to space involves irreversibility of time. Let there be a point (a) occurring at the instant (A). Now (a) must be repeated at, say (A,). Then two point instants are involved viz (A a) + (A, a). There must be distinct. Their spatial aspect is not the basis of their distinctness. Then it must be their temporal aspect. Now let there be another point instant (B b) such that (A a) is before (B b). Then (A, a) will either be ~~before~~ before (B b) or after it. Alexander argues that if we assume irreversibility of time then it follows that, (1) if (A, a) is before (B b) it is distinct from (A a) + (2) if (A, a) is after (B b) it is not also before (B b), and therefore again is distinct from (A a).

Now neither of the parts of this conclusion seems to be warranted. In the first place, the two facts (α) that time is irreversible + (β) that (A, a) + (A a) are both before (B b) do not rule out the possibility that (A, a) and (A a) are identical. In so far as these two bare statements go the conclusion in question seem quite inconsequent. Again if the fourth argument be valid, transitiveness also will be necessary to guarantee even the second part of the conclusion. Otherwise time might reverse the direction of its flow, so that though (A, a) is irreversibly after (B b) it may yet co-incide with (A a) which is irreversibly before (B b). Unless however, the fact that it is only a second dimension which is at issue, somehow renders the two parts of the conclusion relevant. The argument then will be "granted a space of two dimensions only, and irreversibility of time, then the two parts of the conclusion follow and so repetition of time is guaranteed." But it is difficult to see the intrinsic connection of the elements of such an argument. ~~The assertion is~~ Indeed it seems a perfectly arbitrary collection of terms.

The purport of the third argument is to show that transitiveness of time involves a third dimension. The starting point is the given fact of time transitiveness. Alexander then asserts that ~~though~~ though bi-dimensionality makes possible irreversibility of time, this latter is compatible with a pendulum movement of time-process. He claims that this motion connotes a real possibility, and is more than a mere spatial allegory. Then something more than bi-dimensionality is involved as a basis of transitiveness. A third dimension is sufficient to guarantee this character of time. The argument closes with the following statement — "If or if the

Alexander - Space, Time & Deity vol. I, p. 55.

relation of (A), (B) and (C) is transitive, we must represent the priority of the instant B to the instant C in the new dimension by the same spatial convention as we represent priority on the line (a b), that is (C) occupies (c_1) and not (c_2) or (c_3)." This refers to the symbolism of a straight line as representing time flow.



If the instant (A) be prior to (B) and be represented by the position (a) then (C), as posterior to (B) will be represented at (c_1) if time be transitive; for then (C) will be posterior to (A) too. From the nature of Alexander's text at this point, one would be led to suppose that these considerations are given as a reason for supposing that a third dimension of space is enough to guarantee transitiveness. As a matter of fact all we seem to get is information as to how a certain predicament will be expressed, if time be transitive and a certain type of spatial representation be used. But there is provided no explanation of the fact of transitiveness. The connection of transitiveness with tridimensionality seems quite arbitrary.

The last argument of the series claims to exhibit that without transitiveness there can be no third dimension. The sum and substance of what is propounded seems to be the following. Let a point (a) in a third dimension occur at an instant (A) which is before another instant (B). Now (a) must be repeated at (A_1). Then (a A)' & (a A_1) must be different. Space does not provide for this since both have the same space aspect. Then the difference must lie in their time aspect. But if time were intransitive & (B_1) were after (B), then (A) & (A_1) might coincide, because in the excursion from (B) to (A_1) the direction of time flow might have changed. Therefore without transitiveness there can be no third dimension.

The sum & substance of this argument seems to be that without transitiveness of time a point occurring in a third dimension is not guaranteed repetition in time. The reason given is that apart from transitiveness, a repetition occurring after an instant, which itself is after the instant of the original occurrence, might co-incide with the original occurrence. But suppose we have a predicament in which it is alleged that the repetition is in a point instant which, like the original occurrence, is before the instant which in the previous case came between original occurrence and repetition. Is transitiveness relevant to this situation for the securing of distinctness of the two point instants? And is it impossible that in such a situation there be two point instants? If these two questions

Alexander - Space Time + Deity, Vol. I, p. 59. (1)

can be answered in the negative, then we may have repetition apart from transitiveness. Would Alexander assert that in this second situation we only get a ~~guarantee~~ guarantee of repetition in so far as we can find a middle term & assert transitiveness? But surely we realise the difference between t_1 + t_2 without the further predicament that if (t_1) is before (t_a) + (t_a) is before (t_2) then (t_1) is also before (t_2). And anyway, how does the argument establish a special connection between transitiveness and tridimensionality. What is said would apply in the repetition of points under any circumstances, independently of the question of dimensions.

Alexanders own claim as to the achievement of these four arguments is as follows. 'Space and time are indispensable to each other - - - - - - But time, with its distinctive features, corresponds to the three dimensions of space, and in a manner of speech time does, with its one dimensional order, cover and embrace the three dimensions of space and is not merely additional to them.' As a matter of fact, in none of the four arguments do the conclusions claimed seem to be warranted. The first is plausible if the undefended assumption be made that ~~repetit~~ one dimensional space-time must consist of merely motion in a ~~st~~ straight line; ~~but~~ but the other three have conclusions which appear to be quite arbitrary. Alexander himself seems not to be too sure of these arguments, for he warns his readers of their difficulty & seems to ~~extend~~ feel that he is making a rather bold venture in formulating them.

We turn then to another aspect of the doctrine of space-time. The continuum, Alexander holds, is organised into sub-systems which he calls perspectives. This feature of organisation is well exhibited in the predicament of perception. Continuous sense perception is the present outcome of aspects of different perspectives. An empirical object is a meeting point of many perspectives. Consider the percipient as located in a given point-instant. What is perceived is the perspective associated with that point instant - of course only part of the perspective. The particularity however only marks limitedness of powers of perception. The act of perception here and now is the awareness of a distant star which is a million years old. The date of the star is a million years prior to the date of the act of perception. At the same time I may hear a clap of thunder which is only a few seconds prior to the act of perceiving. These facts involve a concrete portion of space-time in which time is variously localised, & space variously dated. The portions of

the star and the thunder have different respective dates. In like manner these dates have different respective positions. Each of the two events is connected with the act of perceiving by a line of advance which, empirically is a succession of physical & physiological events viz the total process resulting in the stimulation of the act of perceiving.

In general, a perspective is a set of point-instants so organized as to constitute a set of motions which all intersect at a common point-instant. This latter is the center of reference – in the concrete example just given it will be the point-instant of the act of perceiving. The intersecting motions are called lines of advance; in the example they are the physico-chemical processes issuing from the perceived event, & resulting in the stimulation of the act of perceiving. Each perspective contains all space and all time but not all point instants. These latter cannot occur in different perspectives but space and time can. Perspectives differ in that amongst them points occur at different dates & times at different positions. They involve, says Alexander, a reshuffling of points and instants. Let (A) & (B) be two perspectives. If the point (s_1) occurs at the date (t_1) in (A), then (s_1) will have a different date in (B) and (t_1) a different position. If (s_1) & (s_2) are successive in (A), then in (B) they may be simultaneous, or the time distance between them be less, or they may have their time order completely reversed. Two positions on my hand which in one perspective were the seat of two simultaneous specks of mud, may in another perspective be the seat of two successive pains. The two positions, as intrinsic to the respective concrete events which are characterized by time, have changed their time order. A qualitative event which occurs in one perspective does not change its date ~~and~~ it's ~~perspective~~ place in that perspective but if it occurs in another it must change either it's date or it's place.

This aspect of the theory provides, so Alexander maintains, a philosophic basis for the physical theory of relativity. According to this theory time lapses and distances between events must be regarded as dependant upon centers of reference. Change the center of reference and both time & space interval between events will change. The two events remain identical, but in some way they must be regarded as having associated with them, relative to different centers of reference, different space and time intervals between them. Alexander claims that on his theory of perspectives this is just what would be expected to take place. Now what Alexander has urged,

Ibid. p. 80. (1)

~~in~~ so far ~~as~~ his theory of perspectives, is that if a qualified event, (a colour, sound etc) occurs in more than one perspective it must change either its date or its position in different perspectives. Now to meet the demands of relativity it must be necessary for it to change both date and position. Thus Alexander has not shown to be involved in his theory. The principle of non repetition of point-instants requires only the either-or formula. The both-and formula is not necessary. But suppose we do get in two perspectives qualified events which have different space and time determinations. ~~Two such events~~ The events involved will, in so far as they are in different perspectives, occupy different point instants. In Alexanders terminology they will be said to "emerge" from these point instants. In so far as they emerge from their space-time predicament they are to be thought of as reducible to it without remainder. Since then the point-instants in their respective perspectives are distinct, the concrete qualified events which emerge from them cannot be identical. But the feature of the relativity theory is that an event may have different space and time determinations + remain identical throughout.

At this point however we return to the enquiry of the notion of perspectives. There are two kinds of perspectives viz space perspectives and ~~time~~ time perspectives. The former is the perspective from a point-instant in respect of it's point. The latter is the perspective from a point instant in respect of it's date. The two are intrinsically different in that the space perspective gives us a picture of time, and the time perspective a picture of space. This seems to mean that in the perspective from the instant of a point-instant no position is repeated but each occurs only once, though times may be repeated. In perspectives from the point of a point instant, each time will occur only once but each point will be repeated. Thus we read, "when we are considering all the perspectives, from every instant, any point of space is occupied, not as in the single time perspective by some one moment of time" and again, further down on the same page "consider the totality of point perspectives - - - - - - - - - - In ~~each~~ a single such perspective one instant is localised in only one position in space" Thus a point perspective will ~~be~~ be a set of groups of co-punctual point-instants, + an instant perspective a set of groups of contemporaneous point instants. Of a time perspective we are actually told that it contains a centre of reference, point-instants which are intrinsically contemporaneous with this, others which are before it and others which are after it. Within the perspective the

the point instants are arranged into groups of isochrones or equi-temporals. These are intrinsic contemporaries.

The two perspectives from a given center of reference cannot be embodied in or combined into a single perspective from the point instant as a whole. Alexander says that if this were done we should get, not a perspective but the whole of space-time. He himself does not further elucidate this statement. Presumably the reasoning implied in it will proceed somewhat as follows:- Perspectives are intrinsic limitations of space-time + not mere arbitrary selections. Hence a ~~space-time~~ perspective must embody within itself a principle of limitation of repetition of space + time i.e. of point-instants. Were this not the case it would either be an arbitrary selection or would contain the whole of space-time. The division of perspectives into space perspectives and time perspectives provides such a principle of limitation within a given perspective. Apart from this distinction perspectives either disappear or become arbitrary selections from space-time.

Now it has already been pointed out that, in a perspective from the point of a point instant, a given instant will occur only at one point. But this instant will occur in all point perspectives and in each it will have a different point. Otherwise the point-instant would be repeated. Thus in the totality of point perspectives each instant occupies every position in space. In the same way, in the totality of instant perspectives, each point occurs at every instant of time. If from the totality of point-perspectives we select all point-instants which are characterised by a given instant, we have a group which consists of all space at a given instant. By a similar process of abstraction from all instant perspectives, of all point-instants qualified by a given point, we get the abstraction of all time streaming through one point. These selections Alexander calls sections. They are not intrinsic parts of space-time but arbitrary abstractions. They are groups constructed by tearing point-instants from the settings in which they actually occur. Actually they are in perspectives, but in the grouping as sections they are torn from their relevant environment. They seem to be accredited with the same status with regard to perspectives, as have real beasts as centaurs + gryphons with regard to men and animals. The latter are groupings of qualities which actually occur, but the former are arbitrary constructions involving the abstraction of the qualities from their environment in which they have actually occurred.

Sections constitute the content of our notions of immovable space and of a single uniformly flowing time of Locke's pure

duration. Thus we construct absolute space and absolute time. These, Alexander says, are legitimate abstractions provided we do not posit them as independent realities. They are to be regarded as the two moments in the structure of space-time. We can consider them in abstraction, just as anatomy & physiology abstract respectively the structure and functioning of the concrete organism. Thus the distinction of status, as between perspectives and sections, is that the former are features of the intrinsic organisation of space-time, while the latter are arbitrary selections from the concrete fact.

But perspectives are not separate entities but elements within the structure of space-time as a whole. They are formed up into a unity. Each embodies a pattern of motion within the kaleidoscope of reality. Thus motion is absolute; each point-instant has it's own unique nature and situation within it's perspective and within the total fact of space-time. There is no absolute rest, for since space-time is a single continuous motion, rest at any point would involve destruction of movement throughout. What we empirically know as rest is simply a case of abstraction from some motion. I may regard the bird which circles above me as in motion, but myself as at rest. This is only because I have ignored the motion of the earth & myself with it. Each perspective is a sub-system of motion within the total fact. Time appears as a general property characterising the various perspectives, but actually existing only in it's concrete embodiments in the different perspectives. The traditional view is that there is one time and all times are parts of it. Alexander's view is that time is a universal which is repeated in many instances ie there is a multiplicity of times.

This line of analysis of the nature of space and time results in the assertion of their interdependence. Apart from each other they cannot exist. In their interdependence the serial nature of time, the order embodied in time is bound up with the tri-dimensionality of space. From two points of view these theses seem to come into radical conflict with traditionally accepted doctrines. In the first place, few would admit that the mind has space characters. Most would admit it to be qualified by time characters alone, but some would assert that it is not even in time. Both positions are contradictory of Alexanders account. The first would involve the possibility of the separation of space and time in concrete fact and the second would allow the reality of entities outside the fact of total space time. The ~~see~~ questions raised by the second position are outside the scope of this essay, for we are here concerned only with the nature of time & not at all with the

* In some cases very much earlier of the perception of a star (1)
quoted above from Alexander

nature of the timeless; not even with the question as to whether there actually are timeless entities. Alexander's own reply to both these positions is ~~that~~ an analysis of our experience of our own minds, in which he claims to exhibit that mind has the characters of space-time in general. This analysis must be followed up because it constitutes a test of Alexanders principle of the interdependence of space & time.

Consider the experience of our own minds. We have to remember the distinction, already noted in a previous section, between the two modes of knowledge viz contemplation and enjoyment. The mind enjoys both itself and other minds, in a kind of non-presentative immediate type of awareness. This is enjoyment, the term covering the whole of the mind's direct experience of itself and other minds. Non-mental objects are contemplated in that they are experienced in a presentative type of awareness. The distinction between contemplation and enjoyment is fundamental and immediate.

In the first place then, mind as immediately experienced both contains time & is in time. Essentially it is experienced as a process. This mental transitiveness comes predominantly into our experience in such predicaments as when" we leave off - - - - - - in a sentence with a 'because', when the forward and defeated movement of the mind is made the centre of attention." The states which have been called "substantive" are only the more impressive phases of mental life; but they are not static but transitions which preserve some attractive character throughout. Furthermore, mental process is continuous. We are not always thinking, but memory, Alexander tells us, will bridge the gaps. In the words of James, there are no gaps in experience though there may be experience of gaps. And mental time is experienced as part of the same time as physical time. The event which I remember as having happened five years ago is presented as ~~being~~ existing five years before my present state of mind. The normal ordinary person regards the objects which he perceives as being simultaneous with his act of perception. He is mistaken, for science shows they are slightly* earlier — but it does not show them to be in no time relation at all to his present act of mind. Thus the enjoyed mental act is experienced in temporal continuity with the contemplated physical fact.

At this point the question arises as to how this connection is known. One end is contemplated and the other is enjoyed. If these are two distinct modes of knowledge and are the only ways in which we can know, how can we be aware of the connectedness of an enjoyment and a contemplated object. Again we

seem to be facing the difficulty which the critics raised for Hume — how can we from distinct experiences achieve the experience of connectedness? How can the experience of (A) plus the distinct experience of (B) give rise to the experience of (A + B)? Now in connection with the experience of mental space, Alexander holds that we are immediately aware of the identity of contemplated and enjoyed space. We enjoy mental space but we enjoy it as identical with the space of the brain which is contemplated. The process is analogous to the awareness of a pain in the toe, as quoted by William James. Alexander says that we feel the toe in the pain, & can thus identify the seen toe with the felt toe. Similarly the enjoyed space of mind is identified with the contemplated brain space. This latter is, as it were felt through & in the experience of the mind. Is it the case then, that we realise the connectedness of mental space & time with physical space & time by first realising the identity of the enjoyed space or time of mind with the contemplated space or time of the brain, & then contemplating this latter in its position in space & time as a whole? Alexander does not actually state that this is the process. Anyway if this were in his mind, it would not get over the difficulty. If enjoyment & contemplation are really distinct how are we to realise the identity of a contemplated and an enjoyed entity? How, if we have no other mode of awareness, do we bring them within the unity of a single experience, such as is necessary for the realisation of the identity of their respective contents? This however if valid, only proves inconsistency in Alexanders statement, for it certainly seems to be the case that mental acts are presented as in temporal continuity with physical facts. If the above critical suggestions are valid, it is Alexanders doctrine of contemplation and enjoyment which must be given up.

However, to continue with the exposition of mental space-time: just as clearly, says Alexander, does the mind enjoy itself as spatial. To be sure, mind is immediately felt, so far as its space character is concerned, only as a vaguely different kind of luminousness. Yet we do actually experience what can literally be called change in the direction of mental life. This we are told is most clearly marked in the higher acts of consciousness, in imagination and in desire. Mental space is continuous, & in like manner with mental time, is within the whole of space, being experienced as spatially continuous with physical facts. We are, all the while we are experiencing them, vaguely conscious of their position as somewhere over yonder, away from the enjoyment of the mental life. Alexander maintains that the appre-

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ration of the following stanza involves that the knower shall "enjoy himself in space, not only along with the statue of Newton, somewhere there, in Trinity College, Cambridge, but also with the strange seas over which Newton's mind is supposed to be travelling, the world of contemplated things before Newton's mind."

> The anti-chapel where the statue stood
> Of Newton with his prism & silent face,
> The marble index of a mind for ever
> Voyaging through strange seas of thought alone.

Enjoyed space is experienced as identical with the space of the brain. It is in this connection that the analogy, already mentioned, of a pointed toe, is used. As a matter of direct experience this identification of mind-space with brain-space is only vague, but in physiology it is rendered more precise by scientific reflection. This has been done by mapping out the brain and by allocating various brain functions to various mental capacities. One part of the brain is involved in vision and another in auditory experiences. Alexander suggests that apart from the immediately felt identity of enjoyed space & the space of the brain, the detailed correlations of mental and brain processes could not have been worked out. The suggestion is, that this detailed correlating is the amplification & precise expression of an immediately felt datum, consisting the vaguely felt spatial differentiation of mind enjoyed in identity with the space of the brain. In this Alexander surely claims too much. Has not the so-called correlation of mind and brain, been merely a question of establishing the fact that given mental processes, felt as qualitatively distinct, occur together with but never without certain distinct brain processes? This process does not involve the identification of mental process with brain process. Two quite different entities may universally accompany each other. Provided the various ~~brain~~ mental processes be distinguishable, it is not necessary that they should be spread out in space that they may be correlated as universal accompaniments of different brain processes.

However, Alexander's claim is that mind is immediately presented as being, in the full sense of the terms, both spatial and temporal. The spatial just as the temporal character of mental process, is immediately given in introspection. There are few who would agree with Alexander in this. He however maintains that in mind the same characters are found as in habitat physical space-time. Mental space & time are repeated in each other and the mind is organised in perspectives. It has already

been outlined, in a previous section, how that Alexander holds that a remembered content in so far as it is a mind state ie memory in the mode of enjoyment, is not merely a present mind act but actually is a past enjoyment, connected with the mind's present through the agency of a specific present mental process which he calls the act of remembering proper. The mind always includes rememberings as well as perceivings and interpretings. These various processes are variously ~~=~~ localized. One part of the mind will be engaged in memory of past mental states while another is occupied in a present enjoyment. Thus mental space is spread out in time and mental time in space. Time is repeated in space, for the mind as concretely ~~presented~~ experienced, always contains contemporaneous but different mental processes. We distinguish between seeing a friend and hearing his voice yet both may be present acts of perception. Likewise given portions of mental space are repeated in mental time. The total fact of hearing my friend's voice is not purely sensory but is complicated by ideal elements. It includes the memory that I heard him previously. We say these memories are assimilated to or overlap the sensory element. This fact Alexander interprets as the repetition ~~of the~~ in time of the space of the sensory element.

Mind, like physical space-time, embodies perspectives. We always experience the mind under the form of experiences radiating from a focal activity throughout mental space & into mental past & future. These lines of advance are usually spoken of as processes of association As with physical space-time, so with its mental counterpart, points and instants change respectively their ~~plus~~ duties & localities in various perspectives. Two capacities may in one perspective function as ~~as~~ contemporary sensory elements in perception. ~~In~~ in another perspective they may appear as memories associated & in succession. There are also mental point perspectives & mental instant perspectives. But there ~~are no~~ is no guarantee of complete mental sections. This is because, on the one hand, no mental perspective contains all mental space ie in the concrete experience of our selves we never find ourselves using all our faculties. Similarly in the self as it is felt in experience, as it is actually given in enjoyment, we never are aware of features from every phase of mental life. Thus there is no guarantee that any given instant will be repeated throughout all mental space, or of the repetition of any given point throughout all mental time. Of course, for complete repetition, though it is necessary that all space and all time should occur in each total perspective, this

does not involve that all mental space + time should so occur. All space + all time will be there but points and instants which in other perspectives were characterised by the empirical quality we call mind will now have some other empirical quality.

We see then that the application to the mind of the doctrine of intrinsic repetition involves three points. They are the following:- (1) The identification of the felt difference of mental processes with spatial differentiation.— this supplies the basis of the repetition of mental time in space. (2) The doctrine that in perception the mind's present activity is influenced by a past mental state which exists in and operates from the past (3) The mode of this operation can be described as the fact that the space of the sensory element in perception is the same as the space of the memory factor.

Consider first the second of these points. Is it not rather the case that we are influenced by a present memory of a past fact of experience? Alexander would agree but would insist (apparently quite rightly too) that the present memory is only effective in virtue of the past event which constitutes that of which it is the memory. The past then, qua past, is operative. But surely where it is a past external situation which is the guide of present conduct, we should not also need to be aware of the past act of mind which was the perceiving of that event. Attention in memory would be wholly on the past external event. Thus perception does not always involve a past state of myself. But even where this is the case, how shall we define its mode of operation. This brings us to the last of the above three points Alexanders answer to our question, + it is this answer which is to provide the basis of the repetition of mental space in time, raises the question as to whether or not sensory and ideal ~~factors~~ factors involve the same brain processes. Alexander identifies mental space with brain space. It would seem then that if the sensory and the memory element of perception occupy the same space that we have identical brain localities at the basis of both the ideal and the sensory elements. Alexander himself says that for securing intrinsic repetition all that is necessary is that the brain elements implicated should "overflow." Now this statement almost seems a quibble. If the processes overflow they are in part identical. Anyway, that they do overflow he seems to think can be argued from the mere fact that memory + sensory elements are agents in perception. He supplies no further empirical evidence of a physiological or of a psychological nature. His contention

might have some ground if his identity theory of mind and brain be granted. In that case radically separate brain processes could not appear in consciousness as, or have a conscious counterpart in a unity – and part-associationist psychology seems more or less unanimous in the assertion that the memory factor in perception is not a separate feature. To emphasize this the term assimilation seems to have been invented. But this identity theory is based on alleged facts of introspection in which Alexander holds the mind appears as spatial. This brings us to the first of our three points. The whole burden of the application of the principle of intrinsic repetition in the case of the mind is to rest on an alleged piece of introspection which practically no one besides Alexander will admit.

It was said at the beginning of the discussion of mental space-time, that there were two issues which, in their traditional articulation, ran counter to Alexander's theory. The first, together with Alexander mode of assimilating it to his theory we have just discussed. The point was as to whether mind is characterized by space. How the second of these issues gives rise to the problem of the relation of space-time to the space of pure mathematics. The question now, is as to what is the sense in which mathematical space can be said to embody time or to have a time character. Traditionally it has been held that the science of geometry involves spaces which are different from perceived empirical space in this respect at any rate, that they are completely outside time. No propositions about time enter at all into any of the various geometries. This contention is in two ways ambiguous in Alexander formulation. First of all it asserts reality outside what he calls space-time & secondly it implies that not space as such is the medium of time's continuity but only ~~that~~ ∉, at best, those features which differentiate empirical space from mathematical space. Alexander's reply to these positions is that though there are many geometries, there is one space only which is their subject matter, & this one space is that which is revealed to us, to some extent at any rate, in perception, as empirical space. It is the method of science to abstract. From the totality of fact geometry selects for it's special consideration that feature which is space. It takes the given fact of space and sets to work to give an account of it's internal structure. Just because, as a science, it accepts it's subject matter there is no reference to time. But philosophy may not abstract. It's function is to relate the conclusions of the

Quotation in Space Time + Deity I p 159 from J. W. Young. (1)

existence of space, & for this purpose it brings into the scene of operations considerations about time. Geometry is not the discovery of a timeless space but, because it is not philosophy it simply ignores the existence of space. The various geometries that have arisen, eg. the Euclidean & the fantastic modern geometries, are not discoveries of so many kinds of space a different spaces, but simply a number of hypotheses about the internal structure, ie it's various features & aspects, of the one empirical space of three dimensions, which is such that it can only exist in unity with time, ie the one fact of space-time or motion. Assume, amongst other things, that a straight line is the shortest distance between two points, & there can result a consistent body of doctrine about the internal structure of space, & which we call Euclidean Geometry. With a different hypothesis we get ellipsoidal geometry. Projective geometry deals with a special aspect of the internal structure of space which is different from that aspect of space which is the subject matter of Euclidean Geometry. The latter is concerned with the metrical properties of figures, the former with the "intersectional properties of points lines and planes" Alexander also quotes the writer of this definition as saying that ellipsoidal geometry can put forward a claim, even in it's present state of development, almost as strong as Euclidean Geometry, to practical empirical application.

We are often told that the figures of Euclidean Geometry are perfect but that those of empirical space are only approximations and therefore not really circles and squares. Hence that the space of Euclidean Geometry is quite other than that which contains empirical figures. The reply is that the circles are alleged parts of empirical space itself — they are suggested selections of space in accordance with certain principles. It is a question as to whether space affords selection on these principles — thus Euclidean Geometry is a hypothesis to be tested. Now what we usually mean by ~~empirical~~ the figures of empirical space are coloured squares, circles etc. These are selections from space on a basis of quality patterns. Now our perception is not of a sufficiently refined degree to judge whether these qualified spaces are true circles or squares etc. Nevertheless even though we admit — and this is not proved by the critics — that there are no true qualified circles, we have not thereby proved that empirical space as such does not exhibit ~~exhibit~~ that systematization which is formulated in the hypothesis of Euclidean Geometry.

But what of geometries involving more than three dimensions?

There are to be regarded as constructions of the mathematical imagination. From life we get the notions of men and of height. We can extend in imagination the height of a man and then write fairy stories about giants. So too from the total presented fact, we get the notions of number and dimension and can extend and synthesise these in imagination, thus constructing the ideas of spaces of more than three dimensions. The geometry which then ensues has the same status as the fairy story in real life. In such an imaginative construction we do not create a new objective reality in a neutral zone of fact, but simply experience a simpler cognitive reaction which consists in considering elements apart from their concrete environment. We merely effect a mental selection and not the creation of a new objective fact.

In like manner Russell's definition of continuity is treated. Space continuity is given to the senses. Our first attempt at conceptual expression is through the notion of infinite divisibility. Russell and his teachers, in their notion of a compact series have simply supplied a precise conceptual expression of the given fact of continuity. They have attempted to supply a criterion of continuity, but Alexander, the metaphysician, has to state the conditions of the given fact. Thus there is no antagonism between the theories of continuity of Russell & Alexander respectively, ~~in so far as~~ even though Russell makes no mention of time in defining space continuity, or of space in defining time continuity.

Thus concludes the exposition of Alexander's doctrine of the interdependance of space and time. We now proceed to state certain reasons why it appears unsatisfactory. In the first place then, there appears to be radical discrepancy between two parts of the theory, viz. the notion of infinite repetition and the doctrine of perspectives. According to the former, time and space cannot exist except in a situation involving repetition of both time in space and space in time. Yet the doctrine of perspectives presupposes the distinction between point perspectives and instant perspectives. It is asserted that perspectives are concrete given portions of space-time, yet the distinction just mentioned is based on the principle that there are perspectives (those from the respective instants of their centers) in which space is not repeated, and other perspectives (those from the respective points of their centers) in which time is not repeated. If this be the case then there is a contradiction and the two aspects of the doctrine of space-time cannot both be true.

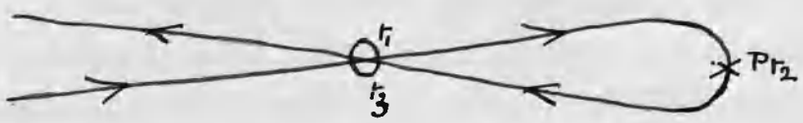
Let us then look at the notion of perspectives in its own

intrinsic nature. Each perspective contains all time and there are many perspectives. Time is a universal form which is embodied in as many individuals as there are perspectives. Within any perspective, events may be in time is simultaneous or successive. But is there any time relation between events of one perspective and another? Events in two perspectives may have the same or different time characters, but since they are in different times how shall this be interpreted? They cannot be said to be in time unless, besides the time which is an aspect of the internal structure of perspectives, there is also another time in which perspectives themselves develop. This solution has no place in Alexanders theory. Alexanders doctrine of intrinsic contemporaries & his distinction between them and the contemporaneity involved in a section, springs from the feature we are now considering. There are to be two kinds of contemporaneity. There is intrinsic contemporaneity which is embodied within a perspective and which is real and in the nature of things. Then there is the contemporaneity which is involved in a section of space-time. This is a relation regarded as between parts of different perspectives, & further more is in some sense artificial, though not wholly so, for the point instants selected to make a space section do really have the same time character. It follows also that we shall have to admit that events in different perspectives which have different time characters are not successive in the same way in which events are successive which have different time characters within any one perspective. Alexander himself does not carry the doctrine of distinguishing between the two kinds of simultaneity to its logical conclusion — he does not then apply it in the case of succession. Anyway it seems that the doctrine of perspectives involves ~~either~~ that we must admit either two kinds of succession & simultaneity or that events may have different dates without being successive and the same date without being simultaneous. The first alternative seems devoid of meaning. What real situation can be presented as an example of this formula? The second alternative seems a pure contradiction in terms

But consider now the distinction between point perspectives and instant perspectives. It involves that any group of simultaneous point instants shall occur in an instant perspective, and that any group which comprises a succession of point-instants which yet have the same space character, shall occur in a point perspective. Now no point instant can occur in more than one perspective. Hence no point instant can be a member of both (1) a group of contemporaries with different space characters and

(2) a group of successives with the same space character. But consider the nature of any given empirical object (at any rate an empirical physical object). It both endures & has parts which are in different positions in space. It has parts which are spatially different from other parts & which yet persist alongside of each other in time. But this means that such parts are members of each one, of two such groups as those described above. Each is a member of a duration & each is a member of a contemporaneous space. But in the doctrine of perspectives this predicament would be impossible. Again then, this doctrine fails to give a full account of the presented facts.

There is still another aspect of the doctrine of perspectives which seems confused if not self-contradictory. On the one hand a perspective is essentially a pattern of motion. All point instants within it are connected with the center by lines of advance which are motions. On the other hand the doctrine of perspectives involves the ~~distinction~~ assertion that in one class of perspectives viz instant perspectives, the time of the center is represented. But how can the intrinsic contemporaries of the center be connected with it by lines of advance. No two phases of a single motion can have the same date. A motion may change its direction and intersect its own path, so that distinct phases may have a common space element. Thus in the diagram there is a motion from (O at t_1) to (P at t_2) and



then a return from the latter to (O at t_3). But (O) is occupied by different dates. Different phases of an identical motion cannot possess the same date. Then in an instant perspective the intrinsic contemporaries are not on lines of advance leading up to the center of reference. Thus the doctrine of intrinsic repetition within perspectives contradicts the doctrine of lines of advance.

The conclusion seems to be that the notion of perspectives is confused, empirically unjustified & self contradictory. Then are we to accept the other arm of our original ~~dichotomy~~ contradiction viz the doctrine of intrinsic repetition? Or rather the doctrine of the function of intrinsic repetition as mediator of space and time continuity! This doctrine comprises the following propositions:- (1) Space is unity & time is distinctness, if they are each taken in themselves. (2) The unity of duration is the fact that it is the repetition of an identical space. (3) The content of an instant is the fact that it occupies different spaces & (4) the internal differentiation of space is the fact-

it occurs at many times. Now the first of these seems contrary to presented fact: Both space and time seem to involve specific modes of differentiated unity. The third proposition contradicts both the second and the fourth. First of all, with regard to its relation to the second - if the content of an instant is its spatial character, then repetition of the same spatial character at many instants is meaningless. If the spatial character is the same, what is the differentiating element which gives rise to repetition? Secondly, with regard to the third & fourth propositions: if the differentiation of space consists in the fact that it occurs at many times, how will the space of intrinsic contemporaries be differentiated? And if not differentiated how will the instant have a structure? It is no good to say that the same space occurs in different perspectives, but in a different time pattern, for the space can be intrinsically differentiated even though it is contemporary & in a single perspective, for each perspective is a concrete piece of space time. And in any way this principle of differentiation by comparison with space at other times, would not account for the given fact, for even a contemporary piece of space is recognised as intrinsically differentiated without such comparison. If this be the case & our discussion is representative of Alexanders theory, then we cannot accept either the doctrine of perspectives or that of intrinsic repetition in the form in which he articulates them.

Now in the class of non temporal entities was included not only space but also the contents of experience which we normally call qualities, e.g. colours, sounds feelings etc. It was the question of articulation of the unity of time and the non-temporal which opened the way to the discussion of Alexanders theory of space-time. Not only space is spread out in time, but these other entities which seem to be other than mere space or time are also given as aspects of a single fact of existence. Is there anything more to be said of this predicament. Alexander says these qualitative contents emerge from space-time. They are to be thought of as not merely space-time and yet as reducible without remainder to space-time. They are the expression of degrees of complexity of organisation of space-time in different localities. They are related to pure space-time in a manner ~~related~~ analogous to the relation of mind to brain.

This doctrine of emergence, however, seems to lead to positions which are inconsistent with Alexanders general doctrine of space time. An empirical quality is identical with the space-time pattern which bears it. But an empirical quality can be repeated. Thus Alexander holds that patterns of space-time organisation

can be repeated.— but how is this possible if these patterns are nothing more than the point instants which constitute them, for any point instant a group of point instants is unique

But what is the meaning of the determination which involves both being identical with & yet other than something else. What have been called empirical qualities appear to be genuinely non-temporal (but not timeless) entities. Yet they occur together with time - they are spread out in time. What is the objection to this apparently obvious ~~en~~ predicament viz that space, time & such qualities as colour, sound, feeling, temperature etc though genuinely different from each other are yet a genuine unity of fact. It is a mere prejudice to assume that unity is compatible only with homogeneity.

The results of the discussion embodied in this section seem to be as follows. The concept of continuity as differentiated unity seems to provide a satisfactory articulation of the time experience. Furthermore the time continuum, though of a specific nature is not an isolated phenomenon. This was expressed by saying that time was spread out over space and empirical objects. These latter are non-temporal features in the continuum of fact. We agreed with Alexander as to the fact of repetition of space & time in each other. This repetition was not however admitted to be universal. The time of mind is spread over non-temporal qualities but does not appear to be spread out in space. If this be the case we must admit that space and time overlap without being co-extensive. But it was thought necessary to reject both Alexanders theory of the function of ~~not~~ such repetition and his doctrine of the objective reality of perspectives. Hence the notion will be adopted that times are parts of time, in place of the notion that times may be instances of universal time structure. Finally Alexanders notion of emergence as expressing the unity of time with empirical qualities & space was also rejected. We have to accept the fact that space, time & qualities are given as a unity. They are different but not separate. We have simply to accept the category of differentiated unity as an aspect of reality.

Section V — Time and Modern Physics

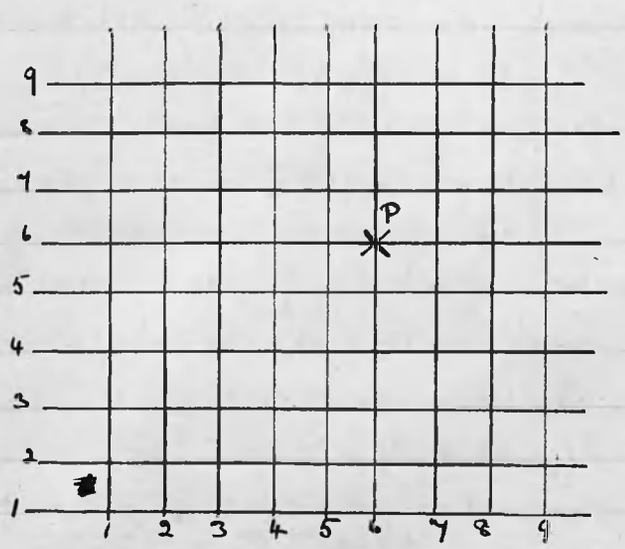
The discussion in the previous section was closed on the problem of the relation of time to the non-temporal within the one continuum of fact. In recent times this question has sprung into prominence, together with certain other time problems, as a result of the development of physical theory by Einstein. He worked out to its logical conclusion, the physical theory of the relativity of motion, and made a system of formulae for the expression of physical concepts, which has resulted in the claim that our notions of space and time & their relations to each other must be radically changed. An attempt will be made first to describe the achievements claimed by Einstein and his followers.

Into the laws of physics and mechanics in their usual form, there enter as components, measurements as to distance & time lapse between various events. Newtons law of gravitation expresses the fact that bodies attract each other with a force directly proportional to the product of their masses, and inversely proportional to the square of their distance. As a matter of fact the force of attraction is expressed as the velocity with which the bodies approach. Einstein holds that the concept of force, as a physical entity over and above the effects which register it, is not phenomenal but metaphysical, i.e. whatever be the meaning of the term force in itself & as an underlying cause, it appears and is amenable to the methods of physical science, only in the form of motions of various directions and velocities. So far as physics is concerned, gravitation is not a quality inherent in bodies, but rather the way in which bodies move when they are in certain predicaments. Now physics only deals with motions in so far as they can be measured, & the conceptual apparatus used in the process is the notion of distance travelled in a given time lapse. Direction is expressed in terms of distances from a given center of reference. Thus the total components of laws of nature will be measurements of distance and time lapse and their relations.

Now distance is associated with position & this latter, whatever it be intrinsically can be expressed by means of co-ordinates. The simplest form of the use of co-ordinates is

in when we say that one body is so much in front of, above + to the right of another body. This other body is the center of reference. More technically, the co-ordinates are three planes which intersect at the body of reference. The positions of other bodies are expressed in terms of measurements, each of which is within one of the planes. We are then able to express the position of any body by taking a center of reference and then assigning to the body in question three numbers arrived at by the above method. An event involves both position and date. We shall describe it as simultaneous with, after, or before the center of reference. If for precision we use a clock, + say that all the events that are simultaneous with the center of reference are at zero time, we can express the other events in terms of time measurements. Given a center of reference we can define completely + distinctly all the events in the physical universe by means of a system of sets of numbers assigned to those events, in principle such as those just described. Each set will consist of four measurements, three in space and one in time, and each set will unequivocally determine a given event. This process is known as the orientation of the event.

Now we have spoken of a rigid body of reference as giving rise to co-ordinates which are distances of other bodies from that given center. But we can abstract from the body of reference and imagine all space around it as being divided up by parallel lines which are equidistant from each other. In two dimensional space we should get sets of lines dividing up the space into equal squares then.



If to each of the respective sets of lines we give a number, then two numbers will denote any corner of any square. P is (6,6). If we take three dimensions we shall get little cubes and then shall need three numbers for denoting a corner. We have, and there

conditions a three-dimensional Cartesian co-ordinate system with respect to the edge of the cube. This latter is called a distance.

The squares can be made as small as one wishes & thus get nearer to the ideal of providing a set of numbers for every point of space. Now these sets of numbers are unique, & their relations to each other are unique also. We can, apparently, express the relations of the points to each other in terms of the numerical relations of the sets of co-ordinates. This procedure opens up the analytical treatment of space & geometry passes into arithmetic.

If we take different systems of orientation, in each case the determination of any individual position will be different. But there is associated with any two points within a set of Cartesian systems of co-ordinates a determination which is absolute, is which is the same whatever be the Cartesian system of co-ordinates we take. This determination is what popular thought calls the distance between the two points, & it can be measured with a convenient rod which we take for a unit or sum of units, eg. a foot rule or a yard stick. But this distance can also be expressed as a function of the co-ordinates. Let (x_1), (x_2) & (x_3) be the co-ordinates in a given system of one some one point & (x'_1), (x'_2) & (x'_3) be the determinations of some other point within that system. Let (Δx_1), (Δx_2) & (Δx_3) be quantities which satisfy the following equations.

$$(\Delta x_1) = (x'_1) - (x_1)$$
$$(\Delta x_2) = (x'_2) - (x_2)$$
$$(\Delta x_3) = (x'_3) - (x_3)$$

Now the two points in question may receive any number of orientations all of which may be Cartesian systems. So long as this latter condition holds good the function

$$(\Delta x_1)^2 + (\Delta x_2)^2 + (\Delta x_3)^2$$

will remain identical throughout. Indeed Cartesian systems of co-ordinates are analytically defined as those throughout the range of which the above function remains identical. Now the square root of this function is what we know in common sense as the distance between our two original points. If we let (S) stand for this distance then the following equation arises:- $(S)^2 = (\Delta x_1)^2 + (\Delta x_2)^2 + (\Delta x_3)^2$

This equation is usually expressed in the abbreviated form

$$(S)^2 = \sum \Delta x_v^2$$

The right hand side of the equation is called "an invariant with respect to linear orthogonal transformations". It expresses the fact that between all the respective orientations of any two points within all possible Cartesian co-ordinate systems, there exists

identical quantitative relations.

At this point we may pass from preliminaries and turn to the specific considerations raised by Einstein. He found the classical formulation of the laws of nature, eg. the laws of motion and the law of gravitation, such that these laws were not universally true i.e. not true for all systems of reference. It is the aim of science to achieve complete universality, & Einstein set himself the problem of finding a formulation which would be universally true, & in respect of which the classical formulae which do work in certain cases should appear as special cases, systematised under a more general concept. As is the usual case, he did not achieve all at once a magnificent synoptic vision, but he worked his way little by little. He first of all attacked the problem of formulating the laws of physics so that they would be true for all systems of reference which execute a uniform rectilinear translation with respect to those heavenly bodies called the fixed stars. Hence his first attempt is known as the "Restricted Theory of Relativity." His reason for so restricting his problem was historical rather than logical. The reference system in question — known in physics as Galilean systems — exhibit in themselves no logical ground of preference over all other systems. It is merely the case that past scientific speculation has found the problems arising out of them more facile of solution, whereas the problems of orientation & of formulation of natural laws relative to systems executing curved or accelerated motion relative to Galilean systems, have always been much more of a stumbling block & a mystery. Thus when Einstein had solved the simpler problem he set himself the wider & apparently more difficult problem, which has given rise to what is now known as the "General Theory of Relativity." The question was," Can we find such a mode of formulation of the laws of nature so that they preserve the same formal structure relative to any frames of reference whatsoever?" The formal structure of a law is the relations which the quantities entering into it bear to each other. The law of gravitation states that two parts of matter will move towards each other, with a velocity proportional to their masses and inversely proportional to the squares of their distances. We shall get individual cases in which mass quantities differ & in which portions of matter are further or less distant from each other. The form of the law will remain identical if these quantities, whatever be their individual values in special cases, retain the same relations in the formula a function which describes the rate and direction of the movements of the pieces of matter in question.

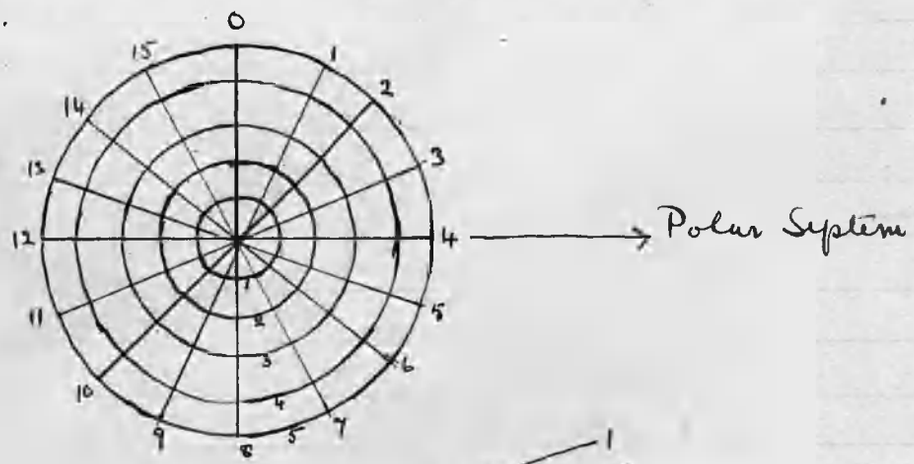
We have already seen that Einstein holds that all laws of nature in physics and mechanics, can be reduced to statements about the quantitative relations of measurements of distances & time lapses. We have also seen that the distance between two events can be expressed in terms of the co-ordinates of the respective events. In the same way time lapses were made the function of time co-ordinates. Take a given event as time center. All events simultaneous with it will be at zero time. We may have two other events whose time co-ordinates are respectively (+ 5 mins.) & (+10 mins.) The time lapse between them will be (10 - 5 mins.) Thus, like distances, time lapse is a function of the co-ordinates. The physical problem as Einstein conceived it, arises out of a predicament in which there are events each of which is determined by four numbers, three of which represent space measurements and one a time measurement. Physical laws are statements of quantitative relations holding between the distances and time lapses between events. Distances and time lapses are functions of co-ordinates & we wish to find formulations of the relations between distances & time lapses associated with events, such that these formulations shall be true within all possible systems of reference. Let there be two bodies which are moving ~~on~~ with regard to each other. Take a body (K) as center of reference from which to describe the movement in terms of a series of coordinates. The series will be of sets of co-ordinates, each of which sets will contain four numbers. Now there may be another body (K') which is rotating with respect to (K). There is no reason why (K') should not be used as a base for description of the motion executed by the two named bodies. But the co-ordinates of the ~~the~~ two bodies will, throughout their motion, be different as assigned respectively from (K) & (K'). Thus Einstein's problem became that of finding a system of relations such that the respective orientations of the two bodies enter into it, no matter what be the system of co-ordinates (provided it be the same for ~~both~~ bodies throughout) in which they receive their orientations.

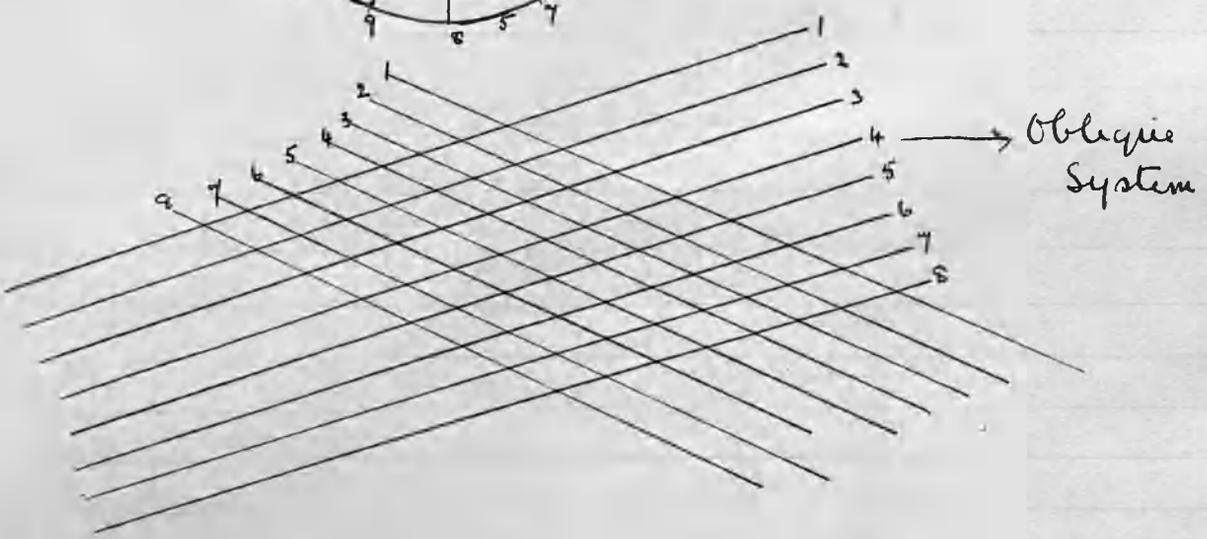
In the case of Cartesian co-ordinates we saw, in the transition to the analytical treatment, that the space reference was ignored & attention was concentrated on the development of the numerical relations of the co-ordinates. Number became the language of spatial dispersion and algebra it's grammar. We can abstract from the spatial reference altogether & develop the language for itself. We may not be able to conceive a four dimensional space in the sense of a space where a position has some other determination besides those implied in ~~Euclid~~ "in front or behind", "to right or to

left", "above or below." We can however construct a purely numerical system which develops the relations between groups of number each consisting of four or more numbers. Thus we get the spaces of analytic geometry which have more than three dimensions. As a matter of fact we have left space behind and are dealing purely with numbers, the term dimension being purely metaphorical.

These considerations bring the physical problem into line with the mathematical problem concerned with the application of the concept Σ. The physical problem is to discover a system of quantitative relations such that the respective co-ordinates of two events enter into it, no matter what be the system of co-ordinates used, provided it be the same for both events. It was just these conditions that the notion Σ satisfied in respect of ~~to~~ Cartesian co-ordinate systems only. Can we then arrange the four number systems which arise from physical measurements so as to produce a corresponding Σ.

At this point we must attempt again to follow up the spirit of certain mathematical processes. We can map out two dimensional flat space by means of co-ordinates other than those which constitute a Cartesian system. We may use polar or oblique co-ordinates, thus.





Further, whatever be the system of co-ordinates, the distance between

any two points remains the same. But with different systems the formulae which express it as a function of the co-ordinates are different ie have a different mathematical structure. Thus the structure of Σ defines the system of co-ordinates used. But besides this, all known orientations possible for a two dimensional flat space embody, each a Σ formula which is derivable from a single formula, by the process of substituting special values for certain variables within it. The new + higher formula (from which the Σ's of the special systems are derived) defines a class of co-ordinate systems which can be used for mapping out flat two dimensional space.

But consider now the lines of latitude and longitude which map out the surface of the earth. It is impossible to map out a flat surface with a system of co-ordinates in which Σ shall have the same structure as it has in the lines of latitude and longitude. By no conceivable substitutions can the class formula for possible co-ordinate systems for a flat surface, be made to render the Σ formula for the lines of latitude and longitude.

Prior to the time of Einstein the mathematician Gauss had set himself the problem of treating curved surfaces eg. the surface of the earth, independently of the fact that they may exist in an empirical space of three dimensions which can be mapped out with Cartesian co-ordinates. For his purpose Gauss used curved co-ordinates. When it came to analytical treatment, there was involved a system of relations as between quantities which was quite different from the system involved in Cartesian orientation. The formula for Σ had a very different structure in the two cases. Now the co-ordinates of Gaussian systems may have different degrees of curvature, + these are reflected in the structure of the respective formulations of Σ. The element in the formula which is associated with the degree of curvature is called the "potential."

In the General Theory of Relativity, the fundamental laws of nature are expressed through the medium of a ∞ formula which is elaborated as a Σ of Gaussian structure. In the application of the mathematical formulae as expressions of physical laws, the groups of numbers which constitute the orientation are associated with events through the medium of measurement in space + time from a body of reference. If Einstein is correct, his work marks the final stage of a process which has taken place somewhat as follows. First numerical relations were used as steps for geometrical predicaments; as a language expressing certain aspects of the nature of space. Then in the analytical treatment

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the space reference was eliminated, & there arose a purely mathematical development of the number predicament which had been used as a language for space. Formally Einstein claims to have been able to adapt the formulae which have had this purely mathematical deduction, so as to become serviceable in the expression of empirical matter. His own summing up of the meaning of the General Theory of Relativity is that "all Gaussian co-ordinate systems are essentially equivalent for the formulation of the general laws of nature."

Now that element within the formulae, which is the mathematical development of the expression of curvature in the original co-ordinates of Gauss, is not always the same. It can be decreased and gradually eliminated. Wherever there is matter, however, the only applicable formulae contain this curvature element. The point at which it is eliminated, is represented by Einstein as the limiting concept of pure space-time, containing no matter. In the final presentation of the theory as the "General Principle of Relativity," the formulae of what was called the "Special Theory", have the status of being the mathematical expression of this limiting concept.

Above it was mentioned that the respective Σ formulations of all the possible co-ordinate systems that are applicable to a plane abstracted from three-dimensional space, can be exhibited as derivatives or special cases, arising out of the assigning of particular values to the variables, of a single formula. This formula gathered into a class all possible orientations of a plane surface. In like manner, Einstein makes use of a system of formulae such that the various laws of physics, which have been expressed as Σ formulations of Gaussian structure, are special cases arising out of this process of the assigning of values. The fundamental formula involved, thus represents the system of all possible forces that can act upon a particle, for the laws of nature are the expression of the operation of physical forces. The structure of this formula involves an element of the form of that which in the Gaussian Σ reflected the curvature of the mesh-system. When this element receives a zero value the resultant is the formulation of the Special Theory. Given another value, it results in an expression which, though different in form from the Newtonian Law of Gravitation, is yet of such a nature that it results in quantities which approximate to the resultants of Newton's formula, in all but cases where an exceedingly high velocity, eg. the velocity of light, enters into the situation. The fundamental

formula from which all these derivatives come is called by Einstein the laws of Gravitation. Thus the formulations of Einstein & Newton are different respectively. The former is a much more general concept than the latter. It is in fact the concept of the essential structure of any possible configuration of matter. The system of formulae which represent this concept is symbolically expressed as $G_{\mu\nu} = K_{\mu\nu}$.

(21) Thus far we have reached the stand point that this system of formulae expresses the relations which hold between certain magnitudes of space & time, distances & time lapses, selected by the processes of physical measurement. The purely mathematical part of the theory has in the main, apparently, long been known to science. It is however only recently that it has been applied as an instrument for expressing physical predicaments; for this development Einstein is responsible. In connection with this application three questions seem to arise. They are the following:- (α) Are the mathematical deductions valid? This is not a question for philosophy and is outside the scope of this essay. (β) Do the formulae work? This is to be solved by testing them by experiment. The problem presented belongs purely to experimental physics. (γ) What are the conditions within concrete experience for the valid application of the formulae. This is a question which can be answered fully only by the philosopher-scientist. It is a phase of the question, already touched upon, as to what are the conditions within empirical fact of the ~~expres~~ possibility of expressing actual existing predicaments by the number system. Up to a certain point this problem is philosophical - it is a question of the analysis of space and time experience. Only a scientist can say whether any given analysis can form the basis for the application of the formulae. To decide this point involves an understanding of the mathematics of the situation. But it is within the province of philosophy to pass judgement on a proposed formulation of the nature of time, from the point of view of the self consistency of that formulation & of its consistency with the rest of observed fact. Of course the notion of "the observed facts" in its widest sense includes the results of experiments & the method by which these are reached. The question of the full and detailed relation of any proposed ~~rel~~ hypothesis of time, to the rest of observed fact, can only be fully answered by one who is capable of analysing the procedure in experiments of the special sciences - particularly in physics. Still it remains that any proposal must be consistent with itself & with both the sense data in their crudest form and with other branches of experience.

In these departments of the problem that philosophy has some voice. It is proposed in the sequel to discuss from these points of view, some recent proposals for the reconstruction of our theories of the nature of time so as to meet the requirements of the theory of relativity.

The impression has arisen, certainly so amongst those of us who are lay enquirers, that the scientists are claiming that the applicability in physics of the formulae of the theory of relativity involve a radical alteration of our theories of time. Three features of the theory seem to be involved in the issue. First there is the fact that the formulae contain a co-efficient of curvature. Analytically this means a certain kind of structure ~~within~~ of the formulae. This however arose, in the first case as the numerical expression of the mapping out of positions by curved lines. We are now told by the scientists that space & time, wherein the theory of relativity is applicable, must have the property of being curved. Secondly the formulae involve that the distance & time lapse between two events are not identical with reference to all systems of co-ordinates. This feature is carried down into the limiting concept of pure space-time. At this level, the formulae for the transformation of the determination of an event with reference to one system of co-ordinates, to it's determination with reference to another are as follows:- Let (R) be one system of reference & let (R') be moving relatively to it with uniform motion in a straight line. Let the direction of the motion of (R') relative to (R) be the x'-axis of (R'). If the determination of an event relative to (R) by (x), (y), (z), (t) & it's determination relative to (R') be (x'), (y'), (z'), (t') then the following equations hold:-

(1) $$x' = \frac{x - vt}{\sqrt{1 - \frac{v^2}{c^2}}}$$

(2) $$y' = y$$

(3) $$z' = z$$

(4) $$t' = \frac{t - \frac{v}{c^2}x}{\sqrt{1 - \frac{v^2}{c^2}}}$$

The quantity (v) is the velocity of (R') relative (R) & (c) is a constant quantity. In the first presentation of this aspect of the whole theory viz as the "Special Theory of Relativity (c) was said to be

* what is a meter for the (K') system is only part of a meter for the (K) system & what is a second for the former is more than a second for the latter. (1)

the velocity of light. In the general theory however this identification does not take place — (c) appears merely as a mathematical element which in the limiting concept of pure space-time is a constant. Now suppose a meter rod is placed on the x'-axis of (K') in such a manner that the beginning co-incides with the point (x = 0), & the end with the point (x = 1). To decide the length of the rod relatively to (K) we must find out where the beginning and end will be with reference to (K). By means of equation ① above, the ~~values~~ determination of these two points at (t = 0) can be shewn to be

(α) - beginning = $0\sqrt{1-\frac{v^2}{c^2}}$
(β) - end = $1\sqrt{1-\frac{v^2}{c^2}}$

Hence the distance between the points is $\sqrt{1-\frac{v^2}{c^2}}$ of one meter. This is less than a meter. The rod is shorter the more quickly it moves in the direction of its length. Again consider a clock at the point (x = 0) of (K'). Let (t = 0) & (t = 1) be two successive ticks. Relative to (K) the determination of these ticks can be shewn to be respectively

(α) - first tick = 0
(β) - second tick = $\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$

Thus with regard to (K) the time that will elapse between the two ticks is not one second but $\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$ of a second. The more quickly the clock travels the more slowly does its ~~mechanism~~ register time.*

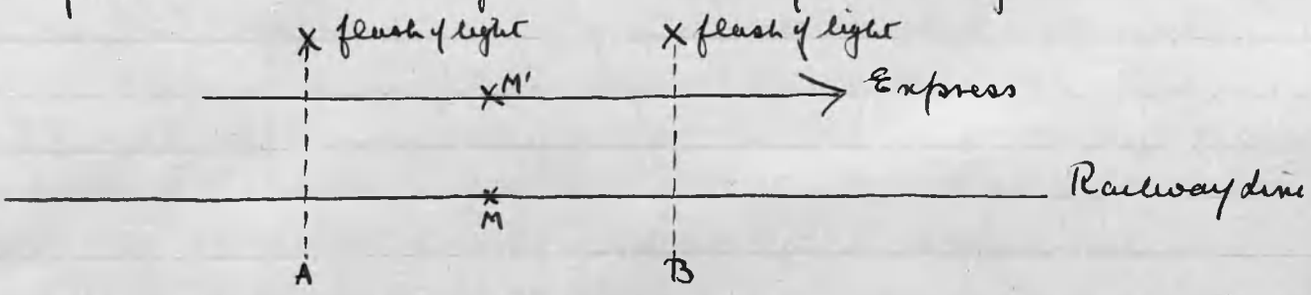
Thirdly space and time measurements are not mutually independant variables as in the classical theory but are co-variables. Thus in the pure space-time formulae, the distance and time lapse co-efficients vary together, in accordance with the velocity of the system relative to which they are defined. This suggests some connection between the two elements ~~in the~~ representing respectively space & time in the formulae. Furthermore a time factor enters into the first transformation equation for space and a space factor into the transformation formula for time. This is exhibited in equations ① & ④ above. These of course only refer to pure space-time: nevertheless the predicament holds throughout. Finally the absolute quantity Σ, is constituted by an amalgamation of space & time factors. Thus space & time values are interdependant in these formulae.

Now from these features of the theory, the scientists seem to have argued — and certainly the impression has gained currency with the lay mind, as a result of their popular expositions & discussions of these features — that there is no single three dimensional space nor a single and independant time series but a set of systems

of space-time, possessing most unfamiliar & paradoxical characters. These systems are the physical counterpart of the systems of orientation which constitute the mathematical aspect of the theory. Each space time system is associated with some one event which is its center of reference. The result is that if we take any two events there is no one single & unique distance or duration between them. Distance and duration are always abstracts from a space-time system & presuppose the selection of a standpoint or center of reference, & as characterising any two events they vary in accordance with the center of reference.

Within any space-time system the space aspect and the time aspect are not mutually independent but interdependent. This predicament is reflected in the formulae in the fact that space & time representatives are not mutually independent variables but co-variables throughout the range of systems of co-ordinates. Furthermore the various space-time system are not mutually independent but constitute a unity. This is the physical basis of the applicability of the transformation equations which express the values of one system as a function of the values of another.

(3) In support of the theory of the variability of duration spans in respect of different centers of reference Einstein propounds the following analysis of simultaneity. First of all he asserts that the notion of simultaneity is meaningless unless it includes a statement of a method of discovering whether it applies in a particular case or not. The following test is then suggested:- Two events shall be considered simultaneous, if objects which move with the same velocity leave them, & reach a point mid way between them, in such a manner that the reading on a clock at the mid point is the same for the arrival of both objects. Now in the



accompanying diagram we are to imagine an express moving in the direction of the arrow with the velocity (V). This movement is taking place with regard to the platform. Two flashes of light occur on the train. Let (M) be the mid point between them and let (M') be an observer on the train. Suppose that when the flashes occur, as judged from the platform (M') coincides with (M). Now (M') is moving in the direction of the arrow with the velocity

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Eddington – Space Time + Gravitation p. 50. (2)

(V) of the train. "If he did not possess this velocity he would remain permanently at (M) & the light rays emitted from the flashes (A) & (B) would reach him simultaneously, i.e. they would meet just where he is situated. Now in reality (considered with respect to the embankment) he is hastening towards the beam of light coming from (B), whilst he is riding on ahead of the light that is coming from (A). Hence the observer will see the beam of light emitted from (B) earlier than he will see that emitted from (A). Observers who take the train as their reference body must therefore come to the conclusion that the lightning flash (B) took place earlier than the flash (A)." Thus what is simultaneous from one point of view is successive from another.

Eddington holds that the variability of time character involved specifically in the relativity hypothesis, refers to the magnitude of duration only and does not preclude the possibility of absolute time order. This means that ~~there will be~~ in the cases where ~~of~~ two events are successive from one point of view and simultaneous from another, the one determination will be more illusory and the other the true time character attached to the events. It also means that in such case, although the magnitude of the intervening duration may increase and decrease with variation of standpoint, there can be no standpoint from which it can be zero. Or in such a case the events would be simultaneous. If these considerations be valid, then we find the disciple contradicting the master's exposition. We turn then to examine Prof. Eddington's proof of his thesis.

He tells us that "where we have actual evidence of one event before experiencing the second" then the first event is absolutely before the second. Now this formula needs more precise expression. Unless it receives further qualification it is obviously untrue. Thus before learning of an event (X) which as a matter of fact has just taken place, I may know that (Y) is going to happen in the immediate future. In this case, although I have evidence of (Y) before experiencing (X) it is (X) which is before (Y). Now by the term "having evidence of" Eddington means a special predicament. If (Y) is an event, then having evidence of (Y), in this particular reference means, being the terminus ad quem of a motion of which (Y) is the terminus a quo. The reception of a ray of light emitted by a flash, would be evidence of that flash. In such a case the reception of the ray is absolutely after the flash, & in general the terminus a quo & the terminus ad quem of a motion are absolutely successive. The former is absolutely before the latter.

This is different from where (X) is merely perceived after (R). (1)

Prof. Eddington now proceeds to the proposition that where there is "experiencing" of an event after the reception of a signal from another event (Y), which is the terminus a quo of the motion, of which the reception of the signal is the terminus ad quem, then that event (let it be X) is absolutely after (Y). This conclusion is mediated by the principle that if one event be before a second and this second be before a third then the first is before the third. The reference in the term "experiencing" is narrowed down to perception. Thus the principle on the basis of which absolute time order is asserted amounts to the following :- In the case where we receive a signal which has travelled from one event, before perceiving another event, then the event which sent out the signal is absolutely before that other event. Even yet, however, the principle is not definite. Two distinct references may be implied in the term perceiving viz either the act of perception or the fact perceived. Three events at least are involved in the principle under discussion. There is the event which is the reception of the signal - let it be called (R). Then there is the event which is the sending out of the signal. This we have called (Y). Finally there is the event which is referred to in the term "experiencing the second event" i.e experiencing the event which comes after (R). This event has been called (X). Thus if we take one possible interpretation of the term perception, the principle will mean that where the act of perceiving (X) is after (R) then (X) is absolutely after (Y). This principle contradicts & mistates our example of relativity outlined above. In this example, the observer in the train sees one light flash after the reception of a light signal, ~~yet~~ from the other flash, yet the successiveness of the flashes is only to be regarded as a relative predicament. On the other hand, the reference in the term perception may involve the ~~pos~~ interpretation of ~~absolute~~ the principle of absolute time order as, that, where (X) is perceived as being after (R) then (Y) is absolutely before (X).

Now in any case, the argument as a proof that relativity does not preclude absolute time order seems to involve petitio principii. The principle which is proposed as the ground of this conclusion makes use of the notion of time order without reference to the possibility that it may have the status of an absolute or only of a relative character. This occurs ~~in~~ both in the statement of the relation of (R) to (X) and in the use of the principle that if one event be before a second & that second before a third then

the first is before the latter.

Now the second part of the argument under discussion viz that referring to the relation of (R) to (X) seems to be superfluous for the proof of the alleged conclusion. And it is in this part of the argument that petitio principii is involved. If it be true, as Eddington claims, that the terminus a quo & the terminus ad quem of a motion are such that the former is absolutely before the latter, then why seek further grounds for the conclusion that absolute time order is not precluded by the theory of relativity. But then of course there arises the question of whether this proposition with regard to the disposition of the two ends of a motion is true. In so far as the events are the termini of a motion one is before the other. If motion were an absolute determination then the events which are the termini of a motion would be absolutely successive. But the relativists hold that motion is relative just as duration and distance are.

We must then examine this contention of the relativity of motion. It is asserted that in the predicament where a body is moving, we always find, and never find anything more than, the fact of the change of distance between that body and another body. Motion is nothing more than change of distance between ~~two~~ bodies. Now distance is a relation. Let there be two bodies (A) & (B). All that can be meant by saying that either (A) or (B) is moving is that each enters into a complex relation, which we call changing distance, with some other body. Let (A) be moving & (B) the body to which it is related qua moving. Now the relation of distance is essentially reversible: if (A) is distant from (B) then (B) has the very same distance from (A). Then if (A) is changing its distance from (B) then (B) is, in the very same measure, changing it's distance from (A). Now it is quite possible for (A) to have this relation of changing distance with respect to (B) but not to have it with respect to some other body (C). Then we must say that from the standpoint of B (A) is moving, but from the standpoint of (C), (A) is not moving.

Now consider the light signal of which motion track (Y) & (R) are, in Eddington's argument, the termini. In so far as the beam of light has moved between (Y) & (R) they are successive. But will not the movement be relative to a standpoint. (Y) & (R) will denote a change of distance on the part of the beam of light, with regard to some other body. Relative to this latter body (Y) & (R) will be situated in the ~~two~~ beams motion track. But there will be (at any rate theoretically) a body with respect to which that which we call the light track will not be the execution of a

movement. Now the argument is to be that in so far as (Y) + (R) are situated in a motion track they are successive. But such a situation depends upon the selection of a stand point. So that after all, successiveness grounded in motion will depend upon the selection of a stand point + will not therefore be absolute.

Popular thought and classical physics maintain that over and above the change of distance with regard to each other in which bodies may be engaged, there is involved a factor which is the cause of such change. This factor is called real motion. In so far as a body is really moving it is involved in the execution of a change which is independant of any center of reference. If it could be shown that two such contents as (Y) + (R) are elements in such a transaction they would be absolutely successive. We must however be quite sure that in this notion of real motion we are not pursuing a shadow. We must know precisely what we mean + also just how we are to know that any given body is engaged in real motion.

According to Bergson + to the thinking of common sense, this character of real motion must be regarded as an intrinsic state of the body which is said to be qualified by it. It is given in such experiences as that of the fiery track of the shooting star or the sight of an express train rushes through a railway station. Now there has been much discussion of the relation of such sensible appearances to the so called real physical world. There seems no need to enter this arena so far as the question of the absoluteness of this sense character be concerned. Now visible motion, whether or not it be more than mere change of distance, seems to be a character which palpably depends upon the selection of a stand-point. From the platform the express is seen as moving. If the observer is in another train which is running alongside the express it is the platform and not the fast express which appears to be moving. Common sense will of course regard the experience of the observer in the train as pure illusion. This is one hypothesis of explanation which is accepted apparently as mere prejudice.

Now according to one line of thought, the motion of sense experience is not to be regarded as real motion but as a character attached to the real motion as a result of its relation to a perceiving mind. Sometimes it is regarded as confused apprehension of real motion, sometimes as a sensation is the mental correlative of real motion. The problems raised in this connection need not be discussed here. Real motion is to be

construed as the successive occupation by a body of different positions. If the instants & points have an absolute order then the motion is absolute too & conversely if it can be proved that the motion is absolute the succession & space disposition will be absolute also. Two physical experiments have been held to prove the fact of real motion.

The first is Newtons famous bucket argument. Rotate a bucket containing water, around it's axis. First of all the bucket moves relatively to the water & the surface of the latter remains unchanged. Then the water takes up the motion of the bucket. There is now no relative motion as between water and bucket: but in this case the water becomes depressed in the center. Let the bucket now cease to move. The water continues to move as it is moving relatively to the bucket but its concave surface still characterises it. At last there is again no relative motion as between water and bucket, & again the surface of the water becomes flat.

Now this experiment certainly seems to shew that relative motion as between the bucket & the water has nothing to do with the contour of the latter's surface. We find that in both cases of relative rest as between the two, the surface of the water is in one case flat and in the other concave. But both these contours are compatible also with relative motion between bucket and water. But to shew that the phenomenon of concavity is independent of the motion relative to the bucket, is not the same thing as shewing that it is ~~done~~ due to the absolute motion of the water. There is the hypothesis that it is due to the water's motion relative to the earth. Thus the phenomenon recorded in this argument seems quite consistent with the theory of relative motion.

The second argument is the experiment known as "Foucaults Pendulum" The plane in which a large pendulum begins to swing is noted. As time goes on, making further observations of the plane in which the pendulum swings, it is found that the successive planes so registered begin to intersect. From a consideration of the angle made by the intersecting planes and the lapse of time between the two planes considered scientists have been able to arrive at a computation of the earth's velocity about its axis. The result arrived at is the same as that obtained when the velocity is calculated relative to the fixed stars. This experiment is supposed to shew that the earths movement is independant of the fixed stars.

However the system of successive planes, relative to which

the velocity of the earth was calculated was itself at rest relative to the fixed stars. That the resultant velocity was the same as that calculated from the fixed stars is therefore entirely in accordance with the hypothesis of relative motion.

The result of this discussion seems to be that Prof. Eddington's argument is not sufficient to prove the possibility of absolute time order, & furthermore that there is nothing in the nature of motion to warrant this conclusion.

But let us return to Einstein's argument with regard to the relativity of simultaneity. There are other points arising out of it which call for discussion. He claims to have exhibited the relativity of simultaneity depends on the meaning and validity of his statement, that it is meaningless to say that two events are simultaneous unless they enter, with a third event into the specific predicament defined by Einstein as his test. The two flashes in the example do not enter into this system of relations with the mid point of the train, so that Einstein argues that so far as this point is concerned they are not simultaneous. If the statement be taken literally it means that the intrinsic content of simultaneity is nothing but this specific predicament. Now as a matter of fact the term simultaneity is used to express a specific predicament into which events can enter & which can become the object of perception. Further the notion can be applied conceptually in the case of events which are outside the limits of perception. This content would not normally be held to be the same as the predicament defined by Einstein. Either therefore he is guilty of a rather perverse misapplication of terms & relativity does not express the nature of time as we normally understand the reference of this term, or else he must show how the content usually denoted by the term simultaneity is reducible to the predicament which he describes. This he does not attempt to undertake. Eddington points out that perception of simultaneity involves that rays of light from the alleged simultaneous objects affect the visual senses at the same time. This may be the case — anyway it is a matter for physiology. But the <u>perceived fact</u> of simultaneity is not this predicament. If the situation really does occur it is rather a physical & physiological condition of perceiving rather than the percept itself.

However it would be sufficient for the validity of his argument if Einstein had proved that the predicament which he calls the test is the universal accompaniment of simult—

aneity. But if this is his contention he states no grounds for it. Common sense would admit his suggested test in cases where both the flashes & the centre of reference are "absolutely at rest". If we accept the relativist analysis of motion then we may say that in a sense this restriction is meaningless. We cannot however argue that as a consequence the test of simultaneity is universally applicable. We have to show whether, in any part, it is applicable at all if all motion be relative. Here again no demonstration is forthcoming.

Now Einstein's alleged criterion of simultaneity contains a space predicament. If it be true that this latter is a universal accompaniment of simultaneity is if it be true that the notion of simultaneity ~~is true~~ is impossible apart from the conception of the distance between the alleged simultaneous points, & if there is a similar dependency as between space characters and time, then here we seem to get close to the alleged interdependence of space and time.

Up to now the exposition has been concerned with the time aspect of the space-time system. We must now look at the space aspect. Consider two points which are some distance apart. How to ascertain the magnitude of this distance, common sense would make the following suggestions. If the points be at rest simply lay a measuring rod along side of them and take the readings on it opposite the points. If however the points are in motion the readings must be taken simultaneously. But these suggestions are for a system where there is absolute motion and absolute rest. What is to be done where we have only relative motion. The relativists have constructed a universal principle, in accordance with which the readings are taken, & together with them the clocks at which they were taken. By making space measurements in accordance with this principle it is possible to achieve a consistent & verifiable expression of the laws of nature. But it is found that distance varies in accordance with selection of standpoint in space-time system. The necessity of including the clocks of the readings indicates from the aspect of space the interdependence of space & time with in any space-time system.

Such considerations as these raise the question as to how far the relativity paradoxes arise not from the nature of time & space but on account of the conventions which scientists have chosen as their methods of measuring. There is a certain body of fact to which we normally apply the term time. It includes what we call simultaneity & successiveness of events. These facts are given in perception. Whether the simultaneity of two events has been

(1)

* But the event time character is that in virtue of which it is successive or simultaneous appears to be such. The argument of this section is designed to shew that the relativists have not raised considerations which necessitate abandoning this view.

(5)

thought to be intrinsic to them or at any rate not to involve in its definition a third event. Apparently the relativists are challenging this. Now besides these facts which constitute time there is a process which we call measuring time. The date of an event is not an intrinsic character of the event* but presupposes some other event in it's definition. I may date (X) as after (A), but I can equally well date it as before (B). (X) is both after (A) and before (B). There is no contradiction with in (X) — the case is that with regard to two different objects it enters into two different predicaments. Again, whatever be the nature of the time lapse between (X) + (Y), the measurement of it can only be defined in reference to another ~~clock~~ object eg a clock. To measure is to establish between the time lapse and the clock a certain system of relations. If a different clock be used is it not quite to be expected that a different system of relations will ensue? There is nothing new or paradoxical or repulsive even to common sense in this. The same is true of space. To measure the distance between (X) + (Y) is to establish a system of relations between the distance and a measuring rod. Use one rod and the measurement will be "five" (perhaps feet) — use another and the measurement will be "one + three quarters" (perhaps meters). The one measurement can be expressed in terms of the other, just as in the relativity theory there are conditions of transformation from one space-time system to another. Thus measurements are a kind of a language for representing space + time. When a precise date is required the usual procedure is to associate the event with the reading on a clock which occurs as a light signal from the event reaches it. This at any rate appears to be the method of the scientists. There is nothing paradoxical in the supposal that if another clock be chosen the signal might reach it + give rise to a different reading. The time lapse between two events is measured by the difference between the readings associated with them. When other clocks are chosen the result of the process of measuring may be quite different. All this means nothing more than the commonplace that ~~if~~ a given event may enter into different relations with different other events. Consider the case of simultaneity. When two events are simultaneous, suppose that it is the case that signals, proceeding with equal velocity from them, will reach a certain point in such a manner that the difference between the readings which mark, on a clock situated at that point, their arrival at the point, will be zero. There is no difficulty in supposing that if other points be chosen this system of relations will not hold — and wherein does this fact involve that the two

light signals are no longer simultaneous? Is it possible that the paradoxes of the relativity theory have arisen from a confusion of time characters with the measurement of these? From one point of view, the measuring of their time character may result in a zero difference between the dates of two events. If another standpoint be taken there may be a positive difference. So far we are not dealing with time characters themselves. Now simultaneity is the predicament in which there is no intervening time lapse between events. Is it possible that the scientists have assumed that this absence of time lapse + zero difference in dates are the same thing? If this identification is made, then predicaments which present a positive difference in dates will be regarded not as alternative measurements of simultaneity but as expressions of non-simultaneity. A given measurement of time may be conditioned by the use of a method which involves space considerations eg the notion of the distance of the standpoint from the respective events where time lapse is to be measured. It will however be the measurement + not the time character which will be impossible apart from these space factors. A similar condition may arise in connection with the methods used in measuring space. We shall then get, not the interdependance of space and time, but the dependance of certain space and time measurements on the employment of methods of measuring which include both space and time factors.

These considerations are suggestions arising from the consideration of ordinary everyday methods used in measuring. The example of Einstein + some of the typical remarks about measuring + about interdependance of space + time, which come from relativists, suggest that the whole ~~fact~~ appearance of paradox arises from a confusion of space + time with measurements of these features. The complete verification of the suggestion would involve an analysis of actual experiments which are held to reveal the applicability of the relativity formulae. This is a matter for physics — anyway it is outside the capacity of the one who offers the suggestions. We leave it therefore + turn to pursue further developments of the ~~the~~ theory of relativity.

(6) It was shown above how the organisation of different systems of orientation into a single system, in the mathematical aspect of the theory, is embodied in a fundamental Σ formula which becomes the new law of gravitation. Now it is being argued that this formula is the counterpart of an actual physical fact which embodies space + time as interdependent aspects of a single

fact. This fact is called the relativity continuum. It is conceived as the basis of the phenomena of relativity & interdependance of space & time. Within it the paradoxes of relativity find their solution. The parts of the continuum are not points or instants or shapes or durations but events. An empirical object is a complex of events. So too is the motion of a particle. The events are not connected by distances and time lapses but by "intervals." This ~~fact~~ latter is the fact which is represented by the quantity Σ in it is the character of two events which is the same whatever be the system of co-ordinates in which they are defined. Intervals are sometimes referred to as tracks of events. An interval is not a motion, for in so far as a motion involves velocity, direction, distance & time lapse it is not an absolute character but is relative to a standpoint. Events enter into various systems of relations. In the first place each bears to everyone of the rest a set of absolute interval relations. These relations are perfectly reciprocal. But besides the system of interval relations into which it enters each event is related to a special system of lengths and durations which which characterise all other events. Each event enters into one set of interval relations but it enters into many systems of distance and duration predicaments & each set into which it enters is in some way specially correlated within the nature of things with one special event. The interval system is declared to possess a character called curvature, & which is the physical counterpart of the potential in the Σ formulae of the relativity theory. Between any number of events there are an infinite number of intervals just as an infinite number of lines may join any two points. There is one line which is the shortest in length between

the points — this we usually select from all the other connecting distances & call it the straight line between the points. Of all interval magnitudes connecting two events in the relativity continuum there is one & only one with the greatest magnitude. If we take such intervals between the two events as possess a magnitude other than this, there are an infinite number for every magnitude. That interval which is greatest is called a geodesic.

Space or time in themselves are abstracts from the relativity continuum. The unity of space and time within any system & the unity of space-time systems themselves are ~~[illegible]~~ only

※ So says Eddington - Space Time + Gravitation (1)

alternative expressions of the fact that space + time are abstracts. Consider a three dimensional spatial pattern. Its size + shape are, within space, absolute for they are the same from every standpoint.* But it also has a plan and elevation. These vary together in accordance with standpoint taken. We are told that we must think of the relation of distance and duration to the intervals in analogy with the relation of plan and elevation to size and shape. The relativity continuum is the system of all intervals + spaces + times are systems of distances and durations. Thus we are told that spaces and times are to be regarded as unified in the continuum in lieu analogous with the unity of the three dimensions in space. The relativity continuum however, is to be a four dimensional affair containing time and three space dimensions. Individual space and time systems are analogous to the abstractions which occur when within space a standpoint is assumed + a system of co-ordinates constructed. Just as in space, the co-ordinate determination of a point varies in accordance with centre of reference so in the relativity continuum the space and time characters of an event vary in accordance with centre of reference.

Now there is one feature in which this suggested analogy with space cannot hold. There is a certain interchangeability characteristic of the dimensions of space. With a change of standpoint, that which was the elevation of a body may become its plan. Again that which was perceived as the forward-rearward direction can become the left-right dimension. But what sense is there in saying that the time character of an entity may by a change of standpoint be transformed into a space character.

Indeed the whole influence of the relativity continuum seems to be a hysteron proteron. The continuum is to be the ground of the applicability of the relativity formulae + of the arrangement of space + time into a multiplicity of space-time systems. What then is the meaning of the term continuum, how are we to understand that the relativists conceive it. We are told that it is the physical counterpart of certain features in the mathematical expressions. But this tells us nothing about the nature of the continuum - it is merely a re-statement of the fact that the theory of relativity works, but it is no explanation how this comes about. Thus far then the concept which is to explain the need for the revision of our theories of space + time + at the same time the fact that the new formulae are applicable is itself perfectly indefinite. We are told that the continuum is to space-time systems as are the various orientations of an object in space to the space

itself. This may refer either to the empirical space itself or to the relation of the various mental aims to the class formula in the analytical treatment. It was shown how all possible systems of co-ordinates, eg two-dimensional Cartesian or polar or oblique coordinates, which can be used in mapping out two dimensional empirical space, are gathered into a class by a fundamental formula which characterises them all. In so far as the reference is to the latter of these viz to the mental aims in the analytical treatment, we are told nothing about the physical continuum at all – we are simply dealing with mathematical formulae & not that which they express, that factor which enters into the predicament which we call applying these formulae. In so far as the former predicament is the reference, the argument is a hysteron ~~proto~~ proteron. The judgement of an analogy cannot be made apart from a knowledge of the alleged analogous entities. But what is the intrinsic nature of the relativity continuum? We seem to have little more than a name standing for the faith that somehow or other the applicability of the relativity formulae is intelligible.

This vagueness is evident in the alleged character of curvature too. The case is that certain formulae are capable of physical application; they have the same mathematical structure as those used in the non-Euclidean analytic exposition of curved surfaces. There enters into them a factor which is a measurement of time. It seems to have been argued that for these reasons there is a four dimensional curved continuum which these formulae express. But although we know from what is empirically presented what is meant by a curved surface we surely need a little more enlightenment as to what constitutes a four dimensional curve which includes time. What is curved time? Time on the curved space we know is presented as part of space as a whole – it is a selection from space representing part of the internal structure of space. Space contains curved surfaces but to speak of space itself as curved seems not false but meaningless. Eddington says that by curvature of the continuum we mean simply that wherever we are in the region of matter, it is impossible to take such a standpoint, that with respect to it, the formulae which can be applied to articulate the nature of the parts of matter, are never all such as have the mathematical structure of those used in Euclidean analytic geometry. But this is only a statement about the type of formulae which apply – it tells us

Eddington – Space Time & Gravitation p 186. (1)

nothing about the conditions of their applicability, nothing about the intrinsic nature of that to which they apply. We know only that this nature, whatever it is, can be expressed by these formulae. Indeed at one point Eddington says in so-many words that we know nothing of the underlying structure to which the name continuum is given, except that the mathematical formulae do express the relations of its parts — thus we find him asserting "The first simple concepts are necessarily indefinable and their nature beyond our understanding". He suggests that we are in the position of investigators who should study chess records & learn the laws of the moves but not know what are the entities which execute the movements. ~~This has also~~ Suggestions of this nature have opened the way for new statements of idealism. It is said by some philosophers that no doubt the physicists are in this position, but that in the study of the mind we find the clue to the intrinsic nature of these objects which constitute the continuum. How unless some such operation can be carried out it is useless to invoke the notion of the continuum, regarded as something over and above the system of formulae, as an organ of explanation of their applicability. The term, so far as the exposition of the mere relations goes, is simply meaningless. To use it is simply to fall into the fallacy which vitiated the theory of instants viz that of assuming the application of the formulae & the use of the mathematical conventions is warranted, & then attempting to construct imaginatively a predicament which amounts to nothing more than "just that which would explain all."

The analogy of the chessmen ~~given~~ reproduced above is based on an unexpressed assumption as to the nature of the correlation which exists between the mathematical representation & the physical facts represented. He assumes that each defining group of four numbers which is generated by a co-ordinate system is related, by some undefined one-one relation, with an entity which he calls a point instant, & that the relations between these entities are parallel with the relations of the groups of numbers amongst each other. In the same way the series of instants was constructed to be exactly similar (in Russell's sense) to the series of numbers. Now the bare fact of the matter is that if certain conventions of measurement are used the formulae in question are found to work in actual measuring & verified calculations based on the formulae. What is needed is an investigation of the processes which constitute measuring in those experiments of physics. Then there arises the further question as to how far have physicists tended to choose just those conventions for measuring which would allow of expression through

the medium of the mathematical formulae to hand. There are questions which, since they involve analysis of actual experiments, would take us well into the realm of physics.

(7) It is by Dr Whitehead that the problem of applicability seems to have been most thoroughly discussed in very recent times. We proceed then to discuss his treatment of the problem. Physical formulae claim to be applicable within the realm of nature. Now Whitehead holds that a system of formulae deduced by himself & somewhat divergent from the formulae of Einstein, responds to the experimental tests with a satisfactoriness equal to that attaching to the Einstein formulae. Whitehead's system differs from Einstein in that whereas for the latter space-time is heterogeneous & of non-Euclidean curvature, for the former it is homogeneous & Euclidean. That space-time must have this latter character Whitehead claims to be able to deduce from the nature of our knowledge in physics. Given a certain constitution of the space-time content of our experience he holds that he can explain the applicability of the formulae.

Then for Einstein's exposition of the time relativity aspect of the theory has been discussed and criticised. Then Eddington's notion of the continuum was thought unsatisfactory, as being an oscillation between a mere reduplication of the formulae & a hypostatic process. Many of the apologists of relativity are content to proceed in Eddingtons vein when they leave the borders of mathematics or physics & attempt to deal with the question of the meaning & condition of the applicability of the formulae. Whitehead is more soundly philosophical than either Einstein himself or Eddington. ~~We turn then to survey his theory.~~ First of all he defines the realm of nature – it is at least ~~that~~ the object of that part of our mental activity which we call awareness through the senses. It is always presented or posited through sense awareness as a non-mental object. The relativity formulae claim to apply to a part of nature viz that part which is the object of sense awareness which is not illusory.

Nature is not a pure homogeneous mass but is differentiated ~~into~~ ~~parts~~ in it certain parts. Each part has two aspects viz an internal nature and an attached system of relationships. It is of such & such an intrinsic nature and it enters into such and such relationships. The former is it's adjectival aspect & the latter is it's aspect as a factor. It's relationships may be of two kinds viz contingent and necessary. The former are such as do not determine it's internal nature whereas the latter do have this function. The necessary relationships of an entity constitute it's significance. The entities

which are the other terms of a given object's significance are said to be what it signifies. Knowledge of the internal nature of an object involves ~~no~~ knowledge of it's significance but not knowledge of the internal nature of each of the entities which it signifies.

A further pair of correlatives which nature exhibits are permanence & passage. Consider the red billiard ball. It's properties of redness, hardness & roundness persist but they grow older. They remain identical & yet contain within their existence an aspect which consists of the arrangement on the basis of earlier and later. The aspect of passage is also called the system of events. The permanent properties are said to be situated in the events. This fact constitutes the unity of permanence & passage in a single object. Sometimes Whitehead seems to reduce the predicament of situation to bare identity. The permanent properties are said to be the character of the events — they are what they are because events are what they are. Yet though they are the character of events the latter constitute passage whereas the former are permanent. We are left without further elucidation of this apparent contradiction.

Events are a unity in the relations of one event to the rest ~~are~~ of the nature of significance. Permanent aspects are said to be ingredient in events. The situation of a character is an aspect of impression. It is a differentiation of events which is dependant on the totality of events. Contingency arises within nature because some natural objects are partly constituted from outside. Sense objects eg redness, warmth, bitterness are such because they involve the mind as a condition. Physics is the description of the non-contingent in nature, i.e. those aspects of the sensibly presented world which are independant of mind. Thus the object of physics is not merely what is presented to the senses — it includes the non-mental conditions of what is sense presented, even though these conditions are not themselves actually presented to the senses. Whitehead claims that the science of physics can be formulated independantly of mental ~~conditions~~ considerations. The logical connection of the laws of ~~nature~~ of physics is grounded in the unity of events. The limited spread of events which is presented as the situation of an object perceived through sense awareness, is posited as within a wider whole of passing reality. Such a ~~point~~ finite extent is presented as a limitation which essentially has a beyond. It passes sensibly into wider limits.

In so far as nature consists of events it is presented as stratified. Hence it is presented as containing differentiations which

Whitehead – Concept of Nature p 52. (1)

Whitehead calls duration. A duration is a part of objective passage is a part of the system of events which is characterised by a property which Whitehead calls immediacy. The notion of simultaneity is defined as the totality of the immediate. A duration is a block of simultaneous events. It is an objective predicament & is not imported into nature by mind. To say that it is characterised by simultaneity does not mean that it is instantaneous, for a duration is a concrete part of nature and therefore includes passage. Its essential marks are that it is the totality of events which possess immediacy. Simultaneity is the term used to express this peculiar totality. The term immediacy does not mean that of which the mind is now sensibly aware. If this were the case a duration would not be intrinsic to nature, but would be the reflection in nature of the extent of the mind's capacity for attending through the medium of sense-perception. Now that which sense awareness actually appreciates is called "the discerned". That which is signified by the discerned & known only as such is called the "discernible," & a duration consists of "those events whose characters, together with those of the discerned events, comprise nature present for discernment."

Within the total fact of nature with which we make our first ~~acquaintance~~ acquaintance through sense awareness, we have differentiated events from permanences. Some events are known in their intrinsic nature but any event signifies all the rest. Durations are limitations of events by the property of immediacy. Now the realm of pure events is further differentiated, throughout its whole extent, by a two fold principle which is the basis of what we call space and time. The systematic nature of events has a two fold aspect. The fact of this ~~dis~~ twofold principle of differentiation is illustrated by our differences of treatment of the property of "mass" in different predicaments. We speak of a given mass & quantity being spread out in time. Then whatever be its duration it retains its identity — it is the same quantity. The total predicament of enduring mass has the same mass quantity whether the duration be great or small. But take the predicament when we say the mass quantity is spread out in space. The mass of the total predicament of the given mass spread out in space, is not merely that mass but the sum of its repetitions. The total mass varies with the spread in space. A permanent object of given mass is the spread of that mass in time. The object will have that identical mass whether it endures for a minute or an hour. In the case where I have an object constituted of

four parts of equal mass, then it is the spatial spread & not the temporal spread of ~~one of the~~ the mass of any of the parts that is repeated. The mass of the total object is now the sum of the masses of its parts.

Space and time are not independent entities but aspects of the systematic unity of events. They are therefore not co-dependent. This is exhibited in the structure of duration. A duration is based on the maintenance of a relation which Whitehead calls "co-gredience." The duration contains passage — we should ordinarily say it contains a succession of events. But the unity of this succession depends upon it's being the relation by way of cogredience to one of the events known as the percipient event. This center is not the mind but the mind's standpoint within nature. The percipient event must preserve its unity, for only so does the duration comprise a unity of successive elements. The unity of the percipient event consists in the fact that it is absolutely at rest, & over against it the other events which form the duration are in flux. As absolutely at rest it is absolute position. Its unity therefore is identity of position — it is here and the duration is now. Only as within a duration is it event at all, but only in so far as a duration includes a percipient event & is based on co-gredience does it possess the unity necessary to its being a duration. Co-gredience is the basis for the abstraction from events of those groups of factors which Whitehead identifies with the points of scientific space.

Durations enter with regard to each other into a relation which Whitehead calls extension. A minute is said to extend over a second & a second to be extended over by a minute. If (A) extends over (B) then (B) is part of (A). There are no durations which are not extended over and none which do not extend over some other. This is the fact which we call continuity of events. The relation of extension is transitive. Moreover durations are organized in families. Any two durations are of the same family unless they overlap in a finite event without containing a third duration as a common part. Two durations which are wholly outside each other are in the same family.

Whitehead now proceeds to expound his principle of extensive abstraction which is his instrument for the explication of the applicability of the relativity formulae. Abstract from the system of events a set of durations which shall obey the following laws:-

(α) of any two members of the set the one contains the other as part, &

(β) there is no member which is a common part of every other member of the set. Such a set could be diagrammatically represented

thus. Such a series of durations as that from (c) towards (a) has as it's

_____ (a)

_____ (b)

_____ (c)

_____

terms, progressively smaller durations, but there must never be reached a duration which is smaller than all the others. If this were to happen the second condition stated above would be violated. As a matter of fact such a set is said to converge on a duration with no temporal thickness. But this latter does not exist, for durations are essentially passage. Such a set of durations as ~~these~~ that just described gives us what Whitehead calls an abstractive set. The set has no actually existing limit because there are no parts of the system of events which do not contain passage.

We ~~next~~ proceed to the definition of certain relationships into which abstractive sets may enter. Of any two such sets the one (p) will be said to cover the other (q), when every member of (p) contains as it's part some members of (q). In such a case the abstractive set (q) inheres in every member of (p), i.e. take any member of (p) & there are members towards the smaller end of (q) which are parts of that given member of (p)

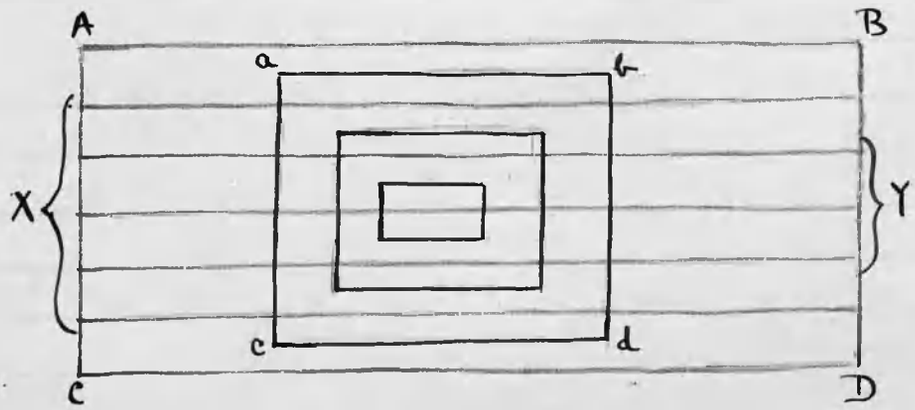


Diagram I.

A set of oblongs — (ABCD) is one of them — arranged so that two sides remain the same length (those corresponding to AB & CD) & only the other two diminish, would move closer & closer towards a line. This is the diagram in (XY). The set of squares, of which (a b c d) is one, would converge towards a point. The set of oblongs covers the set of squares but not vice versa.

Where the members of two abstractive sets are infinite in number each set may cover the other, for given any event (x) which is part of the one, we can always, by proceeding far enough down in the direction of the smaller end of the other find one of it's members (y) which is part of (x); and then by going further down the set of which (x) is a member we can find another event (z) which will be part

of (γ). This process can be carried on indefinitely & in such a case the two sets are said to be equal. The class of concentric circles and the class

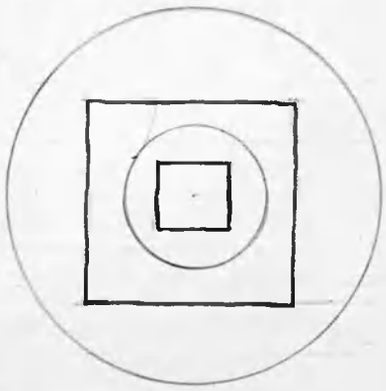


Diagram (2)

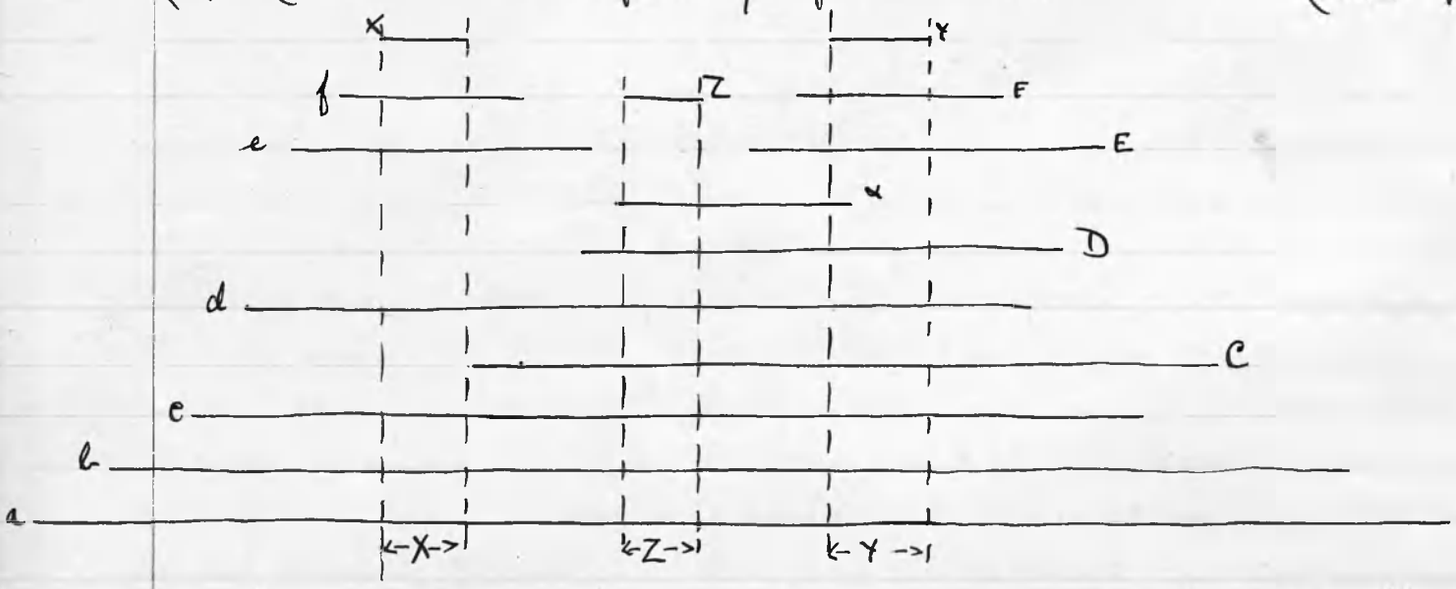
of diminishing squares represented in diagram (2) are equal. Take any circle, and if we go far enough down amongst the smaller squares we shall find a square which will go inside it. The same applies to the squares. This however is not the case with the squares and oblongs of diagram (1). However far down the series of oblongs we go we shall never find a figure which the square (a b c d) completely covers.

Now consider a group of abstractive sets such that all the sets within it are equal and no set outside it is equal to any within it. Such a set of abstractive sets is an abstractive element. Now if (β) covers (γ) then each of the sets that is equal to (β) covers all the sets that are equal to (γ). Thus one abstractive element can be said to cover another. But no two abstractive elements can be equal, for if the (β) element be equal to the (γ) element then all the (γ) sets are already included in the (β) element, which by definition is all the sets that are equal to (β).

The terms of the abstractive sets so far considered have been durations, but a set can be constructed whose members are finite parts of a duration — such a part would be nature as in a billiard ball or a table or other empirical finite object. Corresponding to such a set we also find an abstractive element. Now the abstractive element whose members are sets of durations is the content of an instant. The set of all such elements constitutes an order which satisfies the conditions of the time series for science. But an abstractive element which is based on finite parts of a duration is an event-particle. This is the content of the simplest concept in nature. The instant is said to be a "prime" because its abstractive sets are covered only by their equals. The event particle is an "anti-prime" for its sets cover only their equals.

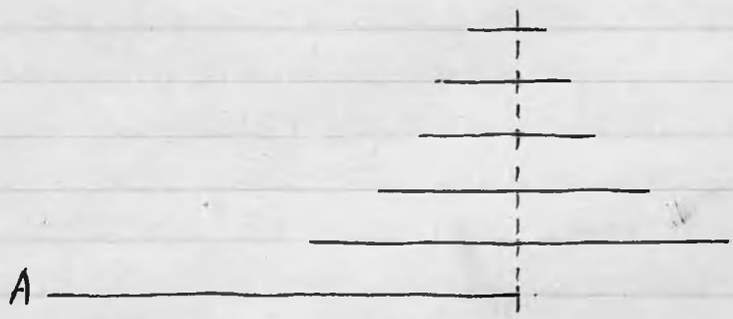
It has been mentioned that passage, the empirical time in nature, is organised into families of durations. Now the durations which enter into a moment are all of one family & corresponding to the family of durations there is a family of moments. No two

moments in the same family cover a common abstractive set, for their smaller defining durations are completely outside each other. (X) & (Y) below are completely separated. The two moments (a, b, e, d & f & ex)



and (a, b, C, D, E, F, Y, etc) possess common durations in (a) & (b). The moment (a, b, c, C, d, D, x, Z etc.) comprises durations which are common to both the other moments, but the latter is covered by neither of the former. Since the smaller contained durations of any two moments of the same family are outside each other then such moments cannot cover a common abstractive set

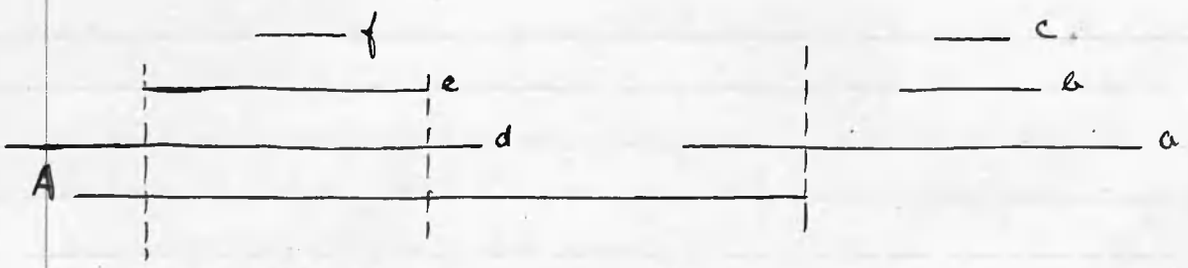
There are two moments in the family of moments corresponding to each duration which are boundary moments. Let (A)



be the given duration. Consider an abstractive set in which the durations overlap (A) but are not contained within it. Such a set defines the boundary moment of the duration. The continuity of the system of events & the fact of passage involve that each duration have two such boundary moments viz the earlier and the later.

Moments, of which the shorter contained durations are entirely separated from a given duration, are said to be outside that duration. The moment defined by the abstractive set (a b c d)

P.T.O. for diagram.



is outside (A). Moments of which the shorter included durations are parts of a given duration, are said to be within that duration. The moment defined by the set (d, e, f, etc.) lies within (A). Thus any moment of a family of moments can be defined with reference to any duration within the family of durations to which the given family of moments corresponds. Any moment within such a family of moments, must be either within, without, or a boundary of, any given duration of the family of durations defining the given family of moments. Now any two moments are boundaries of some duration. A third moment which lies within this duration is said to be between the other two. The passage of nature, the time aspect of nature, distributes a family of moments as a series. This is the time series which can become the correlative of the numbers which enter into the mathematical expression of physical predicaments.

Any two abstractive elements which enter in common a given abstractive set are said to intersect. No two moments of one family can intersect. Corresponding to durations of other families there are other families of moments. It is possible for a moment of the time series (A) to be intersected by every one of the moments of another time series (B). Whitehead assumes that it is only possible for not more than four time series to intersect in a given abstractive set. The abstractive set, a set of sets, which is covered in common by a moment from each of two different time series is called a level. Where three time series are involved we get a nect & where there are four the resultant is a planet. Every planet is included within some event particle. With this assertion Whitehead simply drops the notion "planet" from his exposition saying that it is an "artificial word" for which he has no great love. The whole of a given time series may intersect any one moment of another time series. This gives rise to a set of non-intersecting levels within the moment intersected by the time series. Where two time series so intersect a given moment we have a set of non-intersecting nects. In the two cases we get a series of parallel levels and nects respectively.

Now abstract from the continuum of events a set of parts which obeys the following rules (α) each member of the set is

coprecedent with some given duration + (β) each member covers a given event-particle. Such a group Whitehead calls a station + a station "prolonged indefinitely" is a point in space. Each time system, therefore, has its own set of points. Any point in one set is uniquely correlated with some line with in another set. This brings us to the point of defining the order of points in space. The multiplicity of points are not a mere assemblage but are organised. Those points which intersect a rest in the event particles of the rest constitute a line. Those which in like manner intersect a level, constitute a plane. The lines and planes associated respectively with sets of parallel rests + levels are sets of parallel lines and planes.

Any point of one time system is uniquely correlated with some line of another time system. To occupy a point is to be at rest + rest is absolute position. But rest and motion are correlatives. The unique correlation of points and lines in different time systems is an expression of the physical fact that an object which is at rest in one time system includes other aspects of nature which constitute motion in a straight line in some other time system.

Now let (M) + (N) be two moments contained respectively in two intersecting time systems (α) + (β). The series of moments of (α), in intersecting (N) will generate a series of levels in (N). The order of this series is described as the (α) direction in (N). In similar fashion there is a (β) direction in (M). Any one of the levels which is comprised by the series said to constitute the (β) direction in (M) is said to be perpendicular to that direction. Now (M) + (N) by reason of their intersection contain a common level. This will in (M) be perpendicular to the (β) direction in (M). In (N) it will be perpendicular to the (α) direction in (N). Let there be in (N) a rest (C) whose event particles are spread out in the (α) direction of (N). The level which is common to (M) + (N) may be called (λ). Then (C) is perpendicular to (λ). Then there is a set of points which intersect (N) in those of its event particles which are included in (C) + which is a line in the space of (N's) time system; and this line has perpendicular to it, in the space of (N's) time system, a plane which is constituted by the points which intersect (N) in those of its event-particles which are comprised by (λ).

By the process of extensive abstraction Whitehead has defined an assemblage of groups of parts of the continuum of events. These various kinds of groups are instants, event-particles and points. Further, on the basis of the relation of covering, he has defined the notion

of intersection, & thence the predicaments which he calls perpendicularity and parallelism. Points, instants and event-particles organised on the principles of parallelism and perpendicularity constitute an abstraction from the continuum of events. They are an aspect comprised within this continuum. Whitehead claims that he has formulated an expression of the theory of relativity which, though different from the Einstein formulation, answers equally well the empirical tests. Furthermore he claims that he can show how that his formulae follow from the nature of the system which he has abstracted from the continuum of events. To test these claims is no part of the scope of this essay for it would take us into the field of mathematics and experimental physics. But we must examine the theory of time experience which is made the basis of this superstructure. However, before passing to these final considerations we must survey Whitehead's philosophical arguments, mentioned above, for his preference of his own system to that of Einstein. This survey must be undertaken because these arguments constitute further reasons for accepting Whitehead's formulae ie for the acceptability of his hypothesis as to the nature of time.

Whitehead holds that the continuum of events is not only of non-varying but also of Euclidean curvature. Contrary to Einstein he says that space-time is not bent. Whitehead thinks that he can prove this to be the case from the nature of our knowledge of ~~the~~ facts in physics. The space-time system is the system which the relativity formulae represent is an abstraction from the significance of events. Hence neither itself as a whole nor any part of it can be known apart from knowledge of the whole continuum of events. Then does it follow that I must know everything in nature as a condition of knowing anything? This is obviously contradictory of the practice & progress of science. Anyway we do not need to know the contingent relations of a factor before we can know it's nature. Nor do we need to know the internal nature of each of all the other factors to which it is necessarily related ie which it signifies. We need only to know them as signified ie as relata involved in the system of significance. Then we do need to know the relations. But even here we do not observe individually each of the relations — yet they must be known. Whitehead therefore assumes what he calls the uniformity of significance of nature. The necessary relations are homologous in form throughout nature so that we can extend universally the character observed in any

limited area. This argument is held to prove, as against the contention of Einstein & his group that the curvature of the continuum is unvarying.

However, Whitehead himself must allow there to be some differentiation within the continuum of events. There are various durations. There are parts — only so can the question as to whether we must know everything before we know anything have any meaning. There is the part observed now and there is the part that is outside it & which comes within knowledge by extension of the nature of the observed. Whitehead must then admit differentiation within his system of events. And Einstein allows some degree of homogeneity. The law of gravitation defines for him the condition which all possible predicaments within space-time must obey. Whitehead has not proved that a degree of homogeneity different from that proposed by Einstein is needed.

The crux of the argument propounded is that the nature of the part presupposes the whole and yet I am able to know the part without it's being necessary for me at one and the same time to know the whole. It is not necessary for me to know everything in knowing anything. Here is an apparent contradiction. Whitehead claims that it is removed if it be admitted that the whole is homogeneous; for then I can extend my knowledge of the content of the part. How surely this is not a solution of the alleged contradiction but only a re-statement of it. If I extend my knowledge of the part then I ipso facto pass outside the part. In knowing the part I know the whole.

A second argument is designed to exhibit the necessity of assuming universal Euclidean curvature of the continuum. It has already noted that the construction which Whitehead calls an abstractive system is to mediate the application of his own formulae & that these differ from those of Einstein in that they are of Euclidean formal structure. It is now urged that if we admit that the continuum itself has a feature, which Whitehead calls Euclidean curvature, intrinsic to it we can then account for the nature of our de facto judgements with regard to quantities of space and time. Whitehead claims that hitherto such an explanation has been lacking.

It is argued that equality is at any rate a predicament in which different entities are qualified by a common property. Moreover the property is one of a group. If the given class of qualities be (Y) any entities which possess one and only one property from (Y) & have that property in common, are said to be (Y)-equal. It

is as though the red and white billiard balls were said to be equal in shape but unequal in colour but that as between shape and colour there is neither equality nor unequality.

Congruence is at any rate a species of equality. The entities which it characterises are finite stretches of the continuum of events. The class of magnitudes is involved as a qualifying class in the predicament of congruence. Whitehead defines magnitude as that class of properties which is such that all others can be defined in terms of any one by means of numbers. He then lays down a number of conditions which he claims all classes of properties must possess if they are to be able to give rise to the predicament we call congruence. Then, apparently on the authority of Sophus Lie he asserts that there are an indefinite number of qualifying classes which satisfy these conditions. Any two stretches which are congruent with respect to one such class may not be congruent with respect to another.

Yet as a matter of fact we do all agree in our judgements of congruence. There are of course differences arising out of varying powers of discrimination — this is a question of accuracy of judgement. But Whitehead maintains that over and above this, from different standpoints ie with respect to different qualifying classes, two entities may be truly both congruent & not congruent. So far as the mere notion of congruence goes there is nothing to provide an objective basis for our ~~same~~ de facto unanimity of congruence judgements & selection of congruence classes in respect of space and time. Further, although we make and agree in judgements of congruence with respect to time, there have hitherto been defined no conditions of congruence for time. Whitehead claims that there must be some property intrinsic in the continuum of events ~~to~~ which is the basis of these two features of ~~our~~ ~~the~~ de facto congruence judgements in respect of that continuum. This property will need precise definition. From the notions of perpendicularity and parallelism as he has defined them, Whitehead claims to be able to formulate predicaments which will give rise to just those judgements of congruence which we actually make & in which we agree, both with respect to the space and time aspects of the continuum of events. That is, the intrinsically Euclidean structure of the continuum of events and the nature of our knowledge of space & time congruence are essentially bound up together.

The second argument is a more unfamiliar one than the first. Are we to take it that the notion of a multiplicity of qualifying

classes in respect of congruence is ~~a live possibility~~ regarded by Whitehead as really a live possibility? Now if it be true that the essential feature of magnitudes is that all are expressible in terms of any one by means of real numbers, it follows that we cannot know the magnitude of anything apart from the comparison of it with something else. We cannot realise that a foot ball has size as distinct from shape colour or texture unless we have compared it, for instance with a billiard ball. A thing does not intrinsically possess a certain volume of extendedness but this is only a relation of it to something else to be ascertained by comparison. It is further implied that we cannot recognise two things as being merely of different magnitudes. We must always assess one as so many times larger or smaller than the other. Now we are at any rate in the habit of supposing that this predicament does not hold good. We feel we can distinguish between (A's) magnitude & the fact that (A) is greater than (B). Furthermore it seems often to be the case that we have realised that one thing was larger than another without having gone through the process of assessing one numerically in terms of the other. We remember two things and are certain that (A) was larger than (B) but when asked how much, we have to cast back in our minds and compare them again. Various witnesses may agree that (A) was larger than (B) & yet disagree as to how much. This seems to point to the fact that magnitudes in themselves, relations of magnitudes amongst each other, & numerical expression of magnitudes are different features, distinguishable from each other. Magnitudes we take to be properties which are recognisably different in themselves from colours & sounds etc. Where two entities possess a common magnitude we should say they were equal. It seems a pure confusion to apply the term in the case of other ~~qua~~ properties than magnitudes & it is little good to assert that two entities which are equal with respect to one class of magnitudes will be unequal with respect to another, unless actual cases of such overlapping of bona fide different classes of magnitudes are produced. The notion of a multiplicity of qualifying classes in respect of equality or congruence – & this is the centre-pin on which the argument turns – is difficult to appreciate; it seems meaningless.

Anyway for Whitehead, the basis of our de facto recognition of congruence in the continuum is to be the predicaments of parallelism and perpendicularity. Thus it is stated that two portions of the continuum are congruent in so far as they are the opposite sides of a parallelogram. This same condition is

applied to stretches of time. Whitehead does not say whether the perpendicularity here involved are those of normal perception or those which are defined by extensive abstraction. He certainly does not show that the two are identical. It is difficult to see how two time stretches can be characterised by a predicament identical with what we perceive as parallelism in space. And even in respect of space, are we to take it that being opposite sides of a parallelogram is a property from a qualifying class & in virtue of which two stretches are equal! This predicament seems rather to be an accompaniment of some cases of equality. There seems to be in the case of two such stretches, the intrinsic possession of a common magnitude, a predicament which appears distinct from the further property that the two stretches are sides of a given parallelogram. If this be the case perceived parallelism (& likewise perceived perpendicularity) does not constitute the nature of either a space or time congruence. The other alternative is that perpendicularity & parallelism as defined by extensive abstraction are distinct from the perceived features having the same names, and in some way enter into the intrinsic nature of congruence. Whitehead has not raised this question because he seems to have passed over the possibility that his definition of Euclidean structure and the perceived fact bearing the same name may not be identical.

The two points just made as critical comments on the second argument for the thesis of ~~the~~ universal Euclidean structure of ~~of~~ the continuum of events are first, that the notion of a multiplicity of qualifying classes in respect of equality seems not to be a live possibility, & secondly that there appears to be at least lack of precision in the exposition of the thesis that the alleged Euclidean structure of the continuum of events is the basic feature of space + time congruence. A third point seems to crop up which Whitehead has not mentioned. If we are to account for our merely de facto judgements of congruence, do we at best need anything more than the appearance of Euclidean structure. May not their basis be more psychological than physical. The structure alleged by Einstein is admitted by him to depart from Euclidean structure only in an imperceptible degree. Is it possible that a deficiency in powers of perception, creating an illusion of Euclidean structure (which yet for practical purposes has no ill effects) accounts for ~~our~~ ~~to~~ the nature of our de facto judgements of congruence.

Apart, however, from these considerations just outlined, Whitehead claims on experimental grounds that his formulae are as work-

able as those of Einstein. We must therefore examine the constituents of space and time which he propounds as the basis of their applicability. The fundamental notions involved are those of (α) the internal nature of durations + (β) families of durations. A duration is characterised by immediacy. This latter term is normally used to describe the object of perception. The specious present is immediate because it is the sense presented part of time. This cannot however be the meaning for Whitehead for, firstly, a duration extends far beyond the content of perception, it includes the discernible as well as the discerned. Secondly, immediacy is a character of nature whereas if it were merely a question of the perceived it would be a reflection of the mind upon nature. Seeing that he uses the term in a sense so widely different from its normal application, Whitehead ~~has~~ seems scarcely to have been as precise as might have been expected in his exposition. It is difficult to see what really the term does mean for him.

Immediacy is essential to the unity of a duration. But there is another term whose significance, we are told, is equally essential in the constitution of a duration. This is co-presence. Apart from being a co-presence predicament a duration fails in the matter of being a unity of successive parts. Is copresence another name for immediacy? In ~~co~~ the situation of co presence we are presented with the differentiation of space and time, but equally do we recognise that these two features are not independent. The temporal thickness of a duration fails to remain a unitary entity apart from its copresence with a percipient event, which within the duration retains its identity. The percipient event expresses absolute ~~space~~ position which is the same thing with absolute rest. This predicament, both in its alleged function and in the terminology used to express it, savours of the time-honoured notion that change is only perceived against the permanent background of an unchanging mind. But once again Whitehead tells us that a percipient event is not mental but a purely physical affair.— an event-particle within nature as embodying this duration. Co-presence is no more the unity of consciousness, than immediacy is the fact of presentation to the senses. Again we seem to be amongst terms whose meaning-value has suffered in the ~~hands~~ of ~~summary~~ summary mode of their exposition.

With regard to a multiplicity of families of durations + consequent time systems, Whitehead in his "Concept of Nature"

merely assert that he sees no reason why this should not be the case. But surely the real point is as to whether or not the notion constitutes a genuine concept. It has certainly, in the form of the notion of a multiplicity of time systems, become a commonplace of contemporary scientific and philosophic thought. But it is difficult to attach any real meaning to it; at any rate if taken literally. In Whitehead's exposition it is not always clear whether he regards it as a fact that is immediately presented in perception or as a hypothesis. The question arises as to whether at bottom, Whitehead is not entangled with the idea that explanation of the applicability of the mathematical formulae consists in the construction, by analogy with the structure of the formulae, of some entity to which they are alleged to correspond. This line of thought is simply a specious form of begging the question. If we are to explain the conditions in virtue of which the physical facts are amenable to expression through the medium of a mathematical language, we shall need to furnish genuine new concepts. Eddington does not even seem to have realised this problem. Whitehead is the better philosopher because he has faced it — hence his attempt to formulate such notions as immediacy, co-presence & intersection of families of durations. But there is a suspicion of arbitrariness about much of his exposition. Without proof we find the assertion that only four systems of moments can intersect in a common event-particle. We are not even told why systems of duration should intersect at all. Is this because the notions of families of durations & a multiplicity of intersecting time systems are not at bottom genuine concepts and hence carry no implications. In other words Whitehead seems to some extent to be ~~following~~ achieving little more than Eddington viz to be speciously reduplicating the structure of the system of formulae.

There is however one further point in which Whitehead's account ~~differs~~ of time in connection with the Theory of Relativity differs from that of most others. He raises a point which seems to have escaped them altogether viz the bearing on the nature of time, of the time manifestations in the sphere of mind. Here we are faced with the problem which Alexander raised as to whether mental time and physical time are one & in what sense, if in any at all Space is involved in the time of the mind. Is it the case that we have two kinds of time which perhaps are the expression of a fundamental temporal form. Though Whitehead raises these questions he does not discuss them because he claims

to be able to account for the applicability of this formulae without going outside the realm of nature. So far as this essay is concerned the question has been discussed in the previous section.

This brings us to the end of the survey. At this point therefore we make the attempt to present a summary. In the first section the problem was indicated as comprising the interpretation of that fact which we regard as being involved in those experiences which we normally call change, succession and movement. Then a survey was made of a group of time theories which have logical affinity. First there was the popular interpretation on the basis of annihilation and creation, then there was philosophic progression & the notion of growing unity & finally the absolutist criticism of this creationism. All these theories of time seemed to fail in internal consistency. Then we outlined the theory which we called the theory of successiveness. It had its origin and gained support amongst scientists & those philosophers who set out to vindicate the claims of scientific analysis. This theory involved the distinction between time and the past-present-future schematism, & the whole preoccupation with the problem of creation and annihilation was set down to the failure to realise this distinction. It was seen fit in this essay to adopt this standpoint. The next step was to discuss the detailed articulation of the concept of successiveness. The time metaphor of popular thought were noticed, & the theory of instants was discussed as an attempt at a precise formulation of the notion that popular thought was vaguely reaching at in it's metaphorical statement. The series of instants seemed to be little more than a vague abstraction. It was difficult to see how we were to conceive an instant and it's relation to the perceived empirical facts. In the end the theory of instants was found simply to represent the demand of science for the right to express physical predicament through the medium of mathematical formulae. Arising out of these various considerations came our discussion of the relational theory of time. It's development brought us up against some rather paradoxical results; but paradox is not self contradiction. A formulation of time on the relational basis was suggested, which did not outrage the immediate facts presented. We had however to proceed to an examination of the notion of relation employed both in the theory of instants and in the relational theory. The question of the subjectivity of time was discussed in connection with the analyses of the time relation propounded

by Leibniz and Kant. This hypothesis of relyeitivity was rejected. It was then seen, how, as a result of Bradley's criticism of the notion of relation, neither the theory of instants nor the relational theory could be regarded as ultimately true. The theory of the time continuum was propounded to meet the difficulty. After discussing certain details that arise in connection with this theory, which seemed satisfactory, we turned to the question of the relation of the time feature of reality to the non-temporal features. This led the way to a discussion of Prof. Alexander's theory of space-time. Finally an attempt was made to survey some recent speculation with regard to the nature of time, which has arisen out of the physical theories of relativity. It was admitted that the full discussion of this problem required detailed physical & mathematical knowledge. Nevertheless there ~~were~~ are features which come within the scope of philosophy. At any rate certain recent attempts to articulate the nature of time on the basis of the notions of the interdependence of space & time within a continuum of fact which embodies relativity of time lapses and distances, were discussed & found unsatisfactory. The main conclusions of the essay are as follows:-

(1) The notions of annihilation & creation must not enter into the articulation of time.

(2) Past-present-future schematism is not constitutive of time but is a reflection of the mind upon time.

(3) Time is fundamentally a continuum exhibiting a specific mode of differentiation

(4) It has not been shown that the notions of interdependence of space & time, multiplicity of spatio-temporal systems & curvature of space and time are implied in the applicability of the most recently adopted physical formulae. Indeed it has not been clearly shown what is meant by these terms as signifying characters of the actual physical world as distinct from the peculiarities of structure of the systems of mathematical formulae which are used as a language for the expression of the physical situations.

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